INNOVATION AND FIRM PERFORMANCE IN TRANSITION ECONOMIES, WITH SPECIAL EMPHASIS ON KOSOVO

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Abstract

This thesis aims to investigate the effects of innovation on firm performance in transition economies, measured by sales growth and export intensity. It takes into account the relevance of the novelty of innovation, open innovation methods, business environment factors and the stages of transition, factors not investigated by the previous literature on transition economies.

The research consists of three empirical investigations. First, the process of innovation and its effect on the firm performance in seven transition economies is explored using the CDM model and a firm level dataset drawn from the Eurostat's Community Innovation Surveys for the years 2004 and 2006 (separately and pooled). Second, the impact of innovation on firms' export performance is investigated for 28 transition economies, using BEEPS Survey data for the years 2002, 2005 and 2008. Third, the effect of innovation on export performance of firms in Kosovo is studied using primary firm level survey data undertaken by Riinvest Institute, in which the author was directly involved.

The work in this thesis makes a number of original contributions to the literature on transition economies and specifically in Kosovo. The extent of open innovation efforts, measured by the breadth of cooperation, significantly increases the sales of radical innovations (products new to the market), while the internal firm capabilities for innovation influence only incremental innovations (products new to the firm). Product and process innovations in recent past significantly increase the firms' sales growth. Public subsidies for innovation are generally not efficiently converted into innovation output, but significantly increase the sales growth of firms that have introduced radical innovations.

Furthermore, the firms' export intensity increases with the degree of product novelty (new products as opposed to significantly improved products) and the effect is higher in more advanced stages of transition. Firms in advanced reforming countries that perceive their domestic market environment as uncertain, are inclined to increase their export intensity, while a weakness of rule of law has a negative effect. Tertiary education of employees facilitates firms' export intensity in all transition stages, while specialised skills become effective only at the advanced stage of transition. Networking, knowledge spillovers and foreign ownership increase the firm's export intensity in all stages of transition. Largely, transition reforms moderate the effects of determinants of export performance.

Similar findings are confirmed in the investigation focusing on the firms in Kosovo. In terms of innovation, products introduced as new to the market have the highest positive effect on export intensity of firms. The export intensity also increases with number of newly introduced products, an innovation indicator introduced to the literature for the first time. Uncertain domestic environment encourages firms to increase their exporting activity, similar to the effect of university education and locational factors. Smaller firms indicate for catching-up with larger firms as the same factors show to exercise relatively higher effect on export intensity of micro and small firms.

Overall, the findings suggest that open innovation practices are more likely to induce novel innovations. The higher the degree of novelty the higher the influence on export intensity of firms. In addition, in countries with an uncertain domestic environment, export promotion policies can encourage firms to increase exporting activities and balance risks associated with the domestic market. These effects are moderated by the stage of transition.

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Abbreviations

BEEPS	Business Environment Enterprise Performance Survey
CBK	Central Bank of Kosovo
CDM	Crepon, Duguet and Mairesse
CEEC	Central Eastern European Countries
CEFTA	Central European Free Trade Agreement
CIS	Community Innovation Survey
GDP	Gross Domestic Product
EBRD	European Bank for Research and Development
EU	European Union
FIML	Full Information with Maximum Likelihood
FDI	Foreign Direct Investment
GLS	Generalised Least Squares
GMM	Generalised Method of Moments
KTA	Kosovo Trust Agency
LIML	Limited Information with Maximum Likelihood
MTI	Ministry of Trade and Industry
OECD	Organisation for Economic Co-operation and Development
PAK	Privatisation Agency of Kosovo
RBV	Resource Based View
R&D	Research and Development
SME	Small and Medium Enterprises
SOE	Socially Owned Enterprises
SOK	Statistical Office of Kosovo
TE	Transition Economies
UK	United Kingdom
UN	United Nations
UNDP	United Nations Development Programme
UNMIK	United Nations Mission in Kosovo
US	United States
VIF	Variance Inflation Factor
WB	Western Balkans
WTO	World Trade Organisation
3SLS	Three Stage Least Squares

Chapter I

Introduction

Contents

1.1 Introduction

This thesis explores the process of innovation and its impacts on firm performance. It investigates the performance of firms with respect to their sales growth as well as their export intensity, taking into account the degree of novelty of innovation, aspects of open innovation, business environment and stages of transition.

Innovation expresses the process of change or the transformation of knowledge, ideas and inventions into commercially viable goods, services or processes. It has evolved throughout the history though its analysis in the economics literature goes back to Adam Smith who, in 1776, implicitly argued that innovation drives growth. The more explicit analysis of innovation, its definition and economic role was provided clearly by Schumpeter in 1934. As Kline and Rosenborg (1986) posit, as a systemic process of change, firms' innovation is driven by a continuous increase in the knowledge base. It is particularly important because it differentiates firms in terms of products and technologies and drives their sustainable growth and competitiveness in the domestic as well as international markets (Cantwell, 2005). Similar suggestions were provided by Schumpeter who indicated that radical technological changes (changes introduced for the first time in a market) lead to the creative destruction of products and firms and the creation of new ones which in general influence growth, while the imitation of such innovations leads to adaptions and further inducement to growth (Fagerberg, 2005).

As Pavit (1984) notes, the production, adoption and spread of innovations have influenced the process of economic and social evolution. Innovative countries became economic and technological leaders, as did the United Kingdom during most of the 19th century, while other countries could catch up and take the economic lead, as United States or Germany did in the second half of the 19th century (Fagerberg and Godinho, 2005). Likewise, the European economy aims to become the most competitive economy by increasing the overall innovation effort to the level or higher than other innovation driven economies such as US and Japan. The former socialist economies, now known as transition economies, which are the specific subject of this thesis, are also aiming to follow the same path. However, their capability to absorb knowledge and technological changes as well as the ability to generate innovation is much more limited and presents a challenge in their catch-up phase.

Overall, innovation is considered to be a driver of the economic growth, firm performance and exporting activities. As such, it has become an attractive field of research. The literature to date provides inconclusive results on the effect of innovation on firm performance and exporting due to different measures or indicators of innovation or performance, different contexts of investigations and also different methodologies applied.

The aim of this chapter is to provide an introduction to, and explain, the main ideas explored in this thesis and the rationale for the choice of these ideas and the method of investigation. The chapter is organised as follows. First, we explain the research objectives of the thesis. Then we discuss research questions examined in the empirical chapters. We conclude this chapter by providing the overall structure of the thesis.

1.2 Research objectives

The empirical analysis aims to achieve three main objectives. The first objective of this thesis is to explore the innovation and firm performance relationship in transition economies using a multistage model, comprising of the four equations (innovation propensity; innovation investment; innovation output; and the firm performance) (Chapter III). We extend the literature by accounting for several aspects of innovation, including the relevance of the degrees of novelty and the open innovation expressed by the breadth of external cooperation on innovation. The second objective of this thesis is to investigate the impact of innovation on export performance of firms in transition countries, as accounting for the relevance of the degree of novelty, the domestic business environment factors and the stages of transition reforms (Chapter IV). As a further extension of the literature we account for the relative novelty of newly introduced products and several business environment factors, with particular emphasis on the influence of uncertainty of the domestic environment. In addition, we assess different determinants of firms' export performance across different stages of transition. The third and final objective is to explore the effect of innovation on export performance of firms in Kosovo, accounting for the degree of novelty and business environment indicators (Chapter V). The innovation process has not been previously explored for firms in Kosovo, which is the most laggard of transition economies and the last country to enter the transition process, thus making this the first study to investigate the process in this country.

With respect to the first objective (Chapter III), the literature to date has mainly focused on the exploration of innovation in developed economies, or countries at the technological frontier (countries producing at the proximity of their technological capabilities); while despite the important role of innovation for firm performance, less attention has been paid to transition economies. Governments in transition countries also did not give priority to innovation in the early stages of transition. However, the reforms undertaken over the last two decades have facilitated firms' growth as well as their innovation activities. Transition economies undertook economic and institutional reforms aiming to reach standards of industrialised economies (we explain this in more details in Chapter II). With respect to the firm development, several microeconomic reforms were undertaken, such as restructuring of firms, privatisation and facilitation of a competitive environment. In addition, the liberalisation of trade enabled firms to target export markets as an additional opportunity for growth. On the other hand, the knowledge and technology inherited from the previous socialist system was not much applicable to the market oriented environment. The process of catching-up with new technological developments became an imperative for firms in transition countries in order to shift from advantages based on the low cost of labour and natural resources to innovation driven competitiveness.

Due to the limited internal capacities for innovation in the early transition, firms were more risk averse and mainly inclined to imitation and incremental innovation (Radas and Bozic, 2009). Access to knowledge and technology beyond their internal resources required cooperation with external organisations, or an open approach to innovation. Few studies investigating innovation and firm performance in transition economies have assessed the effect of different types of bilateral cooperation between firms and external organisations on innovation, and in any case the reported findings are not conclusive. The open innovation approach indicates that the internal boundaries of a firm's capacity to innovate can be efficiently extended through access to diverse external knowledge in a multiparty cooperation model. As Chesbrough and Vanhaverbeke (2011) suggest, companies should find a way to utilise the distributed pools of knowledge possessed by customers, suppliers, universities, national labs, consortia, consultants and even their own competitors. The combination of diverse knowledge increases the chances of finding creative solutions leading to more radical innovations. In this thesis we aim to extend the literature by investigating if the breadth of knowledge expressed by the degree of cooperation with external organisations matters for innovation, and in particular if it is more effective for radical or incremental innovation.

With respect to innovation and firm performance relationship Barlet, et al. (2000) assume that radical innovations may require time to be commercially successful due to a possible inert reaction of the market, but may as well be commercially successful if the market or industry is innovation intensive and more prone to technological and product changes. Thus, the degree of innovation novelty is an important feature in explaining the dynamics of firm performance. Such aspects are only considered in a few studies in the developed economies but, to our knowledge, there is no investigation to date with respect to transition economies. Among other reasons, innovation is generally considered as ’a feature and property’ of technologically advanced economies and firms in these countries, while it was not a priority in the agendas of the governments in transition countries, especially in the earlier stages of transition. Similarly, researchers did not give much attention to the capability of firms to introduce radical innovation or explore its impact on firm performance. Therefore, to achieve the first objective of this thesis we further extend the multistage model of innovation exploring also the relevance of the degree of innovation novelty, as measured by sales of products new to the firm and sales of products new to the market.

With respect to the second objective (Chapter IV), we follow the literature considering innovation as a driver of export performance, known as the technological gap theory. This theory implicitly assumes that innovation sustains competitiveness in the export markets through the introduction of products that are new to the respective market. It is assumed that competition in export markets will need some time to imitate and adapt such products, thus putting pressure on the innovating country or firms to continuously innovate and sustain the first mover advantage. Therefore, the degree of novelty of innovation becomes relevant for export performance of firms.

An important aspect not considered by the technology gap theory is the issue of endogeneity raised by the new growth theory (Grossman and Helpman, 1994). More innovative firms are more active on the export markets but, at the same time, those present in international markets absorb new knowledge and ideas of new products and processes that they may further develop and benefit from in subsequent periods. This creates the ‘learning by exporting’ effect. Studies remain inconclusive in terms of the causality effect between exporting and innovation, suggesting that the relationship depends on the relative development of the market. However, the causal relationship between the two can be properly assessed in a dynamic relationship in order to explore the effects of one or the other factor in one period on the outcome of the other factor in the next period. The cross-sectional data we utilise in this thesis allow us to only investigate the effect of past innovation on present exporting.

In addition, other theoretical models such as productivity based models have put the productivity effect at the forefront of firms’ exporting behaviour, suggesting that productive firms self-select into export markets (Melitz, 2003). Alternatively, more recently it is suggested that the productivity is mainly innovation driven so it is innovation in the first place that explains the productivity, as well as the export performance of firms (Caldera, 2010). Another important export related view that we consider is the so-called ‘Uppsala view’ of international trade (Johanson and Vahlne, 1977), which highlights the importance of relative certainty or stability in the market environment. It assumes that if the domestic market environment is uncertain, it is likely to push firms towards safer export markets. Considering all the relevant theories on innovation and exporting, we extend the economic literature on innovation and export performance by exploring the effects of a number of innovation indicators, the relevance of the degree of novelty and the effect of business environment factors for firms in 28 transition economies, not accounted for in previous studies. In particular, we explore the effects of the determinants of export performance across different stages of transition. As Damijan, et al. (2015) suggest, the export performance of transition countries has improved significantly with the progress of transition reforms. This implies that improved institutions and market environment have a moderating effect on factors that explain export performance of firms. Among others, innovation is a crucial determinant. Reforms have also resulted in better protection of intellectual property rights and a more supportive environment for innovation. Among other indicators, in Chapter II we show the positive trend of the research and development investments in most of the advanced transition economies. Market oriented institutions also facilitate a favourable business environment, including better access to finance, better quality education system, good infrastructure and support for foreign investors and SMEs. Notwithstanding, the speed of reforms and the initial level of development and institutional basis varied hugely across transition economies. Some countries have advanced faster with reforms, most countries are at an intermediate stage of transition, while few countries have remained as the laggards, still in the early stage of transition. The heterogeneous transition environment is accounted for by grouping countries based on the level of transition progress (elaborated in Chapter IV).

Finally, in pursuit of the third objective we explore the impact of innovation on export performance for the case of firms in Kosovo (Chapter V). Kosovo embarked on market and institutional transition reforms almost a decade after other transition countries. The initial lag affected the transition progress compared to other countries in the region. Today, Kosovo presents the only laggard economy of the CEECs, along with few countries of the former Soviet Union (Azerbaijan, Belarus, Tajikistan, Turkmenistan and Uzbekistan). The motivation to investigate the impact of innovation on export performance of Kosovo firms is based on the knowledge of the author of this country, the ability to collect primary data, and the fact that the innovation process has not been investigated in this laggard transition country. Exploring the effects of innovation, business environment and other relevant indicators on export performance of firms can provide relevant information and policy implications that may enhance the capability of Kosovo firms to export. Also, this is the first study that explores the relevance of the degree of novelty of innovation as measured by products new to the market and products new to the firm for the case of Kosovo. In addition, a new quantitative measure of product innovation expressing the number of newly introduced products is presented. In general objective three is to see if the case of Kosovo is any different from other transition economies that we empirically assess in Chapter IV.

1.3 Research questions

The research questions explored in this thesis can be grouped into three main areas. In Chapter III the research questions are related to the investigation of the determinants of radical and incremental innovation and their relationship with firm performance, as measured by sales of products new to the market and new to the firm. We account for various determinants of innovation both at input and output level as suggested by various schools of thought (explained in Chapters II and III), mainly focusing on the role of internal capacity to innovate and of open innovation for the commercial success of innovation. In addition, we investigate the relationship between innovation (both radical and incremental) and firm performance (expressed by sales growth). In line with objective one, we define the following research questions, which are addressed in Chapter III:

i. *Does open innovation facilitate firms' innovation efforts?*

ii. *Is the degree of innovation novelty facilitated by access to external knowledge, or an open innovation approach?*

iii. *Can firms' innovations become commercially successful (expressed by sales of products new to the market and sales of products new to the firm) if they rely on their internal capacities for innovation?*

iv. *Is the relationship between innovation and firm performance moderated by the degree of product novelty?*

We respond to these questions (*i, ii, iii* and *iv*) in Chapter III by employing a four-equation CDM model of innovation. For the two 'input phase' equations (propensity to innovate and innovation investment equations), we employ the Heckman Sample Selection two-step approach and the Heckman Full Information Maximum Likelihood models. For the two 'output phase' equations (innovation output and firm performance equations), a Three Stage Least Squares estimator and simultaneous equations approach was used. This investigation utilises the large firm level dataset of the Eurostat's Community Innovation Surveys 2004 and 2006 for seven transition economies.

In Chapter IV the research questions are related to the second objective of this thesis, or to the investigation of the impact of innovation on export performance of firms in transition economies. We account for various determinants of firms' exporting as suggested by export related theories (explained in more details in Chapter IV), but mainly focus on the effect of innovation with respect to the degree of novelty (new products versus significantly improved products), the effect of business environment factors, as measured by the macroeconomic uncertainty (in terms of inflation, exchange rate or regulatory policies), infrastructure, rule of law and access to finance indicators. To account for the moderating effect of the stages of transition reforms across 28 transition countries we investigate the determinants of export performance across three transition stages, namely the laggard, medium and advanced reforming countries. In line with the second objective of the thesis, we define the following main research questions, which will be explored in Chapter IV:

v. Is the degree of novelty a significant contributor to the increased export performance of firms in transition economies?

vi. Does uncertain business environment influence firms' export intensity?

vii. *Do the determinants of firms' export performance have the same effect across different stages of transition?*

We respond to these questions (*v, vi* and *vii*) in Chapter IV, by employing pooled cross-sectional Tobit Corner Solution and Probit model estimations, utilising at the large firm level Business and Enterprise Performance Surveys (BEEPS) 2002, 2005 and 2008 datasets for 28 transition economies, grouped into laggard, medium and advanced reforming countries.

In line with the objective three of this thesis, in Chapter V we investigate the effect of the degrees of novelty of product innovations (products introduced as 'new to the market') and the business environment factors on the export performance of Kosovo firms. We define the final three research questions:

viii. *Do products new to the market affect export performance of Kosovo firms?*

ix. *Does an uncertain business environment influence export performance of Kosovo firms?*

x. *Is there a difference with other transition economies?*

We respond to these questions (*vii, ix* and *x*) in Chapter V, adapting a similar approach as in Chapter IV, by employing cross-sectional Tobit Corner Solution and Probit models, and utilising a Kosovo firm level dataset of the Riinvest Institute Business Performance Survey undertaken in 2013.

1.4 Structure of the thesis

This thesis is structured as follows. In Chapter II we review the theoretical and empirical literature. We start by defining innovation and critically reviewing the literature on the measurement of innovation as well as discussing the relevance and measurement of the degree of novelty of innovation. Next, we discuss the development of theories of innovation in a historical perspective since the first contributions of Schumpeter in 1934. We discuss the relevance of neoclassical growth model that considers innovation as an exogenous factor, as well as the new growth theory which raised the important issue of endogeneity between innovation and growth. In addition, we analyse the theoretical views that are based on the Schumpeterian theory considering innovation as an internal firm factor. While the resource-based view of the firm suggests that innovation is determined by internal resources, the evolutionary view highlights the adaptive nature of the innovation model due to the evolution of the market environment. More recently the observed innovation dynamics has culminated in an open innovation approach. This is followed by the analysis of theories exploring the innovation and export performance relationship, as well as the relevant theories on firm exporting, such as the technology gap theory, the productivity based theory and the so-called 'Uppsala view' of international trade. Next, based on the firm's innovation theories we discuss the determinants of innovation. We further discuss innovation in the transition context and the progress of transition in respective countries. The empirical literature on innovation and firm performance and the literature on innovation and export performance are then critically reviewed and the main gaps in the empirical literature on transition economies are highlighted.

In Chapter III we estimate the relationship between innovation and firm performance to provide answers to the research questions *i, ii, iii,* and *iv*. We start by elaborating upon the previous research on innovation and firm performance and discuss the gaps in the literature in the context of transition economies. First we discuss the relevance of the degrees of novelty with respect to the commercial success (effectiveness) of innovation as well as the firm performance. Then, we discuss the empirical literature on innovation 'input phase', both in terms of measurement of innovation input and the determinants of innovation input. We further analyse the innovation 'output phase', by discussing the innovation output indicators used in the literature, as well as the determinants of innovation output and highlight the main features with respect to the degree of innovation novelty and the relevance of open innovation. We then discuss the firm performance indicators used in the literature and review empirical findings on the determinants of firm performance. The four stage CDM model, together with extra features used in this analysis, is also elaborated in this chapter, together with the Community Innovation Survey (CIS) cross-sectional data for the years 2004 and 2006 that we use in the empirical analysis. Finally, we provide empirical results for each stage of the innovation and firm performance model.

In Chapter IV, we empirically estimate the impact of innovation on export performance of firms in transition economies in order to provide answers to research questions *v, vi, and vii*. We use the Business Enterprise and Enterprise Performance Survey (BEEPS) data for 2002, 2005 and 2008 for 28 transition economies and estimate a Tobit model for firms' export performance. We provide a critical review of the literature on innovation and export performance as well as discuss the business environment and other related factors. We also define the stages of transition as per European Bank for Reconstruction and Development (EBRD) transition progress scoring. In line with the EBRD methodology we divide countries into three sub-groups based on the stage of transition (the advanced transition, intermediate transition and laggard transition group). Then following the relevant export related theories we review the determinants of export performance. We then discuss the empirical results and undertake sensitivity analysis.

In Chapter V, responding to research questions *viii, ix* and *x,* we empirically examine the effect of firms' innovation activities on their export performance for the case of Kosovo, accounting also for the relevance of business environment factors. We use firm level data obtained from the survey undertaken by Riinvest Institute for Development Research in Kosovo in 2013 in which the author was directly involved. We start the chapter by discussing the specific context of Kosovo. We provide an overview of the development of transition in Kosovo. Unlike in Chapter IV using BEEPS data, here we utilise the information on whether the products are new to the market, thus taking into account the degree of product novelty. The results of the estimation procedure are then elaborated.

In Chapter VI, we provide a summary of main findings of the thesis. Based on the findings we suggest a set of policy recommendations. We also indicate the main contributions to knowledge, limitations of the thesis and suggestions for future research.

The next chapter critically reviews the theoretical and empirical literature that sets the framework for the empirical research in the subsequent chapters.

Chapter II

Innovation and firm performance: review of the theoretical and empirical literature

Contents

2.1 Introduction

The process of innovation may be as old as mankind as it represents the dynamic and systematic advancement of products, processes and organisational work methods of all kinds. In the specific context of firm innovation, the literature on innovation widely accepts the work of Joseph Schumpeter in 1934 as the pioneering contribution in the field. According to Schumpeter (1934, p. 65) innovation is expressed as the development of a new product, a new method of production or a new source of supply, and the exploitation of new markets and new ways of organising a business. This definition of innovation has essentially survived to the present time and is the basis of a similar definition by the Oslo Manual (OECD, 2005) and the Eurostat's Community Innovation Surveys.[1] The Oslo Manual emphasizes that minor and insignificant changes or those with insufficient level of novelty are not recognised as innovation while those with significantly improvements are acknowledged as innovation (OECD, 2005, p. 37).

In the process of innovation, firms may initially develop conceptual models for new products or processes. The newly developed models may represent inventions and not innovations (Freeman, 1982). In order to become an innovation, conceptual models have to be converted into a commercialised proposition. Mansfield (1968, p.83) posits that inventing an idea may not have any importance if it cannot be applied. A new inventive idea will have economic sense and impact only if it is commercialised. Innovation does not necessarily need to represent an invention (Schumpeter 1934, p.89). Innovation inputs or the expenditure on research and development may lead to both inventions and innovation, but may also fail to generate an output.

[1] The Oslo Manual (OECD, 2005, pp. 31-39) defines innovation as the development of a new or significantly improved product (good or service), or process, a new marketing method or a new organisational method in the business practice, workplace organisations or external relations. The Community Innovation Survey, undertaken in all EU member states also uses the Oslo Manual definition of innovation.

Firms engage in innovation in order to increase their productivity, competitiveness, market share which will ultimately increase their profits (Love and Roper, 2015). Various theories on innovation and firm performance have evolved since the time of Schumpeter. While the neoclassical school of thought assumes that markets always tend towards an equilibrium, the Schumpeterian view is based on the assumption that new and radical products or technologies create a continuous market disequilibrium. A key limitation of neoclassical theory is the assumption that technological change is an exogenously determined factor. This is addressed by the new growth theory (Romer, 1990; Aghion and Howitt, 1990; Grossman and Helpman 1994) which argues that growth and technology develop simultaneously. Alternative theories followed a more evolutionary view (Nelson and Winter, 1982), assuming that as the environment continuously evolves, the way we conceptualize innovation would also evolve. Another view, known as resource based view of Penrose (1959), suggests that the internal resources of firms are key to innovation development and firm growth. On the other hand, the observations of practical implementation of innovation led to the innovation systems view which considers innovation as part of a wider system in which institutions play an important role (Nelson, 1993; Lundvall, 1998). The challenge of the firm’s limited internal capacities for innovation was recently met by the so-called ‘open innovation’ approach, or access to external knowledge as a complementary source of innovation (Chesbrough, 2003).

In line with the theoretical views and observations of the impact of innovation at the firm and national levels, innovation has become a synonym for change and growth at both micro and macro levels. The European Union considers innovation as the generator of growth and source of competitiveness. To be more competitive with other world economies, EU aims to increase R&D investments from the current level of about 2 percent to 3 percent of GDP by 2020 (EC, 2014). To reach the target, the role of private sector enterprises as the generators and owners of the innovation processes is crucial. This is particularly important for transition economies that are in the process of EU integration, as well as for those that have become EU members but are still lagging behind other developed economies in terms of innovation and growth. In addition to development issues, transition economies are also faced with the reforms of their institutions and overall market environment, aiming to reach the standards of other industrialised economies. While the literature on innovation and firm performance has generally focused on the developed economies as technological leaders, the analysis of this process in transition economies has attracted less attention. In particular, the assessment of firms' capabilities to generate radical innovation and its relevance to improved performance and exporting, in countries facing the challenge of establishing market oriented institutions and implementing transition reforms has been largely neglected.

The main aim of this chapter is to critically review the theoretical and empirical literature on innovation in order to provide the theoretical basis for the research questions investigated in later chapters. The remainder of the chapter is organised as follows. In section 2.2 we assess the literature on the measurement of innovation. In section 2.3 we critically review the theoretical contributions on innovation and its relationship with firm performance and exporting. In section 2.4 we assess the literature on the determinants of innovation at the firm level. In section 2.5 we analyse the process of innovation in the context of transition economies. In section 2.6 we critically review the empirical literature on innovation and firm performance relationship and on innovation and firm's export performance. In section 2.7 we conclude the chapter.

2.2 Measurement of innovation

This section critically assesses the characteristics of various indicators of innovation used in the economic literature and discusses their limitations and strengths. One of the challenges noted in the earlier economic literature was the wide-range of meaningful measures of innovation, as well as the choice between input and output indicators (Kuznets, 1962). Innovation that is observed in the form of products or technological processes represents only the last step of the innovation process. To reach to that level, firms have to put in efforts and engage human, financial and technological resources. Research and development (R&D) expenditure and a head-count of R&D staff are commonly used in the economic literature to proxy the innovation effort or inputs invested by firms. Among input indicators, R&D expenditure is a quantifiable input and allows for the assessment of the financial costs and returns from an innovation, both at the micro and macro level. The R&D indicator is used to set innovation targets at the country level and at the European Union level. However, R&D expenditure measures only the input intensity of the innovation process, but does not reveal the success rate of innovation in terms of its commercialised output. As defined by the Oslo Manual (OECD, 2005), if an innovation process does not lead to a commercialised output, no innovation has taken place. The process of generating innovation, or converting the firm's efforts, knowledge and R&D related expenditure to a commercial output is referred to as a black box, which is often not well explored (Aghion and Tirole, 1994).

Kamien and Schwartz (1982) note that if the technical advance is largely the product of internal R&D activity, R&D expenditure may be the right measure of innovation, whereas if R&D is carried out outside the firm, then innovation output is a better measure. In the case of small and medium sized enterprises (SMEs) an output measure is preferred, as SMEs usually have either no R&D departments or only small ones. Moreover, SMEs often do not acknowledge innovation effort and related expenditures as R&D expenditure (Griffith, et al., 2006). Consequently, the use of R&D expenditure as a measure of innovation does not provide a complete picture and may create biased results, especially for SMEs that may develop their new products and processes through external sources of knowledge. The so-called "Singapore effect" is an example of a situation with high rates of innovation not relying on internal R&D but rather on external sources, both domestic and foreign (Kleinknecht, et al., 2002). It means that R&D measures indicate the expenditure or the investment dedicated to produce innovation output, but may not express the outcome of the process (Acs and Audrestch, 1988). Therefore, innovation output indicators are preferable to innovation input measures (Bleaney and Wakelin, 2002).

As the data on patents and new product and process announcements in journals became more readily available, the investigation of the innovation process shifted to the determinants of innovation output. Various studies (Hall, et al., 1986; Jaffe, 1986; Pakes and Griliches, 1980) have used the data on patented inventions from the US patent office. Patents as an indicator of innovation output provide the identification and guarantee for the authenticity of a new product or process and are used for empirical studies in many occasions. However, many patented products and processes are never commercialised, and many innovations have never been patented, which weakens the case for using patents as a means of identifying innovation (Kamien and Schwartz, 1982; Acs and Audretsch, 1988). As Kleinknecht, et al. (2002) argue, it happens because some firms, due to their strategic and competitive behaviour, use patents only to prevent other firms from getting the right to produce the same product and create a barrier to entry and competition (a blocking rather than an enhancing action). In addition, due to strategic objectives, firms may often decide not to patent their innovation. Among other reasons, if the risk of imitation is low, the benefits from patenting may be low; therefore, firms will not consider patenting. Alternatively, a higher risk of imitation may increase the incentives to patent. This is empirically supported in studies by Levin, et al. (1987) and Brouwer and Kleinknecht (1999).

Acs and Audretsch (1988) have used product announcements in journals as a measure of innovation output. This measure focuses on acknowledged product and process innovations, but there are drawbacks to this indicator as well. As journals have mostly reported product innovation and less process innovation, there seemed to be a bias in the results. A second problem that may cause a bias is the selection of journals used for the compilation of the new product database. Some journals may have not been included, and some firms may have not reported their product innovations in journals. Kleinknecht (1993) asserts that in some market niches a firm may refrain from publication of new products in journals as other publication channels may be more efficient.

The aforementioned limitations of the innovation indicators specified so far have influenced the development of new alternative measures. The first 'Oslo Manual' published by the Organisation for Economic Co-operation and Development (OECD) in 1992 set the guidelines for gathering and interpreting data on technological innovation (Becheikh, et al. 2006). These guidelines extended the original work with respect to the definition of innovation by Schumpeter decades earlier as noted in the introduction of this chapter. The Oslo Manual guidelines were the basis of the first harmonized Eurostat Community Innovation Survey (CIS) at the firm level in the European Union member states and candidate countries, carried out in 1993 (and regularly since then). The survey is designed to provide information on a range of innovation activities of firms across different sectors and regions, employing new measures of innovation: both qualitative (newly introduced products, services, processes, and marketing and organisational methods) and quantitative (sales of newly produced products and services). As the data on firm level innovation became available, new innovation indicators began to be used by increasing number of studies

(Loof and Heshmati, 2002, 2006; Freel, 2003; Avermaete, et al., 2004; Hall, et al., 2009; Roper, et al., 2010; Amara, et al., 2013; D'este, et al., 2015; Bozic and Mohnen, 2016).

In a survey of the literature on innovation in the manufacturing sector published between 1993 and 2003, Becheikh, et al. (2006) found that 38 percent of the papers focused on product innovation, 43 percent examined both product and process innovation, while only 1 percent considered process innovations alone. Also, 13 percent of the papers studied innovation via patent data and 6 percent of them did not specify which type of innovation was examined. Vaona and Pianta (2008) indicate that the purpose of investigation determines the choice of innovation measures. They argue that product innovation improves competitiveness and increases the quality and variety of goods, while process innovation affects the production capacity and efficiency. In addition, the availability of data on sales of new products provides a quantitative measure of the commercial success of new products. As such, it has been widely applied in the strand of literature investigating innovation and firm performance relationship (Crepon, et al., 1998; Loof et al., 2001; Loof and Heshmati, 2002, 2006; Griffith, et al., 2006; Masso and Vahter, 2008; Hashi and Stojcic, 2013).

Amara, et al. (2008) argue that the amount of innovation reported by firms has increased over the years and the main question no longer is whether firms develop new products and processes but rather how impressive and novel the innovations are. The quality and the novelty of an innovation indicate the knowledge intensity of a firm and the economy. The concept of novelty has been illustrated in various ways in the innovation literature. A radical innovation is considered an innovation that derives from engagement of substantial knowledge, technology and other resources, which offers higher benefits to consumers (Leifer, 2000; Sorescu, et al., 2003). Radical innovation is associated with higher risk compared to the introduction of incremental innovations, while it may offer higher benefits and even alter consumers' behaviour (Gatignon, et al., 2002; Slater, et al., 2014).[2]

The degree of innovation novelty is measured in various ways. Amara, et al. (2008) have created an index ranging from 5 to 25 as a sum of scores from different types of risk encountered by firms during the innovation process. Nieto and Santamaria (2007) made a distinction between an innovation denoting an incremental change which may include changes in the presentation, design or any other component, and innovation representing a more significant change or products incorporating new functions. These concepts generally benchmark the degree of technological improvements over the existing products and not in relation to the market, which means that an innovation can be new to the firm, but not to the market. Other concepts defining novelty of innovation in terms of a market refer to radical innovation as breakthrough (Zhou, et al., 2005; Phene, et al., 2006), disruptive (Christensen and Bower, 1996; Christensen, 1997) or discontinuous innovation (Anderson and Tushman, 1990).

Table 2.1 presents the degrees of innovation novelty defined by Oslo Manual (OECD 2005, p.36) expressing the novelty that a new product represents in a market. Products new to the firm represent the lowest degree of novelty, products new to the market express an intermediate degree of novelty, while products new to the world present the highest degree of novelty.

Table 2.1 Degrees of novelty of product innovation

Degree of novelty	Maximum	Intermediate	Minimum	Not an innovation
Category	New to the world	New to the market	New to the firm	Already in the firm

Source: Oslo Manual (OECD 2005, p. 36)

[2] The introduction of smartphones is the best recent example of how a radical innovation can affect the respective industry (technology changes inducing also imitation and incremental innovations) and consumers' behavior (shifts in demand).

The economic literature refers to the new products introduced for the first time to a firm's market or the world as a radical innovation, while new products that are only new to the firm are referred to as an incremental innovation or imitation (Cozarin, 2006; Amara, et al., 2008, 2010; Goldberg, 2008; Vega-Jurado, et al., 2008; Radas and Bozic, 2009; Plechero and Chaminade, 2010; Martinez-Roman and Romero, 2013; Bjerke and Johansson, 2014; D'Este, et al., 2015). The category of product innovation introduced for the first time to the world is rarely used in the literature as it is not included in the innovation surveys, except for Canada where the data is available, while the category on innovation new to the market is generally used for developed economies and is largely neglected in the literature on transition economies. The respective degrees or categories of novelty ensure the same measurement methodology across different countries. If a product is new to the firm's market, it presents a relative degree of novelty compared to the competition in the same market whereas products that are new to the firm only represent an imitation of the products already introduced by their competitors. Of course it has to be noted that the categorisation of new products introduced by firms depends on the subjective judgement of firms' managers, so if they lack sufficient information on products available in the market, they may incorrectly categorise the product and cause a measurement bias.

Overall, a broad range of indicators allows for flexibility in analysing the innovation process and its outcomes, but limits the generalisation of results as each indicator may present a particular perspective. The input measures such as R&D expenditure may not always result in innovation output, while patents as an output indicator may not always lead to the commercialization of the product. Alternatively, commercialised or introduced innovation output provides a direct measure of innovation success. Likewise, the data on newly introduced products provide information on the degree of innovation novelty, thus distinguishing radical from an imitative or incremental innovation. This is particularly important in analysing what determines the firm's ability to introduce radical innovation and to what extent is the novelty of innovation related to the firm performance. To understand why do firms innovate the next section critically reviews the literature on innovation theories.

2.3 Firm innovation theories

The research on the relationship between innovation and firm performance has attracted a great deal of interest. Kline and Rosenborg (1986) argue that due to the profits earned from first mover innovators, other firms engage in the imitation of the products in order to take a share of the market and profits.[3] Therefore, eventually there will be too many firms in the market which will bring down the average profit of firms into normal profit. This effect will be the driver for the subsequent innovation by some firm as whoever makes the first step gains more competitive advantage. This process turns the innovation into an engine of dynamic changes in the economy. As noted in OECD (2005), without diffusion innovation has no economic impact. Models of innovation have been modified throughout the 20th and 21st Centuries since the first work published by Schumpeter in 1934. The availability of improved data had a significant effect on the enhancement of the research methodologies and theoretical views which evolved particularly in the last thirty years. In this section we discuss the theoretical views on the firm's innovation relevant to the focus of this thesis. First, we review the Schumpeterian theory of innovation, considered as the pioneering theory in formalising the modern theoretical perspective on

[3] Markides and Geroski (2004, pp. 16-17) argue that, for companies to benefit from the presence of a first mover, a fast second mover strategy can be applied, namely by adapting the innovation and introducing it into a market just after the new product of the first mover starts to emerge. The smartphone competition strategy between Apple and Samsung can partly explain such an effect, with Apple being the first mover and Samsung being a fast follower.

innovation. Then, we discuss other alternative views on firm innovation. We conclude this section discussing the innovation and international trade theory.

2.3.1 Schumpeter's contribution to the literature on innovation

The discussion of the effects of innovation on growth dates back to the classical school. Freeman and Soete (1997) argue that in his "Wealth of Nations" Adam Smith (1776) recognised the role of innovation but under another terminology, as an improvement in machinery and as an invention by those who used the machines. Further, they note that apart from Adam Smith, Karl Marx in his model of capitalist economy of 1858 acknowledged the importance of technical change in capital goods, while Alfred Marshall in his "Principles of Economics" (1890, 1920) described knowledge as a critical factor to the economy. Despite the indications of the importance of innovation by the earlier economists, the first explicit research on innovation was conducted by Schumpeter in "The Theory of Economic Development" in 1934 and later in "Capitalism, Socialism and Democracy" in 1942. The ideas developed in the first book are now referred to as Schumpeter Mark I (1934), while those in the latter as Schumpeter Mark II (1942).[4]

Eggink (2013) notes that at the time when Schumpeter published his theories, innovation was not part of the mainstream economic thinking, but it started attracting the attention of a growing number of economists since the 1980s. As Carlsson (2003) suggests, Schumpeter's contributions in the economic literature were motivated by the needs of the society to understand sources of economic growth. Schumpeter Mark I theory is characterized by the fundamental role played by entrepreneurs and new firms in undertaking innovative activities. Schumpeter (1934) assumes a constant state of disequilibrium, created mainly by new knowledge and innovation

[4] The labels Schumpeter Mark I and Schumpeter Mark II were originally introduced by Nelson and Winter (1982) and Kamien and Schwartz (1982) to characterize synthetically the theoretical models of innovative activities proposed by Schumpeter, respectively, in the Theory of Economic Development (1934) and in Capitalism, Socialism and Democracy (1942) (See Breschi, et al., 2000). These are discussed below.

expressed through new products and technologies. He also suggests that asymmetric information among entrepreneurs explains why only some entrepreneurs possess new knowledge and convert it to new technology. He viewed an innovating firm as the manifestation of an individual possessing specific skills to undertake a new activity that could challenge other 'optimizing' firms and generate growth in the economy, thus causing a disequilibrium (Lazonick, 2005, p.32). This version of the theory meant that innovations are undertaken by small firms operating in competitive markets (as opposed to firms with market power). As Frank (1998) argues, Schumpeter's view suggests that the introduction of a radical innovation shifts the production cycle and the state of the economy which, prior to the innovation, operated in a static state where all firms earned zero economic profit.

One criticism of Schumpeter's (1934) views is related to the focus of his theory around the individual and his entrepreneurial skills, while neglecting other important sources of knowledge (Freeman, 1990, p.26). Schumpeter himself seems to have been aware of the gaps in his theory, as by observing the economic dynamics of the time his theory evolved into that known as Mark II. In his new view he contradicts his initial theory and considers that instead of being conducted by innovative entrepreneurs, innovation is undertaken on a continuous basis by the firm or corporation and leads to "creative destruction", or the introduction of new products and technologies that he refers to as radical innovations which shift or replace the existing industries (Heertje, 2006, p. 83). Schumpeter Mark II suggests that innovation is mainly determined by the role of large established firms and the presence of relevant barriers to entry due to the market domination of larger firms. He relates this hypothesis to the state of the market structure where under perfect competition with all the firms being more or less equally competitive, the incentive to invest in innovation is weak and R&D may not be promoted in a most efficient way (Gilbert, 2006). The Mark II theory is based on the view that large firms have a competitive advantage in undertaking innovation in comparison to small firms due to their technological capacities and financial abilities to bear the high cost of innovation. Large firms are able to devote profits and other financial resources to the innovation process and hire specialists and a large number of staff to conduct their R&D activities.

Schumpeter's view was contradicted by Arrow (1962) who hypothesizes that innovation intensity is higher in competitive industries. Arrow (1962, p.620) argues that the incentives of a monopolist firm to introduce an innovation are relatively lower than those of a firm in a competitive market, because the monopolist firm will have to replace their own processes or products, while a firm in a competitive market will replace the processes or products of competitors leading to a takeover of their market share and profits. While the former has to invest against its own preferred status quo, the latter will invest against the competitors preferred status quo, providing more incentives to invest for the latter. Analysing these views, Acs and Audretsch (1988) suggest that innovation is associated with large firms in monopolistic markets and concentrated industries with higher barriers to entry, while the small firms are more innovative in competitive markets. Although Schumpeter's views in Mark I and II seem contradictory, both of them tend to be applicable to different sets of firms. While the Mark I view relates more to small firms, the Mark II view relates to larger firms. In the next section we discuss alternative theoretical views on innovation.

2.3.2 Alternative theories on innovation

Following the neoclassical school which implicitly considered innovation as an important factor of growth, Solow's (1957) presented a growth model which included technological change as an exogenous explanatory factor of growth. In his model Solow assumes that technology is an externally determined factor. He suggests that the effect of technological change on the productivity of labour and capital is equal, implying that any change exerted by innovation would have the same effect on both, labour and capital factors (the so-called ‘neutral technological change’) (Verspagen, 2005). Since the neoclassical school views a firm as an optimal allocator of resources, it assumes that firms are able to adapt to the external shocks which lead to movements of the production function as well as movements along the production function (Mytelka, 2001; Hanusch and Pyka, 2007). Neoclassical economists consider that a stable economic growth is achieved by internal adjustments of labour and capital, while the long-run growth or the change left unexplained is determined by the exogenous technological change (Wong, et al., 2005; Egging, 2013).

Lazonick (2013) argues that by considering innovation an exogenous factor the neoclassical theory does not focus on the innovative firm, so it lacks a theory of firm innovation. Moreover, it only considers knowledge as a commodity in the model, but it does not make any differentiation of the knowledge per se (Mytelka, 2001). The key difference between the neoclassical and Schumpeterian view is that the former assumes an economy that always tends towards an equilibrium while the latter assumes an economy at continuous disequilibrium caused by innovation (Eggink, 2013).

Although the importance of the Schumpeterian view on innovation is recognised as the most prominent work and also as the first modern research on innovation, the empirical literature on innovation and growth was mainly based on Solow’s neoclassical model - until the 1990s. Only since early 1990s did the neoclassical growth theory evolve and knowledge was recognised to be endogenous to growth (Romer, 1990; Aghion and Howitt, 1998). The endogenous growth theory hypothesizes that the economic growth is explained by the level of innovation and technology, whereas innovation activities depend on the share of GDP dedicated to it (Grossman and Helpman, 1994). The endogenous growth theory suggests the simultaneity in the relationship between innovation and growth in the macroeconomic perspective, though a similar feedback effects are assumed also at the firm level. Since the 1990s, endogenous growth theory has been at the centre of studies considering innovation and growth, at both macro and micro levels (Crepon, et al., 1998; Wong, et al., 2005).

Alternatively, years before the endogenous growth theory was published, Nelson and Winter (1982) developed their evolutionary view which, in a micro perspective, considers innovation as an internally determined factor affected by the internal firm knowledge, organisational structure and the research and development expenditures (Scerri, 2005; Santos, et al., 2014). This view considers the development of innovation from an organisational team perspective and is more related to the Schumpeterian theory (Eggink, 2013). It also indicates that innovation models should be adapted to the changes in the market environment and the way that practical implementation of innovation activities may evolve. In this perspective, Kline and Rosenborg (1986) suggested that innovation should be treated in a non-linear model, where feedback loop effects between R&D, production and the various steps in the innovation process should be accounted for, as opposed to the common practice of looking at how innovation inputs are transformed into output in a linear dimension. In addition, it is also suggested that the market environment and institutions present an important factor of firm's determination to innovate and should be considered in the evolutionary innovation models (Edquist, 1997; Lundvall, et al., 2002). The increased importance of an interaction between the actors and of the utilisation of knowledge was acknowledged, leading to the introduction of the concept of 'innovation systems' (Mytelka, 2001). The main contributions in the literature on innovation systems put the role of institutions as a facilitator of innovation at the centre of the microeconomic perspective on innovation

(Freeman, 1988; Lundvall, 1992: Nelson, 1993; Carlsson, 2003). Lundvall, et al. (2002) argue that the concept of innovation systems and the role of institutions for the economic change was highly accepted in the developing economies, while in developed economies the dominating idea that market solves all the issues made the role of innovation systems more peripheral.

In an earlier contribution, around the time when Solow introduced his neoclassic growth model, the importance of firm resources to the development of innovation in a more structured and organised manner was introduced by Penrose (1959) in her book "The theory of the growth of the firm". The economic literature refers to the Penrose's work as the intellectual foundation of the "resource based view" (RBV) of the firm (Lazonick, 2005). Cantwell (2000) links her theory to the Schumpeterian, or as referred to, a neo-Schumpeterian school of thought because of the underlying assumptions that innovation is an internal firm factor and that R&D plays a crucial role in large firms. Penrose herself (1959, p.137) postulates that in the long run profitability, survival and growth of the firm depend on the ability of the firm to establish resources that can facilitate adaptation and extension of firms' operations in spite of the changing dynamics in the economy. Furthermore, other authors consider her work as the foundation of the resource based view, basically supporting the view that firms' heterogeneous growth is determined by their heterogeneous resources (Hatten and Hatten, 1987; Barney, 1991). The RBV aims to optimize the current resources and capabilities of the firm and increase its resource base for the future (Grant, 1996). Barney (1991) defines three key types of resources that firms rely on for developing innovation, namely the physical capital, the human capital and th organisational resources. Among the three types of resources, Senge (1990) suggests that human resources present the most relevant factor for adapting to the changing environment, access to new knowledge and continuous learning. Likewise, RBV indicates that competitive advantage relies on the valuable, rare and imitable resources (Barney, 1991; Bosch-Sijtsema and Postma, 2004; Alguezaui and Filieri, 2014). The importance of knowledge related factors is emphasized also by Zack (1999) who argues that the ability of enterprises to organise their overall resources better than their competitors and provide higher value for consumers is explained by their superior knowledge. Having a superior knowledge is a unique resource for the development of radical innovation (Zhou and Li, 2012). In this regard, a sub-strand of literature within the RBV known as knowledge based view (KBV) has mainly focused on the knowledge heterogeneity of firms (Kostopoluos, et al., 2002). As Alguezaui and Filieri, (2014, p.4) suggest, “the knowledge-based view of the firm assumes that the wealth-creating capacity of enterprises is situated on the knowledge and capabilities that they acquire and retain”.

The RBV has been criticised for its applicability in economies with limited resources. Alguezaui and Filieri (2014) indicate that firms may well organise their resources but may be limited in terms of skills, knowledge or other specific resources necessary for developing innovation. Descubes, et al. (2013) argue that in developing economies where, unlike developed economies, internal firm knowledge is relatively weak and the incremental innovation prevails, the concept of the RBV may not be appropriate. However, this problem may be tackled through external cooperation (De Faria, et al., 2010) though, as West, et al. (2014) argue, cooperation within the RBV mainly takes the form of a vertically integrated research that looks at the depth rather than the breadth of knowledge.

The breadth of knowledge or the horizontal combination of different knowledge resources matters with respect to the degree of innovation novelty (Taylor and Greve, 2006). The literature on innovation and creativity suggests that research processes that combine diverse sources of knowledge are more likely to lead to creative and unique ideas for innovation (Gilson and Shalley, 2004; Taylor and Greve, 2006). This is particularly valid for developing economies, where the internal firm knowledge is limited (Descubes, et al., 2013), as well as for transition economies although it has been largely neglected in the innovation literature related to these economies. In line with these related views, the more recent open innovation approach promotes all types of cooperation in the innovation process. The work of Chesbrough (2003, 2006) defined and framed a contemporary approach to open innovation.[5] Chesbrough (2006, p.1) defines open innovation as follows:

"Open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively."

Chesbrough (2003) assumes that firm's internal knowledge can be commercialised so that firms make a value of it, while the external knowledge can be internalized so that they can utilise the value created outside the firm. As he further argues, making use of the intellectual property only for internal purposes and in isolation from others is not an optimal option for enterprises, but alternatively they should find ways of cooperation to make use of what has already been generated in the market and combine it with their intellectual property.

The open innovation approach integrates and complements the vertical integration of research by adding the horizontal perspective of cooperation (West, et al., 2014). Also, open innovation implies coordination and cooperation cross-geographically and across different enterprises and institutions in order to share and utilise new knowledge (Alguezauri and Filieri, 2014). Bingham and Spradlin (2011, p.40) argue that firms commonly rely on employees that have skills needed for their immediate needs, and they continuously look for people with specific skills

[5] Chesbrough (2003) notes that Freeman (1988) publication is among first contributions to an open innovation concept.

that may be needed for future projects. Instead, they suggest, it is much easier to cooperate with external organisations who might possess those specific skills.

Oakey (2013) criticizes Chesbrough's approach to open innovation, mainly because cooperation may further complicate the cost, the time and the protection needed when a firm engages in R&D. Baldwin and Von-Hippel (2011) raise doubts about the legitimacy of calling it open innovation, as open innovation should provide a public good, non-rivalrous and non-excludable. Additionally, West and Bogers (2014) argue that the literature on open innovation focuses only on value creation and neglects the analysis of the capturing of the created value. However, Chesbrough and Appleyard (2007, p.60) consider that the open innovation approach accounts for the public availability of knowledge as well as the value creation and value capture, and they further specify that:

> "Notion of openness is defined as the pooling of knowledge for innovative purposes where the contributors have access to the inputs of others and cannot exert exclusive rights over the resultant innovation. In its purest form, the value created through an open process would approach that of a public good. It would be "non-rival" in that when someone "consumed" it, it would not degrade the experience of a subsequent user. It also would be "non-excludable" so all comers could gain access."

Overall, we may conclude that, compared to previous views on innovation, the open innovation approach considers both the internal and external knowledge resources in an integrated model of innovation, aiming to increase the knowledge synergy and efficiency of the innovation process. As Eggink (2013) argues, the classical and neoclassical schools of thought fail to properly explain the role of innovation in economic development mainly due to their assumption on the static state of an economy tending always towards an equilibrium, and neglecting the dynamic role of innovation in the theory. This is not the case with the evolutionary theory of innovation that extends the Schumpeterian view and adds the role of the enterprise in organising resources for innovation, as well as considering the role of the institutions outside the firm, in a more interactive model of innovation. The innovation process is complemented by an open innovation approach, where firms interactively cooperate with external agents and institutions, both horizontally and vertically. In addition, the interactive process of innovation creation and its endogenous nature should be accounted for. The evolution of the innovation related theories leads to the conclusion that the historical views on innovation are complementary to each other rather than contradictory, and except the neoclassical model of Solow (1957) that considers innovation as an exogenous factor, other views tend to relate to and complement the original Schumpeterian theories known as Mark I and Mark II. Nevertheless, although Schumpeter did emphasise the novelty of innovation, or the radical innovations that affect firm growth, the later theoretical views did not pay much attention to the novelty aspect of innovation. In the next section we discuss the theory of firm innovation and international trade.

2.3.3 Firm innovation and international trade

The importance of innovation is also acknowledged with respect to international trade both at the firm and country level. Fagerberg (1996) noted that since the 1960s it had become obvious that the US trade performance was not based on the abundant capital but rather on the technological performance of the country, and that the neoclassical view on growth and trade neglected the technological differences across countries. This led to trade theories, such as new-endowment models which relate knowledge to trade (Wakelin, 1998), while the technology and product life cycle theories became the reference point for the impact of innovation on exporting (Posner, 1961; Vernon, 1966; Krugman, 1979), which in the literature on trade is known as the technology gap theory (Maggi, 1993; Roper, et al., 2006). The first influential model was introduced by Posner (1961) who hypothesized a simplified world of two countries, a developed and a developing country, assuming that the developed country is an exporting technological leader with absolute trade advantage, while the technologically laggard economy relies mainly on imitation (Fagerberg, 1996). The model assumes that the technological leadership provides temporary monopoly power to the developed country, as the developing economy needs time to catch-up. Later, Krugman (1979) introduced a model, showing that the patterns of trade and the process of innovation and technology transfer across countries are continuous, which is acknowledged in the literature as a key contribution to the technology gap theory. Similar to Posner, he also uses a simplified model of two countries: innovating North and non-innovating South. As Fagerberg (1996) argues, the model suggests that the innovating North will continuously export new products to the non-innovating South. Further, under the constant state of other factors, non-innovating South would catch-up technologically, become capable to imitate the imported products and put pressure on the innovating North to continuously innovate in order to keep the trade balance and its relative competitiveness.

Similar to the neoclassical growth model of Solow (1957), the technology gap theory suggests a unidirectional model of innovation and trade assuming technological change as an exogenous factor. As argued in this chapter, theories on endogenous growth (Romer, 1990; Grossman and Helpman, 1994; Aghion and Howitt, 1998) have suggested for simultaneous effects between economic growth and innovation, in this case implying that innovation improves exporting and, at the same time, exporting enhances innovation. This is known as the ‘learning by exporting’ effect, as in the export markets firms are exposed to new and higher standards and knowledge (Salomon and Shaver, 2005; Harris and Moffat, 2012; Hu and Wang, 2016). However, the learning by exporting effect might not hold in all cases. For example, if a firm from Germany as one of the world's technological leaders, exports to a laggard transition economy (e.g. Kosovo) there will not be much new knowledge to be absorbed there. Similar suggestions are provided in the economic literature (Harris and Moffat, 2012; Gashi, et al., 2014). In contrast, firms are expected to learn by exporting to more developed markets where the level of knowledge and technological intensity is relatively higher (Salomon and Shaver, 2005; Silva, et al., 2012, Araujo and Salerno, 2015; Loof, et al., 2015).

The technology gap theory and the endogenous growth theory are both developed in a macroeconomic framework, but their theoretical hypothesis and assumed relationship between innovation and export performance also apply at the firm level (Kumar and Siddharthan, 1994; Wakelin, 1998; Roper, et al., 2006; Damijan, et al., 2010). Alternatively, a microeconomic model of firm's decision to engage in exporting was put forward by Melitz (2003), based on the assumption that the heterogeneous productivity of firms is the key factor behind exporting. This model assumes that the least productive firms are less competitive on the export markets so they are forced to exit and serve only the domestic market, while their export market share is taken up by more productive firms (Melitz and Ottaviano, 2008). The rationale behind this assumption is the high sunk costs incurred when exporting which increases the marginal costs of serving foreign markets, thus leading to higher export prices (Delgado, et al., 2002). So, only the most productive and efficient firms will be price competitive in the foreign market. Although Melitz (2003) does not assume that productivity improvements are innovation driven, Caldera (2010) argues that the cost decrease affecting productivity is attributable to innovation, as by introducing new technologies and production processes firms reduce their marginal cost of production. However, assumptions that process innovation or productivity improvements are a driving force behind export performance neglect the relevance of product innovation as an export driving factor, as suggested by the technology gap theory of Krugman (1979). The proposition of the technology gap theory that new products are important for firm's exporting, leads to the suggestion that the novelty of innovation matters as well, so it is not just about the firm innovation (new to the firm only), but also about the degree of innovation novelty (new to the market).

Among other views on firm's exporting, the influence of the market environment on firm behaviour is relevant- particularly as the focus of this thesis is on transition economies which are in the process of the market and institutional reforms. Beleska-Spasova (2014) argues that the domestic market factors are specific to the environment and are outside of the enterprise control, so their influence on firm's behaviour is not negligible. The domestic environment factors as measured by the uncertainty of the market environment have been generally neglected in the export related literature (Morgan, 1999; Zou and Stan, 1998; Sousa, et al., 2008; Beleska-Spasova, 2014). An uncertain environment may be characterized by intense competition, unfavourable governmental regulations, or even limited growth opportunities (Zahra, et al., 1997).

Johanson and Vahlne (1977) are the first to point out that the sequence of events in the internationalization process is determined, in part, by the conditions of a firm's domestic environment. Their model is known as the Uppsala model and suggests a gradual involvement in exporting, from an ad-hoc involvement when firms lack the knowledge of export markets, to a more intensive involvement as they gain the necessary knowledge in different export markets.[6] A 'learning by exporting' effect is not explicitly stated in the Uppsala model, but it is implicitly assumed that firm's knowledge of export market grows through experience which in turn results in further development of their operations in foreign markets (Johanson and Vahlne, 2009). An

[6] The name Uppsala model derives from the Uppsala school of Economics in Sweden.

important aspect of the Uppsala Model is the importance given to the effects of the uncertainty in the market environment. Although the uncertainty may apply in both export and domestic markets, as Johanson and Vahlne (1977) posit, firms will be inclined to focus on the market that they perceive as less risky. So, any uncertainty in the domestic market will provide a motive for firms to turn their attention to foreign markets. This happens because in the presence of domestic market uncertainty firms will target markets that may provide more certain revenue sources, offer them increased flexibility and adjustment of their overall risk (Morgan, 1999; Dixon, et al., 2010; Higon and Driffield, 2011). This is particularly relevant in the context of transition economies where continuous market reforms and policy changes may create uncertainties which affect firm behaviour, influencing firms to shift their focus towards export markets, an issue not accounted for in the previous studies on innovation and export performance of firms in transition economies.

Overall, as Johanson and Vahlne (2009) suggest, the theoretical views on the drivers of firms' export performance have evolved with market dynamics and changes in business practices, while previous theories and models still apply. Therefore, in this thesis, a complementary approach will be undertaken, accounting for several theoretical viewpoints that aim to explain firm's export performance. Other relevant views and hypotheses with respect to export performance of firms in transition economies we analyse in more details in Chapter IV and V.[7] In the next section we discuss the determinants of innovation.

2.4 Determinants of innovation

A vast amount of literature has focused on analysing the determinants of innovation across countries and industries, in economics as well as in managerial and marketing literature. Among

[7] In Chapter IV and V we also discuss the effects of networking, knowledge spillovers and foreign ownership on export performance of firms.

other studies, few of them have surveyed the literature in a historical perspective and have identified determinants of innovation used in various studies over the past few decades or since the early 1960s (Souitaris, 2002, 2003; Becheikh, et al., 2006; Erturk, 2016). Souitaris (2003) finds that the results reported in the literature differ across studies, mainly due to different measures of innovation, different control variables, samples, industries and countries. As he indicates, broadly speaking, two groups of variables can be identified, one group using quantitative measurable variables and the alternative group using qualitative measures of determinants of innovation. As Souitaris (2003) argues, a universal model of the determinants of innovation is not easy to establish, as the choice of variables was based on the context of research focusing on various economic, social and cultural aspects.

Due to the wide range of innovation determinants used in the literature, Souitaris (2002) introduced a ‘portfolio model’ of potential explanatory factors of innovation. he proposes four groups of determinants: i) contextual variables (sub-grouped into firm’s profile and competitive environment indicators); ii) indicators of external communications (sub-grouped into communication with stakeholders, external organisations and networking); iii) strategic variables (sub-grouped into innovation budget, business strategy, management attitudes, manger’s profile), and iv) indicators of organisational competencies (sub-grouped into technical and market competencies, education of personnel, training and experience of personnel and internal processes). Alternatively, Santos, et al. (2014) follow the guidelines of Cabagnols and Bas (2002) and suggest six group of factors: i) the firm characteristics; ii) the demand characteristics; iii) conditions for appropriation or the intellectual property rights indicators; iv) external sources of knowledge; v) market structure; and vi) indicators of the firm strategy. In another comprehensive survey of empirical literature on the determinants of innovation between 1993 and 2003, Becheikh, et al. (2006) propose a more simplified grouping of variables, namely the firm's internal factors and the external factors which include over 50 variables used in various studies as presented in Table 2.2.

Table 2.2 Internal and contextual determinants of innovation

Category	Variables
Firm internal factors	
Firm's general characteristics	Size / Age / Ownership / Past performance
Firm's global strategies	Defined strategic orientation / Diversified strategy / Export orientation / Differentiation strategy / Cost reduction strategy / Protection mechanisms
Firm's structure	Formal structure / Flexible structure / Centralized / Empowered employees / Interactive between units
Control activities	Financial / Strategic
Firm's culture	Resistant to change / Continuous improvement / Innovation oriented
Management	Presence of the project leader / CEO characteristics / CEO change / CEO qualification and experience / Perception of risk / Perception of innovation returns
Functional assets and strategy	R&D assets / R&D strategy / Personnel qualification and experience / Human resource strategies / Advanced equipment / Capacity utilisation / Marketing strategies / Monitoring of competitors / Financial autonomy / Turnover / Profit / Budget
External or contextual variables	
Firm's industry variables	Sector / Industry demand growth / Industry concentration
Firm's regional variables	Geographic location / Proximity
Networking	Interaction with universities / research centres / competitors / industrial and professional associations / consultants and service providers / suppliers / customers
Knowledge or Technology acquisition	Formal and informal knowledge / technology acquisition
Government and public policies	Government policies / Public financial support
Surrounding culture	Risk avoidance / Feminity vs Masculinity / Collectivism vs Individualism / Temporal orientation

Source: Becheikh, et al. (2006)

In a more recent study, Erturk (2016) suggest grouping of innovation factors into: i) objectives and effects of innovation, and ii) factors hampering innovation. The literature also suggests that industry and country characteristics moderate the effects of the determinants of innovation (Souitaris, 2003; Becheikh, et al., 2006). However, despite different methodologies used to identify innovation determinants, the literature generally employs similar factors, often named differently and generally based on theories of innovation discussed in the previous section.

The choice of variables seems to have been affected by the subject, context and theories considered in the analysis. As we do not attempt to review all the determinants of innovation used in different fields of economic literature, in this section we briefly analyse the main variables considered by the literature relevant to this thesis and related to the innovation theories discussed in the previous section.

In line with the Schumpeter Mark I and II hypotheses, the firm size is considered an influential factor for innovation. Larger firms are assumed to be more innovative as they benefit from economies of scale, accumulate a larger store of technological knowledge and capabilities, can devote more human and financial resources to the research process and can absorb risk (Damanpour, 1992; Tsai, 2001; Stock, et al., 2002). However, Kamien and Schwartz (1982) note that the effect of size has a diminishing return after a certain point. As they argue, researchers in large firms become less motivated because compensation is not directly related to their performance. This view indicates for a potential inverse U-shaped relationship between innovation and size.

In addition, the Schumpeterian Mark II hypotheses suggests that an increased market share leads to increased innovation intensity. On the other hand, as we discussed in the previous section, Arrow (1962) hypothesis that this may not be the case because motivation to innovate is more likely to be found in competitive industries. In this debate, Aghion, et al. (2005) suggest that the relationship between market share and innovation may as well be moderated by the size of the firms, as smaller firms tend to be more innovative in competitive industries, while larger firms in oligopolistic industries. Studies also indicate that the age of the firm, or its experience, is an important explanatory factor for innovation, although this has received little attention in the context of innovation (Balasubramanian and Lee, 2008). The rationale is that firms accumulate knowledge and experience through time which help them in producing innovation (Freel, 2003). In contrast, and in line with the Schumpeter Mark I hypotheses, entrepreneurs usually represent younger firms expected to be inclined towards radical innovation (Acs, et al., 1997). These theories produce contrasting views on whether younger or older firms are more innovative.

With respect to the resource and knowledge based views, the literature associates the technological and human capacities as the key firm factors that facilitate the exploitation and transformation of new knowledge into new products and/or processes (Crepon, et al., 1998; Keizer, et al., 2002; Landry, et al., 2002). Internal firm capacities are mainly expressed by internal R&D expenditures. Pepall, et al. (2008, p.572) considers that technology is the main driver of innovation, while others (Avermaete, et al., 2004; Hausman, 2005; Roper, et al., 2006) suggest that highly skilled or educated employees and the relatively higher knowledge base of firms are the most important push factors for innovation.

In line with the open innovation theory (Chesbrough, 2003, 2006), networking and cooperation with external organisations and agents such as universities, research laboratories, consultants, suppliers as well as customer are suggested to facilitate innovation, although the significance and magnitude of the effects is not consistent among various studies (Parida, et al., 2012; Hemert, et al., 2013; Spithoven, et al., 2013; Theyel, 2013). In a survey of open innovation literature of SMEs, Hossain (2015) indicates that cooperation also matters for the degree of innovation novelty. Overall, while the literature has generally assessed the effect of different types of cooperation on the degree of innovation novelty, the relevance of a multifaceted cooperation for innovation which may facilitate creativity and unique ideas as suggested by Taylor and Greve (2006) has not been accounted for in the previous literature, in particular for the case of transition economies.

Based on the evolutionary view of Nelson and Winter (1982), the market environment factors are important for innovation. The economic literature has considered environmental factors from the perspective of perceived obstacles arising from the market environment that firms operate in. Among other factors, cost, knowledge and access to market barriers are considered as main obstacle to innovation (Galia, et al., 2012; D'este, et al., 2015). In addition, the literature on innovation systems emphasizes the role of government's supportive policies or the public financial support as an important facilitator of innovation (Goldberg, et al., 2008; Hewit-Dundas and Roper, 2010; Hashi and Stojcic, 2013). As an additional systematic support for innovation, a strong appropriability system, or good protection of intellectual property rights is positively related to expected profits, and as such acts as a push factor for innovation (Griffith, et al., 2006).

Among other factors, knowledge spillovers enhance firms' knowledge and innovation (Bozic and Mohnen, 2016). Knowledge spillovers or information from external sources, such as of market sources, universities or industrial associations is considered to enhance the innovation process (Martinez-Roman and Romero, 2013; Bjerke and Johansson, 2014). Delgado, et al. (2016) suggests that knowledge spillovers are facilitated also by clusters or a geographical proximity of different innovation related stakeholders such as companies, institutions and other organisations which are related by knowledge, skills, inputs, demand, and/or other linkages. Similar to the knowledge spillover concept, exporting firms also learn by exporting, as suggested by the endogenous growth theory, a factor that is assumed to positively affect innovation (Erturk, 2016). Foreign owned firms are also assumed to have wider access to knowledge and technology, as well as more diverse experience which makes them more prone to innovation (Domadenik, et al., 2008; Guadalupe, et al., 2012).

Freel (2003) reports significant differences between the size and significance of the determinants of innovation when different industries are considered. In this regard, Pavit (1984) suggested to take into account the presence of heterogeneity between different industrial sectors. He introduced a taxonomy to describe technological behaviour of innovating firms by grouping them into four main categories based on their technological trajectories: supplier dominated firms, specialised suppliers, science based firms and scale-intensive firms. Alternatively, OECD (1997) has classified manufacturing industries into four categories based on the R&D expenditure as a proportion of total turnover. Industries are divided into: high-technology industries, medium-high-technology industries, medium-low-technology industries and low-technology industries. Both these taxonomies have been criticized for their limited applicability across different industries. Pavit's taxonomy is based on the aggregated industry innovation data, it neglects the possibility that firms may belong to more than one sector at the same time and that it is mainly applicable in the manufacturing sector (Archibugi, 2001), while Baldwin and Gellatly (1998) argue that the OECD taxonomy defines technology intensities by referring to the main activity of the firm which results in some industries being overestimated and some underestimated. Most of the studies on innovation generally control for the industry heterogeneity, while some of them also explore differences in the determinants of innovation across manufacturing and services sector (Bozic and Mohnen, 2016). In Chapter III we discuss in more details the empirical literature on determinants of innovation input and output and their expected effects.

In summary, the review of the literature in this and the previous sections of this chapter identifies some of the gaps that we aim to address in the empirical chapters of the thesis. First, although the importance of the novelty of innovation and its effect on firm growth has been emphasized since the time of Schumpeter through his "creative destruction" view, and the information on products new to the market have been available in the Eurostat's Community Innovation Surveys since 1993, the studies on the novelty of innovation were mainly undertaken for the developed economies, while the transition context is largely neglected. Furthermore, the more recent approach on 'open innovation' and its relevance for radical innovations (products new to the market) has not been fully explored, in particular with respect to a multi-stakeholder cooperation for innovation that facilitates access to a diverse knowledge. In addition, although the technology gap theory (Krugman, 1979) suggested competitiveness in foreign markets is enhanced by innovations (products new to the market), studies analysing the effect of innovation on export performance of firms did not account for the degree of novelty. Finally, the Uppsala view of international trade suggesting that an uncertain domestic environment (a relevant feature of transition economies) pushes firms towards export markets, has also not been addressed in the literature on innovation and firm's export performance.

In the following section we review the literature on innovation in the context of transition economies.

2.5 The transition context and innovation

Transition economies in the Central Eastern European countries (CEECs) and the former Soviet countries have started the transition period in late 1980s, moving from the communist economic system towards a market economy.[8] North (1990) points out that the reform process is a crucial factor for economic prosperity of these countries, a point later supported by various authors indicating a positive relationship between the quality of institutions and growth (Williamson, 2000; Roland, 2005, Efendic, et al., 2011; Estrin et al., 2013; Driffield, et al., 2013).

[8] The other countries in transition in other regions of the world (China, Cambodia, Vietnam, Laos, e.g.) are beyond the scope of analysis in this thesis and we will not discuss them.

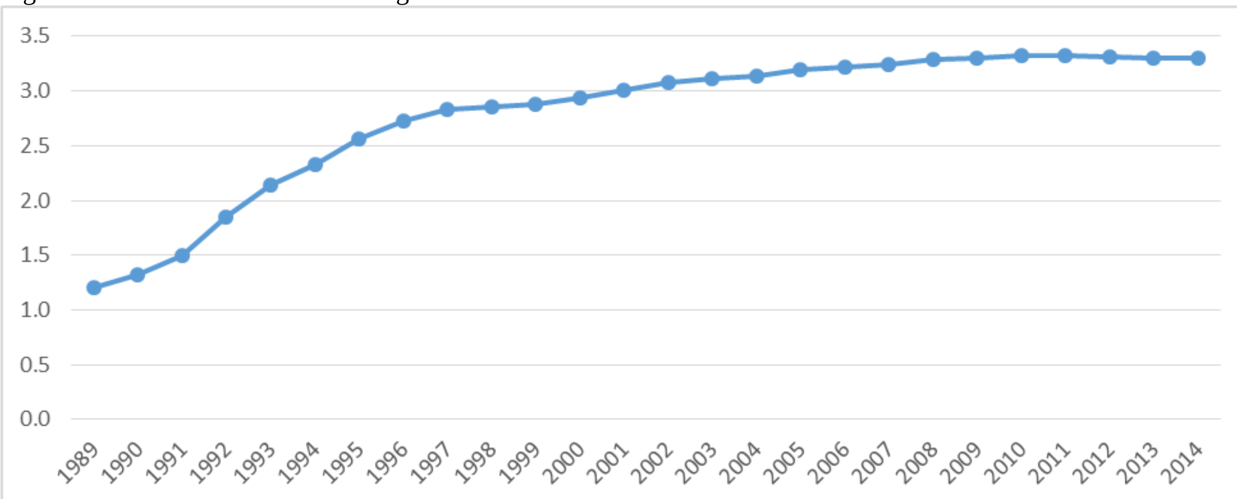
In the process of transition, the establishment of the market oriented institutions and the implementation of economic reforms presented two main challenges for the respective countries (Sonin, 2013; Sikulova and Karol, 2014).[9] The transition approach differed across countries, with some in the CEECs (e.g. Poland, Estonia, Slovakia, Czech Republic) following the neoclassical so-called shock therapy approach or a more radical macroeconomic, structural and institutional reforms, while others (e.g. Slovenia, Hungary, Romania) implementing a more evolutionary approach aiming to reform the economy as well as support the catching up of enterprises in new market conditions more gradually (Sikulova and Karol, 2014; Dana and Ramadani, 2015). Different starting points, or initial conditions, affected the pace of reforms and created heterogeneity in the level of progress in transition across different countries. The transition economies needed to catch up fast in order to keep up with the pace of technological change and achieve the standards of industrialised economies which in the developed countries were reached over a long term period (Murrel, 2005).

After 25 years since the beginning of the transition period, only few countries have almost reached the level of industrialised economies, while most of them still lagging behind. Kosovo being the last country in Europe to enter the transition process is considered the most laggard European transition economy (EBRD, 2013). The level of transition progress is assessed by the European Bank for Reconstruction and Development (EBRD) on an annual basis considering the progress in several aspects of transition. The progress is quantified on a scale of 1 to 4+ (or 4.3) with 1 indicating the lowest level of transition progress and 4.3 indicating the level equal to that

[9] The transition reforms followed the Anglo-Saxon model aiming to create institutions that can maintain a stable market environment with extensive coordination of market actors and no interference from political or social actors (Tache, 2008).

of an industrialised economy.[10] Figure 2.1 shows the transition index averaged across all transition economies over the period 1989 – 2014.

Figure 2.1 The transition index averaged across all transition economies 1989 - 2014



Source: Author's own calculation using EBRD transition data

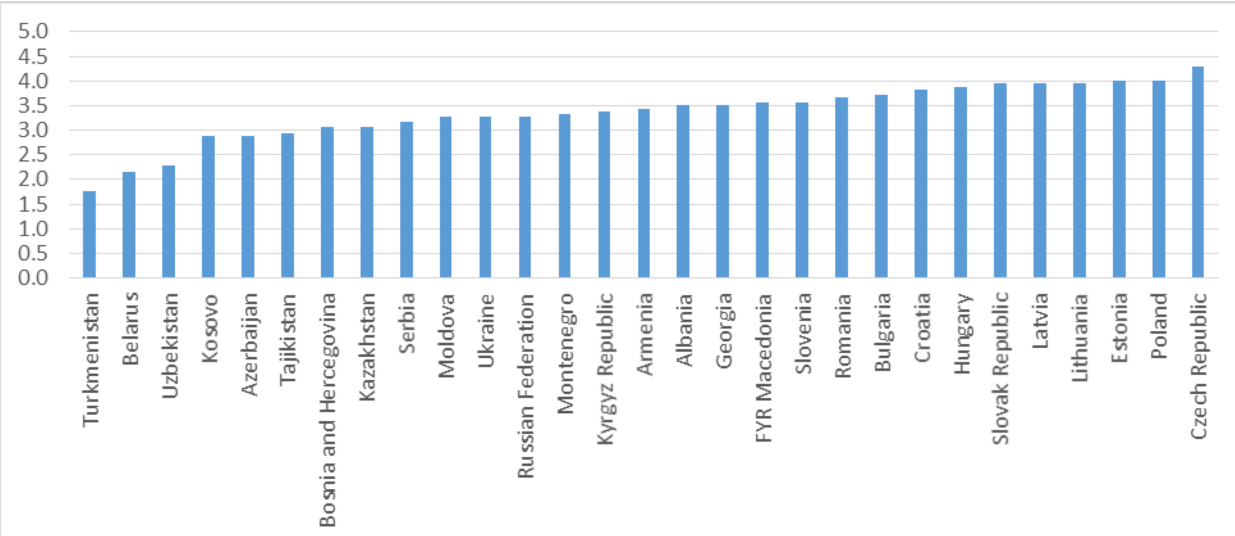
It is indicative that in the first decade of transition, countries seem to have been more offensive in reforming policies and establishing market oriented institutions, while since 2000 the rate of change seems to have been much slower. Some authors argue that due to the liberalisation of trade and privatisation of state owned enterprises it was easier to make a huge difference at the earlier stage of transition (Roland, 2005; Falcetti, et al., 2006).

Figure 2.2 presents the transition index by country for 2014. Some of the countries are still lagging behind and only few of them have reached comparable levels with other developed countries. One common aspect of the most advanced economies (transition index score of about 4) is that all of them are EU members. This indicates that the pressure to join the EU motivated countries to speed up their institutional reforms. On the other hand, most laggard economies

[10] EBRD provides a broad range of indices, while the microeconomic and market and trade related reforms are grouped into six main areas: i) large scale privatisation;; ii) small scale privatisation; iii) firm restructuring and governance;; iv) price liberalisation; v) trade and foreign exchange system liberalisation; and vi) competition policy. The scores for the six indicators are averaged to produce 'The transition index'. In Chapter 4 we discuss in more details the relevance of stages of transition and define transition stages based on the EBRD transition index.

(transition index score less than 3) are a group of the former Soviet Union countries and Kosovo. While few countries are at the lower (laggard reformers) or upper (advanced reformers) end of the transition index score, most of them are in an intermediate stage of transition.

Figure 2.2 Transition index 2014, by country



Source: Author's own calculation using EBRD transition data

The market driven environment influenced the creation of a vast number of new enterprises.[11] Their contribution to the economy was remarkable and they are regarded as the main sources of growth in CEECs (Manev, et al., 2014). SMEs in particular had a strong influence on the economic development due to their ability to innovate new products and processes (Bruque and Moyano, 2007; EBRD, 2014). However, Radosevic (2009) suggests that compared to firms in developed economies the capability of firms in transition countries to develop innovation is much weaker, while Radas and Bozic (2009) indicate that firms in transition economies are mostly associated with incremental innovation. Among other reasons, limited knowledge absorption

[11] Entrepreneurship was developed in the former Yugoslavia also in the pre-transition period, as an exception from other former transition economies of the time, as it applied a type of market socialism allowing for the public, cooperative and social ownership as well as micro sized private enterprises.

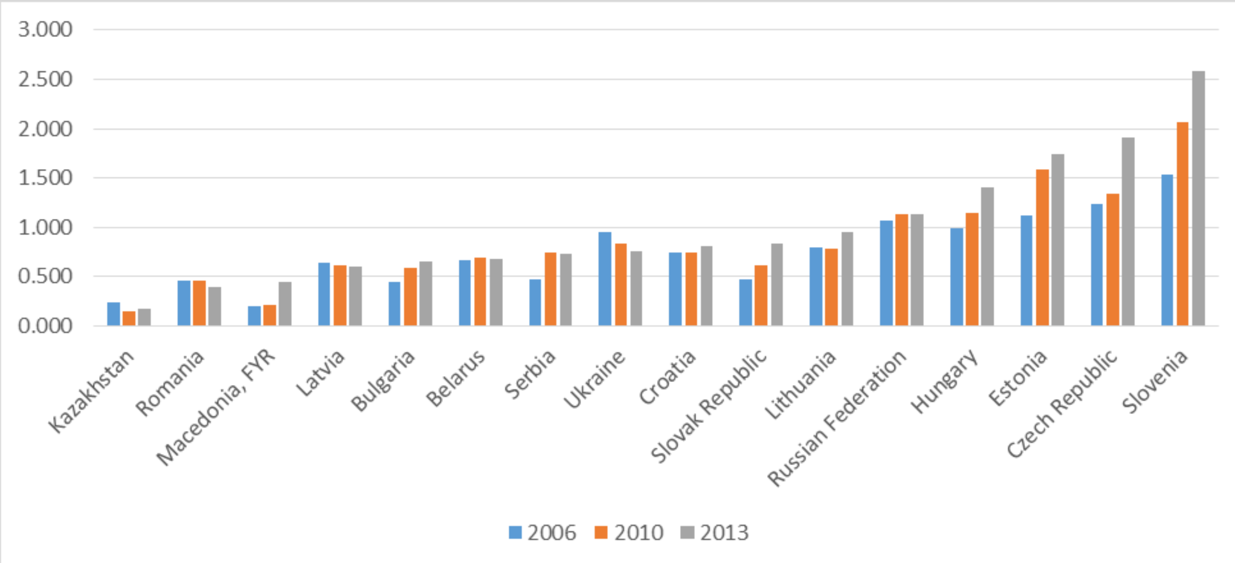
capacities negatively affected catching up with technological changes (Filatotchev, et al., 2003; Grimpe and Sofka, 2009; Roper, 2009). New enterprises lacked access to public support for innovation (Jasinski, 2003), while re-established firms had to contest their working culture inherited from the centralized economic systems with not much reflection on the technological changes (Dyker, 2004, p.203).

However, to increase productivity and competitiveness, firms in transition countries had to engage in innovation activities (Svarc, 2006; Costantini and Melitz, 2008). This created the so called ‘innovation paradox’, or the case when economies try to intensify innovation activities in order to develop new products and processes, increase productivity and stimulate growth, while at the same time lacking internal capabilities to undertake innovation (Oughton, et al., 2002).[12] Svarc (2006) emphasizes that some transition countries, such as Slovenia, Hungary and Estonia have made great progress in terms of economic development and transition reforms in the earlier phase of transition, but their knowledge-based factors and innovation capacities have not been successfully realised. As Figure 2.3 shows, most of the transition economies experienced a positive trend in their innovation intensity over the last decade, with Slovenia, Czech Republic, Estonia and Hungary being more intensive innovating countries, as measured by the share of research and development expenditure in GDP.[13]

[12] Rodrik (2006) analyses the alternative export growth model of China, a more specific transition economy, where export growth has facilitated a rapid economic growth. He argues that despite the fact that China has comparative advantage in labour supply and labour intensive exports (toys, garments, simple electronics assembly) her success was driven also by highly sophisticated products, presenting a paradox for a country that can match the bundle of export sophisticated products to countries with an income per-capita of three times higher. As Rodrik further suggests, “it is not how much you export, but what products you export that matters”. The China model is a specific case, mainly due to the scale of the economy and the labour supply advantage, but the product sophistication through innovation can be also applied by firms in the CEECs and former Soviet countries that are in the focus of this thesis.

[13] Expenditures for research and development are current and capital expenditures (both public and private) on creative work undertaken systematically to increase knowledge, including knowledge of humanity, culture, and society, and the use of knowledge for new applications. R&D covers basic research, applied research, and experimental development (World Bank Indicators Databank, 2016).

Figure 2.3 Research and development expenditure as % of GDP in 2006, 2010 and 2013



Source: World Bank Databank (Data for other countries is not available)

Slovenia seems to be the only transition economy to aim for the R&D investment target set by the EU, as its investment in research and development reached at about 2.5 percent of GDP, while only four other countries (Czech Republic, Estonia, Hungary and Russian Federation) have invested over 1 percent of GDP in research and development. The positive trend of innovation investments for most of the countries suggests that as countries advance in their transition reforms investment risks decrease while market opportunities increase, influencing innovation and private sector growth (Boerner and Hainz 2009; Driffield, et al., 2013).

The investment in research and development at the country level indicates some degree of positive correlation with transition reforms, as the four more advanced reforming countries appear to be also the more intensive innovating economies. Among other factors, the restoration of private ownership, privatisation of state owned enterprises and enforcement of property rights protection are suggested to have shaped the structure of firms and induced innovation and market dynamism in transition economies (Karlsson and Dahlberg, 2003; Driffield, et al., 2013; Sonin, 2013; Dana and Ramadani, 2015). Domadenik, et al. (2008) note that imposing budget constraints for the large socially-owned firms and facilitation of new firm creation induced a greater competition and increased innovative efforts of enterprises since the early phase of transition in Slovenia.

Undertaking reforms leading to the establishment of supportive legislation, liberalisation of trade and creation of privatisation opportunities, as well as a relatively cheap labour force, attracted significant amounts of foreign investors over a historically short period of time (Kalotay and Hunya, 2000; Smallbone and Welter, 2009). FDIs have been a key vehicle of technology diffusion world-wide, and transition countries were no exception (Dyker, 2001). Foreign investors were more proactive in introducing new technologies and were more intensive in innovation activities (Szanyi, 1997; Zemplinerova, 1998; Uzagalieva, 2012). The literature also suggests the knowledge spillovers from foreign firms to the domestic firms which may further induce innovative activities (Fagerberg and Srholec, 2008). Foreign firms also play an important role in fostering innovation cooperation networks in the countries they operate (Kurz and Wittke, 1998; Uzagalieva, 2012).

With respect to networking, Grimpe and Sofka (2009) emphasize that cooperation with customers on the one hand and with academic institutions on the other hand have shown to be a promising innovation strategy in transition countries. In contrast, Jasinski (1997) suggests that policies supporting links between academia and industry have produced only some isolated successes in mid 1990s but there was no great impact at the aggregate level. Similarly, Roper (2009) indicates that in Western Balkan (WB) countries, in-house R&D and employees with university education make little contribution to innovation. He further suggests that the university-business linkages across the WBCs follow the traditional science approach rather than more contemporary innovation models based on stronger collaborative relationships.

To shift from the traditional or institutional based research to a more market oriented system of knowledge sharing and innovation, transition countries followed the models of the developed economies (Radosevic, 2009). In Croatia for example, building an innovation policy as a new growth paradigm has gone through three phases. The first phase centralized the science policy according to the models of neighbouring west European countries. The second aimed to create a development model of science-industry cooperation and financial support for innovative small and medium enterprises based on the best practices applied in Germany and Italy. The third phase aimed to establish the national innovation system through the government's public-policy innovation programme. Kravtsova and Radosevic (2012) note that, among the CEECs, Slovenia, Czech Republic, Hungary and Estonia have applied a broader range of policy instruments for innovation. EBRD (2014) suggests that similar innovation policies have been undertaken across the transition economies. However, a one size fits all policy has not proved appropriate due to these countries being at different levels of economic development and stages of transition reforms (EBRD, 2014; Veugelers and Schweiger 2015).

Overall, after over two decades of transition reforms and institutional changes, some transition economies have gradually progressed in reaching standards of advanced industrial economies (Canada, Spain, Sweden, UK, US, e.g.) while most of the countries are still lagging behind. Similarly, despite a positive trend in intensifying innovation activities in most transition countries, the level of investments in the majority of the countries is below 1 percent of GDP, while the EU targets aim to reach an average of 3 percent of GDP by 2020. The development of supportive innovation systems and public policies that provide incentives for innovation and promote innovation networks, are preconditions for the intensification of innovation activities in transition economies. However, as suggested by the literature, policies should be adapted to the specific context of each country, due to differences in the level of development and the stage of reforms (Veugelers and Schweiger 2015).

To sum up, we can conclude that the transition countries present a heterogeneous environment in terms of the transition progress. This is observed in the process of implementation of the reforms and, influenced by the restoration of private ownership, privatisation of publicly owned enterprises and enforcement of property rights, among others, also in increasing capacities for innovation and firm growth in general. As a result, the effect of innovation on firm performance may be moderated by progress in transition or the stages of transition, an approach not considered in the literature to date which we aim to address in this thesis.

In the following section we review the empirical literature on innovation and firm performance.

2.6 Review of the empirical literature

In this section we review the empirical literature on innovation and firm performance relationship and the literature on innovation and export performance relationship. Here we provide only the main findings of the literature on the effects of innovation on performance and exporting and the reverse relationship, while the more detailed discussions on the effects of the determinants of innovation and firm performance, as well as export performance, are discussed in the empirical chapters III, IV and V of the thesis.

2.6.1 The literature on innovation and firm performance relationship

Since Solow's (1957) decomposition of economic growth much research has focused on the factors which underlie the productivity residual, that part of output growth not explained by the growth of factor inputs (O'Mahony and Vecchi, 2002). Solow (1957) suggested that technological change is one of the key factors explaining productivity and economic growth of the United States during the 20th century. The productivity slowdown noted in much of the industrialised world in the 1970s, increased the interest of researchers to estimate the effect of innovation on firm productivity (Griliches, 1986).[14] Early research models on firm innovation and performance were based on the Cobb-Douglas production function augmented with a technology variable (Griliches, 1979). The model postulates that R&D or innovation is the engine of growth, assuming that it is determined exogenously. Apart from traditional inputs such as labour and capital, the innovation indicator added to the model is approximated by the stock of R&D capital or the flow of expenditures, expected to improve productivity (Griliches, 1980). As Griliches (1979) points out, because the model takes into account only R&D, it ignores imitation and other sources of quality changes that are not the direct product of R&D activity.

Various authors (Mansfield, 1965; Minasian, 1969; Griliches, 1980) investigated the relationship between R&D capital stock and total factor productivity using data on US firms and the results generally confirmed the positive and significant effect of R&D on productivity. Griliches (1980) used US data on 39 manufacturing industries at 3-digit level for the period 1959-1977. He found that for the first period from 1959-1967 the elasticity of the annual growth rate of productivity with respect to the R&D growth rate was 0.07. In the second period, however, the R&D estimate is found to be close to zero, suggesting that it accounted for more than a quarter of the productivity slowdown in the estimated period. This finding suggested that past R&D was embodied in the new technology of the time, so if there was a slowdown in capital growth it reduced or postponed the effect of R&D on productivity. This suggestion is important in the sense

[14] Cullison (1989) suggests that four factors mainly contributed to the US productivity slowdown in 1970s: a decline in investment per worker; more intensive environmental and worker protection regulations; the end of the population shift from low productivity farm and self-employed jobs to higher productivity jobs; and, the effects of the 1973-75 and 1980-82 recessions on economic growth.

that R&D of the current period may not be considered as the source of firm productivity or performance in the same period, but it is the past R&D activity which impacts firm productivity in the current period.

In another study in 1986, Griliches used a much larger firm level data of over 1000 large manufacturing companies for the same period. In this study he was able to distinguish between basic R&D and other forms of R&D, and between private and state financed R&D investments. In comparison to his previous study, he finds slightly higher elasticity of R&D, which is said to be due to the better data set. In addition, cross section and time dimension estimate of R&D indicated similar results, suggesting that current and past R&D have significant and positive impact on productivity. He reports three main findings in this paper. First, R&D contributed positively to productivity increase. Second, basic research appeared to be more important than other types of R&D in relation to productivity, and third, privately financed R&D expenditures appeared more effective than state financed R&D. Moreover, he found that differences in levels of productivity and profitability are related to differences in the basic research intensity of firms. He emphasized that the results may be subject to simultaneity issue as R&D may not be the component that causes firm success as measured by productivity and profitability, but rather that success allows firms to indulge on this type of 'luxuries'.

The significant and positive impact of R&D capital on productivity differences among firms were supported by studies of Cuneo and Mairesse (1984) and Mairesse and Cuneo (1985) for France and by Sassenou (1988) for Japan. Sassenou (1988) in a cross section analyses reports the size of R&D coefficient of 0.10 for the whole sample and 0.16 for firms belonging to the scientific sector. This finding indicates that in science-intensive industries the impact of R&D on productivity is higher comparing to the average impact for the whole sample. In other studies, in

Japan, Goto and Suzuki (1989) find that R&D growth and productivity growth are positively related. Kwon ad Inui (2003) find that R&D elasticity is significantly higher for the large and high technology firms than for other types of firms. Harhoff (1994) investigated R&D and productivity relationship in German manufacturing firms for the period 1977-1989 using sales as a measure of firm performance, and found that the elasticity of sales with respect to knowledge capital is in order of 14 percent. In the time-series estimation, the estimates are smaller but remain positive and significant.

Brower and Kleinknecht (1994) and Geroski, et al. (1993) found a significant and positive relationship between R&D and profit margin as another measure of performance. Geroski, et al. (1993) show a causal relationship which runs from changes in R&D to the changes in profit margin. Some other studies (Griliches and Mairesse, 1991; Hall and Mairesse, 1995; Wakelin, 2001) using firm level data and investigating the effect of R&D expenditure on productivity found the R&D coefficients to be slightly higher than of the previous studies. Wakelin (2001) in a study of UK innovating firms for the period 1988-1992 indicate a significant and positive impact of R&D on productivity similar to the results from the US, France and Japan. In addition, when sector fixed effects are included in the model, R&D appeared to become insignificant, suggesting an important role for sectors in explaining productivity. In a more recent study, Sterlacchini and Venturini (2013) perform a panel estimation of the elasticity of manufacturing industry productivity with respect to the stock of R&D capital by using data for 12 manufacturing industries for five developed countries (US, Germany, France, Spain, Italy) over the period 1980-2002. They find that elasticity of productivity with respect to R&D is highest in US and lowest in Italy. They suggest that across industries there are uneven capabilities to translate the internally generated knowledge into productivity growth. This implies that European Countries are still relying on a lower knowledge base compared to the US.

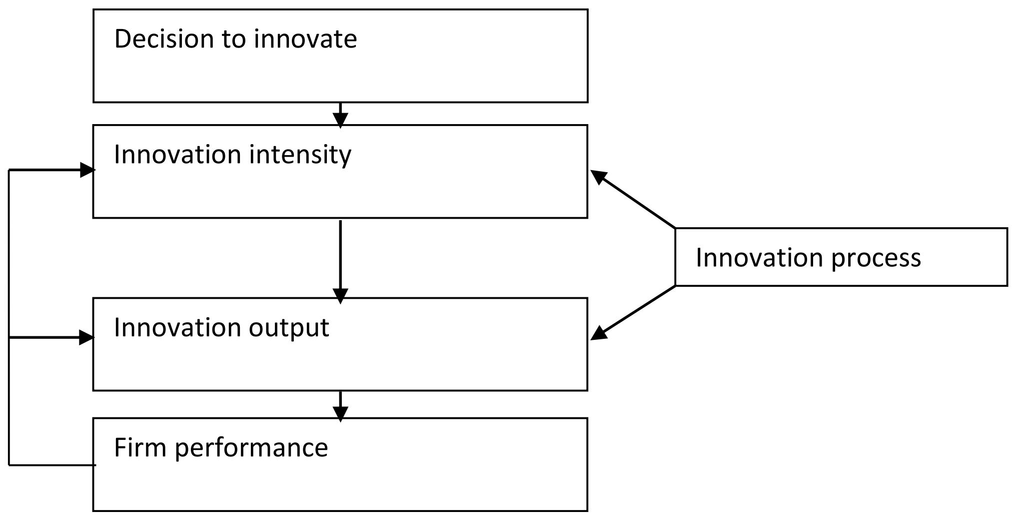
While the positive relationship between R&D and productivity has been generally confirmed by various studies in different countries, there are considerable variations in terms of size and significance of the R&D effect. Even though the evidence shows that there is a positive effect, R&D has limited explanatory power in explaining differences among firms, sectors and countries (Griliches and Mairesse, 1991). Including R&D as an input factor in the production function may not capture the full impact of innovation on productivity. If new products or processes developed from R&D are not commercialised, these R&D investments cannot have any impact on productivity. In particular, when the analysis focuses on SMEs, R&D expenditure is not the right measure to investigate the relationship between innovation and firm performance as most of them do not have an R&D department, may acquire their R&D externally, and may not keep separate specific records of their R&D expenditure. In addition, samples composed of firms which conduct R&D may produce biased results as they leave out firms which have not conducted R&D. Another limitation of the previous literature arises from the simultaneity bias between innovation and productivity which has generally not been accounted for.

Some of the methodological limitations observed in the earlier literature on firm innovation and performance has been addressed by Crepon, et al. (1998) who introduced a multi-stage model of innovation known as the CDM model.[15] This model is a substantial improvement in the methodology of innovation studies at the firm level as it comprehensively analyses the innovation process and the complexity of conversion from inputs to commercialised output and its impact on firm performance. Figure 2.4 presents the innovation process as portrayed in four stages by the

[15]CDM refers to the initials of three authors of the model, Crepon, Duguet and Mairesse.

CDM model and how different elements of the process are linked to each other together with the feedback in different stages.

Figure 2.4 The CDM Model



Source: Kemp, et al. (2003, p. 10)

The first stage of the model is concerned with the firms' decision on whether or not they wish to engage in innovation (propensity to innovate equation); therefore, all firms are considered in the analysis. Following the decision to innovate, the sample in the second stage of the model consists of only those firms who invest in research and development (innovation intensity equation). The conversion of inputs into output is analysed in the third stage of the model (innovation output equation), while the fourth stage investigates the impact of innovation output on performance (the firm performance equation).

The CDM model controls for two limitations which were common in innovation studies. The first one is the sample selection bias, which occurs when only innovating firms are included in the sample. The second one is the simultaneity between innovation and performance as predicted by the endogenous growth theory, which is accounted for by the estimation methodology which allows for full correlation between the disturbances.[16]

In the initial CDM model, the propensity to innovate function is expressed by a dummy dependent variable taking the value of one if firms have engaged in R&D activity, and zero otherwise. In the innovation intensity function the dependent variable expresses innovation effort as measured by the intensity of R&D expenditures. The innovation output function is expressed by product innovation sales (the proportion of sales from innovative products on total sales) and alternatively by the number of patents. The firm performance function is a Cobb-Douglas production function augmented by innovation output. Crepon, et al. (1998) use the asymptotic least square system estimation to allow for correlation between the disturbance terms of the four equations, assuming that causality may run from one to another. Drawing on French manufacturing firm data they find that innovation output with respect to both innovation sales and number of patents increases with the firm's research effort, as measured by research capital expenditures per employee. For patents as a measure of innovation output, the indicated elasticity of R&D is about 0.9 while for innovation sales is about 0.4.

Although the initial CDM model portrayed the full flow of the effects between firm innovation and performance and accounted for potential simultaneity, as Loof and Heshmati (2002) note, it did not include a feedback effect of productivity on innovation output. In addition, it also relied on the assumption that the correlation of disturbances is possible between the propensity to innovate and firm performance function, while as Loof and Heshmati (2002, 2006) suggest, one can account only for an eventual semi-correlation between the input phase and the

[16] The econometric approach of the CDM model is discussed in more details in Chapter III. In addition, while findings of the literature related to all four steps of the model are elaborated in Chapter III, in this section we only discuss empirical findings on the effects of innovation output on performance and vice versa.

output phase. Therefore, they proposed an alternative estimation methodology, the so-called ‘modified CDM model’, estimating a system of two equations (the propensity to innovate and innovation intensity equations) accounting for the sample selection bias in the first step, and a system of two simultaneous equations accounting for the causality between innovation output and firm performance in the second step.

Using the modified CDM model and Swedish CIS data for the period from 1996 to 1998, Loof and Heshmati (2002) find the impact of R&D intensity on innovation output to be positive and significant with an elasticity of about 0.3. They account also for the feedback effect of productivity on innovation output, but find an insignificant effect and even negative. While the elasticity of productivity growth with respect to innovation output is reported positive and significant and in the range of previous studies, similar to Crepon, et al. (1998). Additionally, using the same CIS data, Loof and Heshmati (2006) show that the effects of R&D intensity on innovation output are somewhat similar between the manufacturing and service sector firms in Sweden while the elasticity of innovation output with respect to R&D intensity is relatively larger than of previous studies, or about 0.5 to 0.6. Using different measures of performance (annual growth rate, value added per employee, sales per employee, profit per employee), they find that innovation output has a positive effect on productivity in both sectors; on sales growth only for manufacturing sector; and on employment increase and profit growth only for the service sector. They also investigate the relevance of innovation novelty, controlling for the sales of products new to the market, and find a significant and positive effect on productivity growth for the manufacturing sector. Similar effect of products new to the market on performance of French manufacturing firms is indicated by Barlet, et al. (2000) employing a logistic regression. In another study, drawing on Swedish CIS data for the period 2002 – 2004, Johanson and Loof (2009) suggest that innovation output is an increasing function of innovation input and that labour productivity is significantly associated with innovation output with an estimated elasticity of 0.3 to 0.5.

As an alternative to the previous CDM methodologies, Grifith, et al. (2006) assume that all firms engage in some level of innovation and expend some type on innovation expenditures (even if they do not report such expenditure) so all of them should be included in all stages of the analysis. Therefore, they predict research expenditures for all firms from the first step estimation (joint estimation of the first two equations) of the CDM model. They use the CIS data for France, Spain, UK and Germany for the period between 1998 and 2000 and find that innovation output expressed by product or process innovation is positively associated with R&D intensity, and productivity was found to be significantly associated with innovation investments for all four countries, with a magnitude of effect as in previous studies (elasticity of between 0.6 to 0.13), while with respect to product innovation they find an insignificant effect only for Germany. In contrast, they did not find a significant relationship between firm productivity and process innovation, except in the case of France.

Kemp, et al. (2003) investigate the relationship between innovation and firm performance for the case of the Netherlands. They use turnover growth, employment growth and profitability as measures of performance. As an alternative to the CDM model, they use single equation instrumental variable approach instead of simultaneous equation models. This approach involves predicting values for the dependent variable in each stage of the CDM model and using it as an instrument in the next stage, which imposes a higher level of collinearity between the explanatory variables and in turn may bias the results of each stage. On the other hand, the CDM model uses only the predicted values of innovation intensity as an explanatory variable in the innovation output equation to account for the potential endogeneity between the two, while the endogeneity between innovation output (Stage 3) and firm performance (Stage 4) is properly accounted by the simultaneous equation estimation. They indicate a significant positive effect of innovation output on turnover growth and employment growth, but not on profitability and productivity. They also demonstrate the positive effect of turnover growth and profit on innovation input and output is also indicated, suggesting that larger turnovers and profits induce innovative activities.

An alternative methodology also applied by Folkeringa, et al. (2005) who draw on panel data to investigate the relationship between innovation effort and turnover growth and employment growth of Dutch firms. They employ multiple regression analysis and include lagged values to account for the causal relationship between innovation and performance. Their results indicate that process innovation generates higher turnover growth, while direct effects of new products and services on turnover growth are weaker. In another study for the Netherlands, using the same measures of performance Klomp and van Leeuwen (2001) also find a positive effect of innovation on turnover growth, but an insignificant relationship between innovation and employment growth. In addition, Hall, et al. (2009) using the modified CDM version (the version of Griffith, et al., 2006) suggest a positive effect of R&D intensity on the introduction of product or process innovation in Italian SMEs, while productivity increase is reported to be more strongly associated with product innovation as opposed to process innovation.

Only few studies have investigated the relationship between innovation and firm performance in relevant transition economies, something that will be addressed in this thesis. A study by Masso and Vahter (2008) investigated innovation and firm performance relationship for Estonia, applying the modified CDM methodology developed by Griffith, et al. (2006). They find that product innovation is significantly and positively affected by innovation effort, while productivity increases significantly only with respect to product innovation. A positive relationship between innovation output and performance is reported also by Stoevsky (2005) and Roud (2007) for Bulgaria and Russia respectively. More recently, Hashi and Stojcic (2013) apply the CDM model using the CIS 2002–2004 dataset for a set of 16 European countries, including developed and transition economies. They report that investment in innovation activities positively influences the sales of new products which, in turn, contributes to productivity increase. They indicate a positive but insignificant effect of productivity on innovation output only for developed economies and a negative and significant effect for transition economies. They argue that this might be due to a high specialization of firms in TEs in labour intensive products.

Overall, although a positive relationship between innovation and firm performance is commonly found in the previous studies, findings in the literature are not conclusive and suggest that the magnitude and sign of the effect of innovation on firm performance may be influenced by the measures of performance employed and the development context of countries under consideration. The bulk of previous studies cover developed economies, whereas in transition economies it seems that innovation has not attracted the attention of many researchers despite the positive trend of innovation investments and the advancement with transition reforms.

The next sub-section examines the empirical literature on the relationship between innovation and export performance.

2.6.2 The literature on innovation and export performance relationship

Following the technology gap theory, the literature investigating the relationship between innovation and exporting increased substantially. In a survey of studies on innovation and exporting, Love and Roper (2015) suggest that there is a strong positive association between the two variables. They further add that innovating exporters are better performers in general. Lo

Turco and Maggioni (2015) argue that innovation is highly important in preserving a firm's competitive position in export markets.

Earlier studies, investigating a univariate relationship of innovation and exporting activities, of Hirsch and Bijaoui (1985) for Israel, and Kumar and Siddharthan (1994) for India suggested a positive and significant impact of R&D intensity on firms' export intensity. Similarly, Ozcelik and Taymaz (2004) also suggest that R&D activities are significant drivers of international competitiveness of Turkish manufacturing firms. In contrast, Lefebvre, et al. (1998) and Becchetti and Rossi (2000) indicate an insignificant effect of R&D intensity for Canada and for Italy, respectively. In addition, Van Beveren and Vandenbussche (2011) for Belgium and Lamote and Colovic (2015) for transition economies find an insignificant relationship between firm R&D expenditures and the likelihood of engaging in exporting activities.

Other studies have used innovation output measures to estimate the effect of innovation on exporting. Using Tobit and Probit models, Wakelin (1998) and Sterlacchini (1999) find that innovating firms in the UK and Italy, respectively, are more likely to export compared to non-innovating firms, while they suggest a weak effect of innovation on export intensity. Wakelin measures innovation output by the number of innovation types, whereas Sterlacchini (1999) uses proxy indicators of innovation output such as the share of designs and engineering expenditure and share of pre-production development expenditure in turnover. Following the approach of Wakelin (1998) and Sterlacchini (1999) Roper and Love (2002) suggest that product innovation has a positive effect on both the propensity to export and export intensity for a sample of plants in the UK and Germany. They find a significant effect of product innovation on export intensity only for Germany. In another study, Van Beveren and Vandenbussche (2011) suggest a positive and significant impact of product innovation on the intensity of trade for Belgian exporting firms.

While in a more recent study, using BEEPS data and applying the Tobit estimator, Gashi, et al. (2014) find that innovating SMEs in transition economies (firms having introduced at least on type of innovation) are associated with higher export intensity compared to non-innovators. Similarly, Lewandowska, et al. (2016) suggest that the Polish firms conducting both product and process innovation experience higher export intensity of new products. Although the reviewed studies acknowledge the issue of endogeneity, they generally investigate a univariate relationship between innovation and export performance, with some of them defining innovation as a lagged variable.

Alternatively, following Melitz (2003) hypothesis that productivity drives firms towards export markets, other authors (Cassiman and Golovko, 2007; Leonidou, et al., 2007; Wagner, 2007; Monreal-Perez, et al., 2012) have controlled for both innovation and productivity as the main factors fostering firm's export performance. Cassiman and Martinez-Ros (2007) find that productivity induces firms to select themselves into export markets because innovation affects productivity in the first place. On the other hand, Cassiman and Golovko (2007) find that differences in productivity among exporting and non-exporting firms disappear when product innovation is included in the model. In a more recent study, Bertarelli and Lodi (2015) find that productivity and the number of innovation indicators (measured by product, process and organisational-marketing innovation types) increase the likelihood of exporting for firms in South East European transition economies.

Damijan, et al. (2010) used a bivariate Probit model and lagged values of innovation and export variables to account for the potential endogeneity between innovation and export performance for Slovenian firms over the period 1996-2002. They find only weak indications that firms learn by exporting and do not confirm the causality of the relationship. Alternatively, Monreal-Perez, et al. (2012), drawing on manufacturing firm data in Spain for the period between

2001 and 2008, investigate the dynamic relationship between innovation and firm's export activity by controlling also for firm productivity. Their findings indicate that product innovation is a significant factor in explaining export intensity of firms, whereas the interaction with productivity does not show to be significant. Due to the longitudinal nature of data, the study investigates if the previous export intensity affects the ability to produce product innovation, but the results are insignificant.

The export destination effect is investigated by Boermans (2013) who finds that firms exporting to countries outside Africa become more capital intensive than exporters within the African region as a less developed economy. Similarly, Ito (2011) finds that Japanese exporters to North America and Europe are more innovative than exporters to Asia as a less developed market. Salomon and Shaver (2005) find that Spanish exporters increase their patent applications and product innovation subsequent to exporting, but this is more pronounced with lags of two years subsequent to exporting. In contrast, Baldwin and Gu (2004) find no impact of exporting on innovation for Canadian firms. Similarly, Damijan, et al. (2010) suggest that exporting does not encourage firms in transition economies to become first time innovators. These inconclusive results suggest that the relationship may depend on the level of economic development of the export destination countries (Boermans, 2013).

To sum up, the literature reviewed in this chapter confirms the positive and significant effect of innovation on export performance, but the results are not conclusive across different studies, particularly in terms of the feedback effect of exporting on innovation activities of firms. Product innovation is suggested to have significant impact on export performance of firms. When controlling for the productivity of firms as another factor influencing export performance, the results are inconclusive as it seems that innovation rather than productivity is pushing firms into export markets. Furthermore, although the technology gap theory emphasises the importance of products new to the market in maintaining firms' competitiveness in the respective markets, none of the studies has accounted for the degree of novelty or the effect of products new to the market, on export performance of firms. This shortcoming as well as the assessment of the effect of business environment factors on the export performance of firms will be addressed in the empirical chapters of the thesis.

2.7 Conclusions

In this chapter we have critically examined the theoretical and empirical literature on innovation and firm performance which will provide the theoretical basis for the empirical investigation in the following chapters. We have also highlighted the gaps in the literature which are addressed in the empirical chapters of the thesis.

After some 80 years since Schumpeter's (1934) contribution, and a vast amount of literature on the subject as well as dramatic changes of the technology, economy and society, his views and his definition of innovation still dominate the field and are considered the underlying principles of the innovation theory. The availability of a broad range of innovation indicators has allowed for the analysis of the process of innovation as well as its effects on firm performance (profitability, sales, employment, productivity as well as exporting activity). However, the empirical work has produced inconclusive findings and raised the debate of which measures are more relevant and suitable for depicting the relationship between innovation and firm performance. While the literature before the 1990s has mainly used the R&D expenditures as a measure of innovation, later studies concluded that innovation input approximated by R&D may not always convert into innovation output. Similarly, innovation output measures such as patents may not be very useful either as some patents may never become innovation (as well as the fact some innovations are never patented). With the launching of the Eurostat Community Innovation Survey in 1993, which provided data on sales of new products as well as indicators on the degree of novelty, these innovation output measures have been commonly applied in the literature. Among other reasons, sales of innovation output express the commercial success of innovation (one of the basic elements of the concept of innovation) and enable assessment of the performance of innovation.

With respect to innovation theories, Schumpeter (1934, 1942) considered innovation as an internal firm factor mainly affected by entrepreneurial motivation on the one hand, and the market domination of large firms on the other. He further suggested that radical innovations have a disruptive influence, the “creative destruction” (creation of novelty and destruction of old products or technologies) which as a result sustain firm and economic growth. These features were neglected by the neoclassical model which viewed innovation as an exogenous factor, assuming that the economy continuously inclines towards an equilibrium. Theoretical developments of the neoclassical school of thought led to the new growth theory suggesting that knowledge or innovation and growth are endogenously determined. However, the new, or endogenous growth theory, lacks a theory on firm innovation. Alternatively, extending Schumpeterian views and aiming to address his narrow focus on the entrepreneurial creativity and skills as a driver of innovation, the theory evolved into what is known today as the resource based view hypothesizing that the firm’s internal capacities and the way resources are organised are key factors in determining innovation. In addition, acknowledging changes in the dynamic market environment, the evolutionary view suggested the necessity for firms to continuously adapt their practices to the environment. This led to the promotion of the concept of the ‘innovation systems’ and the role of institutions at the centre of the microeconomic theory of innovation. Although the Schumpeterian view on innovation has been extended by later theories, the relevance of the novelty of innovation suggested by Schumpeter, and its importance for firm performance has not received much attention. In a more contemporary and a complementary perspective to the previous theories, Chesbrough (2003) conceptualised the cooperative open innovation approach. This is particularly important for the case of transition economies where internal firms' resources for innovation are rather limited, and a more comprehensive cooperation with external stakeholders may enable access to specialised knowledge and introduction of radical innovations. Nevertheless, this has not been explored in the context of countries in transition.

In addition, the importance of innovation has been recognised also for its effects on international trade. The technology gap theory of Krugman (1979) suggested that new products enable developed economies to be constantly competitive in les developed markets. Although it is not explicitly elaborated, his view on new products implicitly refers to the products that are new to the exporting market. While Krugman (1979) assumes technology to be exogenous, the new growth theory suggests the opposite. Furthermore, both theories are developed from a rather macroeconomic perspective. A firm level perspective on exporting was provided by Melitz (2003) who assumes the heterogeneity of firms' productivity levels to be the main driver of firm export heterogeneity. However, his model does not account for the fact that productivity may be explained by new technological processes and also ignores the role of product innovation. In addition, the Uppsala model of international trade suggests that environmental factors should be considered in the firm's exporting models, predicting that to balance their risk portfolio firms tend to move to the relatively safer export markets. This is relevant in particular to the transition context where market reforms and challenges of implementing reforms may create uncertainties, an issue not investigated in the literature on transition economies.

The literature does not provide a homogenous set of variables that may affect innovation. Nevertheless, despite the broad range of determinants, the literature tends to follow the indicators which derive from main schools of thought on firm innovation, an approach we follow in this thesis.

With respect to the transition context, the challenges faced by these countries during the process of transition from a socialist system to a market economy seems to have limited their capability to produce and absorb knowledge, especially in the early stage of transition. In later stages of transition there has been a positive trend in reaching the standards of industrialised economies. The restoration of private ownership, privatisation of publicly owned enterprises and enforcement of property rights created a more supportive environment for innovation, and few countries have significantly increased investments in research and development. Nevertheless, most of the countries still lag behind both, in terms of transition reforms as well as in investing in innovation activities. This suggests that the effect of innovation, and also other firm performance factors may be moderated by the stages of transition (the progress made with transition reforms), an issue which is further explored in this thesis.

The review of the literature shows that the empirical studies have generally relied on the research and development as the main measure of innovation and assumed innovation to be an exogenous factor. The earlier strand of the literature mainly confirms the hypothesis that innovation is a significant driver of firm performance on the one hand, and the export performance on the other hand but these studies are subject to biased estimates. Later strands of the literature have improved on this and acknowledge the endogenous nature of innovation and performance growth but they are not conclusive and seem to depend on the context of analysis and the measures of both innovation and performance used. Later literature provides more consistent estimates of the impact of innovation on productivity, but the results vary significantly with respect to other measures of performance. A causal relationship between innovation and exporting is found only in a few studies, indicating that the relative stages of economic development of export markets may explain the variations in results. The bulk of studies have of course focused on developed economies while transition countries have attracted less attention by researchers.

To sum up, the review of the theoretical and empirical literature identified the following gaps that will be addressed in the subsequent chapters. First, the novelty of innovation has been only considered in few studies for developed economies and ignored in studies on transition economies. Second, the open innovation approach has not been much explored in the case of transition economies, where internal firm resources are limited while innovation activities and in particular radical innovations may be enhanced by external knowledge. Third, up to date studies on firm exporting in transition economies fail to consider the relevance of the novelty of innovation or the products new to the market on exporting activities of firms. Fourth, the effects of the uncertain domestic environment factors on the firm's export performance has not been assessed in the literature on transition economies. Fifth, the stage of transition (the progress achieved with transition reforms) which shows to be positively related to the level of innovation investments in countries in transition, suggesting a moderating role for transition reforms on the effect of innovation and other firm performance factors, is not accounted for in the literature on transition economies. These shortcomings of the literature, or the gaps in knowledge, are addressed in the next three empirical chapters of the thesis.

Chapter III

Innovation and firm performance in transition economies: the relevance of novelty and open innovation

Contents

3.1. Introduction

The process of innovation consists of various layers of knowledge and physical resources (Schumpeter, 1934, p. 5). It is a complex process, often referred to as the innovation 'black box', in which knowledge and other resources are converted into an output (Aghion and Tirole, 1994). New products that result from the innovation process are at the heart of economic growth (Loof and Heshmati, 2006). Innovation contributed to the evolution of new firms, industries and large corporations. The relationship between innovation and firm performance has been of much interest in the economic literature. Earlier studies have investigated the impact of the research and development (R&D) expenditures on firm productivity using a Cob Douglass production function (Griliches, 1979; Griliches and Mairesse, 1984; Kline and Rosenberg, 1986; Mairesse and Sassenou, 1991). In these studies, knowledge capital was added to the production function in addition to the conventional input factors such as labour, capital and materials. These studies showed that in general research expenditures have a positive effect on firm productivity. However, as Kemp, et al. (2003) argue, the respective literature is based on a limited modelling framework as it explores only the effect of the innovation input on firm performance, while neglecting the black box of innovation process in which firm's efforts are converted into innovation output.

When investigating innovation and firm performance relationship one must also account for the endogeneity or the causal inter-dependency of innovation and growth, both at the macro and micro level (Romer, 1990; Grossman and Helpman, 1994). Additionally, any research involving only the innovating firms should take into account that they do not represent a random sample of the population of firms, and that this approach may lead to biased results if this aspect is not accounted for. These issues have been addressed by an alternative strand of literature applying a multi-step methodology, introduced by Crepon, et al. (1998) (better known as the CDM model) that considers the whole process of innovation development and its relationship with firm performance in four steps. First, the model analyses the factors affecting the firms' decision to engage in innovation activities. In the second step, some of them decide to invest in relevant innovation activities. The input is converted into output as a third step of the model, while the successfully developed innovation output affects firm performance in the fourth step of the process. Most of the studies applying the CDM model suggest a positive relationship between innovation and firm performance (Loof, et al., 2001; Klomp and Van Leeuwen, 2001; Loof and Heshmati, 2002; Griffith et al., 2006; Hall, et al., 2009; Johanson and Loof, 2009; Hashi and Stojcic, 2013). Barlet, et al. (2000) suggest that in the presence of a strong innovation potential in a specific market or industry, the commercial success of innovation increases with the degrees of product novelty. The Oslo Manual (OECD, 2005) provides an ordinal categorisation of the degrees of innovation novelty as discussed in Chapter II, including innovation new to the firm as the lowest degree of novelty, innovation new to the market and innovation new to the world as the highest degree of novelty. While only few studies have analysed the novelty of innovation and its impact on firm performance in the developed economies (Barlet, et al., 2000; Loof and Heshmati, 2006), the issue has not been investigated in the few studies analysing the innovation and firm performance relationship in transition economies (Stoevsky, 2005; Masso and Vahter, 2008; Hashi and Stojcic, 2013).

Another strand of literature that investigates the determinants of innovation novelty mainly applies a qualitative perspective with respect to the degrees of novelty (Nieto and Santamaria, 2007; Amara, et al., 2008, 2010; Vega-Jurado, et al., 2008; Plechero and Chaminade, 2010; Martinez-Roman and Romero, 2013; Bjerke and Johansson, 2014; D'Este, et al., 2015). These studies generally focus in the developed economies while the literature on transition economies is scarce (Radas and Bozic, 2009).

Firms in developing economies have weak internal skills and technological capabilities for novel innovations (Bell and Pavit, 1993). For the same reasons firms in transition economies are mainly associated with incremental innovation (new to the firm innovation), which is a likely explanation why the novelty of innovation did not attract much attention. As an alternative to internal firm capabilities, open innovation and access to external knowledge may act as a facilitator for radical innovation (innovation new to the market or new to the world). Freeman (1988) and Chesbrough (2003) hypothesize that cooperation with external agents and other institutions can make up for the knowledge limitations within a firm. While current studies account for the various individual types of firm's cooperation with external parties, the synergy effect arising from combining different sources of knowledge has not been taken into account.

In this chapter we contribute to the economic literature on innovation in two main ways. First, we extend the current CDM literature on innovation and firm performance in transition economies by examining the relevance of innovation novelty. Second, we investigate the effect of the degree of open innovation with respect to innovation novelty. For this purpose, this empirical research draws on the large scale firm level harmonized Eurostat Community Innovation Survey (CIS) dataset, covering about 75,000 firms, undertaken in 2004 and 2006.

The outline of the chapter is as follows. In section 3.2 we discuss the literature on innovation and firm performance, analysing the factors that affect innovation input, innovation output and firm performance. In section 3.3 we explain the empirical methodology. In section 3.4 we discuss empirical results and finally in section 3.5 we conclude the chapter.

3.2. Review of the literature

An earlier survey article by Neely and Hii (1998) and a more recent one by Love and Roper (2015) on firm innovation and performance indicate that most of the surveyed studies arrive at the conclusion that the relationship between innovation and performance is a positive one. Firms engaging in innovation are not only more likely to introduce better quality products appealing to consumer tastes, but also may reduce the production costs and/or increase production efficiency (Garcia-Vega and Lopez, 2010). The level of effort expended in the innovation process and the knowledge resources employed may determine the degree of novelty that the innovation will represent. A successful innovation outcome is likely to improve the firm performance. However, Barlet, et al. (2000) suggest that two different and opposite effects can occur when new products are introduced in the market. First, the 'inertia' effect arises when the market acceptance of products with a higher degree of novelty tends to increase gradually over time, thus the improved new products performance will only be weak over a short period of time. This tends to occur in markets with little technological opportunities and higher resistance to change. Second, the 'efficiency' effect prevails if the product novelty responds to the market demand and is valued by consumers, leading to a commercial success of the innovation. This effect tends to happen in markets with abundant technological opportunities and lower resistance to change.

To provide a better understanding of the whole process of conversion of knowledge into innovation output and its impact on firm performance, as well as the relevance of the degrees of novelty, in this section we first discuss the literature on the innovation input measures and its determinants. Then we analyse the relevant literature on factors determining the innovation output with respect to the degrees of product novelty. Finally, we discuss firm performance measures and its explanatory factors.

3.2.1 Innovation input

In the economic literature innovation input is mainly measured by the expenditure on innovation. Geisler (1995) uses the number of scientists and engineers, while Oliver, et al. (2004) use the number of engeering hours as the input measures of innovation. Some studies consider only internal R&D expenditures as the measure of innovation input (Crepon, et al., 1998; Griffith, et al., 2006). Alternatively, Klomp and Van Leeuwen, (2001) and Stoevsky (2005) use the ratio of innovation investment to total turnover (innovation intensity). Others define innovation expenditure in a broader sense so that it includes also investments on machinery and other assets that are indirectly related to innovation (Loof and Heshmati, 2002, 2006; Kemp, et al., 2003; Hashi and Stojcic, 2013).

Since the first published work of Schumpeter in 1934 (Mark I) and then later in 1942 (Mark II), discussed in Chapter II, the economic literature has used the firm's size as one of the main determinants of innovation input. While Schumpeter "Mark I" hypothesizes that new firm creation by innovative entrepreneurs is the motive behind innovation, in his work in 1942 ("Mark II") he postulates that large firms are the drivers of innovation, suggesting that in concentrated markets large firms have resources to invest in innovation because they make above normal profit. The larger the market dominance is the higher the firm's profits will be, leading to higher innovation investments. As discussed in Chapter II, Schumpeter's hypothesis was later opposed by Arrow (1962) who suggests that firms in a competitive market have higher incentives to innovate compared to monopolistic firms.

Much of the literature show a positive and significant relationship between firm's size and innovation intensity (Roud, 2007; Maso and Vahter, 2008; Johanson and Loof, 2009; Hashi and Stojcic, 2013), but some studies have arrived at a negative (Loof and Heshmati, 2006), insignificant (Loof and Heshmati, 2002), or even a U-shaped relationship (Felder, et al., 1996; Kemp, et al., 2003). Thus, despite the broad consensus on the positive effect of firm's size on the innovation input, the results are not very consistent across different studies.[17] In addition, with respect to the market dominance perspective Schumpeter's hypothesis is confirmed empirically by several studies (Aghion and Howitt, 1990; Crepon, et al., 1998). Others have utilised another perspective and have analysed the effect of an increased market competition on the innovation effort, suggesting a positive relationship (Geroski, 1995, Blundell, et al., 1999), negative (Levin, et al., 1985) or even a U-shaped relationship (Aghion, et al., 2005).

Cohen and Levinthal (1990) argue that among other factors and in line with the knowledge based view, investment in research is a function of prior knowledge developed by firms. They define the prior knowledge as the developed skills of employees or the knowledge absorbed through prior project on technological research or other related fields, what they call the firm's 'absorptive capacity'. Although previous engagement in innovation activities is expected to increase a firm's knowledge and the probability of success in future projects, firms are not always successful in completing an innovation project (Garcia-Vega and Lopez, 2010). A positive impact of previously abandoned or still ongoing innovation on firm's innovation intensity is suggested by Hashi and Stojcic, (2013).

Although the firm's internal knowledge is crucial to innovation they may not rely only on these internal resources. Freeman (1988) postulates that the firm's innovation activity depends on its interaction with external partners. Later, Chesbrough, (2003) and Chesbrough, et al. (2006) developed the idea of the so-called 'open innovation', i.e., that resulting from cooperation with agents outside the firm. As Chesbrough, et al. (2006) argue, open innovation is about utilising both

[17] For results of earlier studies testing the Schumpeterian hypothesis on the effect of size on innovation intensity, see the surveys undertaken by Cohen and Levin (1989), Cohen and Klepper (1996) and Klette and Kortum (2004).

inflows and outflows of knowledge as this may boost the firm internal knowledge and innovation respectively. De-Jong and Vermeulen (2006) maintain that the main incentive for firms to cooperate with external parties is to compensate for the limitations within the internal pool of knowledge. Through cooperation firms access diverse knowledge resources that support their innovation process (Gronum, et al., 2012; Spithoven, et al., 2013; Bjerke and Johansson, 2014).

Among other factors, the learning by exporting effect is assumed to take place when firms export their products in foreign markets (Salomon and Shaver, 2005; Boermans, 2013). The effect may not be significant if firms export in less developed markets (Silva, et al., 2002). Several studies on innovation and firm performance have found exporting to have a positive effect of on innovation expenditures (Loof and Heshmati, 2002; Kleinknecht and Oostendorp, 2002; Kemp, et al, 2003).

In line with the innovation systems approach and the role of institutions in promoting innovation, studies also suggest that innovation investment can be facilitated through public subsidies (Klomp and Van Leeuwen, 2001; Kemp, et al., 2003; Czarnitzki and Licht, 2006; Benfratello, et al., 2008; Mohnen, et al., 2008). On the other hand, Zuniga-Vicente, et al. (2014) indicate that majority of the surveyed studies on innovation subsidies published over last five decades tend to suggest that public subsidies are likely to decrease private investment on R&D below the social optimal level. This implies that public support on innovation may serve as a replacement for firms' own expenditures rather than as an additional investment. Among other reasons, they point out that high risk of R&D projects and financing constraints contribute to crowding out of private investments. Alternatively, in a recent meta-regression analysis of the literature on innovation subsidies, including over 50 papers published since 2000 and mainly investigating developed economies, Dimos and Pugh (2016) they don't find a crowding out effect from subsidies, but also suggest a weak influence of subsidies on additional increase in private investments. For the case of transition economies, public support for innovation was not among the governments' priorities due to limited budgetary resources compared to developed economies. However, the process of integration into the European Union has facilitated access to EU funds for innovation for countries that have advanced with the transition reforms and integration into EU. Hashi and Stojcic (2013) argue that without financial support firms would be very selective and try to focus only on most profitable innovation projects.

The foreign ownership is suggested to be positively correlated with innovation efforts. Belonging to an international group provides a wider access to information on marketing as well as technological and financial resources (Amara, et al., 2010). Maso and Vahter (2008) point out that foreign owned firms are more likely to be successful innovators, while Kanoa, et al. (2016) suggest that for foreign subsidiaries it is not just the membership in a group but also the location of the group that matters for innovation.

Another factor assumed to affect innovation effort is the system of protection of intellectual property, or the appropriability conditions (Isaac and Reynolds, 1988; Chesbrough and Vanhaverbeke, 2011). If firms operate in an environment where their intellectual property is well protected, the chances of receiving full benefits from innovation are higher and, thus their incentives to innovate will be higher. Griffith, et al. (2006) find a positive relationship between innovation investments and the degree of appropriability conditions, while most of the studies using the CDM approach did not consider appropriability conditions in the input phase of innovation.

Among other determinants of innovation input, the economic literature has also analysed factors hampering innovation. These factors are mainly grouped into knowledge, market and cost barriers (Galia, et al., 2012; D'Este, et al, 2014; D'Este, et al., 2015). These respective barriers are found to negatively influence the innovation input process, but in some cases also positively (Loof and Heshmati, 2006; Doloreux and Melancon, 2008; Mohnen, et al., 2008; Radas and Bozic, 2009; Hashi and Stojcic 2013).

In the next section we discuss the innovation output and its explanatory factors.

3.2.2 Innovation output

The output of the innovation process has been identified and measured in several ways. Patents used to be a common measure in the earlier studies (Pakes and Griliches, 1980; Hall, 1987; Jaffe, 1986) Others have used journal citations of product innovation (Acs and Audretsch, 1988), while following the Oslo Manual Guidelines and the CIS survey data, qualitative measures of innovation indicating if firms have introduced a product, process or another type of innovation have been commonly applied (Becheikh et al., 2006). Studies applying the CDM model have mainly used the proportion of sales attributable to innovation as an output measure in investigating innovation performance (Loof, et al., 2001; Johanson and Loof, 2009; Hashi and Stojcic, 2013).

The innovation output is suggested to be largely explained by the level of innovation effort or the innovation investments as measured by the amount of research and development (R&D) and other innovation related investments (Crepon, et al., 1998; Loof, et al., 2001; Maso and Vahter, 2008), and in some cases an insignificant relationship is indicated (Klomp and Van Leeuwen, 2001; Loof and Heshmati, 2006; Roud, 2007). The literature also suggests that the degree of innovation novelty is an increasing function of the investments in research and development (Cozzarin, 2006; Amara, et al., 2010; Deste, et al., 2015; Bozic and Mohnen, 2016).

The resource based theory suggests that the heterogeneity of firms and their capability to be more productive and competitive depends on their inimitable resources, among which the intangible knowledge of their own employees is crucial (Barney, 1991). To create new knowledge and increase the pool of knowledge created over time, internal R&D activity is very important (Amara, et al., 2008). D'Este, et al. (2015) argue that the novelty of product innovation is significantly explained by the internal R&D expenditure. Alternatively, in line with the knowledge based view, empirical findings suggest that involvement of skilled employees in R&D activities has a significant and positive impact on novelty of innovation in developed economies (Cozzarin, 2006; Amara, et al., 2008; Therrien, et al., 2011; D'Este, et al., 2015), while for transition economies it has been studied only in Croatia where it was found to be insignificant (Radas and Bozic, 2009). An adequate pool of skilled workers required for internal R&D is a challenge for many firms, especially the smaller ones (Freel, 2005).

As an alternative to firm internal based innovation, Leiponen and Helfat (2010) argue that the interaction with external parties enhances the innovation performance. Sanchez-Gonzales (2013) emphasizes that the degree or breadth of cooperation is important in enhancing the firms' abilities to develop radical innovation. The rationale for this is that the diverse and combined cooperation with various stakeholders helps enterprises to increase the intensity of exploration. Cooperation with various parties may enable a higher degree of multidisciplinary approach as well as enhance firms' abilities to introduce unique products. Verhoest (2007) argues that such multiparty cooperation can be facilitated by Universities (as in the case of the University of Talin in Estonia), which can act as a focal point between businesses, researchers and other relevant institutions.

Most of the studies (Propris, 2002; Loof and Heshmati, 2002, 2006; Radas and Bozic, 2009, e.g.) have investigated the effects of types of cooperation on innovation output, while the relevance of the breadth of open innovation has been generally neglected in the literature. Radas and Bozic

(2009) for Croatia suggest that cooperation with research institutes or universities positively influences radical innovation, while cooperation with other firms increases only incremental innovation. Propris (2002) for the UK finds that cooperation with client firms and suppliers affects firms' radical innovations but reports an insignificant effect of the former on incremental innovations. In another study for the UK, Tether (2002) suggests that firms having introduced novel innovations tend to be more likely to engage in cooperation for innovation but the significance of the relationship is weak. With respect to innovation performance, Loof and Heshmati (2006) for Sweden find that cooperation with other firms or organisations has a positive and significant impact on innovation sales of the services sector firms but an insignificant effect in the manufacturing sector. In a more recent study for Sweden, Johanson and Loof (2009) find no significant effect of either type of cooperation (cooperation with suppliers, clients, businesses or public sector) on firms' innovation sales.

Access to information is also suggested to be an important factor in explaining innovation output. Amara, et al. (2008) found that access to research and informational network sources positively influences innovation and the degree of novelty, while business network information sources have an insignificant effect. Mention (2011) finds that market information increases the propensity to introduce radical innovation, while business information sources induce incremental innovation. Loof, et al. (2002) find that access to market and institutional information sources are positively related to innovation sales. Other studies (Loof, et al., 2006; Masso and Vahter, 2008; Hashi and Stojcic, 2013), however, have found that information sources have a positive, negative or even insignificant effect on innovation sales. The inconsistency of results might be explained by the country specificities and different methodologies used in different studies.

The relationship between firm's size and innovation output is found to be generally positive and significant, though in cases they were insignificant (Baldwin, et al., 2002; Klomp, et al., 2001; Loof, et al., 2002; Kemp, et al., 2003; Loof and Heshmati, 2006). In an earlier study, Cohen and Klepper (1996) found a negative relationship between the innovation output intensity (ratio of output generated per R&D expenditures) and size, while Kleinknecht and Mohnen (2002) find an insignificant relationship. With respect to novelty, Amara, et al., (2008) suggest that firm size is positively and significantly associated with degrees of novelty of newly introduced products. As firms grow they increase financial capabilities required for more radical innovations (Sorescu, et al., 2003). Similarly, Cozzarin (2006) indicates that large firms tend to be the highest introducers of innovation new to the country and new to the world. These findings are in line with the Schumpeter Mark II (1942) hypotheses indicating that the large firms can bear higher costs of R&D and therefore are more inclined towards products with higher degrees of novelty.

Among other factors, as with the input phase of innovation, the ability of firms to protect their intellectual property is expected to influence the innovation output. A positive effect of the appropriability conditions as measured by the effectiveness of the patenting, trademarks and copyrights system on the likelihood to introduce an innovation in general and a product innovation in particular is found by Baldwin, et al. (2000) and Cozzarin (2006) respectively, both for Canada.

Being part of a multinational group is also suggested to have a positive effect on innovation output. Ciabuschi, et al. (2011) argue that if firms aim to introduce radical innovation, being a member of an international group can facilitate their access to specific expertise within the group. Nelson (1993) postulates that firms establish, integrate and own research and development processes and facilities necessary for the introduction of an innovation. The multinational corporations operate in different markets enabling them to learn from the diverse markets and competition but also to share the knowledge across their subsidiaries.

Public subsidies for innovation are also indicated to have a positive influence on innovation output (Czarnitzki and Licht, 2006; Mohnen, et al., 2008). As radical innovation is expected to be positively associated with costs and high risk, public support may mitigate the risk and motivate firms to engage in radical innovation (Martin and Scott, 2000; Hewitt-Dundas and Roper, 2010). In transition economies the support for innovation became relevant as countries progressed towards accession to the EU which involved also accession to EU financial support. However, Lazibat, et al. (2012) indicate that the main problem in transition economies is the ineffective conversion of subsidies into a commercial output. Such an argument is supported by findings of Hashi and Stojcic (2013) who report a negative effect of subsidies on innovation output in transition economies as well as in a set of mature EU economies. On the other hand, Maso and Vahter (2008) find that in the case of Estonian firms, subsidies positively affect product innovation but not the process of innovation.

In addition to previous factors, the diversification of product offered to the market is suggested to facilitate commercial success of an innovation (Hernandez-Espallardo, et al., 2012). As firms diversify, they tend to enhance the learning process across different production lines and technologies (Breschi, et al., 2003). This in turn increases their innovation output efficiency and makes them more likely to introduce new products. Finally, better firm performance is expected to lead to improved innovation performance, thus indicating a causal relationship between the two. The impact of improved firm performance on the innovation output has been found to be positive for the developed as well as the transition economies (Crepon, et al., 1998; Loof, et al., 2001; Loof and Heshmati, 2002, 2006; Masso and Vahter, 2008; Hashi and Stojcic, 2013).

The next section discusses the firm performance determinants.

3.2.3 Firm performance

Surveys of the earlier literature on innovation and firm productivity by Mairesse and Sassenou, (1991) and Griliches (1998) show that the investment in research and development has a significant and positive effect in explaining firms' productivity growth. In a later study, Adamou and Sasidharan (2007) find a similar effect also between R&D intensity and firms' turnover growth. The strand of literature using the CDM model show that the innovation output is positively and significantly related to firm performance, as measured by firm productivity indicators (Crepon, et al., 1998; Loof, et al., 2001; Johanson and Loof, 2009) or sales, sales growth and profit related indicators (Klomp and Van Leewen, 2001; Kemp, et al., 2003; Folkeringa, et al., 2005; Loof and Heshmati, 2006; Mansury and Love, 2008).

However, the findings are not consistent across different industries, countries and performance measures. Loof and Heshmati (2006) report a positive relationship between innovation and employment growth for Swedish services sector. In addition, when they use productivity as a measure of performance they suggest that the so-called 'efficiency' effect prevails in the manufacturing sector, indicating a positive relationship for radical innovation (new to the market) and an insignificant for incremental innovation. Mansury and Love (2008) show that innovation has a consistently positive effect on growth but no effect on productivity of service sector firms in the United States. Masso and Vahter (2008) find that only process innovation has a positive effect on firm productivity in Estonia, while Hashi and Stojcic (2013) report a positive relationship between innovation output and productivity for a group of transition economies. Similar results have been reported by Roud (2007) for Russia. On the other hand, product innovation has been shown by Roper, et al. (2008) and Freel and Robson (2004) to have a negative effect on productivity in Ireland and the United Kingdom respectively.

Firms diversify their product range and increase product quality through the introduction of new products and increase production capacity and/or decrease production costs through process innovation. Klette and Griliches (2000) indicate that an improvement in product quality explains an improved performance. Gunday, et al. (2011) find that different innovation indicators (including product, process or managerial innovation) are positively correlated with at least one aspect of firm performance as measured by return on sales, assets or profitability indicators.

In line with the resource based view, internal firm capacities are expected to affect firm performance (Johanson and Loof, 2009). Loof, et al. (2001) find that the share of skilled employees has a positive effect on firm growth. On the other hand, Hashi and Stojcic (2013) find that relying on internal capacities to undertake innovation it has a negative influence on the productivity of firms in transition economies but they report a positive effect for the mature West European economies.

With respect to the type of ownership, the economic literature indicates that multinational firms have higher productivity compared to domestic firms (Djankov and Hoekman, 2000; Sabirianova, et al., 2005; Johanson and Loof, 2009; Gorodnichenko, et al. 2015). As discussed in the section on innovation input, being part of multinational group provides a wider access to knowledge. Dunning (1993) postulates that foreign firms are more competitive due to the technology they possess, the way they are organised internally and their access to external network. Adamou and Sasidharan (2007) find that the effect of foreign ownership on the growth of firms varies across industries, being positive, insignificant and even negative.

Among other factors affecting firm performance, having access to diverse information sources, the presence of innovation subsidies, access to finance and size are also expected to improve firm performance. Access to information provides firms with market knowledge and facilitates their effort in introducing products that meet specific consumer needs. Mansury and Love (2008) found that external sources of information have a positive effect on growth of firms. Access to innovation subsidies may increase the financial capability of firms and consequently firms' growth. Beck, et al. (2005) show that the cost of finance is among key obstacles to firm growth in the developing economies, something that applies also to the transition economies. Finally, the literature also suggests that firm performance is related to its size, but findings are not consistent. A positive relationship between firm size and productivity increase is reported by some studies (Loof, et al., 2001; Johanson and Loof, 2009) while others report a negative relationship (Adamou and Sasidharan, 2007; Roud, 2007).

In the next section we present the empirical research methodology.

3.3. Research methodology

This section presents the research methodology of this empirical chapter. First, we discuss the data used in the analysis. Then, we present the general model and econometric specification. Finally, we specify the variables used and discuss descriptive statistics.

3.3.1 Data

For this analysis we use the firm level data obtained through the Eurostat's Community Innovation Survey (CIS) which has been undertaken throughout the statistical agencies of EU member states and candidate countries. The data collected in the surveys in 2004 and 2006 are used for the empirical analysis, covering the innovation activities of enterprises over the three years prior to the survey. The surveys are based on the Oslo Manual and have a core harmonized questionnaire and a harmonized methodology to avoid any peculiarity that each country may have, thus providing the only harmonized, comparable source of enterprise innovation data across Europe.

Being unable to access the raw data in the Eurostat database, we use the anonymised data provided by Eurostat on CD-ROMs. One key limitation in the dataset is that the information on the number of employees is not provided (this is how the data has been anonymised). The following transition economies are included in the analysis: Bulgaria, Czech Republic, Estonia, Hungary, Lithuania, Romania and Slovakia.[18] The countries under investigation have experienced broadly similar progress in terms of transition reforms in the respective survey period. We provide more detailed analysis with respect to institutional reforms in transition economies in Chapter IV.

The survey covers all firms with more than ten employees in each country, thus containing both innovating and non-innovating firms. Following the Oslo Manual definition, the CIS defines as innovators all enterprises which in the three-year period prior to the survey have introduced a new or significantly improved product or a process innovation or at least have engaged in an innovation research activity. The reproduction of previous products and reselling of traded goods are not considered an innovation. The survey questionnaire also provides information on the degrees of product novelty, by including questions about new goods or services that were new to the market or new to the firm only. In addition, it also provides information on sales of new as a proportion of total turnover.

In the CIS 2004 survey data, about 27 percent of all firms have introduced at least one innovation activity. Among innovators, about 76 percent of firms have introduced at least one new

[18] Although the CD-ROM data also includes Slovenia and Latvia, firms in these countries were not included in the final dataset due to complete missingness of some of the variables of interest.

or significantly improved product, whereas about 44 percent of firms have introduced at least one new product to the market before their competitors. Similarly, in the CIS 2006 dataset, about 28 percent of firms have had at least one innovation activity. Around 72 percent of innovating firms have introduced at least one new product, whereas about 42 percent of innovating firms have introduced at least one new product to the market before their competitors.

In addition, the survey provides data on firm characteristics, innovation inputs, factors hampering innovation activities and other factors related to the firm's innovation activities. All enterprises in the survey are asked to answer general core questions including questions on whether or not a firm has undertaken any innovation research activity and/or has introduced an innovation output (a new product or a new process) in the previous three years. Conditional on being an innovator (having answered one of the two previous outcomes positively), a subset of additional questions was posed to the innovating firms only.

The two survey datasets represent random samples of the same population of firms in two consequent survey periods in 2004 and 2006. Wooldridge (2009, p. 445) suggests that pooling the random samples of the same population obtained at different points in time gives an independently pooled cross section. By pooling the data, the sample size increases and, in turn, the estimators' precision increases and makes the test statistics more powerful. Wooldridge further suggests that to account for the fact that the population distribution may have changed across time, a year dummy should be included. Therefore, in order to provide additional robustness checks and benefit from a larger dataset, in addition to analysing each of the two surveys separately, we also pool the two datasets into a CIS pooled dataset.

The dataset provides information on firms' sales in the respective survey years and in two years prior to the survey. For the variables of interest that are expressed in financial values (Euros), we have adjusted for inflation for the given period in order to be able to make valid comparisons and avoid inflated values. All the values are adjusted based on 2004 prices.[19]

3.3.2 The model and econometric specification

The CDM model which allows a comprehensive exploration of the multistage process of innovation has been widely used in the literature of innovation and firm performance. The initial CDM model assumes correlation between the error terms of the four equations expressing the propensity to innovate, innovation investments, innovation output and firm performance respectively (Crepon, et al., 1998). Alternatively, the first modified CDM model introduced by Loof and Heshmati (2002, 2006) estimates the structural model in two steps. First, the input phase equations (the propensity to innovate and innovation investment equations) are jointly estimated, and second, the output phase equations (innovation output and firm performance equations) are also jointly estimated.[20] This model hypothesizes that the effect of research expenditures on firm performance improvement is exercised through the innovation output and there is no direct relationship between the propensity to innovate and firm's performance improvement. Consequently, the assumption of correlation between the error terms of four equations suggested in the initial CDM model is no longer relevant (Loof and Heshmati, 2002, 2006; Hashi and Stojcic, 2013). In the input phase, the propensity to innovate equation (including all firms) and the innovation investment equation (including only the innovating firms) are jointly estimated to account for the selectivity bias. In the output phase, innovation output and firm performance

[19] We have adjusted for inflation to obtain the growth rate of real turnover. In addition, we have excluded the outliers, firms that have reported a real growth rate of over 500 percent and real decline of over 99 percent.
[20] For simplicity of reference, hereinafter we refer to the first two equations of the CDM model as the 'input phase' and we refer to the last two equations of the CDM model as the 'output phase'.

equations are estimated jointly as a system of simultaneous equations, thus accounting for the causality effects between the two (Loof, et al., 2001; Johanson and Loof, 2009).

Other studies have further modified the model by estimating the second stage (innovation output and the firm performance equations) for the whole sample of firms (Griffith, et al., 2006; Masso and Vahter, 2008; Hall, et al., 2009). They assume that all firms spend some resources on innovation even if some of them do not explicitly acknowledge such investments. As a result, they predict innovation expenditures also for the non-innovating firms. Predicting investment values for firms that have not reported any innovation investment is quite a strong assumption. If that assumption holds, we must also assume that firms may have introduced innovation outputs which they do not explicitly acknowledge. We argue that these assumptions are too strong and may not best represent the reality of the firms' innovation process.

In this empirical investigation we follow the first modified CDM model which is now well-established in the literature on innovation and firm performance (Loof and Heshmati 2002, 2006; Johanson and Loof, 2009; Hashi and Stojcic, 2013) and construct a general structural model containing the following four equations:

Stage 1: Propensity to innovate

$$i_i^* = x_{1i}\beta_{1i} + \varepsilon_{1i} \tag{3.1}$$

Stage 2: Innovation investment

$$r_i^* = x_{2i}\beta_{2i} + \varepsilon_{2i} \tag{3.2}$$

Stage 3: Innovation output

$$k_i = x_{3i}\beta_{3i} + r_i\alpha_i + invmills_i\widehat{\lambda_i} + \varepsilon_{3i} \tag{3.3}$$

Stage 4: Firm performance

$$g_i = x_{4i}\beta_{4i} + k_i\alpha_i + \varepsilon_{4i} \tag{3.4}$$

The Equations 3.1 and 3.2 of the model represent the CDM model input phase, while the Equations 3.3 and 3.4 express the CDM model output phase. The amount of investments in the Stage 2 (Equation 3.2) is observable only for a selected sample of firms that have undertaken an innovation activity in the three years prior to the survey. Therefore, innovative effort r_i^* can be estimated only if firms' innovation expenditure is observed.[21] Since not all firms in the sample are innovators and have invested in innovation, the Equations 3.1 and 3.2 can be further expressed as:

$$i_i = \begin{cases} 1 \; If \; r_i^* = x_{2i}\beta + \varepsilon_{2i} > 0 \\ 0 \; if \; r_i^* = x_{2i}\beta + \varepsilon_{2i} \leq 0 \end{cases} \tag{3.5}$$

$$r_i = r_i^* \; if \; r_i^* = x_{2i}\beta + \varepsilon_{2i} > 0, \text{ otherwise } r_i = 0 \tag{3.6}$$

In Stage 1 i_i^* represents the latent or unobserved variable whether or not the firm has decided to innovate, with i_i (3.5) being its observed counterpart taking the value of one if firms have undertaken innovation activities, zero otherwise. The x_{1i} *and* β_{1i} represent the vectors of independent variables and the corresponding parameters, while ε_{1i} represents the error term with zero mean, constant variance and uncorrelated with the explanatory variables.

In Stage 2, r_i^* represents the latent or the unobservable innovation or R&D investment, with r_i (3.6) being its observed counterpart with positive values when $r_i^*>0$, x_{2i} *and* β_{2i} represent the vectors of the independent variables and the corresponding parameters, while ε_{2i} represents the error term with zero mean, constant variance and uncorrelated with the explanatory variables.

In Stage 3, k_i represents the observed level of innovation sales, x_{3i} and β_{3i} express the vectors of independent variables and corresponding parameters which, among others, also includes the inverse Mills ratio estimates ($\widehat{\lambda_i}$) from the input phase estimation and the performance feedback

[21] The CIS questionnaire includes questions on several types of innovation expenditures, such as the acquisition of R&D and other external knowledge and the acquisition of the machinery, equipment and software as part of the total innovation expenditure.

effect from Stage 4, r_i represents estimates of innovation input from Stage 2, while ε_{3i} represents the error term with zero mean, constant variance and uncorrelated with the explanatory variables.

In Stage 4, g_i represents the observed level of firm sales growth, x_{4i} and β_{4i} express the vectors of respective determinants of firm performance and corresponding coefficients, k_i represents the estimates of the innovation output from Stage 3, while ε_{4i} represents the error term with zero mean, constant variance and uncorrelated with the explanatory variables.

The literature applying the CDM model has addressed the selectivity issue by estimating the first two stages of the model (Equation 3.1 and 3.2) jointly by the Heckman sample selection estimator (Loof, et al., 2001; Loof and Heshmati, 2002, 2006; Griffith, et al., 2006; Masso and Vahter, 2008; Johanson and Loof, 2009; Hashi and Stojcic, 2013). In most of the studies they refer to the sample selection model as the generalized Tobit model whereas the estimation methodology is the Heckman sample selection with Full Information Maximum Likelihood (FIML).[22] Wooldridge (2002, p. 571) emphasizes that using different names for a selection model is fine, but it must be understood that it is a model of sample selection and not a corner solution outcome. The FIML estimator is consistent, asymptotically efficient and normally distributed (Wooldridge, 2006. p. 587). Moreover, Wooldridge suggests that the FIML is the minimum variance unbiased estimator. It implies that the potential bias tends to go to zero as the sample size goes to infinity.

The model assumes joint normality of the disturbances in two equations. The error terms, ε_{1i} from Equation 3.1 and ε_{2i} from Equation 3.2 are assumed to be random error terms with zero mean, constant variances and are not correlated with the explanatory variables (Green, 2003, p. 782; Wooldridge, 2002, p. 562). The correlation of two error terms is assumed on the basis of unobservable characteristics of firms.

[22] Amemyia (1985) refers to this model as Tobit 2 whereas other authors (Loof and Heshmati, 2002, 2006; Griffith, et al., 2006; Johanson and Loof, 2009) refer to the model as generalized Tobit with maximum likelihood estimation.

The alternative method of estimating the sample selection model is a two-step Heckit model, which is a Limited Information Maximum Likelihood estimator (LIML).[23] In this alternative, a Probit estimation is undertaken in the first step to estimate the selection equation (Stage 1), or the propensity to innovate, and an OLS estimation in the second step to estimate the innovation investment equation (Stage 2). The inverse Mills ratio is obtained from the Probit estimation and is included as a variable in the investment equation to control for the selection bias.[24] Wooldridge (2009, p. 612) suggests to first estimate the model with the Heckit two-step estimator, and if the correlation between the disturbances of the two equations is indicated (suggesting the sample selection issue) then re-estimate the model using the Heckman FIML estimator.

In general, both methods involve some restrictions which should be considered. First, Wooldridge (2009, p. 610) emphasizes that the independent variables in the innovation investment equation (Stage 2) should be a subset of the independent variables in the selection equation (Stage 1), but in rare cases it makes sense to exclude elements from the selection equation if there is an economic rationale to do so. However, if they are excluded incorrectly it can lead to inconsistency of results. Second, at least one variable that explains the selection equation should not affect the investment equation. Crepon, et al. (1998) and later Loof, et al. (2001) included the same variables in the first two equations of the innovation input phase. Later studies (Loof and Heshmati, 2002, 2006; Maso and Vahter, 2008; Johanson and Loof, 2009; Hashi and Stojcic, 2013) differentiate between the first and second equation at least by identifying a factor that determines the

[23] The sample selection model is based on the work of Heckman (1979).
[24] Inverse Mills ratio is named after John P. Mills and represents the ratio of the probability density function over the cumulative distribution function of a distribution.

engagement of firms in innovation but does not have an impact in the investment stage. They also include additional variables in the investment equation.

In the output phase of the modified CDM model, both the selectivity and the simultaneity issues are addressed. Since in the output phase the sample consists of only firms with positive innovation sales and innovation expenditures, to account for the selectivity bias the inverse Mills ratio obtained in the input phase estimation is included as an explanatory variable in Stage 3 (Equation 3.3). In addition, to account for the endogeneity between innovation investments and innovation sales, the estimates of innovation investment from Stage 2 are included as an independent variable in Stage 3 (Loof and Heshmati, 2002, 2006; Johanson and Loof, 2009; Hashi and Stojcic, 2013). Finally, to account for the endogeneity between innovation and firm performance, the output phase equations (Equations 3.3 and 3.4) are estimated as a system of simultaneous equations by the three stage least squares (3SLS) estimator (Loof, et al., 2001; Loof and Heshmati, 2002, 2006; Hashi and Stojcic, 2013).

The 3SLS estimator developed by Zellner and Theil (1962) is a generalised method of moments (GMM) estimator that uses a particular weighting matrix and accounts for the endogeneity between the dependent variables in the two equations (Wooldridge, 2002, p. 194). The 3SLS follows the instrumental variable approach and produces consistent estimates using the Generalised Least Squares (GLS) method to control for the correlation between the disturbances in the system of two equations (Greene, 2003, pp. 331-336). As Greene (2003, p. 406) further explains, the 3SLS estimation follows a three step process: i) The dependent variables of both equations are regressed on the independent variables and the predicted values for each of the dependent variable is obtained; ii) Based on the residuals of each equation a consistent estimate for the covariance matrix of the equation disturbances is obtained; iii) Using the covariance matrix from step 2 and using the instrumented variables from step 1 (dependent variables used in the right hand side as independent variables) a type of Generalised Least Square estimation is obtained.[25]

Greene (2003, p. 409) emphasizes that among all instrumental variable estimators the 3SLS is asymptotically efficient and robust to non-normality with the same asymptotic distribution as the FIML estimator. Additionally, Green (2003, p. 414) suggests that a specification error may occur in the 3SLS estimator if any of the independent variables (assumed to be exogenous) are correlated with the structural disturbances. Hence, the test for the validity of the instruments is suggested. Nevertheless, Wooldridge (2002, p. 195) suggests to account also for the homoscedasticity of disturbances, since in the presence of heteroscedasticity the 3SLS estimator will be asymptotically less efficient.

The next section defines the variables and the model specifications.

3.3.3 Specification of the variables and the model

Following the review of literature in the section 2 of this chapter, we have specified the variables for each equation of the multi-stage CDM model. We specify the input phase of the CDM model by the following equations:

CDM Input phase (Stage 1 & 2)

$$\begin{aligned} innact_j = {} & \alpha_1 + \beta_{11} abinn_j + \beta_{12} groupeu_j + \beta_{13} groupother_j + \beta_{14} eumarket_j + \beta_{15} othermarkets_j + \beta_{16} national_j + \\ & \beta_{17} trademark_j + \beta_{18} marketdom_j + \beta_{19} costfact_j + \beta_{110} knowfact + \beta_{111} nodemand_j + \beta_{112} small_j + \\ & \beta_{113} medium_j + \beta_{114} manuf_j + \beta_{115} services_j + \beta_{116} y06_j + \gamma_1 countrydummies_{1ij} + \varepsilon_{1ij} \end{aligned} \tag{3.7}$$

$$\begin{aligned} lninninv_j = {} & \alpha_2 + \beta_{21} coop_j + \beta_{22} fineu_j + \beta_{23} fingov_j + \beta_{24} abinn_j + \beta_{25} groupeu_j + + \beta_{26} groupother_j + \\ & \beta_{27} eumarket_j + \beta_{28} othermarkets_j + \beta_{29} national_j + \beta_{210} trademark_j + \beta_{211} marketdom_j + \\ & \beta_{212} costfact_j + \beta_{213} knowfact + \beta_{214} small_j + \beta_{215} medium_j + \beta_{216} manuf_j + \beta_{217} services_j + \\ & \beta_{218} y06_j + \gamma_2 countrydummies_{2ij} + \varepsilon_{2ij} \end{aligned} \tag{3.8}$$

The definitions of the input phase variables are given in Table 3.1.

[25] Stata Manual 13 also provides a similar explanation of the 3SLS estimation procedure.

Table 3.1 Specification of variables – Input phase of the CDM model

	Description	CDM Stage 1 Decision to innovate	CDM Stage 2 Innovation investment
DEPENDENT VARIABLES			
innact	Dummy, taking the value of one if firms have introduced an innovation output (product or process) or have undertaken any innovation activity in the previous three years prior to the survey (including: intramural R&D, extramural R&D, acquisition of machinery, equipment and software, acquisition of other external knowledge, training, market introduction of innovations, or other preparations), zero otherwise	X	
lninninv	Natural logarithm of total innovation expenditures in the year of survey, including investment in the intramural and extramural R&D, Development, External Research, Acquisition of machinery, equipment and software, and other technological knowledge		X
INDEPENDENT VARIABLES			
Open innovation			
coop	Dummy, taking the value of one if firms have had any cooperation on innovation activities in the three years prior to the survey, zero otherwise		X
Innovation subsidies			
fineu	Dummy, taking the value of one if firms have received any financial support for innovation activities from the EU in the three years prior to the survey, zero otherwise		X
fingov	Dummy, taking the value of one if firms have received any financial support for innovation activities from the national government in the three years prior to the survey, zero otherwise		X
Internal capacity			
abinn	Dummy, taking the value of one if in the three years prior to the survey firms have had any innovation activity which has been abandoned or is still ongoing, zero otherwise	X	X
Foreign group membership			
groupeu	Dummy, taking the value of one if firms are part of the group and the head office is located in an EU country, zero otherwise	X	X
groupother	Dummy, taking the value of one if firms are part of the group and the head office is located in other foreign countries (not EU), zero otherwise	X	X
Market orientation			
eumarket	Dummy, taking the value of one if in the three years prior to the survey firms have had any sale of goods and services in the EU market, zero otherwise	X	X
othermarkets	Dummy, taking the value of one if in the three years prior to the survey firms have had any sale of goods and services in other foreign markets (except EU), zero otherwise	X	X
national *(base category – local)*	Dummy, taking the value of one if in the three years prior to the survey firms have had any sale of goods and services in the national market, zero otherwise	X	X
Appropriability conditions			
trademark	Dummy, taking the value of one if firms have registered any trademark in the three years prior to the survey, zero otherwise	X	X
Factors hampering innovation			
marketdom	Continuous - Likert Scale 0 (low) to 3 (high) if firms consider that the market domination by established enterprises is a highly important factor in hampering their innovation activities in the three years prior to the survey	X	X
costfact	Dummy, taking the value of one if firms consider that cost of innovation or financing was highly important in hampering their innovation activities in the three years prior to the survey, zero otherwise	X	X
knowfact	Dummy, taking the value of one if firms consider that lack of knowledge on markets and technology was highly important in hampering their innovation activities in the three years prior to the survey, zero otherwise	X	X
nodemand	Dummy, taking the value of one if firms consider that the prior innovation or the lack of market demand for innovation is a highly important factor in hampering their innovation activities in the three years prior to the survey, zero otherwise	X	
Sector			
manuf	Dummy, taking the value of one if firms belong to the manufacturing sector, otherwise zero	X	X
services *(base category – other sectors)*	Dummy, taking the value of one if firms belong to the services sector, zero otherwise	X	X

Source: Author's own specification using CIS data

The propensity to innovate equation (Equation 3.7) is represented by the dummy variable (*innact*), while the investment equation (Equation 3.8) is expressed by the natural logarithm of innovation expenditures *(lninninv).*

The propensity of firms to innovate (*innact*) is a function of: a dummy variable indicating the previous abandoned or ongoing innovation activities (*abinn*); two dummy variables for firms being members of a multinational group with headquarters in the EU or outside the EU (*groupeu*, *groupother*); three dummy variables for the presence in three particular markets (*eumarket*, *othermarkets* and *national*); a dummy variable expressing the appropriability conditions (*trademark*); a continuous variable expressing the importance of the degree of market domination by established firms for hampering firm's innovation activities (*marketdom*).

In addition, three dummy variables express factors hampering innovation (*costfact*, *knowfact* and *nodemand*); firm size is measured by dummy variables for *small* and *medium* sized enterprises (large enterprises as the base category) and two sector dummy variables express manufacturing and services (*manuf* and *service*) included to control for sectoral differences (all other industries are used as a base category).[26] We also include a year dummy (y06) and country dummies as control variables (these control variables are included in each stage of the model). Table 3.1 summarises the description of the above variables.

The variable *nodemand* defines the selection equation (included in Equation 3.7 but not in Equation 3.8), meaning that if firms have considered that no need for innovation and lack of demand for new products are highly important factors in hampering their innovation activities, they are not expected to invest in innovation. In the CIS questionnaire, with respect to questions on factors hampering innovation, sources of information, cooperation on innovation and derived effects of innovation, firms were asked to rank the degree of importance of these factors related to their innovation activities on a Likert scale from 0 (no importance) to 3 (high importance). For the

[26] Economic sectors in the survey are identified at two-digit level based on the statistical classification of economic activities by the European Communities (NACE) methodology.

respective indicators (presented in Table 3.1) included in our model specifications, if firms have considered their effects as highly important, we have specified dummy variables taking value one, otherwise zero. Only for the variable expressing the market domination by established firms we specify it as continuous variable (0 to 3), aiming to capture the relevance of the degree of domination by large firms.

The included variables are commonly used in the innovation studies (Klomp, et al., 2001; Loof, et al., 2002; Kemp, et al., 2003; Loof and Heshmati, 2006; Grifith, et al., 2006; Hashi and Stojcic, 2013) which investigate the input phase of innovation. In line with the findings of the literature discussed in this chapter, we expect that, except factors hampering innovation, all other variables have a positive effect on the propensity of firms to innovate.

With respect to the investment equation (Equation 3.8), although a group of studies has used the natural logarithm of innovation expenditure per employee as a measure of innovation intensity (Crepon, et al., 1998; Griffith, et al., 2006; Loof and Heshmani, 2006), due to the lack of information on the number of employees in the dataset, innovation input is measured by the natural logarithm of the overall amount spent on innovation in the year of survey. The broader definition of innovation investments responds to the criticism that many firms (especially smaller ones) do not include R&D expenditure explicitly in their accounts and therefore R&D expenditure would underestimate the actual amount spent on innovation inputs (Hashi and Stojcic, 2013).

In addition to the variables explaining Equation 3.7 (minus the exclusion variable *nodemand*), the innovation investments equation *(lninninv)* is also a function of: the cooperation of firms on innovation activities as represented by the dummy variable *coop*, and subsidies on innovation activities as represented by two dummy variables expressing subsidies from the EU or the national government (*fineu* and *fingov*). The inclusion of these factors in investment equation

(3.8) and not in the selection equation (3.7) seems logical as firms report these activities conditional on having engaged in innovation activities. As Crepon, et al. (1998) and Wooldridge (2009) note, if it makes sense to include additional variables in the outcome equation, the variables in the two equations do not need to be the same. Similar to the propensity to innovate function, we also expect that all the variables included in the model, except the factors hampering innovation, have a positive effect on firms' innovation investments.

We can now move on to the output phase of the CDM model, the innovation output and the firm performance equations. The two output phase equations are modelled jointly in a system of simultaneous equations. Here too, we define the model specification expressed by the following equations:

CDM Output phase (Stage 3 & 4)

$$\begin{aligned} lninsale_j = {} & \alpha_3 + \hat{\delta}_\iota lninninv_j + \beta_{31} firmgr_j + \beta_{32} codeg_j + \beta_{33} abinn_j + \beta_{34} innintern_j + \beta_{35} skills_j + \beta_{36} prodivers_j + \\ & \beta_{37} patapp_j + \beta_{38} designreg_j + \beta_{39} copyright_j + \beta_{310} marinfo_j + \beta_{311} associnfo_j + \beta_{312} fineu_j + \\ & \beta_{313} fingov_j + \beta_{314} groupeu_j + \beta_{315} groupother_j + \beta_{316} small_j + \beta_{317} medium_j + \beta_{318} manuf_j + \\ & \beta_{319} services_j + \beta_{320} y06_j + \gamma_3 countrydummies_{3ij} + \hat{\lambda}_\iota invmills_j + \varepsilon_{3ij} \end{aligned} \tag{3.9}$$

$$\begin{aligned} firmgr_j = {} & \alpha_4 + \beta_{41} lninsale_j + \beta_{42} abinn_j + \beta_{43} innintern_j + \beta_{44} prodivers_j + \beta_{45} procesef_j + \beta_{46} marinfo_j + \\ & \beta_{47} associnfo_j + \beta_{48} fineu_j + \beta_{49} fingov_j + \beta_{410} groupeu_j + \beta_{411} groupother_j + \beta_{412} costfact_j + \\ & \beta_{413} knowfact_j + \beta_{414} small_j + \beta_{415} medium_j + \beta_{416} manuf_j + \beta_{417} services_j + \beta_{418} y06_j + \\ & \gamma_4 countrydummies_{4ij} + \varepsilon_{4ij} \end{aligned} \tag{3.10}$$

The definitions of the output phase variables are given in Table 3.2. As some of the variables used in the output phase were also used in the input phase, the description of those variables is not repeated in Table 3.2.

Table 3.2 Specification of variables - Output phase of the CDM model

	Description	CDM Stage 3 Innovation Output	CDM Stage 4 Firm performance
DEPENDENT VARIABLES			
lninsale	Natural logarithm of sales of new products (sum of sales of products new to the firm and of products new to the market) in the survey year (Amount)	X	
firmgr	Percentage growth of sales over the two years prior to the survey		X
INDEPENDENT VARIABLES			
Open innovation			
codeg	Degree of open innovation (0 to 7) - number of cooperation partners on innovation activities in the three years prior to the survey **(Main specification)**	X	
cocus	Dummy, taking the value of one if firms have had any cooperation on innovation activities with customers in the three years prior to the survey, zero otherwise **(Alternative specification)**	X	
couni	Dummy, taking the value of one if firms have had any cooperation on innovation activities with universities in the three years prior to the survey, zero otherwise **(Alternative specification)**	X	
colab	Dummy, taking the value of one if firms have had any cooperation on innovation activities with research laboratories in the three years prior to the survey, zero otherwise **(Alternative specification)**	X	
cocom	Dummy, taking the value of one if firms have had any cooperation on innovation activities with competitors in the three years prior to the survey, zero otherwise **(Alternative specification)**	X	
cosu	Dummy, taking the value of one if firms have had any cooperation on innovation activities with suppliers in the three years prior to the survey, zero otherwise **(Alternative specification)**	X	
Internal capacity			
abinn	See Table 3.1	X	X
innintern	Dummy, taking the value of one if firms mainly used only their internal capacities to develop new products or processes in the three years prior to the survey, zero otherwise	X	X
skills	Dummy, taking the value of one if firms consider that lack of qualified personnel was highly important in hampering their innovation activities in the three years prior to the survey, zero otherwise	X	
Highly important innovation effects			
prodivers	Dummy, taking the value of one if firms consider that diversification of product range through new products introduced in the three years prior to the survey is highly important, zero otherwise	X	X
procesef	Dummy, taking the value of one if firms consider that increased production capacity or improved flexibility of production or service provision through new introduced processes in the three years prior to the survey is highly important, zero otherwise		X
Appropriability conditions			
patap	Dummy, taking the value of one if firms have made any application for patents in the three years prior to the survey, zero otherwise	X	
designreg	Dummy, taking the value of one if firms have registered any new product design in the three years prior to the survey, zero otherwise	X	
copyright	Dummy, taking the value of one if firms have claimed any copyright in the three years prior to the survey, zero otherwise	X	
Sources of Information			
marinfo	Dummy, taking the value of one if firms consider that the market information sources such as information from suppliers, customers or competitors, are highly important factor in developing their innovation activities in the three years prior to the survey, zero otherwise	X	X
associnfo	Dummy, taking the value of one if firms consider that information sources from the industrial and professional associations present a highly important factor in developing their innovation activities in the three years prior to the survey, zero otherwise	X	X
Innovation subsidies			
fineu	See Table 3.1	X	X
fingov	See Table 3.1	X	X
Foreign group membership			
groupeu	See Table 3.1	X	X
groupother	See Table 3.1	X	X
Factors hampering innovation			
costfact	See Table 3.1		X
knowfact	See Table 3.1		X
Sector			
manuf	See Table 3.1	X	X
services (base category – other sectors)	See Table 3.1	X	X

Source: Author's own specification using CIS data

The natural logarithm of sales of new products (sum of sales of products new to the firm and of products new to the market) represents the innovation output, the dependent variable *lninsale*. As argued earlier, the innovation sales express a more direct indicator of innovation output and enables the assessment of the innovation performance or effectiveness.

We extend the investigation of the CDM model literature by estimating separately the relevance of the degree of novelty of product innovation – by constructing two additional variables to be used in separate model estimations: the natural logarithm of sales of products new to the market (*lnnewmktsale*) and the natural logarithm of sales of products new to the firm (*lnnewfrmsale*).

Using the same model specification, we estimate the model separately for both types of sales. By doing so, we can assess whether the relationship between the innovation output and its determinants depends on the degrees of innovation novelty.

The innovation output as measured by natural logarithm of innovation sales (*lninsale*), new to the market sales (*lnnewmktsale*) or new to the firm sales (*lnnewfrmsale*) is a function of: firm performance as measured by sales growth over the two years prior to the survey (*firmgr*); open innovation sources, as measured by the breadth of open innovation (*codeg*) expressing the number of cooperation partners on innovation activities over a three year period prior to the survey (0 to 7), and alternatively, by different types of firm's cooperation on innovation activities expressed by four dummy variables (*cosup, cocom, cocus, colab*); internal capacity for innovation (*abinn*, *innintern*, *skills*); highly important effects of product innovation (*prodivers*); appropriability conditions (*patap, designreg, copyright*); sources of information from the market or the business associations (*marinfo, associnfo*); innovation subsidies (*fineu, fingov*); membership of a foreign group (*groupeu, groupother*); and. In addition, we also control for the firm size (*small, medium*), and the sector that firms belong (*manuf, services*).

As an extension to the previous literature applying the CDM model, and following the argumentation provided in the literature review of this chapter, we hypothesize that the relationship between innovation and its explanatory factors depends on the degree of novelty of innovation. In addition, and in line with the literature, we expect that cooperation on innovation activities has a positive effect on innovation output as measured by innovation sales, and particularly on the sales of products new to the market. We argue that a multiparty cooperation on innovation activities increases creativity and generates knowledge synergy. With respect to variables which are considered as major obstacles, we expect them to be negatively related to innovation output. All other variables in the model are expected to have a positive effect on innovation.

In the last step of the CDM model, the firm performance equation, the dependent variable *firmgr* expresses the percentage of sales growth over the last two years prior to the survey. The sales growth indicator is used also by Loof and Heshmati (2006) and Kemp, et al., (2003) as a firm performance measure. Although most of the CDM studies suggest the labour productivity indicator to be a better measure of performance, our dataset does not provide us with such information.

The firm performance (*firmgr*) is a function of: the innovation output as measured by three alternative indicators - the natural logarithm of innovation sales (l*ninsale*), of new to the market sales (*lnnewmktsale*) and of new to the firm sales (*lnnewfrmsale*); internal capacity for innovation (*abinn, innintern, skills*); highly important effects of innovation (*prodivers, procesef*); sources of information from the market or the business associations (*marinfo, associnfo*); innovation subsidies (*fineu, fingov*); membership of a foreign group (*groupeu, groupother*); factors hampering innovation (*costfact, knowfact*); size (*small, medium*) and the sector (*manuf, service*).

Following the discussion in the literature review section, we hypothesize that the impact of innovation on firm performance is sensitive to the degrees of innovation novelty. We expect that products new to the market will have a stronger and positive effect on firm performance as compared to the products new to the firm. In addition, we expect that product diversification (*prodivers*) and increased capacity and flexibility of production (*procesef*) to have positive effects on firm performance. We expect that factors hampering innovation will also have a negative effect on firms' sales growth. All other factors are expected to be positively related to firm performance.

In the next section we present the data descriptive statistics.

3.3.4 Descriptive statistics

The descriptive statistics of the variables included in the input phase of the CDM model, as well as statistics of sales growth (dependent variable in the firm performance equation), for both innovating and non-innovating firms are presented in Table 3.3.[27]

Innovating firms show to have experienced higher sales growth in both years (2004 and 2006), while in general firms have experienced higher sales growth in the period 2004-2006 compared to 2002-2004.[28] Innovating firms have also outperformed non-innovating firms with respect to the share of firms being member of an international group, as well as in being present in an international market. Only around 4 percent of non-innovating firms have registered a trademark in the three years prior to the survey, compared to about 18 and 21 percent of innovating firms. Perceptions towards cost factors as obstacles to innovation seem to have had a similar effect on both types of firms. Compared to non-innovating firms, the importance of market domination

[27] In Table 3.3 we present descriptive statistics of variables which information is available for innovating and non-innovating firms (questions answered by all enterprises). In addition to the information in the table, in the Appendices A3.1.1 and A3.1.2 we present missing observations statistics for variables of the input and output phase which show a fairly low proportion of missingness.

[28] The World Bank GDP growth indicators show that countries included in the analysis have experienced an increasing GDP growth trend in the respective period (See World Bank GDP growth indicators http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG).

by established firms for hampering their innovation activities was considered relatively more important by innovating firms.

Table 3.3 Comparative descriptive statistics – Non-innovating vs innovating sample

Sample		Total	Non-innovators					Innovators				
Variable	Data	Obs	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
firmgr	CIS 2004	35120	25,507	0.16	0.74	-0.99	4.98	9,613	0.21	0.67	-0.98	4.99
	CIS 2006	40245	29,041	0.37	0.82	-0.99	4.99	11,204	0.40	0.77	-0.99	4.99
abinn	CIS 2004	35109	25,507	0.00	0.01	0	1	9,602	0.39	0.49	0	1
	CIS 2006	40217	29,013	0.00	0.01	0	1	11,204	0.36	0.48	0	1
groupeu	CIS 2004	35120	25,507	0.06	0.24	0	1	9,613	0.18	0.38	0	1
	CIS 2006	40245	29,041	0.06	0.24	0	1	11,204	0.16	0.36	0	1
groupother	CIS 2004	35120	25,507	0.01	0.09	0	1	9,613	0.03	0.16	0	1
	CIS 2006	40245	29,041	0.01	0.09	0	1	11,204	0.02	0.16	0	1
eumarket	CIS 2004	35119	25,506	0.27	0.44	0	1	9,613	0.48	0.50	0	1
	CIS 2006	40217	29,013	0.29	0.46	0	1	11,204	0.48	0.50	0	1
othermarkets	CIS 2004	35119	25,506	0.08	0.27	0	1	9,613	0.21	0.41	0	1
	CIS 2006	40217	29,013	0.10	0.30	0	1	11,204	0.22	0.41	0	1
national	CIS 2004	35118	25,505	0.35	0.48	0	1	9,613	0.34	0.47	0	1
	CIS 2006	40217	29,013	0.20	0.40	0	1	11,204	0.35	0.48	0	1
trademark	CIS 2004	35109	25,496	0.04	0.18	0	1	9,613	0.21	0.40	0	1
	CIS 2006	40216	29,012	0.04	0.19	0	1	11,204	0.18	0.38	0	1
marketdom	CIS 2004	35040	25,436	0.98	1.15	0	3	9,604	1.27	1.09	0	3
	CIS 2006	40217	29,013	1.12	1.12	0	3	11,204	1.23	1.07	0	3
costfact	CIS 2004	35038	25,435	0.41	0.49	0	1	9,603	0.39	0.49	0	1
	CIS 2006	40217	29,013	0.34	0.47	0	1	11,204	0.33	0.47	0	1
knowfact	CIS 2004	35047	25,434	0.28	0.45	0	1	9,613	0.06	0.24	0	1
	CIS 2006	40217	29,013	0.34	0.47	0	1	11,204	0.06	0.24	0	1
nodemand	CIS 2004	35048	25,444	0.13	0.33	0	1	9,604	0.05	0.22	0	1
	CIS 2006	40215	29,013	0.13	0.34	0	1	11,202	0.05	0.23	0	1
small	CIS 2004	35120	25,507	0.63	0.48	0	1	9,613	0.39	0.49	0	1
	CIS 2006	40245	29,041	0.64	0.48	0	1	11,204	0.41	0.49	0	1
medium	CIS 2004	35120	25,507	0.29	0.45	0	1	9,613	0.38	0.48	0	1
	CIS 2006	40245	29,041	0.29	0.45	0	1	11,204	0.38	0.49	0	1
manuf	CIS 2004	35120	25,507	0.51	0.50	0	1	9,613	0.57	0.49	0	1
	CIS 2006	40245	29,041	0.51	0.50	0	1	11,204	0.63	0.48	0	1
services	CIS 2004	35120	25,507	0.23	0.42	0	1	9,613	0.22	0.41	0	1
	CIS 2006	40245	29,041	0.25	0.43	0	1	11,204	0.24	0.43	0	1

Source: Stata outputs and author's own calculation using CIS Data

Non-innovating firms show to be relatively more sensitive to the lack of demand for new products and to the knowledge related factors as a relatively larger share of them consider these factors highly important in hampering their innovation activities. Alternatively, innovating firms tend to be larger in size and a relatively higher share of them belongs to the manufacturing sector in both datasets.

As explained in the data section, the innovating firms have to respond to some additional questions in the CIS survey. Therefore, Table 3.4 presents descriptive statistics only for the variables relating to innovating firms.

Table 3.4 Descriptive statistics – Innovating firms sample

Variable	Obs		Mean		Std. Dev.		Min	Max
	CIS 2004	CIS 2006	CIS 2004	CIS 2006	CIS 2004	CIS 2006	CIS 2004 / CIS 2006 [a]	
Dependent Variables (Presented as share of total sales)								
Sales of new products	6,651	7,153	0.28	0.28	0.25	0.25	0.01	0.99
Sales of products new to the market	4,060	4,039	0.23	0.23	0.22	0.22	0.01	0.99
Sales of products new to the firm	5,130	5,591	0.22	0.23	0.21	0.21	0.01	0.99
Innovation investments	7,622	8,550	0.06	0.06	0.11	0.12	0.00	0.89
Independent Variables[b]								
coop	9,611	11,201	0.38	0.35	0.48	0.48	0	1
codeg	9,613	11,204	1.00	1.08	1.80	1.84	0	7
cocus	9,613	11,204	0.17	0.17	0.37	0.38	0	1
couni	9,613	11,204	0.12	0.14	0.32	0.34	0	1
colab	9,613	11,204	0.14	0.15	0.34	0.36	0	1
cocom	9,613	11,204	0.13	0.14	0.34	0.35	0	1
cosu	9,613	11,204	0.25	0.26	0.43	0.44	0	1
innintern	9,613	11,204	0.40	0.40	0.49	0.49	0	1
skills	9,604	11,204	0.10	0.13	0.31	0.33	0	1
prodivers	8,790	10,614	0.34	0.36	0.47	0.48	0	1
procesef	8,624	10,272	0.35	0.34	0.48	0.47	0	1
patapp	9,613	11,204	0.08	0.07	0.27	0.25	0	1
designreg	9,613	11,204	0.08	0.07	0.27	0.25	0	1
copyright	9,613	11,204	0.05	0.04	0.21	0.19	0	1
marinfo	9,613	11,204	0.51	0.50	0.50	0.50	0	1
associnfo	9,613	11,203	0.06	0.05	0.23	0.22	0	1
fineu	9,611	11,202	0.05	0.08	0.23	0.27	0	1
fingov	9,612	11,203	0.10	0.11	0.31	0.31	0	1

Source: Stata outputs and author's own calculation using CIS Data

[a] Due to similar min and max values in CIS 2004 and CIS 2006 the values reported apply to both datasets

[b] Variable *codeg* is continuous (0-7). All other variables are dummies

The descriptive statistic show that some innovating firms have not reported innovation expenditure in the survey year. Similarly, not all of the innovating firms have reported sales of new products in the year of survey. A logical explanation is that some firms that have invested in innovation activities in the year of survey may have not been able to commercialise their products while some that have introduced innovation in the years before may have decided not to invest in the year of survey.

Although the dependent variables of Stages 2 and 3 (innovation input and innovation output equations) are measured by the natural logarithm of the innovation investments (Stage 2) and the natural logarithm of the sales of new products (Stage 3), to make a relative comparison we analyse their share in total sales. The mean share of sales of new products generated in the year of survey is about 28 percent of total sales in both datasets. Whereas the mean share of sales of products new to the market in total sales is about 23 percent, slightly higher than the mean share of sales of products new to the firm (about 22 percent). The mean share of innovation expenditures in total sales in the year of survey is much lower, as it would be expected, or about 6 percent in both CIS 2004 and CIS 2006 datasets.

In terms of independent variables, around 38 percent of firms in CIS 2004 and 35 percent in CIS 2006 have engaged in cooperation for innovation. The variable *codeg* shows that, on average, firms had around one cooperation partner. The most often cooperation has taken place with suppliers (about 26 percent of firms). About 40 percent of innovating firms have indicated to have relied on their internal resources for developing innovation. Only 10 percent of firms in CIS 2004 and 13 percent in CIS 2006 have considered skills of their employees as a highly important factor in hampering innovation activities. About 34 to 35 percent of innovating firms have indicated that the effects of product innovation and process innovation (diversification of products and increase of production capacity and flexibility) are highly important for their performance. The share of firms that have applied for a patent, registered a trademark or have claimed a copyright, is between 5 and 7 percent in both CIS 2004 and CIS 2006. In terms of access to information sources, market information sources were considered highly important by around 50 percent of firms, while information received from professional or industrial associations was considered important only by around 6 percent of firms. Finally, in terms of innovation subsidies, around 10 percent (CIS 2004) and 11 percent (CIS 2006) of firms have received subsidies from the national government compared to about 5 percent (CIS 2004) and 8 percent (CIS 2006) from EU sources.

In the next section we discuss empirical results.

3.4 Empirical results

In this section we first present the diagnostics of the empirical estimation of the CDM model and then discuss the main findings for each equation of the model.

3.4.1 Estimation diagnostics

In this section we discuss diagnostics of the empirical estimations. As a first check, collinearity diagnostics show a very low correlation between the independent variables, or a Variance Inflation Factor (VIF) mean of about 1.5 for both sets of independent variables specified in the first two stages of the model (Appendix A3.1.3). In terms of the estimation of the input phase of the CDM model, although most of the studies (Loof and Heshmati, 2002, 2006; Griffith, et al., 2006; Masso and Vahter, 2008, e.g.) use only the Heckman FIML, for the robustness check we follow Wooldridge (2009, p. 612) suggestion and first undertake the Heckit two-step estimation of a restricted model specification (Stage 2 independent variables are a subset of Stage 1 variables minus the exclusion variable).[29] The Mills Lambda coefficient expressing the correlation between the disturbances of the two equations appears significant in all estimations suggesting that sample selection is an issue. Then, we estimate the same restricted model specification for all three datasets using the Heckman FIML estimator. Similar to the Heckit two-step estimation results, the sample selection is indicated for all estimations and results are consistent for the three datasets using both estimators (Lambda appears significant in all estimations). Then, we undertake the Heckman FIML estimation for the input phase of main model specification (Equations 3.7 and 3.8) which includes three additional variables (the innovation subsidies variables *fineu* and *fingov*, and the open innovation variable *coop*) in Stage 2 (the innovation investment equation) compared to the restricted model. The estimates of the three additional variables appear statistically significant, have the expected signs and there is no significant influence on estimated coefficients of other variables. Except for the CIS 2004 estimation where the Lambda coefficient loses its statistical significance, in all other estimations the sample selection is clearly indicated.

The Heckman FIML estimator is limited in terms of the post-estimation tests. Consequently, to test the robustness of the model we run a separate Probit regression using the same sample and the model specification used in the Heckman FIML estimation (Appendix A3.3). Following Wooldridge (2009, p. 581) we compute a goodness of fit measure called ‘the proportion correctly predicted’. The Probit estimator for CIS 2004, CIS 2006 and the CIS Pooled show high percentage of correct predictions (between 85 and 87 percent). In addition, we also run the *linktest* to check if the model is correctly specified. The *linktest* is the “Ramsey RESET test”, which is best interpreted as a test for linear functional form of the relationship under investigation in the data. It regresses the model on the linear predicted value ‘hat’ and its squared value ‘hatsq’. The correct

[29] For brevity of presentation the detailed results of the restricted model estimated by Heckit two-step and Heckman FIML estimator are presented in the Appendix A3.2.

specification is suggested if ‘hat’ variable appears significant, while ‘hatsq’ insignificant. *Linktest* for each estimation supports the specification of the model (Appendix A3.3). With respect to the dependent variable of the investment equation (Stage 2), the histogram of the variable *lninninv* indicates a normal distribution (Appendix A3.4.0), although in large datasets normality is less of an issue.

With respect to the diagnostics of the 3SLS estimation, Wooldridge (2009, p. 516) suggests not to interpret the R-squared of the regression. As Wooldridge argues, although the regression software packages compute an R-squared for each equation, due to the cross-equational computations and the way it is calculated in the models using instrumental variables, the R-squared may be negative and does not have any natural interpretation.

To test for the over-identifying restrictions, following Greene (2003, p. 414) we undertake the Hansan-Sargan test for the validity of the instruments used in the simultaneous equations (Ho: the instruments are valid). The Hansan-Sargan test strongly supports the validity of each model specification.[30] On the other hand, the null hypothesis of homoscedasticity suggests that we can reject the null hypothesis at 1 percent level statistical significance, indicating the presence of heteroscedasticity.[31] We address the heteroscedasticity issue by adjusting the standard errors. The right procedure to account for heteroscedasticity would be to use the robust standard errors, but this is not available in a 3SLS estimator in Stata. Therefore, to adjust the standard errors we apply the bootstrapping of standard errors.[32] By doing so, we also adjust for a potential collinearity issue

[30] Hansan-Sargan test indicates that we cannot reject Ho hypothesis in any of the estimated models. Test results provided in the Appendix A3.5 after each 3SLS estimation.

[31] To undertake the test for heteroscedasticity after the 3SLS estimation using Stata we use the command lmhreg3 and obtain Langrage Multiplier (LM), Likelihood Ratio (LR) and the Wald test.

[32] “Bootstrapping is a nonparametric approach for evaluating the distribution of a statistic based on random resampling. The bootstrap sampling distribution approaches the true sampling distribution as the number of resamples gets large. The bootstrapped standard errors and the robust standard errors are similar. The bootstrap is an alternative method for estimating the standard errors when the theoretical calculation is complicated or not available in the current software” Guan (2003).

due to the inclusion of the estimates of innovation investment variable *lninninv* (dependent variable of Equation 2) as an independent variable in Equation 3. The reported results of the 3SLS estimation include bootstrapped standard errors. Next, we discuss the main results per each equation of the CDM model.

3.4.2 Main findings - the propensity to innovate equation

The results of the estimation of the propensity to innovate equation (the Heckman FIML estimates of the selection equation) are presented in Table 3.5. As the main focus of this research is the results of the output phase of the CDM model, or the effects of the factors explaining the innovation output and firm performance, and for the simplicity of interpretation, we will not calculate the marginal effects but will discuss only the direction and significance of the coefficients.

The results are consistent across all three datasets. Having abandoned an innovation project in the past suggests a positive and significant effect on the probability to engage in innovation activities for all three datasets. It seems that any previous experience in innovation activities encourages firms for future innovation.

Being a foreign subsidiary, of an EU or another international company, suggests a significant and positive effect on the propensity of firms to innovate in all estimations. In line with the suggestions of Kanoa, et al. (2016), it appears that the international subsidiaries are more inclined to innovation as compared to domestic firms.

The presence of firms in the EU market, other foreign markets and in the national market as well indicates a positive and significant impact on the probability of firms to engage in innovation activities compared to firms operating in local/regional market for all three datasets. Although for the CIS 2006 dataset the presence in the EU market does not appear significant, we can infer that being present in wider and more competitive markets enhances the firms' propensity to innovate. The relevance and importance of intellectual property rights, expressed by the registration of a trademark, indicate a significant and positive influence on the firm's propensity to innovate.

Table 3.5 The propensity to innovate equation (Stage 1) – estimation results[a]

Dataset	CIS 2004	CIS 2006	CIS Pooled
Propensity to Innovate	*Innact*	*innact*	*innact*
abinn	3.895***	4.304***	4.058***
	(0.185)	(0.268)	(0.151)
groupeu	0.350***	0.277***	0.312***
	(0.0350)	(0.0323)	(0.0236)
groupother	0.404***	0.269***	0.323***
	(0.0933)	(0.0801)	(0.0614)
eumarket	0.373***	-0.0152	0.127***
	(0.0285)	(0.0285)	(0.0164)
othermarkets	0.413***	0.180***	0.267***
	(0.0334)	(0.0312)	(0.0219)
national	0.385***	0.241***	0.152***
	(0.0267)	(0.0331)	(0.0153)
trademark	0.901***	0.861***	0.894***
	(0.0352)	(0.0332)	(0.0241)
marketdom	0.203***	0.158***	0.184***
	(0.00932)	(0.00919)	(0.00645)
costfact	0.0544**	0.0861***	0.0604***
	(0.0231)	(0.0221)	(0.0157)
knowfact	-1.117***	-1.154***	-1.131***
	(0.0349)	(0.0305)	(0.0230)
nodemand	-0.660***	-0.643***	-0.645***
	(0.0418)	(0.0378)	(0.0280)
small	-0.568***	-0.625***	-0.607***
	(0.0321)	(0.0312)	(0.0223)
medium	-0.295***	-0.307***	-0.307***
	(0.0309)	(0.0302)	(0.0215)
manuf	0.188***	0.269***	0.228***
	(0.0291)	(0.0268)	(0.0191)
services	0.196***	0.211***	0.196***
	(0.0319)	(0.0297)	(0.0213)
y06			0.0693***
			(0.0139)
cons	-0.991***	-0.583***	-0.746***
	(0.0472)	(0.0421)	(0.0305)
lnsigma			
cons	0.599***	0.594***	0.599***
	(0.00828)	(0.00798)	(0.00574)
Wald Test (rho=0) p value	0.15	0.02**	0.01**
N	33019	37550	70569

Robust standard errors in parentheses
* p<0.1 ** p<0.5 *** p<0.01
Country dummies included
Source: Stata regression outputs
[a] Detailed regression results are presented in Appendix A3.4

With respect to factors hampering innovation, demand factors and knowledge related factors suggest a significant and negative effect on the propensity to innovate. On the other hand, cost factors appear positive and significant across all estimations. Somewhat similar results are reported by Loof, et al. (2002) and Hashi and Stojcic (2013). They argue that hampering factors may influence firms to be more restrictive and select only ideas with higher probability of success and higher return. Challenged by unfavourable business environment conditions, firms may engage in innovation aiming to increase productivity and competitiveness. Similarly, the degree of market domination as an obstacle to innovation appears significant and positive in all regressions. Although one would expect that as higher the dominance of the market by other firms, the lower would be the likelihood of firms to innovate, it seems that the market domination by established firms increases firms' likelihood to innovate.

In line with the Schumpeter (1942) proposition, large firms seem to be more likely to engage in innovation activities than small and medium sized firms. Among other reasons, financial and research resources give them an advantage in comparison to the smaller firms. In terms of the industrial characteristics, belonging to the manufacturing or the service sector increases the probability of engagement in innovation as compared to other industries. Finally, the year dummy variable appears positive and significant suggesting that the probability of firms to engage in innovation was higher in the CIS 2006 compared to the CIS 2004 survey period.

The next section discusses the findings of the Stage 2 of the CDM model estimation.

3.4.3 Main findings - the innovation investment equation

Table 3.6 presents the results of the Heckman FIML investment equation (Stage 2). The results show that the possibility of 'open innovation' motivates and enables firms to increase innovation expenditures. Cooperation with other partners appears to have a significant and positive effect for all three datasets.

Table 3.6 The innovation investment equation (Stage 2) – estimation results[a]

Dataset	CIS 2004	CIS 2006	CIS Pooled
Innovation investment	*lninninv*	*lninninv*	*lninninv*
coop	0.412***	0.364***	0.386***
	(0.0464)	(0.0446)	(0.0322)
fineu	0.560***	0.493***	0.502***
	(0.0879)	(0.0718)	(0.0554)
fingov	0.668***	0.696***	0.690***
	(0.0665)	(0.0608)	(0.0449)
abinn	0.473***	0.413***	0.435***
	(0.0961)	(0.0898)	(0.0662)
groupeu	0.708***	0.648***	0.667***
	(0.0618)	(0.0603)	(0.0430)
groupother	0.769***	0.912***	0.834***
	(0.141)	(0.144)	(0.101)
eumarket	0.233***	0.0572	0.0838**
	(0.0650)	(0.0608)	(0.0340)
othermarkets	0.384***	0.193***	0.265***
	(0.0599)	(0.0569)	(0.0389)
national	0.302***	0.120*	0.0831***
	(0.0685)	(0.0700)	(0.0314)
trademark	0.333***	0.293***	0.321***
	(0.0573)	(0.0557)	(0.0401)
marketdom	-0.0378*	-0.0138	-0.0250*
	(0.0212)	(0.0197)	(0.0145)
costfact	-0.182***	-0.173***	-0.181***
	(0.0444)	(0.0429)	(0.0309)
knowfact	-0.0973	-0.101	-0.0928
	(0.0896)	(0.0858)	(0.0622)
small	-2.235***	-2.166***	-2.192***
	(0.0657)	(0.0626)	(0.0454)
medium	-1.189***	-1.172***	-1.181***
	(0.0583)	(0.0565)	(0.0407)
manuf	0.182**	-0.0466	0.101**
	(0.0717)	(0.0649)	(0.0446)
services	0.283***	0.0982	0.226***
	(0.0778)	(0.0709)	(0.0499)
y06			0.163***
			(0.0292)
_cons	11.27***	11.67***	11.43***
	(0.151)	(0.128)	(0.0953)
N	7599	8538	16137

Robust standard errors in parentheses
* p<0.1 ** p<0.5 *** p<0.01
Country dummies included
Source: Stata regression outputs
[a] Detailed regression results are presented in Appendix A3.4

Firms receiving innovation subsidies from the EU or the national government also show a positive and significant effect on innovation expenditures. Similar findings are reported in the CDM related literature (Griffith, et al., 2006; Masso and Vahter, 2008; Hashi and Stojcic, 2013). As Masso and Vahter (2008) argue, opening up of the EU structural funds in 2004 in Estonia led to an increased support for investments in research and development. It seems that financial support received from the EU and the central government is likely to offset some business risk and provides incentives for firms to increase their own investments in innovation.

Engagement in previous innovation activities appears as a significant factor in increasing firms' investments in research, even in case of failed projects. Being a member of an international group indicates a significant and positive effect on innovation input. Such an effect is found also by other studies applying the CDM model (Loof and Heshmati, 2002; Griffith, et al., 2006; Masso and Vahter, 2008). Access to the knowledge and expertise of the group seems to be relevant for innovation efforts of subsidiary firms. A positive and significant effect on innovation input is also suggested for firms that operate in the national and foreign markets. The coefficient of the variable expressing the presence of firms in the EU market (*eumarket*) losses its significance for the CIS 2006 dataset, but is highly significant in the CIS 2004 and CIS Pooled data.

The variable expressing the appropriability conditions, *trademark*, appears significant and positive across all estimations. As expected, cost related obstacles (*costfact*) appear significant and negative for all three datasets, while other factors hampering innovation appear negative but mainly insignificant.

In terms of the firm size, both small and medium sized firms seem to invest less in innovation. As argued in the literature review section in this chapter, poorer financial and research capacities of SMEs compared to large firms can be a reason for this finding. With respect to the industry, sector dummy variables suggest that firms belonging to the manufacturing or the service sector will invest more in innovation activities as compared to firms in other sectors. The year dummy variable appears positive and significant, suggesting higher investments in innovation activities in 2006 compared to 2004.

Overall, the estimated effects of the innovation input determinants are generally in line with the theoretical expectations and findings in the literature.

In the next section, we will discuss findings of the innovation output equation (Stage 3).

3.4.4 Main findings - the innovation output equation

In the interest of brevity and in order to avoid repetition, the results of the second stage of the CDM model are discussed only for the CIS Pooled dataset (the results for all datasets are presented in Appendix A3.6).[33]

Table 3.7 presents the results of the innovation output equation (Stage 3) 3SLS estimation for the main model specification (Equation 3.9) as well as the alternative specification (In the main specification we control for the degree of cooperation while in the alternative specification we control for the type of cooperation). We will discuss the results of the main specification, while we will interpret the alternative specification results only for the additionally included variables expressing types of cooperation. As the dependent variable is logarithmic, the estimates present semi-elasticities of innovation output with respect to independent variables and their interpretation is not straightforward.

[33] The 3SLS estimation results of the CIS 2004 and CIS 2006 are presented in Appendix A3.6. The results across the estimation for all three datasets are generally consistent.

Table 3.7 The innovation output equation (Stage 3) – estimation results for the main and alternative specifications[a]

Model Specification	CIS Pooled Main Specification			CIS Pooled Alternative Specification		
Innovation sales	Innovation sales	New to the market	New to the firm	Innovation sales	New to the market	New to the firm
	lninsale	*lnnewmktsale*	*lnnewfrmsale*	*lninsale*	*lnnewmktsale*	*lnnewfrmsale*
lninninv	0.688***	0.563***	0.676***	0.765***	0.616***	0.763***
	(0.0676)	(0.122)	(0.0822)	(0.0571)	(0.0981)	(0.0894)
firmgr	2.379***	3.112***	2.137***	2.308***	3.079***	2.050***
	(0.332)	(0.556)	(0.463)	(0.395)	(0.691)	(0.436)
codeg	0.0325***	0.0344***	0.00154			
	(0.00788)	(0.0114)	(0.0119)			
cocus				-0.0380	-0.0460	-0.126***
				(0.0509)	(0.0655)	(0.0484)
couni				0.0121	-0.0394	-0.0243
				(0.0537)	(0.0662)	(0.0605)
colab				0.194***	0.184***	0.224***
				(0.0512)	(0.0562)	(0.0527)
cocom				0.0128	0.0470	-0.0260
				(0.0551)	(0.0557)	(0.0490)
cosu				-0.0438	-0.0140	-0.105**
				(0.0495)	(0.0557)	(0.0481)
innintern	0.178***	0.0583	0.0842*	0.181***	0.0619	0.0881*
	(0.0365)	(0.0637)	(0.0480)	(0.0435)	(0.0704)	(0.0475)
abinn	-0.124*	-0.173	-0.106	-0.138**	-0.162	-0.122
	(0.0695)	(0.110)	(0.0858)	(0.0663)	(0.108)	(0.0795)
skills	-0.00658	-0.0812	-0.0428	-0.00171	-0.0727	-0.0354
	(0.0402)	(0.0581)	(0.0440)	(0.0437)	(0.0542)	(0.0428)
prodivers	0.233***	0.212***	0.173***	0.241***	0.220***	0.182***
	(0.0429)	(0.0623)	(0.0640)	(0.0437)	(0.0839)	(0.0558)
patapp	0.236***	0.191***	0.231***	0.230***	0.185***	0.214***
	(0.0533)	(0.0522)	(0.0649)	(0.0484)	(0.0621)	(0.0621)
designreg	0.0475	0.0454	0.0275	0.0395	0.0353	0.0175
	(0.0478)	(0.0647)	(0.0671)	(0.0479)	(0.0646)	(0.0547)
copyright	0.0845	-0.00867	-0.0902	0.0774	-0.0180	-0.0982
	(0.0633)	(0.0807)	(0.0792)	(0.0573)	(0.0789)	(0.0683)
marinfo	0.155***	0.147**	0.144***	0.159***	0.150**	0.151***
	(0.0375)	(0.0650)	(0.0449)	(0.0362)	(0.0648)	(0.0512)
associnfo	0.121	0.234*	0.0491	0.122*	0.238**	0.0492
	(0.0785)	(0.119)	(0.0987)	(0.0719)	(0.101)	(0.107)
fineu	-0.195**	-0.254*	-0.245**	-0.237***	-0.276***	-0.295***
	(0.0829)	(0.139)	(0.0956)	(0.0699)	(0.105)	(0.0810)
fingov	-0.538***	-0.623***	-0.466***	-0.590***	-0.645***	-0.533***
	(0.0766)	(0.112)	(0.0706)	(0.0762)	(0.120)	(0.0911)
groupeu	0.199**	0.237**	0.247***	0.161**	0.212	0.192**
	(0.0795)	(0.0995)	(0.0937)	(0.0715)	(0.136)	(0.0860)
groupother	0.388***	0.447**	0.314*	0.336***	0.420**	0.240
	(0.149)	(0.205)	(0.162)	(0.122)	(0.206)	(0.153)
small	-1.593***	-2.010***	-1.619***	-1.409***	-1.889***	-1.403***
	(0.165)	(0.335)	(0.222)	(0.169)f	(0.266)	(0.236)
medium	-0.813***	-1.046***	-0.847***	-0.715***	-0.982***	-0.729***
	(0.0959)	(0.192)	(0.132)	(0.100)	(0.158)	(0.133)
manuf	-0.726***	-0.802***	-0.580***	-0.738***	-0.804***	-0.598***
	(0.0648)	(0.0944)	(0.0741)	(0.0697)	(0.112)	(0.0699)
services	-0.952***	-1.074***	-0.783***	-0.960***	-1.077***	-0.797***
	(0.0787)	(0.123)	(0.0952)	(0.0783)	(0.126)	(0.0891)
y06	-0.409***	-0.475***	-0.325***	-0.408***	-0.475***	-0.323***
	(0.0686)	(0.0933)	(0.0922)	(0.0712)	(0.106)	(0.0804)
invmills	-0.0254	-0.0527	0.0105	-0.00922	-0.0299	0.0306
	(0.0452)	(0.0649)	(0.0575)	(0.0423)	(0.0675)	(0.0482)
_cons	6.942***	8.269***	6.725***	6.055***	7.636***	5.720***
	(0.774)	(1.404)	(0.931)	(0.654)	(1.161)	(1.048)
N	11869	7091	9246	11869	7091	9246

Bootstrapped standard errors in parentheses
* p<0.1 ** p<0.5 *** p<0.01
Country dummies included
Source: Stata regression outputs
[a] The detailed regression results are presented in Appendix A3.5

The semi-elasticities express the percentage change in the dependent variable for a unit change in the regressor for cases when the regressor is quantitative (Gujarati, 2003, p. 320). But for dummy variables, the semi-elasticities are obtained, following Gujarati (2003, p. 321).[34]

Table 3.7 shows that the inverse Mills ratio is statistically insignificant across all estimations implying that selectivity bias is not an issue. The innovation input has a significant and positive impact on innovation sales in both model specifications for all three datasets.[35] The results are in line with the findings of other authors, both in the developed and transition economies (Loof, et al., 2001; Maso and Vahter, 2008). The results suggest that, ceteris paribus, an increase in innovation investments by 1 percent, on average, increases the innovation sales by around 0.6 to 0.7 percent. The size of the elasticity is similar to the study by Hashi and Stojcic (2013) for transition economies. In terms of the degrees of novelty, innovation input shows a relatively greater effect for incremental innovators, suggesting that firms in transition economies tend to be more efficient in converting innovation investments into an incremental innovation compared to a more radical innovation.

With respect to firm performance, the sales growth variable appears highly significant in all estimations and indicates a relatively high positive influence on innovation output. This finding is in line with the previous study by Kemp, et al. (2003) using sales growth as a measure of firm performance for the Netherlands. Ceteris paribus, the results suggest that on average, a one percentage point increase in sales growth will lead to an increase of innovation sales between 2 and 3 percent.[36] The effect of sales growth tends to be larger for products new to the market (3.2%) relative to the sales of products new to the firm (2.1%).

[34] This is the Halvorsen and Palmquist method; the semi-elasticity is obtained by taking the antilog (base e) of the coefficient of the dummy variable, reducing it by 1 and multiplying by 100 (Gujarati, 2003, p. 321).

[35] For comparative results with CIS 2004 and CIS 2006 see Table 3.10 in the Appendix A3.6.

[36] The variable *firmgr* is expressed as ratio, so the estimated coefficients present the semi-elasticity of a percentage change in the innovation output for a percentage point change in the firm sales growth.

As hypothesized in the model specification section, the degree of open innovation is expected to have a significant positive effect on innovation output. More importantly, we find that the degree of cooperation affects positively only sales of products new to the market but is insignificant with respect to the sales of products new to the firm. In line with the open innovation view, result show that an increase in the number of cooperation partners significantly improves the firms' ability to succesfully commercialise radical products. The estimated semi-elasticity suggests that, ceteris paribus, firms engaging in cooperation with an additional external partner, on average, increases sales of products new to the market by about 3 percent. The access to diverse knowledge through multifaceted cooperation on innovation seems to add to the knowledge of firms which is further converted into the commercial success of products new to the market. This finding suggests for policies that support inter-linkages between firms, universities and other institutions.

On the other hand, in the alternative specification, where we control for different types of innovation, we find that only cooperation with research laboratories has a significant and positive effect on innovation sales in all estimations. Whereas, cooperation with suppliers and customers indicates a significant but negative effect with respect to the sales of products new to the firm. It seems that the multiplicity of cooperation rather than individual types of cooperation matter for the commercial success of products new to the market. The results are consistent across all estimations for the three CIS datasets (See Appendix A3.6 for comparative results).

To interpret the effects of the dummy variables, we calculate the semi-elasticities as suggested by Gujarati (2013). Table 3.8 presents the semi-elasticities of the dummy variables appearing significant in the main model specification.

The variable *innintern* representing the internal innovation effort appears statistically significant and positive at 1 percent level with respect to overall innovation sales, while it appears weakly significant (at 10 percent level) when its effect is estimated for the sales of products new to the firm and insignificant with respect to products new to the market. The results suggest that, ceteris paribus, if firms have undertaken innovation activities using mainly their own internal resources, their overall innovation sales will increase by about 21 percent compared to firms not relying on their own resources, while the size of the effect is smaller (8%) with respect to incremental innovations. It seems that by relying on their own resources firms are less effective in introducing products new to the market. This result further supports the importance of open innovation for the degree of product novelty.

Table 3.8 Semi-elasticities of innovation output with respect to dummy variables[a]

Main Model Specification	CISPooled Dataset								
Innovation specification	*lninsale*			*lnnewmktsale*			*lnnewfrmsale*		
	Estimated (β)	Antilog(β)-1	Antilog(β)-1*100	Estimated (β)	Antilog (β)-1	Antilog(β)-1*100	Estimated (β)	Antilog (β)-1	Antilog(β)-1*100
innintern	0.19	0.21	21.29	0.06	0.06	6.00	0.08	0.09	8.78
abinn	-0.12	-0.12	-11.66	-0.17	-0.16	-15.89	-0.11	-0.10	-10.06
prodivers	0.23	0.26	26.24	0.21	0.24	23.61	0.17	0.19	18.89
patapp	0.24	0.27	26.62	0.19	0.21	21.05	0.23	0.26	25.99
associnfo	0.27	0.31	31.39	0.38	0.46	46.08	0.17	0.19	18.65
marinfo	0.16	0.17	16.77	0.15	0.16	15.84	0.14	0.15	15.49
fineu	-0.20	-0.18	-17.72	-0.25	-0.22	-22.43	-0.25	-0.22	-21.73
fingov	-0.54	-0.42	-41.61	-0.62	-0.46	-46.37	-0.47	-0.37	-37.25
groupeu	0.20	0.22	22.02	0.24	0.27	26.74	0.25	0.28	28.02
groupother	0.39	0.47	47.40	0.45	0.56	56.36	0.31	0.37	36.89
small	-1.59	-0.80	-79.67	-2.01	-0.87	-86.60	-1.62	-0.80	-80.19
medium	-0.81	-0.56	-55.65	-1.05	-0.65	-64.87	-0.85	-0.57	-57.13
manuf	-0.73	-0.52	-51.62	-0.80	-0.55	-55.16	-0.58	-0.44	-44.01
services	-0.95	-0.61	-61.40	-1.07	-0.66	-65.84	-0.78	-0.54	-54.30

Source: Author's own calculation using Stata regression outputs

[a] The antilog (base e) of the coefficient of the dummy variable is reduced by 1 and multiplied by 100

In addition, the other two variables expressing the internal knowledge of firms, *skills* and *abinn*, appear generally insignificant. While the former suggest that skills of the employees are not a significant obstacle to innovation output, the later suggests that previous innovation activities, abandoned or ongoing, do not have a significant impact on the innovation output performance.

Similar findings are reported by Radas and Bozic (2009) on the probability of firms to introduce new to the market products in case of Croatia.

For firms that consider product innovation as highly important in diversifying their product range and increase the quality of products, the variable *prodivers* indicates that ceteris paribus, on average they increase overall innovation sales by around 26 percent. The effect is slightly higher with respect to sales of products new to the market relative to products new to the firm.

With respect to other factors, applying for a patent, as expected, indicates a significant increase in firms' innovation sales, no matter what the degree of novelty. Other indicators of appropriability conditions, such as claiming of a copyright or registering a new design appear to be insignificant. The market information sources appear to be a significant factor in explaining innovation output. On the other hand, information from professional and industrial associations seems to have an insignificant effect on innovation output, except a weak significant effect on the sales of products new to the market. Other studies (Loof, et al., 2006; Mention, 2011; Hashi, et al., 2013) have also reported insignificant and even negative impact of the different types of institutional sources of information.

In terms of the innovation subsidies from the EU or the national government, they appear negative and significant in all specifications. In line with the indications of Lazibat, et al. (2012) and Hashi and Stojcic (2013), innovation subsidies seem not to convert efficiently into the innovation output, or better saying into a higher quality product innovation that could be well accepted in the market. Therefore, as Tassey (2007) suggests, tax related incentives may be considered as an alternative support measure for innovation. Tax deductible expenditures for innovation can motivate firms to increase their own investments and be more dedicated to innovation projects, which in turn may increase the innovation output efficiency.

In line with Ciabuschi, et al. (2011) we find that, belonging to an international group has a positive and significant effect on innovation sales, no matter what the degree of product novelty. Namely, the results indicate that, ceteris paribus, belonging to an EU or another international group leads to quite a substantial increase in innovation sales, between 22 and 47 percent respectively. With respect to control variables, being a medium or a small firm has a negative and significant effect on innovation sales. Belonging to manufacturing or service sectors, too, leads to lower innovation sales. Finally, the year dummy variable suggests lower innovation sales in 2006 compared to 2004.

In the next section we discuss results of the firm performance equation as the fourth stage of the CDM model.

3.4.5 Main findings - the firm performance equation

Table 3.9 presents the 3SLS estimation results of the firm performance equation (Stage 4). As, in the previous section, we report the results for the pooled sample here, with those for separate years being presented in Appendix A3.6.

The results show that none of the innovation output indicators has a significant impact on firm performance in transition economies. Similar results are reported by Folkeringa, et al. (2005) using the sales growth as a measure of performance.[37] Although the estimated results are contrary to expectation, appearing even negative, the way the variables are expressed may provide a likely reason for this result. As the firm performance variable is measured by the sales growth in the last

[37] Although we do not report it here, in an alternative estimation when we drop other innovation related variables (variables expressing product diversification '*prodivers'* and process innovation effects in terms of increased production capacity or flexibility of production '*procesef'*), the innovation sales variables indicate significant and positive effect on firm sales growth. This may suggest that the innovation sales variables (*lninsale, lnnewmktsale, lnnewfrmsale*) are to some degree explained by the variables expressing effects of innovation.

two years from the survey year, while the innovation output is measured by the sales in the survey year, we can argue that the innovation output does not have an immediate effect on sales growth.

Table 3.9 The firm performance equation (Stage 4) – estimation results for different specifications[a]

	CIS Pooled dataset		
Model Specification	Innovation Sales	New to the market	New to the firm
lninsale	-0.0105		
	(0.0262)		
lnnewmktsale		-0.0298	
		(0.0533)	
lnnewfrmsale			-0.0375
			(0.0434)
prodivers	0.0499***	0.0475*	0.0726***
	(0.0166)	(0.0279)	(0.0228)
procesef	0.0981***	0.0936***	0.0984***
	(0.0134)	(0.0223)	(0.0194)
abinn	-0.0250*	-0.0165	-0.0327**
	(0.0149)	(0.0177)	(0.0146)
innintern	0.0133	0.0138	0.0292*
	(0.0151)	(0.0195)	(0.0172)
marinfo	0.000817	0.0176	0.0108
	(0.0157)	(0.0194)	(0.0174)
associnfo	-0.0359	-0.0466	-0.0477
	(0.0253)	(0.0319)	(0.0301)
fineu	-0.0189	-0.0284	-0.0121
	(0.0245)	(0.0310)	(0.0358)
fingov	0.0314*	0.0427**	0.0199
	(0.0171)	(0.0193)	(0.0185)
groupeu	0.0898***	0.0888*	0.120***
	(0.0284)	(0.0486)	(0.0401)
groupother	0.103**	0.145*	0.141**
	(0.0516)	(0.0877)	(0.0654)
costfact	-0.0664***	-0.0750***	-0.0816***
	(0.0139)	(0.0212)	(0.0214)
knowfact	-0.0225	-0.00815	-0.0158
	(0.0185)	(0.0185)	(0.0248)
small	0.0880	0.0386	0.0131
	(0.0790)	(0.163)	(0.133)
medium	0.0491	0.0355	0.0130
	(0.0425)	(0.0830)	(0.0747)
manuf	-0.0537**	-0.0469	-0.0894**
	(0.0251)	(0.0432)	(0.0394)
services	0.0560**	0.0678*	0.0416
	(0.0260)	(0.0390)	(0.0365)
y06	0.167***	0.158***	0.173***
	(0.0129)	(0.0176)	(0.0179)
_cons	0.226	0.475	0.639
	(0.400)	(0.792)	(0.651)
N	11869	7091	9246
Bootstrapped standard errors in parentheses			
* p<0.1 ** p<0.5 *** p<0.01			
Country dummies included			

Source: Stata regression outputs

[a] The detailed regression results are presented in Appendix A3.5

Another explanation for the insignificant effect of innovation on firm performance can be related to the 'inertia' effect suggested by Barlet, et al. (2000), implying that new products are only gradually accepted in the market. We can also argue that an insignificant effect of innovation output on the sales growth in previous years may suggest that the share of innovation sales in total sales of firms in transition economies is rather small and as such it may not exert a strong impact on the overall sales growth. Moreover, in an ideal relationship between the innovation and firm performance, innovation of the current period would affect performance improvement in the next period and not in current and previous periods - which is the case in our dataset. With respect to the effects of product (*prodivers*) and process innovation (*procesef*), both appear positive and highly significant at the 1 percent level (only for new to the market specification *prodivers* is significant only at 10 percent level). The results are in line with the findings of Folkeringa, et al (2005) who found positive effect of process innovation and rather a weak effect of product innovation on sales growth. A significant and positive impact of process innovation effects on productivity is also suggested for transition economies (Masso and Vahter, 2008; Hashi and Stojcic, 2013) as well as for developed economies (Klomp and Van Leewuven, 2001). Ceteris paribus, the results suggest that, on average, if firms consider product diversification as highly important, it increases their sales growth by 4 to 7 percentage points, while if they consider increased capacity and flexibility of production as highly important, their sales growth tends to increase by about 9 percentage points.[38]

Reliance on the firms' internal resources for innovation has a positive but only weakly significant effect on sales growth only when we control for incremental innovators (new to the firm products). The results suggest that internal knowledge capabilities of the incremental innovators matter for sales growth, but that is not the case for firms introducing products new to the market. A likely reason may be that internal knowledge is mostly limited to the capability of

[38] Because the firm performance measure (sales growth) is expressed as ratio (percentage points divided by 100), to interpret the effects of coefficients in terms of percentage points we multiply them by 100.

introducing products new to the firm, which may also be introduced more intensively compared to products new to the market, and as such also have a more significant effect on firms' sales growth. Using similar proxies for internal firm knowledge other studies also report a positive relationship between firm performance and the firm's internal knowledge (Loof, et al., 2001; Johanson and Loof, 2009). With respect to other proxies of internal knowledge, having abandoned innovation projects in the past has a negative but only weakly significant effect on sales growth.

Firm performance does not seem to be significantly affected by access to information sources as measured by information from various sources such as market and professional associations.

In terms of innovation subsidies, an insignificant effect is indicated for the national government subsidies, while the variable representing subsidies from the EU appears positive and statistically significant at 5 percent level in combination with the sales of products new to the market and at 10 percent level in combination with the total innovation sales, while it is insignificant in combination with the sales of products new to the firm. The results indicate that ceteris paribus, radical innovators tend to be more efficient in utilising innovation subsidies which on average leads to an increase of sales growth by around 4 percentage points. This implies that public support for innovation in transition economies should consider the degrees of innovation novelty when granting financial subsidies to the innovating firms.

In line with the literature (Johanson and Loof, 2009; Gorodnichenko, et al. 2015) being member of an international group indicates positive and significant effect on sales growth. Ceteris paribus, firms that are members of a group located in the EU, on average, tend to have an increase of sales growth by around 8 to 12 percentage points, while being located in other foreign countries, implies a sales growth increase by about 10 to 14 percentage points.

With respect to the factors hampering innovation, cost factors indicate negative and significant effect on performance. Ceteris paribus, if cost of finance is considered as highly important obstacle to firms' innovation activities, on average the sales growth decreases by about 6 to 8 percentage points. As suggested by Beck, et al. (2005), it is indicative that the cost of finance in transition economies is a significant obstacle to firm performance. Such an indication is not shown for the knowledge related factors which appear insignificant in all estimations.

Similarly, being a small or medium sized firm does not have a significant effect on sales growth, suggesting that performance improvement is likely to be independent of firm size. With respect to industries, the dummy variables for manufacturing and service sectors are weakly significant, but show opposite effects. Belonging to the manufacturing sector shows a negative effect, while belonging to the services sector indicates a positive effect on the sales growth. Industry differences between manufacturing and services are suggested also by Loof and Heshmati (2006). Finally, the year dummy variable indicates that innovating firms were more likely to have a higher rate of sales growth in the CIS 2006 compared to the CIS 2004 dataset.

In the next section we conclude the chapter.

3.5 Conclusions

In this chapter we have analysed the relationship between innovation and firm performance using the modified CDM multi-stage model. The model portrays the decision of firms to innovate, their innovation effort, its conversion into innovation output and its effects on firm performance. We extend the current literature using the CDM model by further exploring the black box of firm innovation in transition economies, specifically by examining the relevance of the degrees of novelty and open innovation. For the empirical analysis we used the Eurostat CIS 2004 and CIS 2006 anonymised micro-data for seven European transition economies. For robustness and to increase the precision of results we pooled the datasets and estimated alternative model specifications. We presented an alternative measurement of open innovation that involved a multifaceted cooperation on innovation as compared to the different types of cooperation on innovation

In the input phase of the CDM model, we use the Heckman sample selection estimator to account for the selectivity bias in a joint system estimation of the propensity to innovate and the innovation investment equations. Findings are mainly in line with the previous literature and are consistent across estimated model specifications for CIS 2004, CIS 2006 and CIS Pooled datasets. Among other factors, we find that the propensity and intensity to innovate are an increasing function of international group membership, operating on foreign markets and previous innovation activities. In line with Schumpeter's (1942) hypothesis, small and medium sized firms show lower propensity and intensity to innovate compared to large firms, while belonging to the manufacturing or services sector increases the probability to innovate and the intensity of investments. Factors hampering innovation, such as knowledge factors, cost factors and market domination by established firms exert a positive effect on the propensity to innovate, and a negative effect on the innovation investments. It seems that in an unsupportive market environment firms are motivated to innovate as means of increasing their competitiveness. Nevertheless, once they start spending on innovation, obstacles such as cost of finance or knowledge factors tend to decrease the level of their investments. In addition, innovation investments are an increasing function of cooperation with external parties and innovation subsidies. This suggests that open innovation may compensate for internal knowledge limitations, while subsidies motivate firms to increase their own investments and engage in higher risk investments that may lead to more radical innovation.

In the output phase of the CDM model, we estimate jointly the firm innovation output and performance equations, using a three stage least squares estimator and a simultaneous equations model. Innovation output seems to be an increasing function of firm performance as measured by the sales growth. Higher growth firms seem to be better performers in terms of innovation, while the effect tends to increase with the degree of novelty. With respect to open innovation, results suggest that the degree of cooperation exerts a significant and positive impact on overall innovation sales and on sales of products new to the market but has an insignificant effect with respect to sales of products new to the firm. When we control for cooperation types, we find that only cooperation with research laboratories consistently shows a significant and positive effect across all estimations.

Sales of products new to the firm seem to increase when innovation is sourced internally, which is not the case for sales of products new to the market. We argue that this arises from the limited internal knowledge of firm that may not extend beyond the imitation skills. Innovation output also appears as an increasing function of market information sources and product diversification. Similarly, firms relying on the effectiveness of intellectual property rights or belonging to an international group tend to have higher innovation sales. However, innovation subsidies show a negative and significant effect on innovation output, suggesting an inefficient utilisation of public financial support or the disbursement of some grants to firms which may have financed their innovation expenditure by themselves anyway (public support not generating additionality effect). In terms of size, the Schumpeterian (1942) hypothesis is confirmed again as small and medium sized enterprises are less successful in terms of innovation output.

The firm performance function shows no significant relationship with innovation output. We argue that the market response with respect to new products may be explained by the 'inertia' effect, suggested by Barlet, et al. (2000), implying that new products are only gradually accepted in the market. We expect that the innovation sales in current period will significantly affect sales growth in the next period (but not the previous period), but we were not able to investigate it given the dataset limitations. However, firm performance improves with respect to the derived effects of innovation, such as highly important effects of product diversification and of increased capacity and flexibility of production. Cost factors appear as a significant obstacle to firm performance in transition economies, no matter what the degree of novelty they introduce. On the other hand, innovation subsidies from the national government positively influence sales growth of firms that have commercialised new to the market innovations. Foreign subsidiaries have a positive effect on firm performance, thus confirming the suggestions in the literature that foreign owned firms tend to have higher productivity growth compared to domestic firms. Last but not least, firm performance seems to be independent of its size.

Overall, the analysis show that the degree of novelty is an important and relevant aspect of innovation and firm performance. Findings imply that internal firm capacity for innovation facilitates incremental innovations, while the degree of open innovation enhances radical innovations. Results indicate that firms should engage in multidimensional cooperation with various stakeholders in order to increase their breadth of knowledge and in turn the effectiveness of radical innovations, suggesting for policies that promote open innovation. While innovation subsidies do not show to effectively convert into innovation output, they seem to increase sales growth of radical innovators, suggesting for public subsidies that support innovations with a higher degree of novelty. In addition, effects of innovation through product diversification and increase of capacity and flexibility of production strongly influence firms' sales growth of both incremental and radical innovators. This analysis clearly has a set of policy implications but, in the interest of brevity, they will be discussed in the final chapter.

Finally, this study has also faced some limitations. First, the firm performance measure was limited to one measure of performance, namely the sales growth, as the data on productivity and profit related measures were not available. Second, it would have been possible to fully account for any potential endogeneity between the variables, as well as to investigate the effects of current period innovation on the performance growth in the next period, if we had access to panel data – which is not the case with the CIS data. Third, as in all survey data, the subjectivity of responses offered by firms' managers remains an issue.

In the next chapter we analyse the impact of innovation on export performance of firms in transition economies, accounting also for the business environment factors and the stage of transition reforms.

Chapter IV

Innovation and export performance of firms in transition countries: the relevance of the business environment and the stage of transition

Contents

4.1 Introduction

Following the examination of the determinants of firm's innovation, with special focus on the degrees of novelty of product innovation, undertaken in Chapter III, this chapter investigates the impact of innovation on export performance of firms in TEs, taking into account the relevance of business environment factors and the stage of transition. The economic literature suggests that a firm's innovation activities are a significant driver behind its export performance (Wakelin, 1998; Sterlacchini, 1999; Roper and Love, 2002; Ozcelik and Taymaz, 2004; Damijan, et al., 2010; Anh, et al., 2009). More than thirty years ago, Krugman (1979) had shown that product innovation, which increases the variety of the products and makes them more attractive to customers, also promotes international trade. More recently, Melitz (2003) and Caldera (2010) have highlighted the role of productivity as the vehicle for this process. As we discuss in Chapter II, they assume that a firm self-selects into the export market on the basis of cost reductions and productivity improvements, both of which may result from process or product innovations. Furthermore, higher degrees of product novelty may also increase the competitiveness of firms in international markets and thus positively affect their export performance. Of course, firms active on international markets, particularly in more developed economies, will also learn about new products and processes, develop new links and contacts and gain access to better distribution networks (Salomon and Shaver, 2005). This 'learning by exporting' is expected to enhance innovation, especially in firms in laggard transition economies.

However, the economic milieu has been altogether different in TEs which have gone through major social, political and economic upheavals since 1990, and where the institutions of a market economy had to be built from basic fundamentals. The transformation process itself has been recognised as an essential factor in the growing export performance of firms in these countries

(Rodrik, et al., 2004; Kaminski, et al., 1996). However, the process of building a market economy is closely bound with the nature of the business environment and the quality of institutions developed in the course of transition. Contrary to common expectations that an uncertain business environment hinders business operations, firms that perceive their domestic market to be risky and uncertain are more likely to export than firms which can rely on buoyant domestic markets (Johanson and Vahlne, 1977; Cooper and Kleinschmidt, 1985; Higon and Driffield, 2011).

With respect to the stage of transition reforms, it has been suggested that the competitive profile of firms in Central Eastern European Countries (CEECs) has changed in the course of the consolidation of the new market economy (Havlik, 2000; Havlik, et al., 2001). Over time, as the market system became more established and the institutions of a market economy strengthened, these firms enhanced their innovation activities and improved the quality and marketing of their products.

The aim of the research in this chapter is to contribute to the literature on innovation and export performance in several areas. First, the chapter investigates the impact of degrees of novelty of product innovation on export performance. Second, it considers the impact of a large number of business environment factors grouped into four distinct areas of macroeconomic stability, infrastructure, access to finance, and the rule of law (as perceived by firms). Finally, this study accounts for the moderating role of the stage of transition reforms.

Some studies have investigated the export performance of firms in TEs during the 1990s and 2000s but, only a few of them have considered a large set of TEs. Among other authors, in a recent study Lamotte and Colovic (2015) investigate the probability of new exporting ventures in TEs. Although they attempt to control for the effect of the environment, they only address the effect of crime on the probability of exporting but do not account for innovation novelty and different stages of transition. In another study, Gashi, et al. (2014) investigate the determinants of the SMEs export behaviour in TEs, but do not explore different degrees of innovation novelty, the influence of business environment factors or the differences in the explanatory factors moderated by the stages of transition. Earlier, Damijan, et al. (2010) had studied the causal relationship between innovation and export performance of the Slovenian firms. Similar to other studies, they do not consider the influence of business environment on firms' performance.

To our knowledge no study to date has accounted for the three related aspects (innovation novelty, business environment factors and the moderating effect of the transition reforms or the stages of transition), and using a large sample of firms in 28 countries in transition as addressed in this empirical research. The data used in this investigation draws on the Business Environment and Performance Survey (BEEPS) database. This unique survey of a large number of firms in TEs has been undertaken by the European Bank for Reconstruction and Development and the World Bank in 2002, 2005 and 2008.

The chapter is organised as follows. In section 4.2 we discuss the literature on the relationship between firms' innovation activities and export performance, the influence of business environment on firms' exporting, transition reforms and the concept of the stages of transition, as well as other relevant determinants of export performance. In section 4.3 we present the research methodology, including the discussion of data, the measurement of export performance and the definition of variables influencing it, the descriptive statistics and the model specification. In section 4.4 we present the estimation diagnostics, main empirical findings and discuss the sensitivity of results. Section 4.5 concludes the chapter.

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4.2 Literature review – Theoretical basis

In this section we critically review the theoretical basis on the relationship between innovation and export performance, the influence of the business environment factors and the stage of transition reforms on the exporting behaviour of firms in TEs.

4.2.1 Innovation and export performance

The literature on innovation and export performance relationship is generally based on the technology gap theory developed by Krugman (1979), explained in more details in Chapter II. The model highlights the importance of innovation as a crucial determinant of international trade and suggests that patterns of trade are determined by a continuing process of innovation and technology transfer. Through product innovation firms increase the variety of the products attractive to foreign customers and improve their export performance due to increased competitiveness (Sterlacchini, 2001; Ozcelik and Taymaz, 2004; Damijan, et al., 2010). Product innovation may take the form of completely new products (new to the market or even new to the world) or upgrading of existing products. Following the logic of Krugman (1979) model, it can be asserted that exporting firms have a greater tendency to be more innovative than non-exporting firms and their degree of innovation novelty is expected to be higher, an issue largely neglected in the economic literature.

Another theoretical model on firm's engagement in export markets, introduced by Melitz (2003), maintains that firms have heterogeneous productivity levels and self-select themselves into the export market based on cost reduction and higher productivity. Melitz's hypothesis is in line with previous studies suggesting that exporters are relatively more efficient before they export and are better equipped technologically compared to non-exporting firms (see Bernard, et al., 1995; Bernard and Jensen, 1999). Costantini and Melitz (2008) point out that in order to increase productivity, firms invest in the upgrading of production processes prior to internationalization. In addition, Caldera (2010) suggests that productivity is mainly explained through innovation as it is the innovative firm that has the ability to charge a lower price due to a lower marginal cost of production. As Caldera argues, the cost reduction is the result of process innovation. Prior to their access to international markets, firms also invest in increasing the skills of their staff (Aw, et al., 2011). Therefore, it is possible to suggest that the productivity of firms can be explained or proxied by innovation and human capital factors.

The relationship between innovation and export performance may not be a unidirectional relationship. Theoretical models on endogenous innovation and growth (Romer, 1990; Grossman and Helpman, 1994) suggest that trade contributes to the expansion of domestic growth and product varieties, indicating that the increase of exports driven by innovation will in turn increase domestic investments in innovation activities. Also, exporting firms may access diverse knowledge and information not available in the domestic market which can foster increased innovation (Salomon and Shaver, 2005). 'Learning by exporting' is expected to enhance innovation, especially when firms in laggard TEs such as those in the Western Balkan countries export to more developed countries whereas the opposite might happen if firms export to less developed markets as suggested by various authors (Ito, 2011; Silva, et al., 2012; Boermans, 2013; Hashi and Stojcic, 2013). Some studies suggest that 'learning by exporting' happens only when firms export to a market at a level of development similar to their own domestic market (Blalock and Gertler, 2004; Van Biesebroeck, 2005; Graner and Isaksson, 2009). In contrast, Monreal-Perez, et al. (2012) find no impact of exporting on innovation of Spanish firms. Learning by exporting effect can also be explained in the context of Vernon (1966) product life cycle theory, which assumes that products are introduced in the developed economies and exported to more laggard economies, where the products are adapted and upgraded during the product life cycle. In line with the argumentation in Chapter III, any learning by exporting effect will be reflected in increased innovation activities only after a time lag, as the newly absorbed knowledge requires some time to be transformed into new products or processes.

In general, and following the earlier discussion, innovation activities of firms is expected to have a positive and significant impact on their export performance in both developed economies (see Wagner, 2001 for Germany; Wakelin, 1998; Roper and Love, 2002; Higon and Driffield, 2011 for the UK; and Sterlacchini, 1999 and Sterlacchini, 2001 for Italy) and developing countries (Anh, et al., 2009; Lamotte and Colovic, 2013). Wakelin (1998) has shown that innovating and non-innovating firms in the UK are significantly different in terms of both the probability of exporting and the level of exports. The Wakelin study accounts for the number of innovations (measured by the new or upgraded products, processes and materials) introduced by firms. Although it does not account for the impact of different types of innovation, Wakelin suggests that export potential of firms is positively correlated to an increased number of innovations. Elsewhere, some authors have found that only product innovation, and not process innovation, has a significant and positive impact on export performance (Cassiman and Golovko, 2007; Damijan, et al., 2010; Becker and Egger, 2013). Gashi, et al. (2014) find that innovativeness (firms introducing at least one type of innovation) has a positive impact on export propensity and intensity of firms in TEs. Interestingly, and contrary to these findings, Love and Mansury (2007) find the impact of innovativeness on the export intensity of service firms in the US to be negative (other studies focused on manufacturing).

Other authors have used R&D intensity, an input measure of innovation activities but, as argued in Chapter II, this may provide misleading results as not all innovation inputs are converted to output (Brouwer and Kleinknecht, 1996; Roper and Love, 2002). Moreover, SMEs, which constitute the largest proportion of firms generally[39], do not have formal R&D units and might not keep a separate explicit account for related innovation investments, which they often regard as a general business activity.

Next, we discuss the relationship between domestic market environment and firms' export performance.

4.2.2 Business environment and export performance

In line with propositions of the earlier contingency theory that an organisation is an adaptive system which progresses by reacting to its environment (see, Lawrence and Lorsch, 1967; Woodward, 1970), the business environment is expected to influence firms' strategies, restructuring and behaviour (Becheikh, et al. 2006). In addition, the new institutional economics views suggest that a firm's activity and behaviour is governed and shaped by the quality and efficiency of institutions (Gelbuda, et al., 2008; Coase, 1998). North (1990) defines institutions as the rules of the game in a society, or the mechanism for developing and shaping formal rules in an economy such as laws and policies, as well as the informal rules such as customs, habits and beliefs, all shaping the behaviour of the actors. North (1990, p3) points out that:

*"*Institutional change shapes the way societies evolve through time and hence is the key to understanding historical change.*"*

Similarly, institutional changes also shape the market environment in which firms operate and moderate the way firms evolve through time. Effective legal institutions facilitate enforcement of contracts, protection of property rights and market competition (Berglof, et al., 2012). In an earlier study, Rodrik (1995) argues that better institutions lead to higher productivity in the

[39] The Annual Report on European SMEs 2013/2014 – A partial and fragile recovery, notes that in European countries SMEs account for 99.8 percent of all enterprises active in the nonfinancial business sector, with micro-enterprises accounting for 92.4 percent (Muller, et al., 2014).

economy. Later studies (Berkowitz, et al., 2006; Levchenko, 2007) suggest that trade increases with improvements in the quality of institutions, such as the improved enforcement of contracts and property rights.

Contrary to the conventional expectation that a better and more stable domestic environment will improve firm's performance internationally, an earlier internationalization view of the Uppsala school of thought, known as 'Uppsala model of international trade', introduced by Johanson and Vahlne (1977), elaborated in more detail in Chapter II, maintains that an opposite effect may also be present. If firms perceive that their domestic environment is uncertain and provides fewer and less sustainable opportunities, it creates conditions that encourage firms to shift their attention to exporting (Cooper and Kleinschmidt, 1985). In a more recent study, Dixon, et al. (2010) argue that in emerging markets, such as TEs, where firms are faced with rapid political and economic changes leading to an uncertain environment, a strategic flexibility is very important. Firms can gain some strategic flexibility by exporting their new or significantly improved products to a safer market, as they diversify their market portfolio and offset the perceived domestic market risk.

The later literature on the relationship between firm's innovation and exporting, however, has not considered the view that, in the particular case of TEs, domestic business environment factors might be crucial to the firm's performance (see Damijan, et al., 2010; Gashi, et al., 2014; Lamotte and Colovic, 2015). The World Bank (2015) Doing Business report ranks most of the TEs behind the developed economies in terms of their domestic business environment.[40] Although several studies have highlighted the role of institutions in international trade (Li 2013; LiPuma et al., 2013), there is still limited knowledge about the ways the market environment influences

[40] The "Doing Business Project", launched in 2002, provides quantitative measures of the intensity of business regulations and their enforcement, using a common methodology across 185 countries.

exporting of firms (Lamotte and Colovic 2015). As noted by Deheija and Wahba (2002), if institutional legacy of the TEs is not taken into account the estimates of the determinants of export performance can be biased.

The empirical literature suggests that political and economic conditions may either impede or to facilitate exporting (Jalali, 2012). An uncertain domestic environment is found to have a positive impact on the export performance amongst Greek entrepreneurs (Dimitratos, et al., 2004).[41] Higon and Driffield (2011) found that UK SMEs are more likely to shift their emphasis to exports if they perceive domestic competition to be an important barrier to their business. Finally, Damijan, et al. (2015) suggest that the real exchange rate, reflecting the macroeconomic environment of a country, is an important factor affecting export performance.

Among other key business environment indicators, Lamotte and Colovic (2015) point to a weak implementation of the rule of law impeding firms' international involvement. Further, Nordas and Piermartini (2004) among others (see also Limao and Venables, 2001; Francois and Manchin, 2013), find that the quality of infrastructure, as another indicator of business environment, has a positive impact on export performance. This is self-evident as better road infrastructure reduces the cost of transport, whereas a better communication system is expected to improve the efficiency of communication between trade partners. Others have identified access to finance as one of substantial business environment issues that, if problematic, has a negative impact on firms' export performance (Higgon and Drieffield, 2011; Gashi, et al., 2014).

[41] "The domestic market uncertainty refers to the difficulty (on a scale 1 to 7 – from very easy to very difficult) to forecast the expected sales of the firm in the domestic country due to country's: inflation rate, exchange rate, tax policy, ability of the party in power to maintain control of the government, national laws affecting international business, legal regulations affecting firms (Dimitratos, et al., 2004, p. 19)."

The next section aims at providing a better understanding of the process of institutional reforms in TEs and the progress in transition and how they may affect firms' exporting behaviour in the countries under consideration.

4.2.3 Transition reforms and export performance

The process of transition from centrally planned to a market economy was strongly intertwined with institutional changes in the TEs (Gelbuda, et al., 2008; Smallbone and Velter, 2012). One of the major aims of transition reforms was to establish good quality and efficient institutions that would create a favourable environment for economic reconstruction and growth (Berglof, et al., 2012). The quality of institutions, an important feature of the transition process, has been shown to be an essential factor in growing export performance (Rodrik, et al., 2004; Damijan, et al., 2015). Kaminski, et al. (1996, p. 46) argue that:

"…establishment of market-supporting institutions was perhaps the single most important factor determining foreign trade performance over the transitional period."

Although the former socialist countries began the process of transition in the 1990-91 period, their initial conditions and patterns of development were not all the same. They have all gone through similar phases of institutional and market oriented reforms but at different points in time. Smallbone and Welter (2012) suggest that the institutional reforms were facilitated mainly by the EU membership process, both because of the requirement of joining the EU as well as having access to EU funds and technical expertise. To receive such benefits, TEs were required to undergo a set of reforms and harmonize different sets of regulation (Lamotte and Colovic, 2015). Those countries that joined the EU earlier provided better institutional support for their firms compared to others, such as Western Balkans (excluding Croatia which started the process of joining the EU much earlier) that are still struggling in the process (see Aidis, et al., 2008; Manolova, et al., 2008).

Various authors (Wolf 1999; Damijan, et al., 2015: among others) have highlighted the differences between countries based on their progress in transition reforms progress. Damijan, et al. (2015) argue that high export growth, in both absolute and relative terms, has been an outstanding feature of countries with advanced reforms in both transition and EU integration processes. Havlik, et al. (2001) emphasize that the competitive position of CEECs has generally improved in comparison to other non-EU competitors through their supply capacity. The low labour cost in the early stage of transition (Havlik, 2000) and the modification of export structure towards goods with higher value added at a later stage of transition increased their market shares on foreign markets (Damijan, et al., 2015). Notwithstanding, there is considerable difference among CEECs in terms of export performance. This difference may be partly explained by the stage of institutional reforms in different countries. Similarly, the effect of innovation and other explanatory factors on the export performance of firms is likely to vary across different stages of transition.

With respect to innovation decisions, the impact of uncertain conditions, highlighted by Teece (1986), becomes a critical factor for firms. In general, the uncertainty about the future course of events in the early transition was bound to influence the generation of innovation negatively. In the early transition, TEs also lacked a strong infrastructure for innovation expenditure - such as raising capital, availability and hiring of qualified personnel or gaining knowledge of customer demand (Sofka and Grimpe, 2009). Due to the limited access to advanced technology and R&D capacities firms mainly engaged in upgrading their products and processes rather than introducing new and better quality products. Nevertheless, as institutions improved and reforms progressed, the relevance of these obstacles gradually decreased. The evidence suggests that the average quality of goods produced by firms in CEECs has increased while their competitive strategy has moved from price to quality competition (Benkovskis and Worz, 2013). At the same time, the nature of innovation activities has also changed, from minor upgrades and differentiation of traditional products based on low cost and low prices (Damijan, et al., 2015) to higher level product and process innovation aiming at quality improvements.

The quality of institutions in TEs affects the absorption capacities of firms and their incentives in engaging in research and development for new products and processes (Berglof, et al., 2012). Accordingly, to analyse the performance of firms we should look at factors beyond the internal firm-level variables, as the behaviour of firms cannot be separated from their environment and the prevailing institutions (Dixon, et al., 2010). As Smallbone and Welter (2012) point out, the transition economies represent a form of laboratory for the examination of the moderating role of institutions on firm performance. Although studies have analysed different aspects of transition, they have not investigated the moderating effect of transition reforms on the firm internal and external factors affecting its export performance. In order to consider this, we define stages of transition and identify countries belonging to each stage (laggards, a group having a medium progress and an advanced group) in the next section.

4.2.4 Stages of transition

In its annual *Transition Report*, the EBRD produces annual assessment of 'progress in transition reforms' for different aspects of reforms for all countries using its own methodology based on the judgement of its economists. The EBRD transition index covers a broad range of transition indicators and gives a clearer picture of the stage of reforms. It is also the most commonly used indicator of the progress-reforms (Damijan, et al., 2015). The 'progress in transition reforms' indicator, is constructed on the basis of progress in six main areas: 1) large scale privatisation; 2) small scale privatisation; 3) governance and enterprise restructuring; 4) price liberalisation; 5) trade and foreign exchange system; and 6) competition policy. Transition indices consist of scores assigned to the countries based on the reforms in each area against the standards of an industrialised economy. The scores range from 1 to 4.3. The lowest score represents no or little change from planned or centralized economy, whereas the highest score represents an advanced stage of reforms suggesting a country has reached the standards of an established industrialised economy. [42]

Many authors have used these indices for the purpose of ranking of the institutional development in different countries (e.g., Hall and Jones, 1999; Fischer and Sahay, 2004; Falceti, et al., 2006; Roland, 2005). They have mainly used the overall transition index, which is the average of the ranking of the six sub-indicators or a normalized average index ranging between 0 and 1. Following the established methodology, we define the *transition index* as an average of six sub-indices, indicating the average level of reforms in each transition country for each year of the respective BEEPS survey (see Appendix A4.1 for the EBRD transition scores for 28 transition countries under investigation).[43] Transition scores are not provided only for the Czech Republic in 2008 as the country is deemed to have reached standard of an industrialised economy (EBRD *Transition Report 2008*). Therefore, we assign a maximum transition score of 4.3 to the Czech Republic for the year 2008.

[42] EBRD provides indices for progress of reforms for a range of reforms in transition economies. Scores assigned to reform levels range from 1 to 4+ or 4.3 as a maximum value (1, 1+, 2-, 2, 2+, 3-, 3, 3+, 4-, 4, 4+). The scores are based on the EBRD classification originally developed in the 1994 *Transition Report* and refined and amended in subsequent reports. "+" and "-" ratings are treated by adding 0.33 and subtracting 0.33 from the full values.

[43] For the detailed information on scores of six reform indices per country, see EBRD raw data at: http://www.ebrd.com/what-we-do/economic-research-and-data/data/forecasts-macro-data-transition-indicators.html

In order to group countries based on their degree of transition reforms, we follow the EBRD's transition gap score intervals.[44] Then, based on the range of average scores of transition reforms (or *transition index*), we identify three levels of transition, the laggard stage, the medium stage, and the advanced reforming stage. Advanced reforming countries are considered countries which score above 3.7 on the EBRD *transition index*, or countries with a small to negligible transition gap covering scores of 4-, 4 and 4+ (3.8 to 4.3). Medium reforming countries are those scoring from 3 and 3+ (scores of 3 to 3.7), or countries with a medium to small transition gap, whereas laggard reforming countries are those with a large to medium transition gap, and scores of less than 3 in the average transition index (scores of 3- and below). Table 4.1 shows the transition countries under consideration assigned to these three groups for the respective rounds of the BEEPS survey.

Table 4.1 Transition economies by the stage of transition for 2002, 2005, 2008

Transition Stage	2002	2005	2008
Laggard reforming economies	Azerbaijan, Belarus, Bosnia and Hercegovina, Montenegro, Serbia, Tajikistan, Turkmenistan, Uzbekistan	Azerbaijan, Belarus, Bosnia and Hercegovina, Montenegro, Serbia, Tajikistan, Turkmenistan, Uzbekistan	Azerbaijan, Belarus, Tajikistan, Turkmenistan, Uzbekistan
Medium reforming economies	Albania, Armenia, Bulgaria, Croatia, Georgia, Kazakhstan, Kyrgyz Republic, Latvia, Macedonia, Moldova, Romania, Russian Federation, Slovenia, Ukraine	Albania, Armenia, Bulgaria, Croatia, Georgia, Kazakhstan, Kyrgyz Republic, Macedonia, Moldova, Romania, Russian Federation, Slovenia, Ukraine	Albania, Armenia, Bulgaria, Bosnia and Herzegovina, Croatia, Georgia, Kazakhstan, Kyrgyz Republic, Macedonia, Moldova, Montenegro, Romania, Russian Federation, Serbia, Slovenia, Ukraine
Advanced reforming economies	Czech Republic, Estonia, Hungary, Lithuania, Poland, Slovak Republic	Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic	Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic

Source: Authors' own classification using EBRD Transition Indices.

[44] According to EBRD transition methodology, a country has a large gap towards reaching standards of an industrialised economy if the transition reform score is between 1 to 2+; a medium gap if the score is in the range between 2+ to 3+; a small gap if the score ranges from 3+ to 4; and a negligible gap if the score is 4+. In this empirical analysis we slightly adapt the EBRD gap score intervals and, to avoid overlaps between the groups, instead of four we define three stages of transition progress.

Interestingly, as the tables shows, between 2002 and 2008, only few countries managed to progress to a more advanced stage of transition. A few countries have been more successful with reforms and have moved from the laggard to the medium reforming stage (Bosnia and Hercegovina, Serbia and Montenegro), or from the medium to the advanced reforming stage (Latvia) over the three periods. Most countries seem to have had slower reform progress between 2002 and 2008.

In the next section we discuss other factors expected to impact the firm's export performance.

4.2.5 Other determinants of export performance

In this section we discuss other relevant factors expected to affect export performance of firms, among which we discuss literature findings related to human capital, networking, knowledge spillovers and foreign ownership. In addition, the literature suggests that exporting of firms is also affected by the firm's size and age, as well as by the economic conditions in a country.

Human capital

Human capital is suggested to be the catalyst of firms' internationalization in TEs (Gashi, et al., 2014; Lamotte and Colovic, 2015). The quality of a firm's stock of human capital is expected to affect its productivity, innovation and its export performance. One measure of this quality often used in the literature is the share of employees with higher education in total number of employees. Higher educated people have certain abilities, such as speaking foreign languages that make it easier to establish and maintain contacts with foreign customers (Van Dijk, 2002). On the other hand, firms might be less inclined to invest in costly activities such as investment in innovation related activities which also include investments in skilled and more educated employees as they might put a higher weight on cost reducing activities when competing with a low price strategy

(Lall, 2000). Some authors have found a positive relationship between higher educated employees and export performance (Wakelin 1998; Wagner, 2001; Higon and Driffield, 2011) whereas others have reported negative relationships (see Willmore, 1992; Ramstetter, 1999). Gashi, et al. (2014) found a positive impact for the proportion of employees with university degree and while controlling for the proportion of skilled employees. While in another study, Gashi (2014) found a negative effect of tertiary education on the exporting decision of firms in Kosovo. Analysis of the impact of human related factors on export performance will further shed light on the results which so far have been inconsistent.

Networking

Among other potential factors, the literature on export performance emphasizes the role of external linkages or networking. As Bruton, et al. (2010) point out, personal or social business ties substitute weak support provided by institutions. Powell (1998) suggests that external linkages may enhance export performance of firms by facilitating their access to information on foreign markets and products. The evidence suggests that the limited access to information on international markets and networks with businesses abroad might act as an obstacle to export performance (Rogers, 2004). As countries advance with transition reforms, the business associations are also expected to become more effective in providing relevant support to businesses and in facilitating linkages to international markets. Also, affiliation to a business association is found to have a positive relationship with the propensity and intensity of exports in TEs and also other developing economies (Singh, 2009; Higgon and Driffield, 2011; Gashi, et al., 2014; Lamotte and Colovic, 2015).

Knowledge spillovers

Several types of knowledge spillover effects can potentially affect a firm's export performance. The literature on economic geography and trade (Krugman, 1991) postulates that activities of neighbouring exporting firms may reduce entry costs of new exporters. In line with this view, the agglomeration effect or the presence of exporters in the same region or industry is suggested to have a positive relationship with the industry share of exports (Aitken, et al., 1997; Lovely, et al., 2005; Greenaway and Kneller, 2008). Clerides, et al. (1998) found a positive effect for geographic and sectoral spillovers on the export decision of firms in Columbia, while Antonietti and Canielli (2008) found that firms located in urban areas are significantly more export intensive than their counterparts in non-urban areas. In contrast, Bernard and Jensen (2004b), report an insignificant and negative effect for the case of US firms. The proximity to large cities and urban areas is expected to lead to knowledge sharing and improved productivity at firm level, thus leading to an improved export performance. A more intensive knowledge sharing in the large cities occurs due to higher and easier interactions between different firms, higher education and research institutions and specialist organisations.

Another identified channel of knowledge spillovers is through learning by importing. When firms import some of their inputs, they gain access to information and knowledge from their suppliers about the state of technology and products and processes available in other countries which may lead to a so-called ‘reverse engineering’. Coe, et al. (1997) found that knowledge spillover arising from R&D activities in advanced countries have a significant impact on less developed countries, thus suggesting a knowledge spillover through trade relations. Amiti and Konings (2007) found that Indonesian firms have increased their product diversification as a result of imports, while Bloom, et al. (2016) and Damijan and Kostevc (2015) found evidence of learning by importing. Gashi, et al. (2014) report a positive and significant impact of import intensity on export performance of firms in CEECs.

In addition, the production of innovation at the sectoral level is found to improve the probability of exporting by all firms in the sector, both innovative and non-innovative (Wakelin, 1998). As Roper and Love (2002) suggest, if a particular sector produces a large number of product innovations, this might signal higher quality of the products in the respective sector and in turn affect sales of all firms in the sector.

Foreign ownership

The attraction of the foreign capital was one of the main policy objectives of all TEs since the early phase of transition. Lang (2010) indicates that among other measures, many developing and transition economies, among which also the European transition economies, have established export processing zones in order to attract foreign investors.[45] These zones have particularly proved successful in China (Wang and Wei, 2010). Attracting multinational companies is important because, they tend to make more substantial investments due to a better access to resources such as finance, physical or human capital (Roper, et al., 2006). In addition, they are likely to have advanced production technology, better marketing networks and cooperation with international companies (Ramstetter, 1999). Bloom and Van Reenen (2010) also find that foreign owned firms are likely to have better management practices than domestic firms. Finally, empirical results support the view that foreign owned firms are more likely to become exporters and have a better export performance (Aitken, et al., 1997; Roberts and Tybout, 1997; Correa, et al., 2007; Du and Girma, 2007; Filatotchev, et al., 2008; Bangwayo-Skeete and Moore 2015).

With respect to TEs, Rojec, et al. (2004) found the effect of foreign ownership on the propensity to export to be positive in Slovenia and Estonia, while Filatotchev, et al. (2008) found

[45] An export processing zone is defined as: "(a) a defined geographical area in a state's territory, which (b) constitutes a single administrative unit, in the sense that it is managed by a single entity, and (c) provides certain benefits and incentives to businesses which choose to operate within the area" (Lang, 2010, p. 11).

similar effect on the export intensity of firms for several TEs (Estonia, Hungary, Poland, Slovakia and Slovenia), similar to Gashi, et al. (2014) who studied all TEs.

Other relevant factors

The size of a firm is usually included in the firm's export performance model as a control variable. Aitken, et al. (1997) and Roberts and Tybout (1997) suggest that firm's size positively affects exporting. Verwaal and Donkers (2001) indicate that smaller firms may be more risk-averse, due to the lack of information and relatively greater impact of failure compared to larger firms. Similarly, in transition and developing economies smaller firms are expected to have fewer resources to access international markets compared to large firms (Bangwayo-Skeete and Moore, 2015; Lamotte and Colovic, 2015). Larger firms are seen as better performers in the export markets due to the pool of human resources and also because of the lower unit costs or the economies of scale (Bernard and Jensen, 2004a). However, as firms become larger, they might prefer to enter export markets through foreign direct investments rather than exports (Cassiman and Martinez-Ros, 2007), suggesting a bell-shaped relationship between size and export performance. In most studies (e.g., Wakelin, 1998; Sterlachini, 1999; Roper and Love, 2002) the effect of firm size is found to be positive but non-linear. Nevertheless, some studies report an insignificant relationship (Moen, 1999; Wolff and Pett, 2000; Contractor, et al., 2005).

The firm's age as a proxy for its experience is also used as a control variable in much of the previous studies. Years of accumulated experience may capture 'learning by doing' effects (Higon and Driffield, 2011). For example, Dean, et al. (2000); Lado, et al. (2004); Roberts and Tybout (1997); Moore (2006); and Faruq (2012) report a significant and positive relationship between a firm's age and its export performance. In contrast, Bangwayo-Skeete and Moore (2015) find that new firms are more likely to engage in export markets. The Schumpeterian view related to innovative entrepreneurs is a likely explanation, as young firms are likely to be more entrepreneurial and more innovative. Also, as young firms may not have a high share in the domestic market, they will be tempted to expand into foreign markets as well. In addition, similar to the firm size effect, as firms get older and more experienced, they might accumulate more knowledge and enter exporting markets in other ways, such as through FDIs (Barba Navaretti and Venables, 2004, p. 139).

Finally, Lee and Huang (2002) hypothesize that economic growth of a country boosts firms' exports. Their rationale is based on the assumption that in growing economies, firms will improve their innovation activities, quality of human capital and their knowledge absorption capacity. On the contrary, in a study of 111 developing economies, Bangwayo-Skeete and Moore (2015) find the effect of GDP per capita on the propensity to export to be negative, meaning that the lower the level of development, the higher is the likelihood of firms to engage in exporting. It implies that the domestic demand increases with economic development. This means that, the larger the GDP per capita is, the domestic consumption is likely to increase and firms may be more inclined to serve the domestic market.

In the next section we present the research methodology.

4.3 Research methodology

To present the research methodology, we first discuss the data used in the empirical analysis. Then, we specify variables and discuss descriptive statistics. Finally, we discuss the specification of the model and relevant econometric issues.

4.3.1 Data

This research uses the Business Environment and Enterprise Surveys (BEEPS) undertaken jointly by the European Bank for Reconstruction and Development (EBRD) and the World Bank in many countries. In particular, the focus is on the dataset related to three rounds of surveys in years 2002, 2005 and 2008 in transition economies.[46] Each survey is conducted in a random sample of around 30,000 firms and contains questions regarding the firms' characteristics, their innovation activities, as well as the perceived impact of business environment factors.[47] As explained by the EBRD, the survey examines the quality of the business environment determined by a wide range of indicators showing the interactions between firms and the state. The sample is selected randomly from the population of firms in manufacturing and services (including trade) and designed to be as representative of the population as possible. The sample is distributed between at least two major industrial regions within each country. The sectorial composition of firms in the survey is on the basis of different sectors' contribution to the GDP in each country. The sample is stratified in order to ensure that at least ten percent of firms in each country to be in the following categories: small, large, foreign-owned, and exporting.[48]

Since BEEPS surveys are conducted every three years in random samples of companies, it is possible to pool them and work with a larger sample, provided that the questionnaires in respective surveys have a common methodology and contain the same questions. Each year, the

[46] 5 BEEPS survey rounds are undertaken including the rounds of 1999 and 2012/13. The round of 1999 is not usable because most of the questions were different from other rounds, while 2013 round came out after having written this chapter (also many questions changed). Survey period for BEEPS 2008 includes 2008 and 2009 period, but for the simplicity of analysis, in this thesis it will be referred to as the BEEPS 2008. In 2002, 2005 and 2008 BEEPS survey covers 28 transition economies.
[47] BEEPS has been conducted in transition countries, as follows:: Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Former Yugoslav Republic of Macedonia, Georgia, Hungary, Kazakhstan, Kyrgyz Republic, Latvia, Lithuania, Moldova, Montenegro (in 2002 and 2005 as Federal Republic of Yugoslavia), Poland, Romania, Russia, Serbia (in 2002 and 2005 as Federal Republic of Yugoslavia), Slovak Republic, Slovenia, Tajikistan, Turkmenistan, Ukraine and Uzbekistan. Kosovo and Mongolia were included only in the 2008 survey, but are not included in the analysis.
[48] See BEEPS dataset available at http://www.ebrd.com/country/sector/econo/surveys.

firms are asked if they mind being interviewed in the next round and if they agree, they will be included in the following round. These firms, not being randomly selected, are deleted from 2005 and 2008 surveys in this analysis, although Wooldridge (2002, p. 129) suggests that these cases can be treated as coincidental and can be ignored. As Wooldridge (2006, p. 10) points out, pooling of random samples drawn in different time periods produces independently pooled cross sections which increases the sample size and enables us to get more precise estimators and more powerful test statistics. The pooling is particular important in this investigation as it involves splitting the sample into three subsamples according to their reform stage and the number of observations in each subsample would be rather small to have robust results if we were to rely on annual surveys.[49]

Unfortunately, the relevant questions of interest are the same only in BEEPS 2002 and BEEPS 2005, with some of the questions of interest being dropped in BEEPS 2008. Therefore, we have had to construct two different pooled datasets for this investigation. Firstly, BEEPS 2002 and BEEPS 2005 are pooled together, and hereafter will be referred to as POOLED1 dataset; secondly the three datasets (the previous two plus BEEPS 2008) are also pooled together and hereafter will be referred to as POOLED2 dataset. As Wooldridge (2002, p. 129) suggests, when using pooled cross sections, year dummies should be included in order to account for aggregate changes over respective time periods. As Wooldridge notes, every method applicable to pure cross section analysis can be applied to the pooled cross sections.

The BEEPS dataset also provides a panel element (covering the survey rounds of BEEPS 2002, 2005 and 2008) but its size is rather small, containing around 600 observations as compared to the Pooled BEEPS dataset which includes around 24,000 observations. The size of the panel

[49] Undertaking separate estimations for each survey round involves much smaller number of observations which in turn affects precision of the estimates. Since transition countries have progressed from a year to year with their institutional reforms, number of countries belonging to the laggard transition stage has decreased from 8 in 2002 to only 5 in 2008. Consequently, the subsample is drastically reduced and as such it decreases the precision of the estimates and makes less powerful test statistics as indicated by Wooldridge (2006, p.10).

dataset poses a major limitation in this study, especially because the investigation involves splitting the dataset into three subsamples (for laggard, medium and advanced reforming countries), which would considerably decrease the number of observations in each subsample. This shortcoming can be partially addressed by using interaction terms when investigating the effects across transition stages. However, the panel dataset has another more serious limitation arising from the exclusion of some questions of interest in the BEEPS 2008 survey, which makes the panel dataset not useful for this research. In the BEEPS 2008 survey, questions related to variables expressing 'uncertain domestic environment', 'process innovation', 'skills of the employees', 'networking' and 'import intensity' are not included. Among others, if we drop the indicator that expresses the 'uncertain domestic environment' we would not be able to address one of the main questions of interest in this thesis. Therefore, due to the small size of the panel dataset and the non-availability of some key variables of interest, the panel data element of BEEPS cannot be used and panel estimation cannot be undertaken. In the next section we specify variables.

4.3.2 Specification of variables

The precise measurement of the dependent and explanatory variables is constrained by the way variables have been defined in the BEEPS database. It has already been mentioned that because of the non-conformity of questions in the three rounds of BEEPS, two separate pooled datasets have been constructed. Table 4.2 reports detailed specification of variables included in for the two datasets, POOLED1 and POOLED2.

Table 4.2 Description of variables and their availability in the datasets

Dependent Variable		Variables in the dataset: POOLED1 (BEEPS 2002 & 2005)	Variables in the dataset: POOLED2 (BEEPS 2002, 2005 & 2008)
expint	Percentage share of exports in total sales	Yes	Yes
Innovation			
newprod	Dummy, taking the value of one if firms have introduced a new product line/service in the last 36 months, zero otherwise	Yes	Yes
upprod	Dummy, taking the value of one if firms have upgraded an existing product line/service in the last 36 months, zero otherwise	Yes	Yes
procinn	Dummy, taking the value of one if firms have acquired new production technology in the last 36 months, zero otherwise	Yes	No
Business environment factors[a]			
infrastruct	Dummy, taking the value of one if infrastructure is considered as major obstacle to business operations, zero otherwise. Infrastructure is considered a major obstacle if one of the indicators - *electricity*, *transportation* or *telecommunication* is considered a major obstacle to business operations. In POOLED2 dataset, dummy if *electricity* or *transportation* is considered a major obstacle to business operations.	Yes	Yes
accessfin	Dummy, taking the value of one if *cost of financing* or *access to financing* is considered a major obstacle to business operations, zero otherwise	Yes	Yes
macobst	Dummy, taking the value of one if macroeconomic obstacles are considered a major obstacle to business operations, zero otherwise. Macroeconomic obstacles are considered as major if one of the indicators - *macroeconomic instability* (inflation/exchange rate) or *uncertain regulatory policies* is considered a major obstacle to business operations.	Yes	No
weaklaw	Dummy, taking the value of one if weakness of rule of law indicator is considered a major obstacle to business operations, zero otherwise. Weakness of rule of law is considered a major obstacle if one of the indicators - *anti-competitive practices of other competitors* or *contract violations by customers and suppliers* are considered a major obstacle to business operations. In POOLED2 dataset, dummy if *anticompetitive practices of other competitors* is considered a major obstacle to business operations.	Yes	Yes
Other factors			
uni	Percentage share of employees with university education or higher in the workforce	Yes	Yes
skilled	Percentage share of skilled employees in the workforce	Yes	No
busass	Dummy, taking the value of one if firms are member of a business association, zero otherwise	Yes	No
businf	Dummy, taking the value of one if firms' membership in a business association is considered critical for information and/or contacts on international product and input markets, zero otherwise	Yes	No
impint	Percentage share of inputs imported	Yes	No
largecity	Dummy, taking the value of one if firms are located in the capital city or a city with more than 250,000 inhabitants, zero otherwise	Yes	Yes
sectorspill	Proportion of innovative firms in each sector	Yes	Yes
forown	Percentage share of equity owned by foreigners	Yes	Yes
Control Variables			
size	Number of full time employees	Yes	Yes
age	Years since establishment of the firm	Yes	Yes
gdppercap1	Demand side factor - GDP per capita one year prior to the survey expressed in US Dollars	Yes	Yes

Source: Author's own specification using BEEPS data

[a] In the BEEPS survey, the business environment indicators are ranked on a likert scale from 1 to 4, as responses to the question: "Can you tell me how problematic are these different factors for the operation and growth of your business". Response ranking scales are as follows: 1 – No obstacle; 2 – Minor obstacle; 3 – Moderate Obstacle; 4 – Major Obstacle. These responses are converted to a dummy taking the value of one if one of the constituent indicators is considered a major obstacle, zero otherwise

Dependent Variable

The dependent variable in the model is export intensity (*expint*), or the proportion of sales coming from exports (the sum of direct and indirect export sales divided by total sales) expressed in percentages. The literature on the subject contains the range of export performance measurements. Sousa (2004) finds export sales to be one of the most frequent measures used in the literature. The sales category includes measures of the absolute volume of export sales or the export intensity which shows the proportion of export sales in total sales (Zou and Stan, 1998). Despite being widely used, as Sousa (2004) emphasizes, the appropriateness of these indicators might be questioned. He notes that a firm with small market share in a large export market might be considered more successful than a firm that has a large share in a small export market. However, measuring export sales in relative terms, as the percentage share of export in total sales, adjusts for absolute differences resulting from the volume of sales between firms.

Other measures of export performance such as export related profit (see White, et al., 1998) are open to criticism as well. This is because different firms use different accounting methods, which raises comparability issues, questioning the validity of values used in empirical work (see Samiee and Anckar, 1998; Lages and Lages, 2004). White, et al. (1998) also use other measures such as the number of foreign countries to which a firm exports and the management's satisfaction with export performance. However, the former indicators measure only the quantity of foreign markets served by a particular firm but not the level of exports in these markets, and the latter is only a subjective measure based on manager's perceptions.

Export intensity, the percentage of export sales in a firm's total turnover, is most frequently used in the literature (see Wakelin, 1998; Sterlacchini, 1999; Roper and Love, 2002; Ozcelik and

Taymaz, 2004; Anh, et al., 2009; Damijan, et al., 2010; Gashi, et al., 2014) and will be used in this investigation too.

Independent variables

Innovation

In this empirical investigation we use innovation output indicators. New products (*newprod*), upgraded products (*upprod*) and process innovation (*procinn*) are used as three measures of innovation (all in the form of dummies). While information on product innovation is available in all survey rounds, that on process innovation is available only in BEEPS 2002 and BEEPS 2005 datasets. We differentiate between upgraded and newly introduced products in order to investigate the effect of the degree of novelty. A more direct measure of the degree of product novelty used in the empirical investigation for the case of Kosovo is presented in Chapter V. Similar to findings of Lamote and Colovic (2013) who suggest that the effect of innovation on export performance is stronger in developing countries with higher income, we hypothesize that innovation in general, but the products with a higher degree of novelty in particular, have a stronger positive effect on firm's export performance as countries progress with their transition reforms. The rationale behind this hypothesis relates to the moderating role of institutions that enable a supportive environment which stimulates firms to invest in more radical innovation. In the process, it also enables them to achieve competitive advantage (Dixon, et al., 2010).

Business environment factors

In terms of business environment factors, the surveys contain questions on a large number of business environment obstacles. Given that some of the obstacles are quite similar to each other and reflect the same or very similar feature of the business environment, they are likely to be correlated with each other. For this reason, the obstacles have been put into four main groups which are expected to have an impact on firm's export performance. Dummy variables have been constructed on the basis of the perceptions of entrepreneurs about the importance of each of the obstacles. Although one may argue that perceptions may not reflect the actual state of the business environment, we argue that the perceptions of the managers shape their opinion and the decision making process which in turn affects a firm's engagement and performance in international markets.

The four groups of variables are macroeconomic uncertainty (*macobst* - consisting of indicators for inflation, exchange rate and uncertainty about regulatory policies), infrastructure (*infrastruct* - consisting of indicators for telecommunication, transportation and/or electricity), access to finance (*accessfin* - consisting of indicators for cost of finance and access to finance), and the weakness of the rule of law (*weaklaw* - consisting of indicators for anticompetitive practices of competitors and/or contract violations by consumers and suppliers).[50]

In addition, as a robustness check, the common factor analysis technique was employed to reduce the number of obstacles to a small number of groups. Common factor analysis is generally used for the purpose of data reduction or understanding latent constructs (Conway and Huffcutt, 2003).[51] This methodology produced the same grouping as was done earlier intuitively (see Appendix A4.2 for the factor analysis results). Merging common business environment indicators

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[50] In the POOLED2 dataset, containing all three survey rounds, the infrastructure variable is constructed by combining only transport and telecommunication indicators; the weakness of rule of law is indicated only by anticompetitive practices of competitors; and the macroeconomic obstacle indicators were not included in the questionnaire of the BEEPS 2008 survey.

[51] There are generally two factor extraction techniques, the common factor analysis (CFA) and the principal component analysis. Conway and Huffcutt (2003) further explain that while the first technique aims to explain latent variables which account for correlation between measured variables, the latter is a simply data reduction technique by creating factors that retain as much of the original measures' variance. Consequently, CFA seems to be a more appropriate technique for supporting economic rationale in combining different common variables into a single variable for the model estimation, as its purpose is mainly to support the hypothesis under which common business obstacles are combined in one variable. Factor scores derived from factor analysis are not used as underlying criteria's which make their scores robust are not met, such as sample size and variable to factor ratio. While the first criteria seem to be within the required limits (larger than 400 observations) as suggested by MacCallum, et al. (1999), variable to factor ratio does not meet the required criteria of 4-1 as suggested by (Fabrigar, et al., 1999). The only factor which loads on three variables is factor indicating infrastructure related effects, which loads on three variables (electricity, telecommunication, transportation), whereas other three factors load on two variables each.

into single variables reduces number of variables from nine to four in the POOLED2 model specification and from four to three in the POOLED2 model specification.

The common factor analysis technique was employed only for the POOLED2 dataset due to the data limitation in the BEEPS 2008 dataset which consists of fewer business environment indicators. The common factor analysis results show that the three infrastructure related indicators load into one common factor, have high loadings, a low percentage of uniqueness with the eigenvalue being larger than one.[52] With regards to indicators on financing obstacles, *access to finance* and *cost of finance*, they both load into a common factor with the eigenvalue is larger than one, with high loadings and relatively smaller uniqueness values compared to the infrastructure indicators. Furthermore, indicators of macroeconomic obstacles, *macroeconomic instability* and *uncertainty about regulatory policies* also load in a common factor with the eigenvalue larger than one, with relatively high loadings and a relatively smaller uniqueness compared to indicators in the two previous factors. Similarly, indicators related to the weak rule of law, *contract violations by competitors* and *anticompetitive behaviour of competitors,* are also predicted as part of one common factor. Unlike the first three factors, common factor loadings of these two weaknesses of rule of law indicators are relatively smaller. The eigenvalue of the common factor is smaller than one, indicating relatively higher explanatory power of these two variables individually compared to variables belonging to the first three groups. However, since they load on one common factor and both indicators imply a weakness of rule of law, similar to the first three groups, they are merged into one variable.

As suggested by the economic literature, we define two opposing hypotheses regarding business environment factors. First, we hypothesize that if firms face an uncertain domestic

[52] Eigenvalue indicates the explanatory power of the factor. Common factors with the eigenvalue larger than 1 are generally accepted to be robust, as they suggest that the explanatory power of the factor is larger than of a single variable (Conway and Huffcutt, 2003).

macroeconomic environment (*macobst*) they will tend to intensify exporting to potentially safer markets. Second, we hypothesize that if the rule of law (*weaklaw*), infrastructure (*infrastruct*) and the access to finance (*accessfin*) are perceived as obstacles to the firm's business operations, the respective factor will have a negative effect on the firm's export performance across all stages of transition. Assuming that firms will be more sensitive to changes in the market environment as economies tend to become more developed, we also expect a stronger effect of the related factors at more advanced stages of transition.

Other factors

The share of employees with university degree or higher (*uni*), and the share of skilled staff in the total number of staff (*skilled*) variables expressing human capital in this analysis. In line with the literature suggestions, we hypothesize that the effect of the educated and skilled employees on the export performance of firms is expected to be positively and more strongly related to the level of reforms in a country. The rationale behind this assumption is that as countries shorten the gap in reaching the standards of an industrialised economy, they also improve the quality of their education system. Membership in business association is used in this analysis as a measure of networking or external linkages (*busass*). In addition, the importance of business associations in terms of information (*businf*) on the export markets is considered as well. We hypothesize that being a member of a business association positively influences the firm's export performance, while the effect becomes stronger across the transition stages.

As presented in Table 4.2, the BEEPS dataset provides information for a number of knowledge spillover indicators. The number of inhabitants in the city (*largecity*) expresses large cities and the potential agglomeration economies; the share of firms' imported inputs in total inputs (*impint*) is a measure of learning by importing; the proportion of innovative firms per sector (*sectorspill*) is used as a measure of the group knowledge spillovers. To construct the sectoral knowledge spillover variable, information on sectors is used as provided in the BEEPS survey, including the following sectors: *manufacturing, mining and quarrying, retail and wholesale, transport, storage and communication, renting and business services, and hotels and restaurants*. The variable *sectorspill* is constructed, measuring the proportion of innovative firms in the respective sectors in each country. Following the existing economic literature, we hypothesize that the impact of knowledge spillover factors will be positive and significant across all transition stages.

In terms of foreign ownership, we use the share of foreign owned asset in a firm's total assets (*foreign*) as a measure of foreign ownership. We hypothesize that the foreign ownership will positively affect the export performance of firms, while the effect will be stronger in the early stages of transition, as we expect foreign owners or partners to have a higher impact during the early restructuring period and when its gap between domestic and foreign firms is widest and domestic firms' absorptive capacities and linkages with international markets are at their lowest levels.

Control variables

Size of the firm (*size*), measured by the number of employees will be used as a control variable in this study in order to investigate if there is any difference across groups of countries at different stages of transition. The squared term of size (*sizesq*) is also included in order to investigate the presence of a non-linear relationship.

Information on years since the firm's establishment, provided in the BEEPS dataset, is used as a measure of firm's experience (*age*). Similar to the size effect, a bell-shaped relationship between age and export performance is expected, thus a squared term of age is used (*agesq*).

Finally, the GDP per capita is used as a measure to control for the demand side effects. Given that increased exports will result in higher GDP and GDP per capita, there is potential for a two-way relationship between GDP per capita and export performance. To avoid potential endogeneity, the previous year's GDP per capita is used. In addition, to control for a potential non-linear relationship, the squared term of GDP per capita is also included. We expect a bell shaped relationship of the GDP per capita with export performance.

The next section discusses the descriptive statistics of the dataset.

4.3.3 Descriptive statistics

Descriptive statistics of the annual BEEPS datasets are provided in Table 4.3. The number of firms included in the survey has increased from one survey round to another, but the proportion of the exporters has decreased slightly. Similarly, when looking at the export intensity of exporters only, the data suggest that export intensity has slightly decreased over time.

In terms of innovation indicators, the proportion of firms having introduced new or upgraded products has a remarkable increase over the three survey rounds. A positive trend is observed also for the proportion of firms that have introduced new processes between 2002 and 2005.

The business environment obstacles related to infrastructure, as perceived by firm's managers, access to finance and weakness of rule of law have slightly increased over the three survey rounds, except for the indicator representing macroeconomic obstacles. A relatively lower proportion of firms consider macroeconomic obstacles as a major obstacle to their business operations in 2005 compared to 2002. With regards to human capital related variables, the percentage share of staff with university degree or higher has decreased, while the percentage share of the skilled workers has increased in the two survey periods between 2002 and 2005.

Table 4.3 Descriptive statistics

Variable	Dataset	Obs	Mean	Std. Dev.	Min	Max	Missing %
Dependent variable							
	BEEPS2002	6122	10.97	24.87	0	100	0.50
	BEEPS2005	9085	9.97	24.00	0	100	0.14
expint	BEEPS2008	10542	9.92	24.68	0	100	0.31
Innovation							
	BEEPS2002	6119	0.39	0.49	0	1	0.55
	BEEPS2005	9098	0.35	0.48	0	1	0.00
newprod	BEEPS2008	10517	0.55	0.50	0	1	0.55
	BEEPS2002	6116	0.52	0.50	0	1	0.60
	BEEPS2005	9098	0.51	0.50	0	1	0.00
upprod	BEEPS2008	10460	0.74	0.44	0	1	1.09
	BEEPS2002	6115	0.30	0.46	0	1	0.62
procinn	BEEPS2005	8987	0.33	0.47	0	1	1.22
Business environment factors							
	BEEPS2002	5993	0.04	0.19	0	1	2.60
	BEEPS2005	7508	0.04	0.19	0	1	2.34
infrastructure	BEEPS2008	9880	0.08	0.28	0	1	3.26
	BEEPS2002	5683	0.11	0.32	0	1	7.64
	BEEPS2005	7206	0.10	0.31	0	1	6.27
accessfin	BEEPS2008	9881	0.28	0.45	0	1	3.25
	BEEPS2002	5807	0.26	0.43	0	1	5.62
	BEEPS2005	7163	0.26	0.43	0	1	6.83
weaklaw	BEEPS2008	9903	0.29	0.45	0	1	3.04
	BEEPS2002	5929	0.44	0.49	0	1	3.64
macobst	BEEPS2005	7344	0.34	0.47	0	1	4.47
Other factors							
	BEEPS2002	6022	33.39	31.76	0	100	2.13
	BEEPS2005	8931	28.22	29.35	0	100	1.84
uni	BEEPS2008	10084	25.80	26.43	0	100	4.64
	BEEPS2002	6064	45.92	30.85	0	100	1.45
skilled	BEEPS2005	8979	49.51	31.15	0	100	1.31
	BEEPS2002	6153	0.39	0.49	0	1	0.00
busass	BEEPS2005	9098	0.37	0.48	0	1	0.00
	BEEPS2002	5936	0.07	0.26	0	1	3.53
businf	BEEPS2005	8723	0.08	0.28	0	1	4.12
	BEEPS2002	5798	17.09	31.98	0	100	5.77
impint	BEEPS2005	8854	15.31	30.44	0	100	2.68
	BEEPS2002	6153	0.51	0.50	0	1	0.00
	BEEPS2005	9098	0.53	0.50	0	1	0.00
largecity	BEEPS2008	10575	0.51	0.50	0	1	0.00
	BEEPS2002	6153	0.63	0.18	0	1	0.00
	BEEPS2005	7688	0.63	0.17	0	1	0.00
sectorspill	BEEPS2008	10059	0.78	0.13	0	1	1.51
	BEEPS2002	6153	12.40	30.02	0	100	0.00
	BEEPS2005	9098	9.05	26.42	0	100	0.00
forown	BEEPS2008	10448	7.96	25.06	0	100	1.20
Control Variables							
	BEEPS2002	6122	139.48	498.23	2	9960	0.50
	BEEPS2005	9097	100.99	357.14	2	9900	0.01
size	BEEPS2008	10468	115.10	545.30	2	37772	1.01
	BEEPS2002	6153	14.70	18.70	3	202	0.00
	BEEPS2005	9090	15.55	17.46	4	180	0.09
age	BEEPS2008	10326	13.60	13.66	1	183	2.35

Source: Authors' own calculation using BEEPS data

Finally, the share of foreign owners in total assets of companies has a decreasing trend over the three survey rounds.

A major problem with survey data, particular the BEEPS data, is the amount of missing observations. However, as shown in Table 4.3 the proportion of missing values for variables used in this investigation is fairly low. Due to the large sample size, a low proportion of missing observations or non-responses is expected to be at random.[53] The next section discusses the descriptive statistic by stages of transition.

4.3.4 Descriptive statistics by stages of transition

Descriptive statistics by the stage of transition are provided in Appendices A4.3.1 and A4.3.2, one for each of the two datasets. In terms of differences between countries at different stages of transition, export intensity seems to be increasing at more advanced transition stages in both POOLED1 and POOLED2 datasets. The mean values of export intensity show that firms in these three groups of countries differ significantly in terms of exporting. In regard to explanatory variables used in the model, the proportion of firms introducing new or upgraded products seems to increase in medium and advanced transition reforming stages compared to laggard transition group of countries, while the proportion of firms introducing process innovations in the advanced reforming countries shows to be relatively smaller compared to laggard and medium transition reformers. When assessing the business environment factors, the percentage of firms considering infrastructure, access to finance, macroeconomic obstacles and weakness of rule of law as a major

[53] In the study undertaken by Gashi, et al. (2014) which draws on the BEEPS dataset, data is imputed for all missing observations of explanatory variables in the dataset and the model is estimated with and without imputed data. The main reason for imputing data by Gashi, et al. (2014) is inclusion of gross investments and R&D spending in the model with high rates of missing responses of (up to 60 percent). Despite a high proportion of imputed data, the results reported are generally consistent in terms of the estimates sign, size and significance between imputed and non-imputed datasets. The variables which have a very high proportion of missing observations, such as R&D and gross investments, are not included in the model we are estimating as we are using output, and not input, measures of innovation.

obstacle to their business operation appears to be slightly higher at the advanced reform stage compared to medium and laggard reformers.

With respect to other variables, the mean percentage share of employees with the tertiary education is higher in laggard reforming groups compared to medium transition stage in both datasets, whereas the mean percentage share of skilled employees is higher in medium and advanced stages of transition in POOLED1 dataset. It seems that as countries progress towards the standards of a market economy, firms start to rely more on skilled rather than academically qualified employees. In terms of foreign ownership, while the asset shares of foreign owners decreased from one to another survey round, when comparing data between stages of transition, it appears to be slightly increasing across the transition stages in POOLED2 dataset. Although on average it gives an indication that foreign ownership intensity has been decreasing, these statistics show that foreign owners have been shifting to more reformed economies. Regarding the firm's location, the proportion of firms located in large or capital cities appears to be relatively lower in the advanced transition stage. Finally, as it would be expected, the GDP per capita is positively correlated to the stages of transition reforms in both datasets.

The next section discusses the model specification.

4.3.5 Model specification

The investigation of export performance at the firm level has generally been addressed in a twofold approach, examining both the firms' decision to export (export propensity) and the amount of exports (or export intensity) (see Wakelin, 1998; Sterlacchini, 1999; Sterlacchini, 2001; Basile, 2001; Roper and Love, 2002; Ozcelik and Tamyaz, 2004; Gashi, et al., 2014). Usually there are two alternative strategies, one considering that the decision to export or the probability of exporting may not be determined by the same variables that influence export intensity of the exporters (Basile, 2001), and the other one considering that the same factors affect both outcomes (Gashi, et al., 2014). As Gashi, et al. (2014) argue, export behaviour is determined by the interplay of explanatory factors which mainly affect productivity level and the fixed costs, with same factors affecting both the firm's export propensity and export intensity. If it is assumed that the productivity drives firms towards the export markets and productive firms, in the first place, self-select to export markets (Melitz, 2003), variables explaining productivity will also affect the performance or the intensity of firm's exports. Therefore, following Gashi, et al. (2014) we assume that same variables affect both decisions of firms, the propensity to export and intensity of exporting.

The firm based survey data include a sample of firms which contain exporters and non-exporters, with a significant proportion of firms having reported zero as their share of sales from exports. According to Wooldridge (2006, p. 598) in cases when there is a population distribution spread out over a range of positive values, but with a considerable proportion of zero observations, OLS estimation would lead to negative predictions for some of the firms and therefore another strategy has to be chosen. On the other hand, as the dependent variable has positive values only for some observations, the sample is a censored sample (Gujarati, 2003, p. 616). It is known as such because the dependent variable is zero for a nontrivial fraction of the population, determining the decision of firms to export, but is roughly continuously distributed over positive values, determining the export intensity of firms (Wooldridge, 2006, p. 595). Indeed, as Wooldridge argues, it might be optimal for some nontrivial fraction of firms to have a zero value (in this case zero exports). This, of course, creates a corner solution problem. In this case, the Tobit estimation model is the appropriate modelling strategy, dealing with censored data and the corner solution for dependent variable, as it accounts for the decision of firms whether or not to export, and if yes (positive values of the dependent variable) by how much.

The core model of export performance can be written in the following form:

Export performance = f (Internal firm characteristics, contextual factors).

The Tobit model of export performance can be expressed as:

$$y_i = \begin{cases} y_i^* = \beta x_i + \varepsilon_i & \text{if } \beta x_i + \varepsilon_i > 0 \quad \text{for exporters} \\ 0 & \text{otherwise} \quad \text{for non-exporters} \end{cases}$$

$$\varepsilon_i \sim N(0, \sigma^2) \tag{4.1}$$

Model specification implies that y_i can be observed only through exporters, or a latent variable in cases where its value is positive ($y_i^* > 0$), while dependent variable cannot be observed when $y_i^* \leq 0$. However, in this case the dependent variable can only be equal to zero. The independent variables in the model are expressed as x_i, β represents the coefficients of the variables and the intercept and ε_i is the error term. The model assumes that the error term has a normal, homoscedastic distribution with a linear conditional mean (Wooldridge, 2006, p. 596).

There are a number of econometric issues which need to be explained before we move on to estimate the above model.

Firstly, there is an issue of potential endogeneity. As previously discussed, innovation is expected to increase firm's exports, whereas improved export performance might enhance firm's knowledge and in turn increase its abilities to innovate. This outcome raises a potential endogeneity issue between export performance and innovation as predicted by global-economy models of endogenous innovation and growth (Grossman and Helpman, 1994). However, this will not be a problem here because the innovation variable measures the innovation activities of the firm over the previous 36-month period whereas export performance refers to the current period.

The increased export performance is expected to affect commercialization of the newly developed knowledge into new products or processes only after a time lag through the conversion process of innovation inputs into outputs. As a result, given the way variables are defined in the BEEPS dataset, the problem of potential endogeneity between the two variables does not arise.

Second, as the investigation uses pooled data, year dummies are included in the model (Wooldridge, 2002). Year dummies also enable us to estimate the changes in export intensity over different time periods when controlling for other observable factors. The year 2005 is used as a dummy for the POOLED1 dataset, whereas year dummies for 2005 and 2008 are used for the POOLED2 dataset. The year 2002 is used as the base year for both pooled datasets.

Additionally, to check for any structural breaks over the years for the pooled datasets, a chow test (which, as Wooldridge notes, is simply an F test) is undertaken. Following Wooldridge (2006), to conduct the F test, a year dummy has been interacted with all variables of the model for POOLED1 (year 2005) and POOLED2 (year 2008) datasets. The F test is undertaken as a post-estimation technique. The null hypothesis states that there is insignificant difference between the parameters of two different periods. For POOLED1 dataset, results suggest that at 10 percent level of statistical significance there is insufficient evidence to reject null hypothesis (see Appendix A6.1). Consequently, pooling BEEPS 2002 and 2005 datasets is legitimate. For the POOLED2 dataset, the null hypothesis is rejected for the year 2008 (see Appendix A6.2). However, insignificant year dummies in the POOLED2 estimations do not indicate any significant differences over the years.[54] Whereas as Wooldridge (2002) suggests, including year dummies in

[54] We have additionally estimated alternative model specifications interacting year dummies (in particular year 2008 dummy) with the variables of interest, but the results generally indicated for an insignificant effect of the interaction terms. Therefore, for the sake of brevity and due to lack of significant evidence on the time variant effects we do not present the alternative estimations.

the model will control for any aggregate changes over the years. Consequently, pooling datasets of all three survey rounds in the POOLED2 dataset is valid.

Third, to test the validity of splitting the overall sample into subsamples based on the transition stage, or the homogeneity between parameters across different grouping of transition countries, an F-test is undertaken.[55] The null hypothesis states that there is insignificant difference between estimates of the different subsamples. To conduct the F test as a post-estimation technique, all variables of the model are interacted with the transition stage dummy for each transition subsample. For both pooled datasets, POOLED1 and POOLED2 there is sufficient evidence, at 1 percent level of statistical significance, to reject the null hypothesis, supporting the view that the parameters of the estimated models across the three transition grouping are not equal. Consequently, splitting data into three subsamples of laggard, medium and advanced reforming transition countries is reasonable.

Fourth, the specification issue arising from the use of aggregate variables (country or sector) in a micro model has been addressed. As a result of inclusion of the sectoral knowledge spillovers and GDP per capita in the estimated model, empirical estimation requires caution when specifying the model due to potential sector level and country level invariant effects. In such a case, the assumption that disturbances are independent is not appropriate. Here, as Moulton (1990) emphasizes, standard errors have to be adjusted in order to avoid error in variables due to aggregation issues. As Wooldridge (2003, p. 50) points out, because the outcomes within each cluster (clusters of innovative firms in each sector) are likely to be correlated, allowing for an unobserved cluster effect is very important.[56] Therefore, standard errors have been adjusted by controlling for sectoral cluster. In addition, invariant country effects are accounted by including

[55] For the F-test results see Appendices A4.7.1 – A4.7.6.
[56] In an example provided by him, educational data for students from many schools form a clustered sample, where each school is a cluster.

country dummies in the Tobit model estimation for all subsamples of both POOLED1 and POOLED2 datasets.

The next section presents the empirical results.

4.4 Empirical results

In this section we first present estimation diagnostics. Then, we discuss main findings and the sensitivity of results.

4.4.1 Estimation diagnostics

Firstly, we examine the level of correlation between the variables. For this reason, the correlation matrices for both datasets are produced and presented in Appendices A4.4.1 and A4.4.2. All correlation coefficients fall below 0.45, far below the conventional level of 0.7. As such, multicollinearity does not appear to be a problem in the estimated model. The highest correlation is shown to be between the innovation related variables included in the model. Nevertheless, given the use of three alternative indicators of innovation output, in the sensitivity analysis section in this chapter (section 4.4.3) we present results of alternative specifications, which as well suggest that multicollinearity is not an issue.

Second, we examine the validity of the Tobit model. The results for the POOLED1 database are presented in Table 4.4. The Tobit model imposes a sign restriction on the estimates. This restriction implies that the direction of the impact (positive or negative) of explanatory variables on the propensity to export (probability of being uncensored) and export intensity (for the uncensored sample) is the same.

Table 4.4 Comparison between Tobit and Probit estimates

POOLED1 (BEEPS 2002/2005)									
	LAGGARD TRANSITION			MEDIUM TRANSITION			ADVANCED TRANSITION		
VARIABLES	Tobit parameter	Tobit/Sigma parameter	Probit parameter	Tobit parameter	Tobit/Sigma parameter	Probit parameter	Tobit parameter	Tobit/Sigma parameter	Probit parameter
Innovation									
newprod	4.007	0.07255	0.110	3.767	0.06689	0.140***	8.358***	0.17655	0.236***
upprod	6.983***	0.12643	0.184***	5.540**	0.09837	0.131***	4.923**	0.10399	0.130*
procinn	1.109	0.02008	-0.0452	6.312**	0.11207	0.0823	2.000	0.04225	0.0695
Business environment factors									
infrastruct	-16.83	-0.30473	-0.427	4.408	0.07827	0.0306	-5.194	-0.10972	-0.132
accessfin	3.860	0.06989	0.0930	5.096	0.09048	0.0637	2.787	0.05887	0.0756
weaklaw	-5.592	-0.10125	-0.0544	-8.473***	-0.15044	-0.0912	-6.306***	-0.13321	-0.0696
macobst	1.350	0.02444	0.0313	2.549	0.04526	0.0261	14.10***	0.29785	0.247***
Other factors									
uni	0.258***	0.00467	0.00519***	0.189***	0.00336	0.00369***	0.144**	0.00296	0.00470***
skilled	0.0519	0.00094	0.000448	0.0566	0.00100	0.000454	0.125***	0.00264	0.00228**
busass	23.08***	0.41789	0.454***	21.08***	0.37429	0.418***	8.894**	0.18787	0.218**
businf	-0.523	-0.00947	-0.0220	13.94***	0.24751	0.327***	15.74***	0.33249	0.435***
largecity	-3.902	-0.07065	-0.0560	3.515	0.06241	0.0939	-6.076*	-0.12835	-0.0516
impint	0.225***	0.00407	0.00563***	0.365***	0.00648	0.00761***	0.511***	0.01079	0.0131***
sectorspill	54.06***	0.97882	1.123***	92.70***	1.64595	1.819***	104.3***	2.20321	2.418***
forown	0.409***	0.00741	0.00669***	0.352***	0.00625	0.00599***	0.269***	0.00568	0.00427***
Control variables									
gdpcap1	-0.118**	-0.00214	-0.00195**	0.00746	0.00013	7.09e-05	0.0186*	0.00039	0.000348
gdpcap1sq	2.34e-05**	0.00000	3.84e-07**	-1.96e-07	0.00000	-1.74e-09	-1.18e-06**	0.00000	-2.28e-08
size	0.0603***	0.00109	0.00132***	0.0323***	0.00057	0.000730***	0.0190**	0.00040	0.000540**
sizesq	-1.21e-05***	0.00000	-2.46e-07***	-3.32e-06***	0.00000	-7.15e-08***	-2.59e-06**	0.00000	-7.74e-08**
age	0.340	0.00616	0.00926**	0.520***	0.00923	0.0111***	0.493***	0.01041	0.0144***
agesq	-0.00265	-0.00005	-4.95e-05	-0.00196**	-0.00003	-2.95e-05	-0.00317*	-0.00007	-7.16e-05
y05	15.20	0.27521	0.242	-13.65**	-0.24237	-0.198*	4.252	0.08982	0.0665
Tobit Sigma	55.23***			56.32***			47.34***		
Observations	2,033			5,791			2,785		

Source: Stata regression outputs
Clustered robust standard errors in parentheses
Country dummies included
*** p<0.01, ** p<0.05, * p<0.1

Wooldridge (2006, pp. 603-604) suggests that the appropriateness of the Tobit model, in terms of this restriction, can be tested by undertaking a Probit regression (considering only the propensity to export) and then comparing the Probit coefficients with the Tobit estimates divided by the Tobit overall standard error "sigma". If these are of approximately the same size, the use of the Tobit model is justified. Wooldridge further suggests that differences in sign and magnitude of insignificant explanatory variables in the two models (the Probit and Tobit coefficients) can be ignored.

The Tobit model estimation for each subsample is tested for appropriateness using the method suggested by Wooldridge. Table 4.4, presents the results for the POOLED1 database for each subsample, there are Tobit model estimates, Tobit estimates divided by Sigma, and Probit estimates. For the Probit model, the dummy variable *expprob,* taking the value of 1 for exporting firms and 0 for non-exporters, is used as dependent variable.

As can be seen from Table 4.4, the differences between the Probit coefficients and the Tobit coefficients divided by the Tobit sigma are generally insignificant. Similar results are shown for the POOLED2 estimations as well (see Appendix A5). Therefore, using the Tobit model is shown to be a valid choice for this research.

In the next section we discuss main empirical findings.

4.4.2 Main findings

As we already indicated, the Tobit model has been estimated for the two datasets (POOLED1 and POOLED2), and for three subsamples each. Table 4.5 presents the results of these estimations. Of course, as Wooldridge (2002, pp. 527-534) points out, since firm level data across different countries might suffer from potential heteroscedasticity and can affect the size of the Tobit estimates, the size of the Tobit coefficients cannot be interpreted directly. As a result, Wooldridge further suggests to interpret the marginal effects. In the Tobit model, two marginal effects are obtained. The conditional marginal effect is a measure of the change in the share of export sales for the censored observation. Whereas the unconditional marginal effect is a measure of the total change in exporting, both the propensity of being an exporter (probability of being uncensored) and the change in the share of export sales for the uncensored observations (exporting firms).

Wooldridge (2003, pp. 567-569) recommends reporting both effects. As a result, both unconditional and conditional marginal effects are calculated (for the regression outputs see appendices under A4.8). Here the unconditional marginal effects are interpreted in detail because: i) the small differences between the conditional and unconditional marginal effects, and (ii) the Tobit unconditional marginal effects refer to the whole population of firms.

For the main variables of interest, we present the Tobit unconditional marginal effects (Tables 4.6-4.8)[57] as the basis for the interpretation of results. The interpretation is done by holding all other variables at their mean values.

In the case of dummy variables, the unconditional marginal effects represent the discrete change in the dependent variable when the independent variable changes from zero to one.

Considering that the BEEPS data is based on subjective opinions of firm managers, it requires cautious interpretation as opinions may reflect either pessimistic or optimistic views of respondents. Notwithstanding this, the large number of observations tends to increase the precision of results.

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[57] In order to facilitate the interpretation, the table of marginal effects is divided into three smaller tables, one each for the main groups of variables of interest.

Table 4.5 Tobit regression results for two datasets and three transition stages

Dataset	POOLED1			POOLED2		
	Transition stage			Transition stage		
VARIABLES	LAGGARD	MEDIUM	ADVANCED	LAGGARD	MEDIUM	ADVANCED
Innovation						
newprod	4.007	3.767	8.358***	9.280**	11.66***	12.83***
	(5.823)	(2.337)	(3.058)	(4.648)	(2.018)	(2.691)
upprod	6.983***	5.540**	4.923**	3.798	7.965***	6.180***
	(2.609)	(2.749)	(2.332)	(2.801)	(2.006)	(2.165)
procinn	1.109	6.312**	2.000			
	(4.845)	(2.942)	(2.583)			
Business environment factors						
infrastruct	-16.83	4.408	-5.194	2.097	0.140	-1.516
	(15.00)	(4.297)	(5.845)	(8.515)	(3.244)	(5.664)
accessfin	3.860	5.096	2.787	5.916*	1.532	5.051**
	(3.946)	(3.333)	(2.750)	(3.402)	(2.047)	(2.145)
weaklaw	-5.592	-8.473***	-6.306***	0.783	-8.309***	-11.48***
	(4.815)	(2.916)	(1.790)	(3.893)	(2.185)	(2.163)
macobst	1.350	2.549	14.10***			
	(3.638)	(2.220)	(2.825)			
Other factors						
uni	0.258***	0.189***	0.144**	0.173**	0.170***	0.113**
	(0.0831)	(0.051)	(0.059)	(0.078)	(0.051)	(0.049)
skilled	0.0519	0.056	0.125***			
	(0.057)	(0.044)	(0.048)			
busass	23.08***	21.08***	8.894**			
	(5.153)	(2.646)	(4.416)			
businf	-0.523	13.94***	15.74***			
	(6.057)	(2.820)	(4.800)			
largecity	-3.902	3.515	-6.076*	-1.653	-0.076	-4.885*
	(4.136)	(2.862)	(3.153)	(3.784)	(2.226)	(2.763)
impint	0.225***	0.365***	0.511***			
	(0.059)	(0.0499)	(0.044)			
sectorspill	54.06***	92.70***	104.3***	29.54**	81.52***	105.4***
	(14.35)	(11.76)	(15.12)	(14.82)	(11.65)	(19.28)
forown	0.409***	0.352***	0.269***	0.535***	0.467***	0.456***
	(0.108)	(0.054)	(0.056)	(0.094)	(0.045)	(0.037)
Control variables						
gdpcap1	-0.118**	0.007	0.018*	-0.019	-0.001	0.001
	(0.048)	(0.00527)	(0.011)	(0.022)	(0.004)	(0.006)
gdpcap1sq	2.34e-05**	-1.96e-07	-1.18e-06**	3.12e-06	-2.78e-08	-2.89e-08
	(9.60e-06)	(1.77e-07)	(5.66e-07)	(4.22e-06)	(1.11e-07)	(2.42e-07)
size	0.0603***	0.032***	0.019**	0.085***	0.0498***	0.0314***
	(0.012)	(0.00396)	(0.007)	(0.015)	(0.004)	(0.007)
sizesq	-1.21e-05***	-3.32e-06***	-2.59e-06**	-1.77e-05***	-5.51e-06***	-4.36e-06***
	(2.98e-06)	(6.14e-07)	(1.01e-06)	(4.20e-06)	(7.44e-07)	(1.17e-06)
age	0.340	0.520***	0.493***	0.371*	0.563***	0.636***
	(0.209)	(0.126)	(0.189)	(0.217)	(0.130)	(0.140)
agesq	-0.002	-0.002**	-0.003*	-0.003	-0.002**	-0.004***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)
y05	15.20	-13.65**	4.252	4.825	-0.637	3.307
	(13.81)	(6.318)	(10.11)	(7.908)	(5.686)	(11.33)
y08				-8.821	-14.45	-14.78
				(17.51)	(14.19)	(27.46)
Constant	2.720	-164.3***	-208.8***	-67.62**	-108.2***	-120.7***
	(55.38)	(39.26)	(35.56)	(28.70)	(17.02)	(28.00)
Tobit Sigma	55.23***	56.32***	47.34***	60.15***	61.36***	54.92***
	(4.402)	(2.519)	(1.815)	(3.655)	(2.204)	(1.831)
Observations	2,033	5,791	2,785	3,526	11,720	5,268

Source: Stata regression outputs
Clustered robust standard errors in parentheses
Country dummies included
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Innovation

Table 4.6 presents the unconditional marginal effects for innovation variables.

Table 4.6 Unconditional marginal effects of innovation related variables

Dataset	POOLED1			POOLED2		
	Transition stage			Transition stage		
VARIABLES	LAGGARD	MEDIUM	ADVANCED	LAGGARD	MEDIUM	ADVANCED
newprod	0.79	0.76	2.49***	1.58**	2.45***	3.97***
	(1.14)	(0.47)	(0.87)	(0.76)	(0.43)	(0.82)
upprod	1.36***	1.11**	1.42**	0.63	1.62***	1.86***
	(0.49)	(0.56)	(0.69)	(0.45)	(0.39)	(0.67)
procinn	0.22	1.30**	0.58			
	(0.96)	(0.64)	(0.76)			

Source: Stata regression outputs
Clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results support the hypothesis that product innovations as measured by *new products* and *upgraded products* have a significant and positive impact on firm's export performance. As presented in Table 4.6 the newly introduced products have a positive effect, but are statistically significant only in the advanced stage of transition in estimations using POOLED1dataset, and in medium and advanced stages of transition (at 1 percent and at 5 percent level respectively) in estimations using POOLED2 dataset. The unconditional marginal effects increase slightly across higher stages of transition suggesting that if a firm has introduced new products in the previous three years, holding all other variables at their mean values, its export intensity will increase between 1.5 to around 4 percentage points (from laggard to advanced transition stage). For the upgraded products, the Tobit unconditional marginal effects indicate a positive and a highly significant impact in all transition groupings in the POOLED1 estimations (at 1 percent level in the laggard stage and at 5 percent level in the medium and advanced transition stages). Similar results are also shown for the POOLED2 estimations, but only in medium and advanced transition stages (significant at 1 percent level). These results suggest that, ceteris paribus, if a firm has introduced an upgraded product in the last three years, its export intensity will increase between 1.4 to about 1.9 percentage points (from laggard to advanced stage of transition).

Because the comparison of results across different estimations is not straightforward, for a robustness check and to provide additional confirmation on the comparative effects of innovation on export performance across the stages of transition, we undertake an alternative Tobit estimation for the whole sample using an interaction term combining the innovation related variable and a stage of transition variable. For the latter we use both the EBRD transition index with scores ranging from 1 to 4.3. and, alternatively, as a categorical variable expressing the transition stages as per the three respective transition groupings defined earlier in this chapter: 1 for Laggard; 2 for Medium; and 3 for the Advanced stage of transition. To explore the effect of the interaction terms we calculate Tobit unconditional marginal effects of innovation variables on export performance per each stage of transition using the "margins" command (For the sake of brevity, we present the detailed estimation results and the graphical presentation of the marginal effects, 'marginsplot', in Appendix A4.11).

The Tobit unconditional marginal effects (for both POOLED1 and POOLED2) show that, when interacting innovation related variables with the stage of transition, the effect of innovation related variables (*newprod* and *upprod*) increases across the stages of transition and their size is similar to the estimated effects for the three groupings of countries separately (laggard, medium and advanced reforming countries), confirming the robustness of our findings (comparative results across subsamples) and the chosen estimation approach (See appendices A4.11.1 - A4.11.5). In addition, to control for the combined effect of newly introduced products (*newprod*) and significantly improved or upgraded products (*upprod*), for a robustness check we have also undertaken alternative estimations by interacting these two variables of interest (*newprod* and *upprod*) for each transition sample. Using the 'margins' command, the Tobit unconditional marginal effects are obtained for each interacted variable, which take into account their combined effect as well. The unconditional marginal effects of newly introduced products (*newprod*) are higher than the marginal effects of significantly improved products (*upprod*) for the advanced stage of transition for both POOLED1 and POOLED2 datasets, in line with the indicated Tobit unconditional marginal effects shown in Table 4.6 (See Appendices A11.1.6 and A11.1.7).[58]

In line with other studies (Cassiman and Golovko, 2007; Cassiman, et al., 2010; Becker and Eger, 2013) process innovation generally appears insignificant. Only in the medium transition group of countries it appears statistically significant at 5 percent level. The marginal effects show that, ceteris paribus, if a firm has introduced any process innovations over the previous 36 months, its export intensity will increase by 1.3 percentage points in medium reforming countries.

In general, as hypothesized (section 4.3.2), it seems that the impact of innovation on export performance is moderated by the transition reforms. As countries progress with reforms, new products become more important to firms' export performance. This is in line with the suggestion of Dixon, et al. (2010) that as the economy develops, firms improve their level of knowledge and absorptive capacities making them capable of investing in the production of new products and processes. With regards to the degree of innovation, findings are also comparable to the suggestions of Damijan, et al. (2015) that introduction of goods with higher value added matters in foreign markets. On the other hand, in the early stages of transition, as Lall (2000) argues, firms are more likely to rely on cost reducing strategies rather than investing in innovation. In line with the suggestion by Dixon, et al. (2010, p. 428), a lack of capacity for research and innovation at an early stage of transition stimulates firms to concentrate on adaptation of best practices, or in this case,

[58] We have also undertaken additional estimations using interaction terms between innovation variables for other stages of transition (Laggard and Medium), as well as interactions of process innovation variable (*procin*) with the EBRD transition index. The estimated results generally support our reported findings and the estimation methodology (splitting samples in three main transition groupings). For brevity of presentation, we do not present these estimations.

improvement of their existing products. Seeing the impact of innovation on exporting of firms, public policies in transition economies should be aimed at supportive schemes to stimulate innovation activities at the firm level.

Business environment factors

In terms of business environment factors, as shown in Table 4.7, the perceived *macroeconomic uncertainty*, as hypothesized earlier in the chapter (section 4.3.2), seems to encourage firms in countries at higher stages of transition to shift their emphasis on foreign markets and improve their export performance.

Table 4.7 Unconditional marginal effects of business environment related obstacles

Dataset	POOLED1			POOLED2		
	Transition stage			Transition stage		
VARIABLES	LAGGARD	MEDIUM	ADVANCED	LAGGARD	MEDIUM	ADVANCED
macobst	0.26	0.52	4.20***			
	(0.72)	(0.46)	(0.91)			
weaklaw	-1.10	-1.62***	-1.78***	0.13	-1.65***	-3.29***
	(0.86)	(0.53)	(0.51)	(0.65)	(0.41)	(0.61)
accessfin	0.79	1.07	0.82	0.10*	0.32	1.57**
	(0.86)	(0.73)	(0.84)	(0.62)	(0.43)	(0.67)
infrastruct	-2.69	0.93	-1.41	0.36	0.03	-0.45
	(1.95)	(0.95)	(1.5)	(1.49)	(0.67)	(1.67)

Source: Stata regression outputs
Clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The estimate of the *macobst* variable is statistically significant at 1 percent level and the unconditional marginal effect suggests that, ceteris paribus, if firms in advanced reforming countries consider macroeconomic instability as a major obstacle, they are likely to increase their share of export sales in turnover by around 4 percentage points. The estimates for other transition stages are positive but insignificant. In line with the suggestions of Dixon, et al. (2010), in later stages of transition firms seem to become more flexible and more sensitive to the market environment. Becoming more intensive exporters may be attributed also to a strategic flexibility, as well as mitigations of a domestic risk.

With respect to the rule of law variable, in line with the recent findings of Lamotte and Colovic (2015), *the weakness of rule of law* seems to have a negative impact on exporting. Its estimate is highly significant at 1 percent level in medium and advanced transition stages, while it is insignificant in the laggard transition stage for both datasets. The unconditional marginal effects suggest that, ceteris paribus, if a firm considers the weakness of rule of law to be a major obstacle, its share of export sales in turnover will decrease between 1.6 to 3.3 percentage points (medium to advanced transition stage). As Smallbone and Welter (2012) suggest, the absence of efficient courts limits firms' development in general, and their ability to export in particular.

Among other factors, *infrastructure* related indicators do not show any significant impact on export performance. One possible interpretation is that firms in TEs do not consider infrastructure related obstacles to be a significant factor on their export performance. This indicates that transition countries have generally addressed infrastructure related issues much earlier. Further, in terms of *financing obstacles*, its estimate appears generally insignificant, except in the advanced transition stage and the POOLED2 dataset where it shows statistical significant at 5 percent level. Its sign is surprisingly positive.

Overall, it seems that the Uppsala view of international trade (Johanson and Vahlne, 1977) suggesting a positive impact of an uncertain domestic environment on export performance does not hold significantly in all stages of transition. Considering the results, we can suggest that in the initial years of transition, firms expect continuous changes in the environment so they are less sensitive to them, while in advanced reforming stages, they will have the opposite reaction. Overall, the firm's perception of their surrounding business environment seems to affect their market orientation and should be considered by the policymakers in the respective countries.

Other factors

Table 4.8 below presents the unconditional marginal effects of other variables of interest. The share of employees with university degree or higher has a significant positive impact in all stages of transition and all specifications and is statistically significant at 1 or 5 percent level. The other indicator of human capital, the share of skilled employees, is significant (at 1 percent level) only in the advanced stage of transition. The positive effect of the tertiary education is in line with the previous findings in TEs (Gashi, et al., 2014; Lammote and Colovic, 2015) and developed economies (Wakelin 1998; Wagner, 2001; Higon and Driffield, 2011).

Table 4.8 Unconditional marginal effects of other factors

Dataset	POOLED1			POOLED2		
	Transition stage			Transition stage		
VARIABLES	LAGGARD	MEDIUM	ADVANCED	LAGGARD	MEDIUM	ADVANCED
uni	0.05***	0.038***	0.041**	0.028**	0.035***	0.034**
	(0.014)	(0.001)	(0.01)	(0.011)	(0.01)	(0.014)
skilled	0.01	0.011	0.036***			
	(0.011)	(0.009)	(0.013)			
busass	5.08***	4.53***	2.67*			
	(1.32)	(0.67)	(1.39)			
businf	-0.10	3.2***	5.34***			
	(1.19)	(0.75)	(1.87)			
largecity	-0.77	0.70	-1.75*	-0.27	-0.015	-1.48*
	(0.86)	(0.58)	(0.94)	(0.63)	(0.46)	(0.86)
impint	0.044***	0.073***	0.147***			
	(0.012)	(0.01)	(0.015)			
sectorspill[59]	0.10***	0.18***	0.30***	0.04**	0.16***	0.32***
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.05)
forown	0.08***	0.07***	0.078***	0.089***	0.097***	0.138***
	(0.022)	(0.011)	(0.018)	(0.01)	(0.009)	(0.013)

Source: Stata regression outputs
Clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The unconditional marginal effects show that, holding all other variables at their mean values, an increase in the percentage share of employees with university degree or higher by 1

[59] Because sector spillover variable is formatted in decimal percentages (defined between 0 and 1), to make the interpretation comparable, the values of marginal effects are converted accordingly, meaning that a marginal effect is divided by 100, for example, a Tobit unconditional marginal effect of 10.63 is converted to the value of 0.1063. For the main results, see regression outputs under appendices A4.8.

percentage point will increase the share of export sales in turnover of firms between 0.03 to 0.05 percentage points. Similar effect is shown in terms of skilled employees in the advanced stage of transition. This finding indicates that in comparison to academic education specific job related skills become more important in more advanced stages of transition. Findings are in line with the EBRD (2014) suggestion that, transition economies should invest in education and specialised skills in order to increase firms' knowledge absorption capacities, which this analysis show that may further enhance export performance.

In terms of networking, as presented in Table 4.8, being member of a business association shows a significant (at 1 or 5 percent level) and positive impact on export performance in all transition stages, as suggested by previous studies (Singh, 2009; Higgon and Driffield, 2011; Gashi, et al., 2014; Lamotte and Colovic, 2015). Contrary to our expectations stated earlier in the chapter (section 4.3.2), statistical significance and the size of the Tobit unconditional marginal effects decreases at higher stages of transition, indicating that firms in countries at more advanced transition may use other forms of networking or that networking through business associations is more important for firms in the early stages of transition reforms. The marginal effects show that holding all other variables at their mean values, being a member of a business association increases share of export sales in turnover by around 5 percentage points in the laggard transition stage, 4.5 percentage points in the medium transition stage, and only around 2.6 percentage points in advanced transition stage. Furthermore, in terms of benefits of being a member of a business association, Table 4.8 shows that firms which consider their membership as important for contacts or information on international markets have higher export intensity in the medium and advanced transition stages. The unconditional marginal effects suggest that, holding all other variables at their mean values, if a firm considers its member of a business association being important for information on international markets, it will increase its share of export sales in turnover by around 3.2 percentage points in the medium transition stage, and by around 5 percentage points in the advanced transition stage. As OECD (2012) suggests, facilitation of linkages and access to information on international markets should be considered by policymakers in transition economies.

With respect to agglomeration effects, the firm's location in large or capital cities does not seem to be a significant factor for export performance, except in advanced transition group of countries, and for both datasets, where it appears surprisingly to be negative and statistically significant at 10 percent level. This contradicts the findings of Antonietti and Canielli (2008). The unconditional marginal effect suggests that holding all other variables at their mean values, if a firm is located in large or capital city its percentage share of exports will decrease between 1.4 to 1.7 percentage points. Contrary to the agglomeration economies hypothesis, it seems that firms located in large and capital cities may have more access to their local market and might be less inclined towards, or less concerned about, export markets. Gashi, et al. (2014) reports this variable to be generally insignificant as well.

In line with the hypothesis that firms learn by importing, the estimate of learning by importing variable appears significant and positive at all stages of transition. The unconditional marginal effects suggest that, holding all other variables at their mean values, an increase of imported inputs by 1 percentage points increases the share of export sales in turnover between 0.04 to 0.14 percentage points (from laggard to advanced reforming stages of transition). It seems that firms in more advanced transition countries manage to better utilise information and knowledge gained from the direct contacts with foreign partners, which in turn affects their export sales positively.

Similar to the findings of previous studies (see Wakelin, 1998; Roper and Love, 2002), sectorial knowledge spillover appears positive and statistically significant in all specifications. These findings confirm our hypothesis that a more intensive innovation at the sector level facilitates all firms export performance. The unconditional marginal effects indicate that holding all other variables at their mean value, a 1 percentage point increase in the proportion of innovative firms in a sector will increase the share of export sales in turnover by 0.07 to 0.13 percentage points.

The impact of foreign ownership appears to be positive and statistically significant at 1 percent level for both datasets, as suggested by previous studies (Filatotchev, et al., 2008; Gashi, et al., 2014; Bangwayo-Skeete and Moore 2015). Ceteris paribus, the unconditional marginal effects suggest that a 1 percentage point increase in foreign ownership increases the share of export sales in total turnover by 0.08 to 0.13 percentage points (from laggard to advanced reforming stage). Although the marginal effects of foreign ownership variable are rather small, they are highly significant in all estimations. This finding suggests for policies that will promote foreign investments.

Control variables

With respect to control variables, we interpret only the sign and significance of the coefficients (see Table 4.5). Firm *size* shows to be highly significant (at 1 percent level) and positive in almost all transition groupings and its squared value is negative and statistically significant. This outcome suggests an inverse U-shaped relationship between size and export performance in all stages of transition. These results support the view that when firms grow bigger they might choose alternative methods of entry into foreign markets (e.g., FDI). The transition stage of countries where firms operate does not seem to have a significant effect on the relationship between a firm's size and its export performance.

The same inverse U-shaped relationship, though somewhat weaker, is found for *age*. The variable *age* appears statistically significant at 1 percent level and has positive sign only in medium and advanced transition groupings, while *age squared* term appears consistently negative but its significance is somewhat weaker. As such, it does not strongly support the expected inverse U-shaped relationship with export performance. The Schumpeterian view on innovative new firms, seems to be partly supported only when countries are at the initial stages of transition, also because at the beginning of transition older firms are largely state owned which face serious challenges with strategic changes and a different market environment.

In terms of domestic demand factors, results indicate that an increase of GDP per capita has a U-shaped relationship with export performance in the laggard transition stage and is statistically significant at 5 percent level. The opposite effect is found for advanced reforming countries in POOLED1 estimations, where it appears statistically significant at 10 percent level. In the POOLED2 estimations coefficient of the GDP per capita has similar sign across all three stages of transition as in POOLED1, but it appears insignificant. In line with our hypothesis, these findings suggest that in the first years of transition when countries lag behind in terms of overall market development, an increase in the standard of living as measured by GDP per capita initially decreases firms' export intensity as they may focus on the domestic market, up to a certain level of GDP per capita, while the opposite is found for the advanced transition stage where GDP per capita of the respective countries is relatively higher. In the medium stage of transition GDP per capita does not show any significant effect. The argument of Lee and Huang (2002) is supported only for the case of advanced reformers, while results in the laggard group of countries are in line with the findings of Bangwayo-Skeete and Moore (2015) who suggest that an increased size of the domestic market tends to decrease the firm's export intensity. The direction and the significance of the relation between GDP per capita and firm's export performance seems to be moderated by the stage of institutional development of a country.

Finally, year dummies included in POOLED1 estimations appear generally insignificant and positive. Only the coefficient of the year 2005 dummy appears statistically significant at 5 percent level in the medium transition subsample and has a negative sign. This suggests a decrease in the intensity of exports in 2005 compared to 2002 for the medium reforming countries. With regard to POOLED2 estimations, all year dummies appear insignificant and generally positive. Only the year dummy 2008 in the medium transition subsample is negative, but insignificant.

Overall, the Tobit unconditional marginal effects of individual variables seem rather small, with a relatively higher effect of innovation, networking and knowledge spillover variables on export performance. As expected, the impact of most explanatory variables seems to be moderated by the degree of transition reforms, suggesting that the development of institutional quality is an important moderating factor for firm's export performance. In general, the Tobit unconditional marginal effects confirm the view that transition reforms are positively related to export growth in TEs, and our hypothesis that institutions moderate the effect of firm's explanatory variables on export performance.

Given that we have used certain thresholds to group countries into different transition stages, it is important to undertake a sensitivity analysis to investigate if the transition thresholds used to identify transition stages have a strong effect on the estimates. In addition, we also investigate if estimation results are sensitive to different combinations of innovation indicators. This is done in the following section.

4.4.3 Sensitivity of the results

As explained earlier in the chapter, the transition score thresholds for each of the transition subsamples are based on the transition gap scores provided by EBRD. Because the differences between the development of reforms in the countries on the borderline between the transition stages may be small, it is important investigate the sensitivity of results if these countries were to be included in a transition grouping at higher or lower stage of transition. This exercise will also serve as robustness check for the influence of an increase or decrease in the sample size on the results. In the alternative specifications, countries are included in the laggard transition subsample if their transition score is 3 or less, the medium transition subsample includes countries with a transition score between 3 and 3.5, while the advanced transition subsample includes countries with a transition score 3.6 and higher. Applying new thresholds for each transition grouping leads to changes in the countries in each transition reform group and in the sample size of each subgroup in each dataset. Consequently, the estimation of the model will produce different results.

For the sake of brevity, in Table 4.9 we present the estimation results only for POOLED1 dataset while the sensitivity results for POOLED2 dataset are provided in Appendix A4.9.

Table 4.9 shows the new Tobit estimation of the coefficients, along the original estimate, enabling us to compare the new results with the ones previously discussed. The table shows that the laggard transition and advanced transition subsamples have increased in size, whereas the medium transition subsample has decreased. The results of re-estimation of the Tobit model shows that marginal changes in the transition score thresholds do not have a significant influence on the estimated coefficients. A likely explanation is that firms in countries at the borderline of the higher or lower stage of transition tend to have similar characteristics to the other firms in the countries at the comparable stage of transition.

Table 4.9 'Transition reform score' sensitivity analysis – Tobit estimations for POOLED1 dataset[a]

Transition stage	Laggard Transition		Medium Transition		Advanced Transition	
Specification	Original	Alternative	Original	Alternative	Original	Alternative
Reform score	less than 3	3 and below	3 to 3.7	3 to 3.5	3.8 and higher	3.6 and higher
Observations	2,033	3,188	5,791	5,059	2,785	3,517
VARIABLES						
Innovation						
newprod	4.007	2.491	3.767	3.212	8.358***	7.814***
upprod	6.983***	7.443***	5.540**	6.458**	4.923**	3.986*
procinn	1.109	4.094	6.312**	7.949**	2.000	2.182
Business environment factors						
infrastruct	-16.83	1.621	4.408	1.659	-5.194	-1.332
accessfin	3.860	1.294	5.096	4.284	2.787	3.719
weaklaw	-5.592	-5.591	-8.473***	-8.878***	-6.306***	-7.923***
macobst	1.350	1.812	2.549	2.625	14.10***	11.77***
Other factors						
uni	0.258***	0.165***	0.189***	0.170***	0.144**	0.151**
skilled	0.0519	0.0260	0.0566	0.0262	0.125***	0.123***
busass	23.08***	24.69***	21.08***	20.13***	8.894**	11.64**
businf	-0.523	-0.0746	13.94***	14.41***	15.74***	15.95***
largecity	-3.902	-1.431	3.515	4.766	-6.076*	-6.447**
impint	0.225***	0.246***	0.365***	0.356***	0.511***	0.502***
sectorspill	54.06***	65.25***	92.70***	103.8***	104.3***	79.16***
forown	0.409***	0.357***	0.352***	0.404***	0.269***	0.242***
Control variables						
gdpcap1	-0.118**	-0.0366***	0.00746	0.0183	0.0186*	0.00315
gdpcap1sq	2.34e-05**	7.92e-06**	-1.96e-07	-1.48e-06	-1.18e-06**	-1.02e-08
size	0.0603***	0.0383***	0.0323***	0.0330***	0.0190**	0.0228***
sizesq	-1.21e-05***	-4.45e-06***	-3.32e-06***	-3.33e-06***	-2.59e-06**	-3.17e-06***
sge	0.340	0.440**	0.520***	0.464***	0.493***	0.548***
sgesq	-0.00265	-0.00304*	-0.00196**	-0.00103	-0.00317*	-0.00378***
y05	15.20	-1.518	-13.65**	-19.71	4.252	-5.906
constant	2.720	-94.30***	-164.3***	3,742	-208.8***	-133.9***

Source: Stata regression outputs
Clustered robust standard errors in parentheses
Country dummies included
*** p<0.01, ** p<0.05, * p<0.1
[a] For regression outputs of both datasets see the appendices A4.9.1 – A4.9.6

Across all model estimations, despite the change of sample size, estimates generally remain similar to the previous ones in terms of sign and significance, with insignificant differences with respect to the coefficients' size. The consistency of results further supports the validity of splitting the sample based on transition gap scores. Therefore, the comparison of the estimates across transition stages remains valid.

Next, we investigate if the level of correlation between variables expressing innovation included in the same model affects the estimation results (despite the low correlation between the innovation indicators as shown previously). To this effect, six additional Tobit model specifications using different combinations of innovation indicators are estimated and compared to the results of the main Tobit specification. In Table 4.10 we present the estimation results of these alternative specifications for the laggard transition stage subsample of and the POOLED1 dataset.[60]

In Table 4.10 we compare the results of the original model specification for the laggard transition grouping (same as in Table 4.4) which includes all three indicators of innovation output, to the results of six alternative specifications. In specifications 1-3 only two of the three indicators have been used in each specification while in specifications 4-6 each of them contains only one of the three indicators. The sign and significance of the estimates of innovation indicators in each of the estimated model is not affected even in the case when only one innovation indicator is used. Furthermore, the estimates of all other variables are strongly consistent across all seven alternative specifications. This outcome further supports the findings that using the three innovation indicators in the model does not cause a multicollinearity problem, and in turn does not produce biased results.

[60] For simplicity and brevity reasons we do not present estimations for other stages of transition or for POOLED2 dataset.

Table 4.10 Alternative model specifications (innovation variables) – POOLED1 Laggard transition stage[a]

Model Specification	Original Model	Alternative model specifications					
		1	2	3	4	5	6
Innovation							
newprod	4.007	3.681	5.756		5.985		
	(5.823)	(5.424)	(5.838)		(5.341)		
upprod	6.983***	7.310***		7.988***		8.517***	
	(2.609)	(2.720)		(3.005)		(3.042)	
procinn	1.109		2.478	2.176			4.406
	(4.845)		(4.889)	(4.438)			(4.371)
Business environment factors							
infrastruct	-16.83	-16.79	-16.39	-16.78	-16.23	-16.70	-16.22
	(15.00)	(15.00)	(14.92)	(15.13)	(14.86)	(15.12)	(15.12)
accessfin	3.860	4.021	3.994	3.809	4.188	3.959	3.944
	(3.946)	(3.959)	(3.968)	(3.948)	(3.975)	(3.952)	(3.988)
weaklaw	-5.592	-6.021	-5.736	-5.587	-6.194	-6.019	-5.763
	(4.815)	(4.830)	(4.795)	(4.863)	(4.803)	(4.871)	(4.850)
macobst	1.350	0.951	1.672	1.476	1.280	1.091	1.922
	(3.638)	(3.732)	(3.676)	(3.610)	(3.749)	(3.684)	(3.653)
Other factors							
uni	0.258***	0.254***	0.259***	0.261***	0.254***	0.257***	0.262***
	(0.0831)	(0.0824)	(0.0831)	(0.0834)	(0.0825)	(0.0829)	(0.0833)
skilled	0.0519	0.0405	0.0537	0.0514	0.0422	0.0403	0.0530
	(0.0573)	(0.0571)	(0.0578)	(0.0577)	(0.0577)	(0.0573)	(0.0584)
busass	23.08***	23.51***	23.49***	23.50***	23.94***	23.94***	24.22***
	(5.153)	(5.008)	(5.194)	(5.134)	(5.047)	(4.938)	(5.241)
businf	-0.523	-0.445	-0.292	-0.831	-0.134	-0.742	-0.702
	(6.057)	(6.107)	(6.104)	(6.009)	(6.189)	(6.007)	(6.059)
largecity	-3.902	-4.184	-3.897	-3.928	-4.170	-4.200	-3.913
	(4.136)	(4.121)	(4.044)	(4.129)	(4.015)	(4.113)	(4.016)
impint	0.225***	0.231***	0.226***	0.228***	0.232***	0.234***	0.232***
	(0.0593)	(0.0592)	(0.0595)	(0.0591)	(0.0593)	(0.0589)	(0.0593)
sectorspill	54.06***	54.48***	57.17***	55.84***	58.03***	56.45***	60.58***
	(14.35)	(14.46)	(14.82)	(14.70)	(14.98)	(14.89)	(15.63)
forown	0.409***	0.409***	0.407***	0.409***	0.406***	0.408***	0.406***
	(0.108)	(0.111)	(0.107)	(0.107)	(0.110)	(0.110)	(0.106)
Control variables							
gdpcap1	-0.118**	-0.121**	-0.115**	-0.118**	-0.118**	-0.121**	-0.115**
	(0.0486)	(0.0493)	(0.0485)	(0.0488)	(0.0491)	(0.0494)	(0.0491)
gdpcap1sq	2.34e-05**	2.42e-05**	2.30e-05**	2.34e-05**	2.38e-05**	2.42e-05**	2.30e-05**
	(9.60e-06)	(9.76e-06)	(9.55e-06)	(9.66e-06)	(9.70e-06)	(9.82e-06)	(9.65e-06)
size	0.0603***	0.0608***	0.0606***	0.0608***	0.0612***	0.0612***	0.0614***
	(0.0126)	(0.0128)	(0.0129)	(0.0126)	(0.0131)	(0.0127)	(0.0129)
sizesq	-1.21e-05***	-1.21e-05***	-1.21e-05***	-1.22e-05***	-1.21e-05***	-1.22e-05***	-1.23e-05***
	(2.98e-06)	(3.00e-06)	(3.06e-06)	(2.99e-06)	(3.09e-06)	(3.01e-06)	(3.07e-06)
age	0.340	0.341	0.333	0.323	0.337	0.326	0.305
	(0.209)	(0.214)	(0.206)	(0.204)	(0.211)	(0.209)	(0.201)
agesq	-0.00265	-0.00272	-0.00261	-0.00256	-0.00269	-0.00263	-0.00245
	(0.00176)	(0.00184)	(0.00174)	(0.00175)	(0.00181)	(0.00181)	(0.00172)
y05	15.20	14.82	13.82	15.29	13.50	15.10	13.64
	(13.81)	(13.80)	(14.02)	(13.89)	(14.04)	(13.83)	(14.22)
constant	2.720	5.810	-0.317	2.248	2.988	5.501	-1.654
	(55.38)	(55.98)	(55.77)	(55.94)	(56.34)	(56.47)	(56.90)
Observations	2,033	2,062	2,033	2,034	2,062	2,063	2,034

Source: Stata regression outputs
Clustered robust standard errors in parentheses
Country dummies included
*** p<0.01, ** p<0.05, * p<0.1
[a] For detailed regression results of alternative model specifications 1-6 see Appendix A3.10

As already argued in the literature review section of this chapter, these findings suggest that, it is important to account for individual disaggregated effects of innovation indicators, such as the effects of new and upgraded product innovation and process innovation, and at different stages of transition as well. Although some of previous authors account for individual effects of process and product innovation in their export performance models (Cassiman and Golovko, 2007; Damijan, et al., 2010; Becker and Egger, 2013), others have usually merged the innovation indicators into one singe variable, only controlling if firms have produced any innovation at all (Wakelin, 1998; Love and Mansury, 2007; Gashi, et al., 2014). Merging innovation indicators into one variable carries the risk of suggesting misleading policy recommendations as they are based only on the combined effect of different types of innovation but not on the individual effects of each innovation variable. The approach used in this study addresses this shortcoming.

Next section of the chapter concludes the analysis.

4.5 Conclusions

Drawing on the Business Environment and Enterprise Performance Surveys undertaken in 2002, 2005 and 2008, this chapter highlighted factors affecting export performance at the firm level in TEs divided into three groups at different stages of transition. Countries have been grouped in laggard, medium reformers and advanced transition reformers based on the EBRD index of progress in transition. Empirical findings indicate that the impact of some explanatory factors differ across the three stages of transition. This, in turn, suggests that previous empirical studies on export performance which treated TEs as one group, without considering the stages of transition, may have produced inaccurate results.

Innovation activities, measured by the introduction of new and upgraded products/services were shown to have a positive and significant impact on export performance, more strongly at higher stages of transition. The effect was somewhat stronger for new products rather than upgraded products, i.e., the degree of product novelty seems to be important. However, since the direct measure of novelty was not available in the BEEPS survey, this will be analysed next in Chapter V which investigates impact of innovation on export performance at the firm level in Kosovo. On the other hand, process innovation seems to be an important factor only in the intermediate stage of transition.

In terms of the role of domestic business environment, if firms perceive that there is macroeconomic uncertainty, they tend to export more in countries at high transition stage as a risk shifting mechanism. The weakness of the rule of law exerts a negative impact on firm's export performance, while the quality of the infrastructure does not seem to have a significant impact on export performance. Similarly, the impact of financing obstacles is found to be weakly significant only in the advanced stage of transition.

With respect to human capital related factors, the impact of the university education is positive in all specifications while the impact of higher employee skills becomes significant only at higher stages of transition. There are knowledge spillovers from networking, being in an industry with more innovative firms and importing inputs from abroad, all helping to improve the export performance of firms. The effect of the membership in business associations as a proxy for firm networking weakens in higher stages of transition. However, the effect in higher transition stage is stronger only if firms consider business associations important in terms of getting information on inputs and international markets. This suggests that business associations should be support the export oriented firms and facilitate their access to information and linkages in export markets. In addition, the proportion of innovative firms at the sector level positively influences firms' exports. As Roper and Love (2002) point out, this suggests that the establishment of innovative clusters at the sector level should be encouraged and facilitated by public policy as these clusters, in addition to inducing innovation activities in the respective sector, also foster export performance of firms.

In line with previous findings, foreign ownership share is found to have a significant and a positive impact in all specifications and across all stages of transition. Larger and more experienced firms are also likely to have better export performance though the relationship is a non-linear one. Firm's experience does not seem to affect exports in the laggard reforming countries. This indicates that the experience of firms in the pre-transition period and in the initial stage of transition does not make them effective in the export markets.

Overall, this chapter contributes to the literature on innovation, business environment and export performance of firms in transition economies through an original investigation of the diverse effect of factors explaining export performance across the stages of transition. In particular, it accounts for the effects of both new and upgraded products and new processes introduced by firms, and the different aspects of the business environment in terms of obstacles they pose for exporters. These findings lead to a number of policy implications but, in the interest of brevity and conciseness, we will discuss them in detail in the final chapter.

This investigation has not been without limitations. First, cross section analysis does not capture fully dynamic effects of explanatory variables on export performance, in particular the effects of innovation and the business environment factors. Second, the BEEPS data is based on subjective opinions of firms' managers. Hence, the answers related to the overall business environment can be subject to their pessimistic or optimistic viewpoints and requires cautious interpretation. Notwithstanding, the perceptions of firms' managers matter for their strategic market orientation and the large number of observations tends to diminish the impact of subjectivity.

The next chapter will extend the analysis on the impact of innovation and business environment factors on export performance of firms, but this time for the specific case of Kosovo, by accounting for alternative measures of product innovation expressing the degrees of novelty (products new to the market) and quantity (number of newly introduced products).

Chapter V

The impact of innovation and business environment factors on firm's export performance in Kosovo

Contents

5.1 Introduction

Chapter IV examined the impact of innovation and business environment factors in transition economies across three groups of countries (laggards, those with medium progress and the advanced group). The progress of transition reforms was shown to moderate the effect of factors explaining firm's export performance. The analysis in Chapter IV did not include Kosovo as it was not covered in the BEEPS surveys prior to 2008. This Chapter, therefore, analyses the impact of innovation activities on performance of firms in Kosovo.

For an open economy like Kosovo, being the poorest in the region and at a low level of economic development, the ability of firms to compete internationally is associated with the ability of the overall economy to grow and be more competitive. In addition, due to the relatively small size of the Kosovo market, growth of firms is also determined by their ability to access foreign markets. As such, it is important to understand factors that may influence the international competitiveness of the Kosovo products, or the profile of her exporting firms. The opportunity to be involved in organising and collecting firm-level data in Kosovo made it possible to investigate in more details the factors affecting export performance of firms. Specific attention has been paid to Kosovo because of the author's knowledge of this country and also because of its historical development path, having gone through a different and more specific pre and post-transition stages compared to other transition economies.

Kosovo embarked on the establishment of the institutions of a market economy and implementation of transition reforms from scratch, only in 1999. Having been subjected to a nine-year period of 'special measures' and direct rule by Serbia culminating in the 1998/99 war, Kosovo experienced a complete stagnation of institutional and economic development. In the first eight years of the transition period Kosovo was governed by the United Nations Mission (UNMIK) and unlike other TEs, the market economy reforms were led by UNMIK as part of the international state-building process. After the declaration of Kosovo's independence on 17 February 2008, most state institutions had to undergo a reshaping process under the administration of the Government of Kosovo.

In addition to the slow establishment of institutions, external factors too have been challenging during the entire transition period. In the unsupportive business environment, firms had to rely on their own resources and networks and do their best to cope. A weak application of rule of law created space for unfair competition, resulting in a substantial expansion of the informal economy. Regulatory policies were not in favour of the domestic firms either. Applying an open trade policy with no supportive measures for domestic firms at an infant stage of development, affected the growth of firms and their ability to compete with foreign firms. Finally, the relatively high cost of finance (which also reflects the uncertain business environment) and the difficulties of accessing finance limited investments in new technology and products. Overall, these factors contributed to a slow growing private sector, dominated by micro and small firms.

In other TEs, SMEs have generally been more responsive and flexible in terms of innovation activities and their response to changing market environment compared to large firms (Krasniqi and Kutllovci, 2008). In the case of Kosovo, although SMEs play a crucial role in the economy, constrained internal capacities, such as the potential for knowledge absorption and investment in new technological processes, limit the SMEs' capacity to undertake innovation activities. Furthermore, they also deter the SMEs' orientation towards export markets and their ability to grow.

Public institutions have generally tried to address business environment issues. Administrative procedures for registering new businesses have improved, aiming to facilitate the process of establishment of new firms. However, not much has been done in supporting firms' innovation activities. Despite the overall business environment challenges and lack of institutional support for innovation, Kosovo firms have had to rely on their internal capacities to undertake innovation. Given the limited domestic market size, firms' growth will depend on their capability to expand into the foreign markets. Despite the challenging conditions, and although starting from a very low base, exports have grown steadily, but reached only about 12 percent of imports in 2014.

The analysis in this chapter is based on the theoretical underpinnings provided in Chapter IV. Firm level survey data conducted by Riinvest Institute for Development Research in 2013, in which the author was also involved) will be used in the empirical analysis. The investigation adds value to the literature on innovation and export performance by employing additional measures of innovation based on the OSLO Manual (OECD, 2005), and by investigating the impact of the degree of novelty of product innovation as measured by products introduced as 'new to the market'.

To our knowledge, only a few studies have analysed the factors affecting the export performance of Kosovo firms. Gashi (2014) in a more recent study investigates the impact of human capital on export decisions of manufacturing and service sector firms in Kosovo, but does not account for innovation or the business environment indicators. Holzner and Peci (2010a) draw on a very limited sample of 120 SMEs to analyse the impact of business obstacles on the turnover growth of exporting firms. Their study has a limited number of variables, does not account for innovation and does not investigate the export performance of firms. In addition, there are a number of reports published by different organisations such as the World Bank, the European Commission, the European Bank for Research and Development, the United Nations Development

Programme, etc., but there is no study to date that has empirically examined the impact of innovation on firm's export performance in Kosovo, accounting also for the degree of novelty of innovation and business environment factors.

Kosovo also provides a unique opportunity to assess the determinants of export performance in a country in the laggard stage of transition (see Chapter IV for the definition) by using recent data.

The chapter is organised as follows. Section 5.2 discusses the overall institutional and macroeconomic setting in Kosovo throughout the transition period, focusing on microeconomic, markets and trade related reforms, business environment, macroeconomic and trade performance, and the firms' innovation context. Section 5.3 describes the data and Section 5.4 specifies the determinants of export performance in Kosovo. Section 5.5 discusses the methodology of empirical work while Sections 5.6 and 5.7 discuss the diagnostics and the results of estimation and empirical findings. The last section concludes the chapter.

5.2 Kosovo during the transition period

Kosovo entered the transition process during a complex political and institutional set-up: governed by the United Nations Mission while building its interim institutions and when other transition economies were advancing their reforms towards a full market economy. After 9 years of UNMIK rule, in 2008, Kosovo declared its independence and adopted its Constitution. This marked the second turning point in the process of institutional development. Although there have been many positive developments arising from the second institutional reshape, Kosovo still faces a tough transition agenda, far from reaching the characteristics of an industrialised economy.

In this section we discuss some aspects of Kosovo's developments in order to provide the context for the empirical investigation. The following sub-sections, discuss and analyse the transition reforms undertaken in Kosovo in terms of enterprises, markets and trade, the overall macroeconomic performance of the country, the business environment and finally the development of firms and innovation during the transition period.

5.2.1 Microeconomic transition reforms, markets and trade

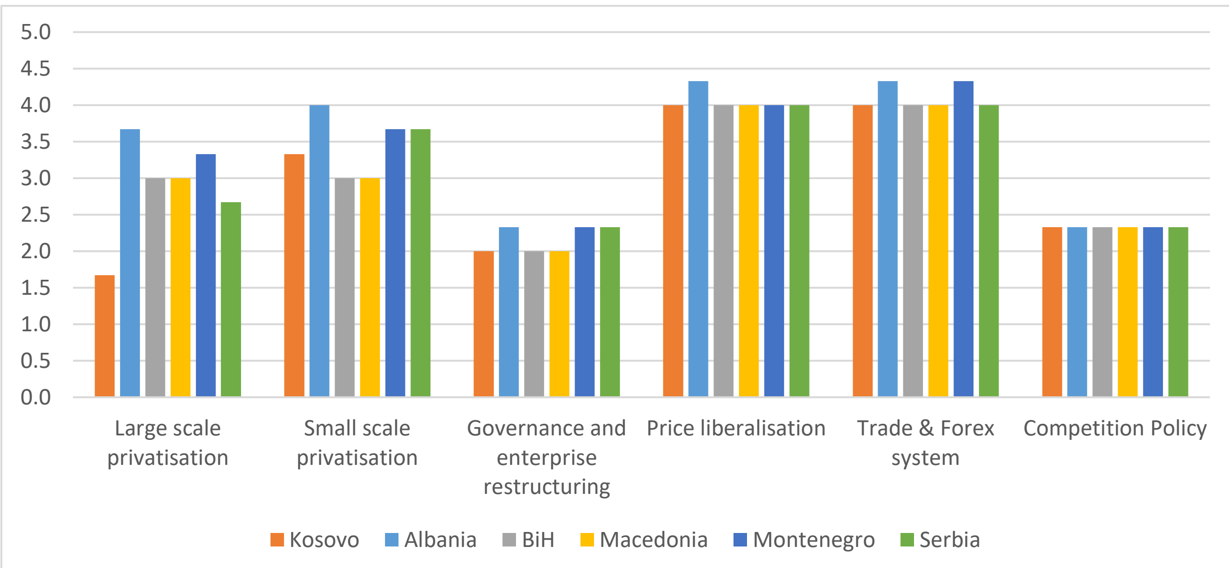
The transformation from a centralized economic system to a market oriented economy largely depends on the development of market oriented institutions (Gomulka, 2000). In Kosovo, the process of establishing institutions, the adaptation and practical implementation of market oriented reforms and the respective legislation were relatively slow. In terms of transition progress, Uvalic (2012) and Bartlett (2007) include Kosovo in the group of successor states of the Former Yugoslavia (Bosnia and Hercegovina, Serbia and Montenegro) that have been late with transition reforms, or the "late reformers", compared to early reforming countries (Slovenia, Croatia and Macedonia).

In Kosovo, the legislation and the models of establishing institutions were mainly imported or copied from abroad which, as Estrin, et al. (2007) indicate, is something that usually needs more time for practical implementation and understanding of concepts by the participants. The transition in last 15 years, as measured by the EBRD transition indicators, lags behind the countries in the Western Balkan (WB) region including Albania, Macedonia, Montenegro, Bosnia and Hercegovina, and Serbia. This section analyses the progress of transition reforms in Kosovo compared to these countries that are still in the process of pursuing EU membership. Although

Croatia belongs to the group of WB countries, it has not been included in the analysis as it has already become an EU member.

The EBRD provides annual transition indicators at country level which enable us to analyse the progress of transition of Kosovo and compare it to the WB countries. The indicators are reported as numerical scores in six main areas as shown in Figure 5.1 ranging from 1 (indicating little or no progress with reforms relative to the initial position) to 4+ (indicating that a country has reached levels comparable to those of an advanced market economy).[61]

Figure 5.1 Progress of transition in selected areas in Western Balkan countries, 2014



Source: Author's own calculation using EBRD transition reform scores

As presented in Figure 5.1, Kosovo is far behind the standards of advanced market economies. It is evident that Kosovo has made substantial progress in price liberalisation, trade and foreign exchange system, but it is lagging behind in 'large scale privatisation', 'governance' and 'competition policy' related reforms, though it is comparable to other WB countries.

[61] The EBRD makes annual assessment of transition indicators on six main areas of transition: large scale privatisation, small scale privatisation, enterprise governance and restructuring, price liberalisation, trade and foreign exchange system and competition policy. For details see http://www.ebrd.com/what-we-do/economic-research-and-data/data/forecasts-macro-data-transition-indicators.html

Restructuring in TEs was closely linked to a set of policies, with privatisation and encouraging FDI regarded as the crucial factors of economic development (Apostolov, 2013). Moreover, privatisation is widely regarded as the most significant element of microeconomic reforms in a transition country (Estrin, 2002). In most transition economies, privatisation has been undertaken in two stages. First, by privatising small socially or publicly owned property, also referred to as 'small scale privatisation' and second, by implementing privatisation of large-scale enterprises as a longer term process (Lavigne, 1999). Unlike other TEs which were able to manage and implement the process by their own institutions, in Kosovo privatisation was led by the international community. The Kosovo Trust Agency (KTA), responsible for administration and privatisation of the socially/publicly owned property, was established in 2002 under the UNMIK administration by the UNMIK regulation 2002/12 as part of the Pillar for economic reconstruction and development. Being led by a UN agency, representing various nations and reflecting various and divergent interests, KTA faced many delays and interruptions in the initial phase of privatisation. From the beginning privatisation faced political pressure and had to deal with the ambiguity of the concept of 'socially owned' enterprises (SOEs). This was mainly due to political pressure from Serbia (and her main supporter on the UN Security Council, Russia), claiming ownership rights in SOEs in Kosovo. To deal with these problems, privatisation was undertaken under the so-called "spin-off" model. This involved SOEs' assets being channelled into a new company "NewCo" while the non-current liabilities remaining in the old company. Thus "NewCos" inherited the rights and interests of the previous SOEs, but not their liabilities. The old SOEs were to continue to exist legally until the full resolution of the claims against the company.

Throughout the first eight years of UNMIK administered, privatisation was the core activity of the country's economic strategy (Knudsen, 2013). After the declaration of independence in 2008, responsibilities of KTA were handed over to the Privatisation Agency of Kosovo (PAK).[62] PAK was established as the successor of the KTA and took over all assets and liabilities of KTA. Because of the political complexity, privatisation initially targeted less problematic and smaller companies (Knudsen, 2013), followed by a more intensive small scale privatisation, transferring a substantial share of companies to private entities.[63] The progress made on small scale privatisation is better than in Bosnia and Hercegovina and Macedonia, the later having embarked on transition reforms much earlier (See Figure 5.1). On the other hand, the large scale privatisation has been implemented at a much slower pace, having also the lowest reform scores compared to other five transition indicators. Among other companies, privatisation of the Post Telekom of Kosovo (PTK), as one of the largest state owned companies, has failed twice. The transition indicator scores of 1.7 suggests that only less than a quarter of large scale enterprises have been privatised.

Privatisation was assumed to be one of the main drivers of foreign investments in Kosovo. However, as Korovilas (2012, p. 283) notes, most of the privatised SOEs were bought by domestic investors. Although foreign investments have been decreasing over the five year 2009 – 2014, on average they account for about 6% of GDP (CBK, 2015). In terms of the number of firms under international ownership, UNDP (2012) estimates that less than 3 percent of the overall number of firms in Kosovo are partially or fully foreign owned.

One of the expected outcomes of privatisation of SOEs in TEs is the improvement of enterprise governance. Berglof, et al. (2012) suggest that privatised firms (former state owned) have been successful in adapting managerial practices of the private sector. However, Lavigne (1999) finds that in the late 1990s structural transformation in terms of management and

[62] See www.pak-ks.org for more detailed information.
[63] The KTA initially and then PAK as its successor applied the sealed auction method for privatisation of SOEs. The SOEs assets are leased for 99 years to the highest price bidder.

governance of enterprises had lagged behind even though privatisation was largely achieved. With respect to Kosovo, EBRD's (2015) assessment indicates that there has been some progress in corporate governance in larger enterprises in Kosovo but the enforcement of legislation is still weak and little action has been undertaken in enforcing market competition and corporate governance.

Unlike the level of reforms achieved in the aforementioned transition areas, Kosovo has made substantial progress in the liberalisation of prices and of trade. The EBRD (2015) assessment indicates that Kosovo has implemented a comprehensive price liberalisation, phased out the state procurement at non-market prices and it has removed all quantitative and administrative export and import restrictions (apart from those related to the agricultural products).

In terms of foreign exchange and international trade, Kosovo first adapted the German DEM currency in early 1999, and switched to Euro in January 2002, as the official circulating currency. As part of the regional trade liberalisation processes initiated by the Stability Pact for Southeast Europe, Kosovo has liberalised its trade regime (Bartlett, 2009). It has acquired full membership in the Central European Free Trade Agreement (CEFTA) established in 2006, which converted bilateral agreements between Kosovo and other countries (at that time, Albania, Macedonia, Bosnia and Hercegovina and Croatia) into one single agreement, as well as expanding it to the other CEFTA members such as Moldova, Montenegro and Serbia (Holzner and Peci, 2010b). Although not recognised by all EU members as an independent country, trade relations with the EU were specified under the Council Regulation 2007/2000 from September 2000, by recognising Kosovo as an autonomous customs unit. In addition, similar to other WB countries, EU granted a preferential trade agreement and the EU's Autonomous Trade Measures (ATMs) to

Kosovo. The domestic producers benefited from these measures as they provided duty free access to the EU market for around 95 percent of Kosovo export products (MTI, 2015).

In 2015, Kosovo signed the Stabilization and Association Agreement with EU, paving the way for complete free trade with EU over a 10-year period. As this agreement regulates a duty free customs policy for over 99 percent of Kosovo products, it provides an opportunity for domestic firms to target the EU market more intensively. Kosovo also initiated a free trade agreement with Turkey in 2013 but the agreement has not been ratified to date. In addition, the country also benefits from the General Preferences System (GSP) with some other countries such as the United States, Japan, Norway and Switzerland. Under this scheme, developed countries offer non-reciprocal, preferential treatment to products from Kosovo (MTI, 2015). A wider integration in the international trade system lagging behind, as Kosovo is not a member of the World Trade Organisation (WTO). Due to political problems, with some countries still not recognising its independence, membership in the WTO has to be addressed as a political rather than a technical issue.

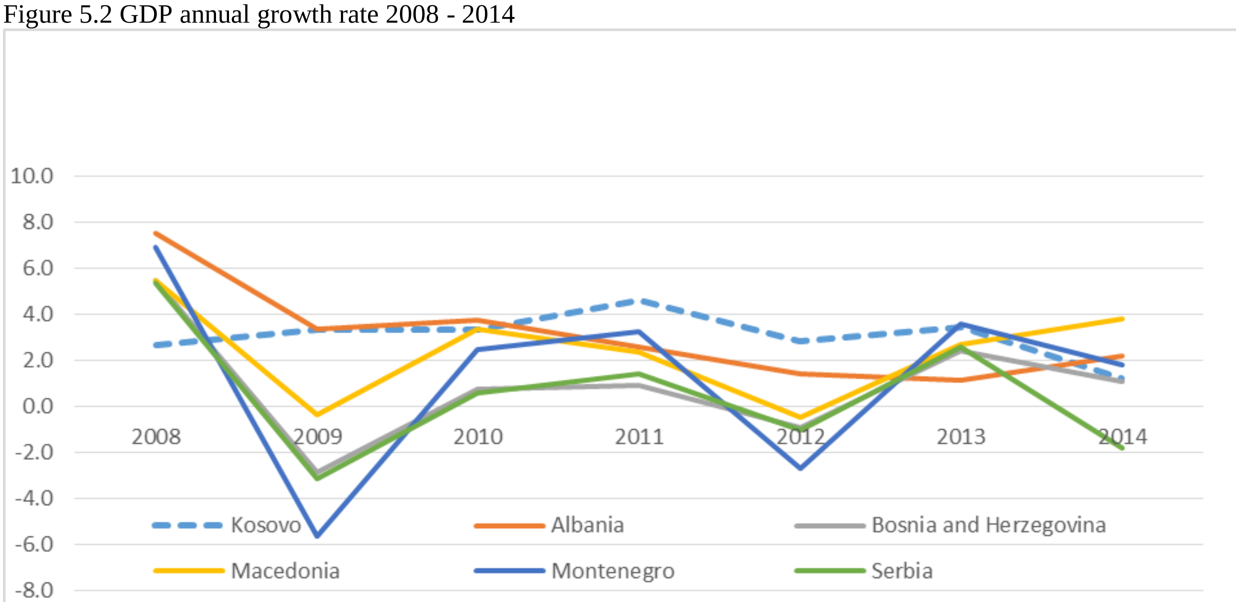
Finally, in terms of market competition policy reforms the EBRD (2015) assessment suggests that besides adopting competition policy legislations and relevant institutions, there was no enforcement of actions on dominant firms in the market. To ensure implementation of the legislation, the Competition Commission was established by the Assembly of Kosovo in 2008 as an independent body with the responsibility and authority for promoting competition and protecting consumers, by controlling certain actions of firms and the emergence of a monopolistic market structure. However, the capacity of the Commission to effectively implement the law and policies is limited, mainly due to the shortage of technical expertise of its human resources (Penev, et al., 2013). Effective implementation of the legislation on competition policies has proved difficult also in other transition economies in their early stage of transition (see EBRD, 1998).

The next sub-section will analyse Kosovo's macroeconomic and export performance during the transition period.

5.2.2 Macroeconomic and export performance

With the GDP per capita just under €1,700 in 2000/01, Kosovo embarked on transition as the poorest economy in the region. In the early years of transition, the annual growth rate reached up to 27 percent (2001) while during the entire transition period the economy has experienced a steady growth, which mainly reflects the low initial GDP level caused by the economic collapse induced by the war. As presented in Figure 5.2 in the post-independence period of transition, the average GDP growth was slightly below 4 percent, varying between 1 percent in 2014 and 4.6 percent in 2011. The growth trend during this period was more stable than in the other WB countries. Among other reasons, Kosovo was less effected by the 2008 financial crisis.

Figure 5.2 GDP annual growth rate 2008 - 2014

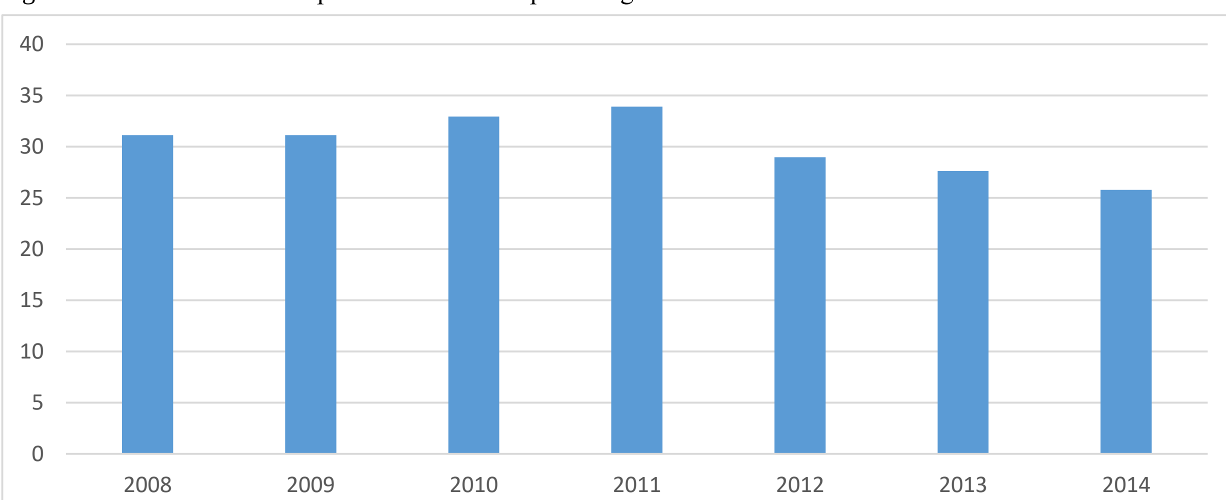


Source: Author's calculation using World Bank indicators

The main growth drivers in the immediate post-war period were the high inflows of development and reconstruction aid by international donors and remittances by the Kosovo diaspora. Based on the World Bank data, international aid accounted for about 70 percent of GDP in 2001. Although the inflow gradually decreased from its high levels, in the period between 2009 and 2013 it still accounted for around 11 percent of GDP. Remittances remain a continuous and stable source of income accounting for about 17 percent of GDP, which is the average level for the last 10 years (MTI, 2015).

Foreign direct investment (FDI) is another driver of growth, making a significant contribution to GDP. The FDI net inflow reached its highest level, at about 12 percent of GDP in 2007 mainly due to privatisation. In the post-independence period the net foreign investment decreased gradually, reaching some 2.7 percent of GDP in 2014. Nevertheless, as around 75 percent of FDIs were invested in services and the construction sector, they did not convert into productive capital formation (MTI, 2015). Along the same line of development, gross capital formation has taken a slight downward trend since 2011, though it is still at a relatively high level (Figure 5.3).

Figure 5.3 Kosovo's Gross capital formation as a percentage of GDP 2008 - 2014

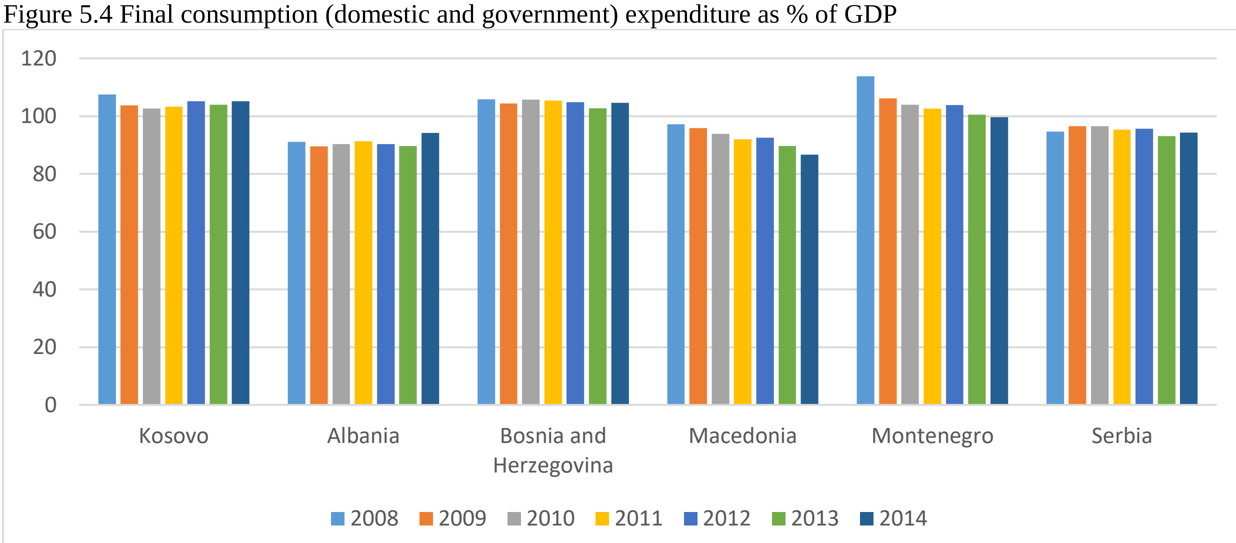


Source: Author's calculation using World Bank indicators

Challenges in mobilizing domestic economic resources contributed to a weak manufacturing sector which actually accounts for about 11 percent of GDP. Among other sectors, wholesale and retail trade account for about 13 percent, agriculture accounts for about 12 percent, construction for about 7 percent, while mining and quarrying, transport and storage and financial services by about 4 percent of GDP each.[64] The industrial sector has gone down in its importance to the economy since late 1980s, due to a systematic underinvestment in the 1990s and destruction in the war of 1998/99. It went from about 47 percent in 1988 down to about 20 percent in early 1990s (after the start of Serbian ruling and suspension of Kosovo institutions of the time) and to about 12 percent in 1998 (Mustafa, et al., 2010).

Figure 5.4 shows that household and government consumption expenditure in Kosovo ranged between 105 and 108 percent of GDP during the 2008 – 2014 period, suggesting for a relatively low share of investment in GDP, consequently a ‘consumption bias’.

Figure 5.4 Final consumption (domestic and government) expenditure as % of GDP



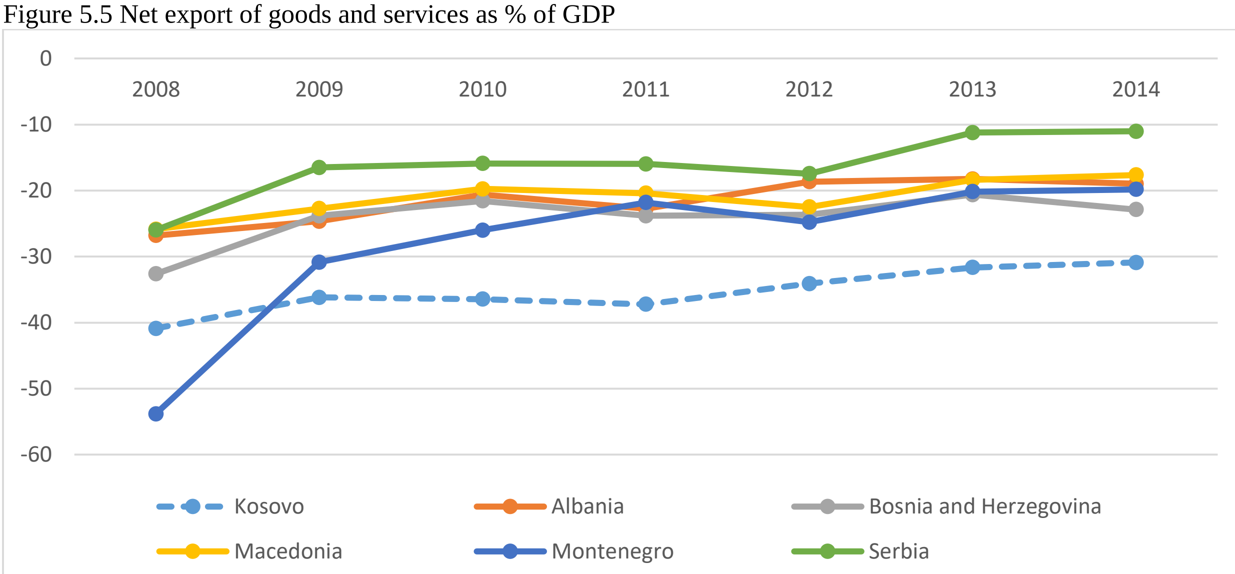
Source: Author’s calculation using World Bank indicators

[64] Economic Statistics (SOK, 2016)

Only Bosnia and Hercegovina faced a similar trend, while in other economies in the Western Balkans the relative share of consumption in GDP is much lower (Indicating for higher relative share of investments and net exports in GDP in the respective countries).

High level of consumption combined with the weak industrial sector created an import dependency, consequently a very high trade deficit. As shown in Figure 5.5, in the post-independence period of Kosovo, the net export of goods and services has been negative, though slightly improved (from -40% of GDP to -30%). This is a feature Kosovo shares with other WB countries though performing worse than all others.

Figure 5.5 Net export of goods and services as % of GDP



Source: Author's own calculation using World Bank indicators

The high trade deficit is mainly covered by the unearned financial inflows, such as international aid and remittances, which continue to sustain the economy. The main portion of the trade deficit is attributed to trade in goods, which in 2014 reached a deficit of about € 2.2 billion (CBK, 2015). However, compared to the early years of the transition, positive trends are observed in trade of goods, as the coverage of imports by export of goods increased from 1.5 percent in 2001, to around 5 percent in 2005, and to about 12 percent in 2014 (SOK, 2014).

Throughout the whole transition period export of goods has grown at an annual average of 10 percent, catching up at a slow pace, which it increased by 60 percent between 2008 (€ 198 million) and 2014 (€ 324 million), reaching to about 7 percent of GDP (CBK, 2015). The main products exported are iron and steel products, ores and concentrates, electrical energy, coal and bitumen, manufactured articles such as tubes and pipes and food products.[65] Among other factors, the relatively low cost of labour, compared to the WB region, provides some degree of cost-competitiveness of the export products (UNDP, 2012).

In terms of export destinations, in the last nine years, between 2005 – 2014, the EU market imported the highest share, about 40 percent, of Kosovo exported goods followed by the CEFTA countries at about 37 percent (SOK, 2014). On average, Italy and Germany are the top EU importers of Kosovo goods. Gashi and Pugh (2014) find a positive relationship between exports and the countries where the Kosovo diaspora is concentrated, suggesting that Kosovo firms tend to export to Kosovo Diaspora related markets more than to the other EU countries. In the CEFTA countries, as the second top destination of Kosovo exports, Albania receives the highest share of exported goods, followed by Macedonia and Serbia.

Contrary to the trade in goods, the net export of services has had a positive balance, reaching about €336 million in 2014, indicating a more established and export oriented service sector in Kosovo. Exports in services almost doubled since 2008 (€ 396 million) reaching at about € 770 million in 2014 (13 % of GDP). Tourism and communication (mainly ICT) related services account for the largest share of the exported services (CBK, 2015).

[65] See “External Trade Statistics” (SOK, 2014)

Among other services, in the last few years there has been a growing trend in the provision of off-shore outsourcing services such as call-centres (low value added) and other services such as software, graphic design and other ICT services (higher value added), mainly for the German speaking countries (Switzerland, Austria and Germany) but also in other EU countries and the US (Tosuni and Vokrri, 2015; Burani, 2016). Responding to the export market needs, a few Kosovo ICT firms have developed IOS/Android smartphone and tablet applications and web designs (Cardno, 2014).

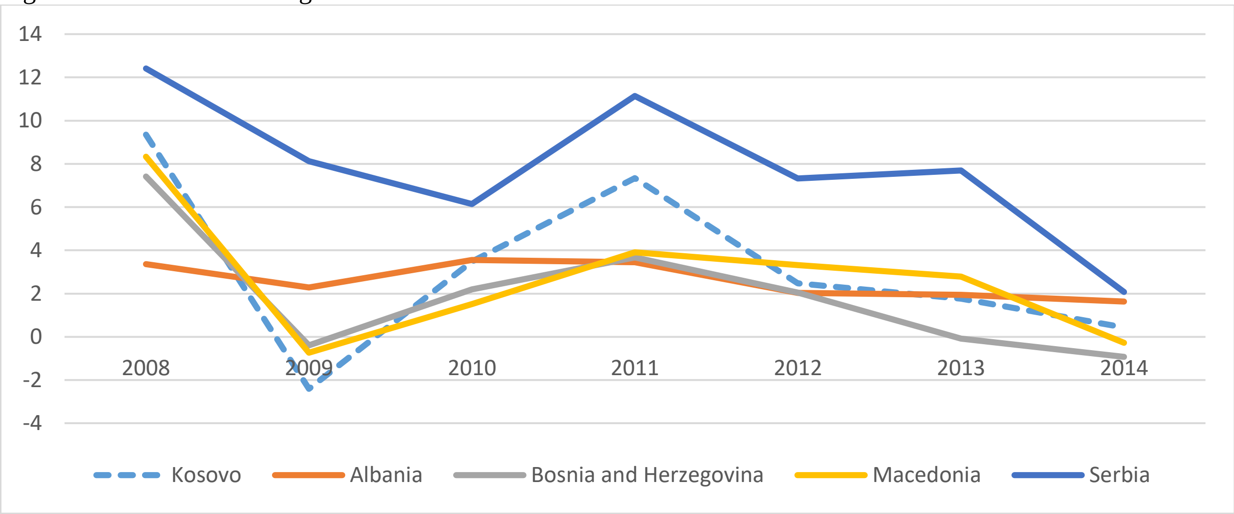
These businesses have a tendency to be closely linked with Kosovar Diaspora firms in Europe and in some cases also to be co-owned by Kosovar Diaspora investors. In such cases, firms are formally classified as foreign owned and not specifically as Diaspora owned businesses. Alternatively, firms may be financed by the Diaspora investors but be established by their family members living in Kosovo and be formally classified as domestic owned firms. In both cases, connections to the firms in the EU market facilitates exporting activities of the respective firms. However, detailed information on these types of businesses are not available and such firms are not identifiable in the database that we use in this research. In the dataset that we use (to be explained in more details in the Data section of this Chapter) around 40 percent of the firms belong to the service sector. Some of them will randomly fall under the group of foreign owned companies, including Diaspora owned businesses, but it is not possible to further disaggregate the ownership type of the firms in the dataset. Other firms that may be financially supported by the Kosovar Diaspora cannot be identified either.

Similar types of firms are also present in other sectors, such as in the Wood Processing (firms producing windows, doors, kitchens and furniture, e.g.) and Food Processing sectors (firms producing pickles, pepper relish, jams, juices, etc.), among others (MTI, 2014a, 2014b). In general, using Diaspora connections in the EU countries, Kosovo exporting firms have easier access to the markets in Switzerland, Germany and Scandinavian countries where the Kosovo Diaspora is concentrated.

Overall the share of goods and services exports in GDP has reached at about 20 percent in 2014. This volume of exports is significantly lower than the average for the WB countries which reached about 25 percent of GDP in the early 2000 and peaked at about 40 percent of GDP in 2014 (Murgasova, et al., 2015).

Due to high dependency on imports, prices in the Kosovo economy mainly depend on prices of goods in foreign markets (CBK, 2015). As Figure 5.6 shows, the inflation rate has been generally low throughout the transition period, between -2 and 9 percent, averaging about 2 percent as in most WB countries, except for Serbia where the inflation rate was relatively higher.

Figure 5.6 Annual inflation growth 2008 - 2014



Source: Author's own calculation using World Bank indicators

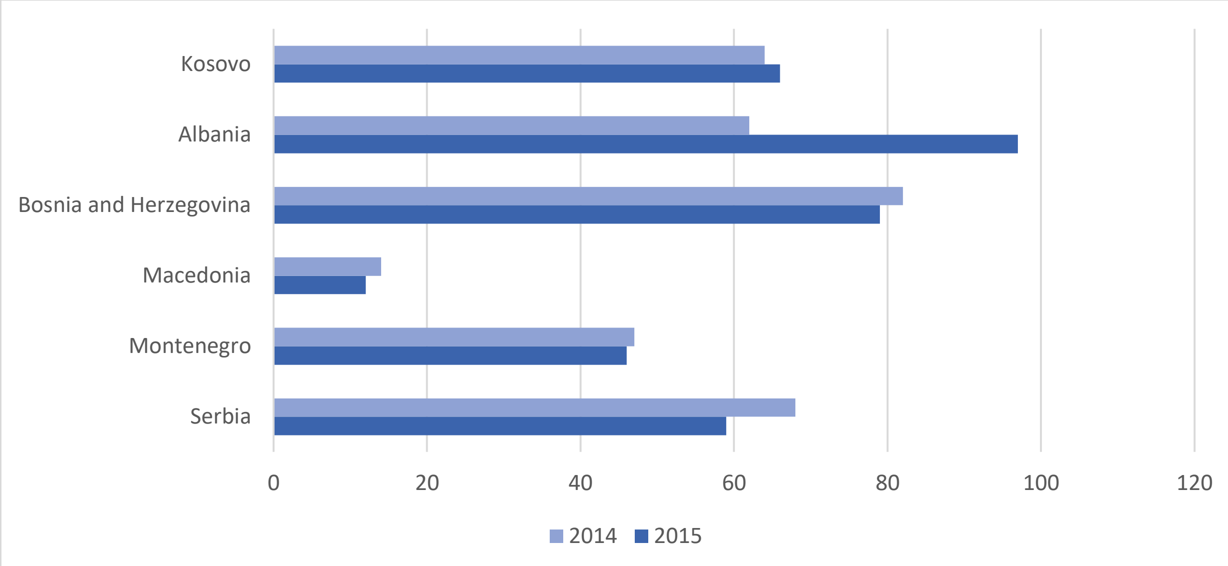
The overall economic situation in Kosovo is dominated by the level of unemployment. During the first ten years of transition the official unemployment was around 45 percent or the highest in Europe. The slow economic recovery was also reflected in slow job creation and reduction of unemployment, which gradually fell by about 10 percentage points. In 2014, the official registered unemployment was around 35 percent, still being the highest in the region. The economic development trend in Kosovo, is in line with the findings of De Melo, et al. (2001) for 28 transition economies, suggesting that the initial economic conditions are the main determinants of the growth of an economy.

5.2.3 Business environment

Kosovo has faced challenging business environment during the transition period, despite considerable reforms aimed at strengthening the business climate over the recent years. Due to a number of reforms, such as shortening the procedures for starting a business, reducing administrative obstacles in getting construction permits and approving supportive policies on investors' protection. Kosovo's position in the World Bank Doing Business ranking has improved. As shown in Figure 5.7 below Kosovo's ranking improved significantly in 2014 (68th place out of 189 countries), before becoming marginally worse in 2015 (69th place), but still relatively better than two countries in the region, Albania and Bosnia and Hercegovina.

The main obstacles perceived by Kosovo firms are the large informal sector, weak contract enforcement and macroeconomic related factors such as uncertainty regarding political and economic policies (Riinvest, 2013). Access to finance remains problematic for the private sector, mainly due to the high cost of finance. However, according to the data of the Central Bank of Kosovo, the interest rates on loans for the private sector have decreased from an average of around 14 percent in 2011 to about 9 percent in 2014, but still being among the highest in the WB region.

Figure 5.7 World Bank ease of doing business ranking 2014 -2015



Source: Author's calculation using World Bank indicators

With respect to infrastructure indicators, such as electricity, transportation and telecommunications, as in the case of other transition economies examined in Chapter IV, these are not perceived by firms' managers as significant obstacles to their business operations (UNDP, 2012).

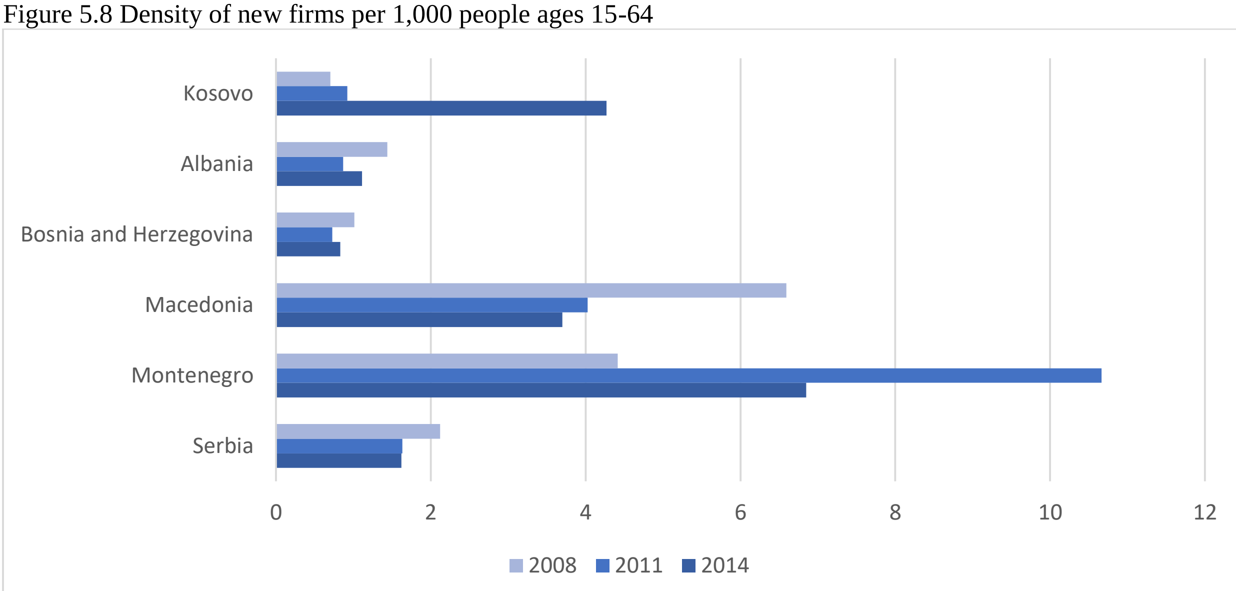
Overall, the stability of public institutions and the quality of business environment are very important factors to firm development and growth (Marinkovic and Dall, 2014). As House (2012, p. 2-3) points out, Kosovo along with other countries in the region such as Albania, Bosnia and Hercegovina, Serbia and Macedonia, have had a decline in national democratic governance over the past years, driven partially by political interests and weak implementation of rule of law especially in fighting economic informality, corruption and organised crime. Such a situation can increase costs of doing business and create the uncertainty of the domestic business environment. Thus, firms may decide to intensify their engagement in the export markets as a risk-shifting mechanism, as already argued in Chapter IV.

5.2.4 Firms and innovation

In the pre-transition period, due to incentives created by central planning (state subsidies and the protected market), state owned firms were few and mainly large (Blanchard, 1997). Transition to the market economy required restructuring of firms and utilising a more dynamic and innovative approach manifested in higher performance and competitiveness (Grosfeld and Roland, 1995; Djankov and Murrell, 2002).

As in other TEs, the early transition period in Kosovo was associated with the appearance of a large number of small firms, mainly in the trade sector (Blanchard, 1997, p. 63). From a few firms active at the start of post-war period, the number of the active private firms reached about 40,000 in 2004 and over 65,000 in 2014.[66] Figure 5.8 below shows that in comparison to WB countries, the density of newly created firms in Kosovo, as measured by the number of new firms per 1,000 people ages between 15-64, is gradually catching up.

Figure 5.8 Density of new firms per 1,000 people ages 15-64



Source: Author's own calculation using World Bank indicators

[66] See Statistical Office of Kosovo (https://ask.rks-gov.net/eng/) and Tax Administration of Kosovo (www.kas.org) for details.

Newly registered Kosovo firms in 2014 mainly belong to trade, hotels, manufacturing, construction and agriculture sectors, while those in manufacturing, trade and hotels demonstrate a growing trend (CBK, 2015).

Compared to the early stage of transition when micro firms accounted for around 99 percent of all firms and they now constitute around 96 percent, with small and medium sized firms constituting around 3.2 percent, and large firms accounting for less than 0.8 percent, indicating that the proportion of bigger firms is increasing (UNDP, 2012). Most of the registered firms belong to the services sector (86 percent), agriculture (around 2 percent) and the rest in the industrial or production sector (12%).

In their earlier stage of transition, firms in most TEs were generally exposed to new technology and knowledge which induced firm innovation (Aghion, et al., 1994; Mickiewicz, 2005). In the case of Kosovo firms, the situation was different, as accessing new technology and investing in innovation was challenging, mainly due to the limited capacity of human resources in absorbing new knowledge, and also due to cost and access to finance, particularly in the first years of transition. Under-developed competencies for technology absorption, and insufficient investment in science and technology have also contributed to a slow private sector growth (World Bank, 2013). In addition to these firm related limitations, Kosovo lacks innovation structure, strategy and programmes initiated at the national level that could support firm innovation (Marinkovic and Dall, 2014). Despite this fact, as noted by Marinkovic and Dall, Kosovo has been more successful than some other regional countries in establishing innovation or incubation centres. On the other hand, it lags behind in terms of industry collaboration and technology transfer through business clustering (UNDP, 2012). Inadequate and out-dated infrastructure at research centres and universities act as an additional obstacle to cooperation for innovation (OECD, 2013).

While other countries in the region have advanced in terms of entrepreneurship and non R&D based innovation related to absorption of foreign technologies and knowledge, Kosovo firms are still at the infancy stage (Marinkovic and Dall, 2014). The number of graduates in science, technology and engineering is limited and the number of researchers working in economic development priority areas is small, leading to insufficient human capital for technology transfer, research and innovation (World Bank, 2013). Further, OECD (2013) shows that compared to other countries in the region, the level of university education in general is significantly lower in Kosovo, as only 8.2 percent of the population hold a university degree, compared to Macedonia (20.4%) or Croatia (24.5%).

Overall, the analysis in this section shows that Kosovo is still at a laggard stage of transition. It has progressed well in terms of market and trade related reforms while it lags behind in privatisation, competition policy and enterprise governance and restructuring. These developments have influenced the slow improvement of overall economic performance. Despite the steady growth over the transition period, it is still behind the level of the region, having a large trade deficit and continuing to be dependent on remittances and international aid. Among other factors, business environment is contributing to the current state, mainly because of a weak implementation of rule of law. Further, the level of foreign investment in the country in last five years have shown a downward trend which negatively effects the overall investment. In addition, a weak innovation infrastructure and limited knowledge absorption capacities at the firm level limited firm innovation activities as a key factor to firm growth and export performance. However, at the firm level, a relatively higher trend of new enterprises compared to other countries in the region shows the dynamic nature of the private sector in recent years. Preferential free trade agreements with other countries and lately the comprehensive agreement with EU for the entire

EU market, present an opportunity for domestic firms to orient themselves strategically towards a larger market. As Boermans (2013) suggests, in small size developing markets (such as Kosovo) access to foreign markets is crucial for firms with a growth ambition.

The next section discusses the data used in the empirical analysis.

5.3 Data

The data used in the analysis were collected through the Business Performance Survey of Kosovo firms in 2013 by the Riinvest Institute for Development Research.[67]

The survey was conducted by experienced and trained interviewers who have worked for Riinvest Institute for several years on previous surveys. To ensure the quality of the survey, and following Riinvest Institute's surveying standards, groups of interviewers were supervised by an experienced survey manager, who was also in charge of the field supervision. As part of the field verification, the survey manager verified between 15 – 20 percent of the respondents visited by each interviewer. In addition, the Riinvest team in charge of the quality control randomly verified the questionnaires by contacting respective respondents by telephone.

The sample was selected from the population of around 65,000 active firms, registered in the Tax Administration of Kosovo (TAK). For the targeted population of firms, aiming to produce reliable results at the 95 percent confidence level, and an error margin of 4 percent, a representative random sample of 600 firms was identified. The sample was stratified based on Riinvest Institute's survey standards, considering the region, size, sectoral distribution and geographic location of the population of firms.

[67] Riinvest Institute is the first independent think tank in Kosovo, established in 1995. Since 2000, Riinvest Institute has conducted annual firm level surveys on various private sector development aspects.

The survey questionnaire was initially piloted on 50 firms to see if there were visible shortcomings or if some questions needed modification in order to obtain appropriate answers from the respondents. The owners or managers of the surveyed firms were the only respondents, as they are informed and allowed to share their viewpoints and/or information and experiences regarding respective issues related to their companies.

Around 50 percent of firms in the sample belong to the trade sector, around 38 percent to the service sector and the rest belong to the production sector. The highest proportion of firms is located in the Prishtina (capital city) region (around 40% of firms). In terms of size, firms with 2 or more employees were included in the sample (including the owner). Around 85 percent of firms in the sample are micro-firms with 10 or fewer employees or, around 14 percent of firms have 11-50 employees and 1 percent have over 50 employees. The proportion of firms owned at least partly by foreign companies or individuals is around 4.5 percent.

The author of the thesis was involved in the development of the survey methodology and the questionnaire. The author's specific contribution was the inclusion of questions on firm innovation, which enables the construction of the variables relevant to the subject of this thesis. The dataset provides information on innovation type, as measured by product and process innovation, introduced by firms over 36 months prior to the survey. An added value to the innovation literature is the inclusion of an additional measure of product innovation in the survey, the quantity of new products introduced by firms, an indicator not used in the previous surveys to date. Following the Eurostat's Community Innovation Survey methodology used and explained in Chapter III, firms were asked if their new products were new to the market or new only to the firm, providing a more direct measure of the degree of innovation novelty. These indicators were not available in the BEEPS data used in Chapter IV.

5.4 Specification of variables and descriptive statistics

This section discusses variables and the descriptive statistics, starting with the dependent variable, followed by the description of independent variables. The definition of variables and descriptive statistics are presented in Table 5.1.

Table 5.1 Definition of variables and descriptive

Variable	Description	Obs	Mean	Std. Dev.	Min	Max	Missing %
Dependent variable							
expint	Percentage share of exports in total sales	581	10.99	25.44	0	100	3.17
Independent variables							
Innovation related factors							
prodinn	Dummy, taking the value of 1 if firms have introduced new or significantly improved products (goods or services) in the last 36 months, zero otherwise	580	0.38	0.49	0	1	3.33
procinn	Dummy, taking the value of 1 if firms have introduced new process innovations in the last 36 months, zero otherwise	580	0.23	0.42	0	1	3.33
prodno	Number of new or significantly improved products introduced in the last 36 months	569	1.92	4.47	0	40	5.17
novelty	Dummy, taking the value of 1 if firms have introduced products as 'new to the market' in the last 36 months, zero otherwise	577	0.20	0.40	0	1	3.83
Business environment related factors[a]							
weaklaw	Dummy, taking the value of 1 if firms consider unfair practices or contract violations by competitors to be a moderate or major obstacle to their business operations, zero otherwise	547	0.38	0.49	0	1	8.83
costfin	Dummy, taking the value of 1 if firms consider cost of finance to be a moderate or major obstacle to their business operations, otherwise zero	567	0.47	0.50	0	1	5.50
macobst	Dummy if firms consider uncertainty about economic policies to be a moderate or major obstacle to their business operations	535	0.50	0.50	0	1	10.83
Other factors							
uni	Percentage share of employees with university education or higher in the workforce	580	5.30	18.40	0	100	3.33
busass	Dummy, taking the value of 1 if firms are members of a business association	599	0.14	0.35	0	1	0.17
sectorspill	Percentage share of innovative firms in each sector (production, services and trade) and in each of the six regions	570	42.46	10.40	20	71	5.00
capital	Dummy, taking the value of 1 if firms are located in the capital city, zero otherwise	586	0.29	0.45	0	1	2.33
foreign	Percentage share of equity owned by foreigners	597	3.02	15.97	0	100	0.50
Control variable							
size	Number of employees	599	7.68	24.07	2	540	0.17

Source: Author's own calculation using Riinvest data

[a] In the Riinvest 2013 questionnaire answers regarding business obstacles are ranked on a Likert scale from 1 to 5, as follows: 1) It is not an obstacle; 2) It is a minor obstacle; 3) it is a small obstacle; 4) It is a moderate obstacle; and 5) It is a major obstacle. These were converted to a binary variable putting the moderate and major obstacle categories to one and other three categories, implying a less than a moderate obstacle, to zero.

The comparative statistics of the Kosovo and the BEEPS pooled dataset are presented in Table 5.2. Similar to the BEEPS dataset discussed in Chapter IV, the proportion of missing observations is fairly low (Table 5.1).

Table 5.2 Comparative statistics of the Kosovo dataset and BEEPS 2002/2005/2008 pooled dataset

Dataset	*Proportion of exporting firms in total*	*Mean proportion of export sales (exporters only)*	*Proportion of innovative firms in total*[a]	*Proportion of innovative exporters in total*
KOSOVO dataset Riinvest Survey 2013	22%	10.9%	43%	53%
BEEPS datasets 28 Transition Economies 2002/2005/2008	25%	10.3%	64%	77%

Source: Author's own calculation using BEEPS and Riinvest data

[a] An innovative firm is considered a firm that has introduced a product or a process innovation in the last 36 months

Dependent Variable

Export performance

To measure the dependent variable, similar as in Chapter IV, export intensity defined as the share of export sales to total turnover represented by the variable *expint*, is used as a measure of export performance. The mean share of export sales in the Kosovo dataset is very similar to the mean for firms in TEs in the BEEPS Pooled dataset, while the percentage of exporters in the Kosovo dataset is slightly lower (22%) than that in other TEs in the BEEPS dataset (25%) (See Table 5.2 below).

Independent Variables

Innovation

The proportion of innovative firms in Kosovo appears to be much lower than the proportion of innovative firms in the BEEPS dataset. This is in line with the expectation that in the early stages of transition firms have limited innovation capabilities and absorptive capacity (Filatotchev, et al., 2003; Rodriguez-Pose, 2001), and also the lack of innovation infrastructure and investments at the firm level, discussed in the previous sections. As shown in Table 5.2 around 43 percent of firms in Kosovo declared that they have introduced a product or a process innovation over the previous 36 months, compared to 64 percent of firms in the BEEPS dataset. The proportion of innovative exporters in Kosovo was also much lower than in the BEEPS dataset, 53 percent in Kosovo compared to 77 percent in the BEEPS dataset.

Based on the available information provided in the dataset, four innovation indicators have been constructed. First, a dummy variable *prodinn* is constructed, taking the value of one if a firm has introduced a new or significantly improved product (good or service) in the last 36 months. The percentage of Kosovo firms that have introduced new or significantly improved products is around 38 percent (see Table 5.1). New and upgraded products not only have affected the export growth in transition economies, but they also have substantially influenced sustainable market position of firms (See Roper and Love, 2002; Damijan, et al., 2015).

Second, a specific question in the survey is related to the novelty of innovation. This question was included in the Riinvest survey by the author for the specific purpose of exploring the issue of novelty. The novelty of innovation, as suggested by the Oslo Manual (OECD, 2005), is measured by the degree of newness of newly introduced products. The variable *novelty* is constructed as a dummy taking the value of 1 if the new or improved products (goods or services) were new to the market, otherwise 0 (as opposed to 'new to the firm'). Around 51 percent of firms that had introduced new products declared that their products were new to the market.

Third, a new and quantitative measure of product innovation is introduced in the Riinvest survey by including a question asking for the number of new products introduced in the previous 36 months. This question was added by the author to get the information on the quantity of product innovation to allow for the estimation of the marginal effect of an additionally introduced product on the export intensity of firms. The variable *prodno* is defined as a continuous variable representing the number of new products introduced by the firm in the previous 36 months. On average, innovative firms in Kosovo had introduced around 6 new or significantly improved products over the 36 months prior to the survey, whereas the mean average for the whole sample is about 2 new products.

Fourth, a process innovation measure is included in the model. Process innovations or new production processes are expected to facilitate productivity improvements (Caldera, 2010). To measure this activity, the variable *procinn* is constructed as a dummy taking the value of 1 if a firm has introduced new or significantly improved process over the previous 36 months, 0 otherwise.

An important issue often discussed in the economics literature is the relationship between export activities and innovation behaviour of firms (Damijan, et al., 2010; Boermans, 2013, e.g.). In addition to the financial benefits from export sales, firms also learn from competition in foreign markets and introduce better products and processes (Salomon and Shaver, 2005). As argued in Chapter IV, the learning does not happen instantly and there is a time lag needed for firms to absorb knowledge from export markets. As in the BEEPS survey, in the Riinvest survey too, firms were asked to provide information on innovation activities over the 36 months prior to the survey, while the export sales used as dependent variable are given for the year the survey is undertaken. This limits the potential endogeneity between innovation and export activity or the learning by exporting effect.

Business environment factors

In terms of the business environment variables, questions similar to the BEEPS survey were included in the Riinvest survey which enable us to investigate the impact of several aspects of business environment on export performance of firms in Kosovo.

First, as argued in Chapter IV, firms may be inclined to increase their export intensity if the business environment in the domestic market, especially in terms of macroeconomic stability, is uncertain. As Streb (2001) points out, unstable political situation can lead to uncertain economic policies and changes in market conditions. This can in turn create uncertain expectations about the potential profit from operating on the domestic market, pushing them towards the export market (which are inherently more stable and predictable) as a risk shifting strategy. To account for this effect, the variables *macobst* is constructed as a dummy variable, which takes the value of one if firms have considered that the uncertainty about economic policies was a moderate or major obstacle to their business operations, zero otherwise.

Second, as discussed in the previous sections of this chapter, the weak implementation of rule of law has been highlighted in other studies as one of the main obstacles to business operations of Kosovo firms throughout the transition period (UNDP, 2012). This finding is opposed by Holzner and Peci (2010a), who found that the 'rule of law' related factors have an insignificant impact on the turnover and growth of exporting SMEs. A further investigation can shed more light on the effects of the weak implementation of rule of law on the export performance of firms. In this regard, as Rodrik et al. (2004) argue, contract enforcement and the prevention of anticompetitive practices are two important aspects of the effectiveness of rule of law and also of the quality of institutions in a country. To investigate the effects of the weak implementation of rule of law, the dummy variable *weaklaw* is constructed, which takes the value of one if firms consider the weak contract enforcement and/or anticompetitive behaviour of their competitors as a moderate or major obstacle to their business operation, zero otherwise.

Third, the cost of finance as an obstacle is expected to negatively affect a firm's ability to invest and increase its export sales. The cost of business finance (interest rates on business loans) in Kosovo is the highest in the region (Ali, 2013) and is therefore expected to have an adverse effect on firms' borrowing. Hanspeter and Wiedmer (2001) suggest that due to small size of firms in South East European transition economies and the inefficient banking system, external financing cost is relatively higher and acts as a major obstacle to firms for their import and export activities. Hashi and Krasniqi (2011), however, did not find a significant relationship between external finance and SMEs growth in the laggard transition economies in South Eastern Europe.[68] Findings in Chapter IV also indicated an insignificant relationship between the firm export performance and access to finance. To estimate the effect of the cost of finance on export performance in the particular case of Kosovo, the dummy variable *costfin* is created, taking the value of one if firms consider the cost of finance to be a moderate or a major obstacle to their business operations, zero otherwise.

Other factors

As discussed in Chapter IV, the education and skills of employees is an important factor for knowledge absorption and improvements in productivity. Moreover, the more educated managers are more likely to target products and markets which have high growth potential (Wasilczuk 2000; Almus 2002; Lamote and Colovic, 2015). The number of educated staff reflects the absorptive capacity of firms and its potential to assimilate and apply external knowledge to improve their productivity and competitiveness on both domestic and foreign markets. Others have found contradictory results for TEs in South Eastern Europe. Gashi (2014), for example, found that the university education of staff in the manufacturing and service sector in Kosovo has even a negative effect on the decision of firms to export but also on the longevity of firms in the export markets. Similar results are also reported by Bartlett and Bukvić (2001) for the early transition

[68] Hashi and Krasniqi (2011) in their study compare three advanced Central Eastern European countries (Poland, Hungary, and Czech Republic) with three laggard countries in South Eastern Europe (Albania, Macedonia, and Serbia and Montenegro).

period in Slovenia, and by Xheneti and Bartlett (2012) for Albania. They argue that this effect is mainly related to a missing link between the curricula of the education programmes and the business needs in these countries. On the other hand, in line with suggestions of Wasilczuk (2000) and Higon and Driffield (2011), the empirical estimation in Chapter IV showed that the share of highly educated employees has a significant and positive impact of firm's export performance in TEs across all transition stages. A similar effect is expected in this analysis. Variable *uni* is constructed to reflect the level of knowledge of employees; it shows the percentage of staff with bachelors or higher degree. As shown in Table 5.2, on average around 5 percent of employees appear to have a university degree or higher, while in the BEEPS dataset analysed in Chapter IV, the share of staff with tertiary education is at about 29 percent. In line with the arguments provided in the previous sections on the level of education, these descriptive statistics show a large gap for skilled employees between Kosovo and other TEs.

In countries with the highly dominant share of micro and small firms, such as Kosovo, and a limited number of large firms, networking serves as another catalyst to export performance (Chetty and Holm, 2000; Lu and Beamish, 2006). As Bruton, et al. (2010) suggest, personal or social business ties substitute weak support provided by institutions. As suggested by Higgon and Drieffield (2011), and similar to the approach adapted in Chapter IV, membership in business associations is taken as a proxy for networking opportunities faced by firms. The dummy variable *busass* takes the value of one if firms are members of any business association, otherwise zero. Descriptive statistics of the Kosovo data show that only around 15 percent of firms are members of any business association in Kosovo, a significantly lower proportion of firms than that for TE firms in the BEEPS data sample (39% in 2002 and 37% in 2005). Given that the affiliation with business associations facilitates information exchange and linkages to international markets, and the findings in Chapter IV of this thesis and the result of other studies (Higgon and Drieffield, 2013; Gashi, et al., 2014), membership in business associations is expected to have positive impact on firms' export performance.

In terms of knowledge spillover effect, as argued in the previous sections, Kosovo lags behind other WB countries in industry collaboration and business clustering. A similar measure as in Chapter IV is used to investigate the potential for knowledge spillover between firms in same sectors, as suggested by previous authors (Wakelin, 1998; Roper and Love, 2002). It is still expected that a larger share of innovative firms in a region will increase knowledge transmission between firms. Following the practice in Chapter IV, sectoral knowledge spillover represented by the variable *sectorspill*, defined as the percentage of innovative firms in total number of firms in each of the three sectors (production, services and trade) and in each of the six Kosovo regions,[69] making 18 sector-region clusters of innovative firms. The mean percentage of innovative firms per region is 42 percent, with the lowest percentage in Peja (around 11 %) and the highest in Gjakova (around 66 %). Similar to Chapter IV, with the inclusion of this variable, which is also expected to pick up the impact of sectors, it is no longer necessary to have sectoral dummies in the equation. In this way we will avoid the problem of multicollinearity.

Another important source of externality is the agglomeration economies or externalities which have already been discussed in Chapter IV. Bellandi (1989) argues that the geographic concentration enhances firm productivity. Concentration of firms in a region is also expected to give them better access to information and links to the international markets. As such, it is expected to have a positive impact on firms' export performance. A common approach to measuring the impact of agglomeration economies is to include a measure for the geographical proximity

[69] Six main regions in Kosovo are: Prishtina (The capital city), Peja, Mitrovica, Ferizaj, Prizren and Gjilan. The share of innovative firms in a region accounts for all firms in the respective region, including smaller towns.

between firms (Koenig et al., 2010) or their location in large urban areas (Roberts and Tybout, 1997). The impact of "being located in large urban areas" can be identified by including a dummy variable for firms located in Prishtina as the capital city. If we add also dummies for firms located in other five bigger cities, then there is the likelihood of multicollinearity. This variable is represented by *capital* taking the value of one if firms are located in the capital city, zero otherwise.

In addition, we investigate if foreign ownership affects export performance of Kosovo firms. As suggested by the literature (Filatotchev, et al., 2008; Bangwayo-Skeete and Moore 2015, e.g.) foreign owned firms have better access to resources and foreign markets. As a result, they are expected to be more export intensive than the domestic owned firms. Similar to the specification adapted in Chapter IV, the variable *"foreign"* expresses the share of foreign owned equity in total assets. The Kosovo dataset shows that the mean share of foreign owned assets is about 3 percent, which is much lower than the mean for TEs in the BEEPS dataset (12 % in 2002 and 8 % in 2008). This low level of foreign owned assets in Kosovo may be a reflection of the decreasing trend of foreign investments (since 2008), which may have been influenced also by the slowdown of privatisation process as discussed previously in this chapter.[70]

Control variable

As shown in Chapter IV, size appears to be a significant factor explaining export performance. Similar findings are reported in other studies, for Italy (Sterlachini, 1999), for the UK and Germany (Roper and Love 2002), for TEs (Gashi, et al., 2014) and for Kosovo (Gashi, 2014). On the other hand, Cassiman and Martinez-Ros (2007) suggest the presence of a bell-shaped relationship between size and export performance. Therefore, it is feasible to include

[70] The proportion of privatised firms is very low in the Kosovo dataset (below 3%). However, in an alternative empirical estimation we include a dummy variable expressing privatised firms (former state owned). As expected, the effect showed to be highly insignificant. For the reason of brevity, we do not present these regression results in this chapter and we do not include the variable expressing privatised firms in our model specifications.

variable *size*, measured by the number of employees to control for a firm's size. In order to check for the potential non-linearity (inverse U-shaped relationship), following the normal practice in the literature, the quadratic form of size, *sizesq*, is also included in the model.

In addition, since the micro and small firms compose the vast majority of active firms in the Kosovo economy (as discussed earlier in the chapter) and a similar representation is reflected in the dataset (around 99% of firms are micro and small), we will also investigate if the export performance of micro and small firms is driven by the same factors (in an alternative estimation we drop medium and large firms which constitute about one percent of firms in the dataset).

5.5 Model specification

This empirical investigation draws on the theoretical and methodological approach undertaken in Chapter 4 on export performance of firms in transition economies, extending the work of previous authors in this area (Wakelin, 1998; Sterlacchini, 1999 and 2001; Roper and Love, 2002; Ozcelik and Taymaz, 2004; Gashi, et al., 2014). Its theoretical foundations is based on the technology gap theory developed by Krugman (1979), that innovation is the main driver behind export performance and of Melitz (2003), that firms with higher productivity self-select themselves to move to the export markets.

The dependent variable is measured by the percentage of export sales in total sales. As we argue in Chapter IV, since the value of this variable is zero for a substantial proportion of observations and only has positive values for a smaller number of observations with (around 22%), the OLS estimation method is not suitable as it would cause sample selection bias and in turn would lead to biased estimates, while if estimated for the whole sample it may predict negative values for some firms (Wooldridge, 2006, p.598).

Following the empirical model in Chapter IV, and the work of other authors (Wakelin, 1998; Sterlachini, 1999; Basile, 2001; Roper and Love, 2002; and others) the Tobit model is used for this analysis as it is suitable to a situation where the dependent variable has the value of zero for a considerable part of the data (Wooldridge, 2006, p.595). The estimated model takes the following form:

$$y_i = \begin{cases} y_i^* = \beta x_i + \varepsilon_i & \text{if } \beta x_i + \varepsilon_i > 0 \quad \text{for exporters} \\ 0 & \text{otherwise} \quad \text{for non-exporters} \end{cases} \tag{5.1}$$

$$\varepsilon_i \sim N(0, \sigma^2)$$

As discussed in Chapter IV, y_i can be observed only through exporters, or a latent variable in cases where its value is positive ($y_i^* > 0$), while the dependent variable cannot be observed when $y_i^* \leq 0$, in which case the dependent variable can only be equal to zero. The independent variables in the model are expressed as x_i, β represents the vector of coefficients of the variables and the intercept and ε_i is the error term assumed to have a "normal, homoscedastic distribution with a linear conditional mean" (Wooldridge, 2006, p. 596).

The model follows the assumption that the export behaviour is determined by the explanatory factors which are mainly of a supply side nature and that the same factors influence both the firm's export propensity and intensity (Gashi, et al., 2014).

Furthermore, as we use aggregate indicators such as the percentage of innovative firms in three main sectors (production, services and trade) in six regions, clustering of standard errors is undertaken. This will avoid potential errors related to the aggregation issues (Moulton, 1990). By clustering standard errors, the estimated model controls for the potential correlation of the regression disturbances within the sector related groupings, which if left uncontrolled can cause standard errors to be biased.

As the available dataset provides several measures of product innovation, three different model specifications are estimated. The indicator of process innovation is used in all three specifications. Each specification uses one of the three alternative indicators of product innovation: Specification (1) the introduction of new products that are new to the market (*novelty*); Specification (2) the introduction of new or significantly improved products (*prodinn*); and Specification (3) the number of new or significantly improved products (*prodno*).

In the next section we discuss empirical results.

5.6 Empirical results

In this section we present the estimation diagnostics and then we discuss the main empirical findings.

5.6.1 Estimation diagnostics

To ensure that the estimation results are robust, diagnostic tests and several robustness checks are undertaken. First, based on the results of the correlation matrix, the model does not seem to suffer from the multicollinearity problem (See Appendix A5.1 for the correlation matrix). Besides the correlation between size and size square term as two interconnected variables, the highest correlation between other independent variables is 0.47, well below the conventional 0.7 level. Second, as in Chapter IV, the validity of the Tobit model is investigated by testing the sign restriction imposed by Tobit model for both exporters and non-exporters (since all firms are included in one model estimation, the signs of estimates for both export propensity and export intensity are the same). As suggested by Wooldridge (2006) the model is tested by comparing Probit estimates with the Tobit estimates divided by Tobit sigma, as shown in Table 5.3 below.

Table 5.3 Comparison of Tobit coefficients divided by Tobit sigma with Probit coefficients for all three specifications[a]

	Model Specification 1			Model Specification 2			Model Specification 3		
VARIABLES	Tobit parameter	Tobit parameter/Sigma	Probit parameter	Tobit parameter	Tobit/Sigma parameter	Probit parameter	Tobit parameter	Tobit/Sigma parameter	Probit parameter
prodinn							17.36*	0.2395	0.360**
							(9.956)		(0.151)
procinn	-18.81	-0.2609	-0.229	-14.46	-0.1980	-0.174	-20.24	-0.2792	-0.290
	(15.500)		(0.220)	(13.796)		(0.194)	(13.945)		(0.196)
prodno				1.347***	0.0184	0.0339***			
				(0.550)		(0.010)			
novelty	20.58**	0.2855	0.346**						
	(9.808)		(0.158)						
weaklaw	-6.126	-0.0850	-0.0558	-3.375	-0.0462	-0.0118	-6.039	-0.0833	-0.0557
	(10.366)		(0.148)	(9.677)		(0.132)	(10.692)		(0.151)
costfin	20.10	0.2788	0.250	22.26	0.3048	0.280	21.32	0.2942	0.273
	(14.692)		(0.187)	(14.869)		(0.190)	(15.491)		(0.197)
macobst	30.34**	0.4209	0.394**	30.51**	0.4178	0.400**	31.45**	0.4339	0.408**
	(14.390)		(0.193)	(15.161)		(0.199)	(14.156)		(0.188)
uni	0.3380	0.0047	0.0038***	0.375***	0.0051	0.0045***	0.369***	0.0051	0.0045***
	(0.117)		(0.001)	(0.114)		(0.001)	(0.116)		(0.001)
busass	-6.223	-0.0863	-0.102	-5.281	-0.0723	-0.0911	-8.313	-0.1147	-0.131
	(15.909)		(0.246)	(16.669)		(0.250)	(16.236)		(0.252)
foreign	0.474	0.0066	0.0043	0.461	0.0063	0.0034	0.493	0.0068	0.0045
	(0.345)		(0.004)	(0.375)		(0.250)	(0.350)		(0.004)
sectorspill	0.549	0.0076	0.0064	0.530	0.0073	0.0056	0.524	0.0072	0.0055
	(0.439)		(0.006)	(0.437)		(0.005)	(0.453)		(0.006)
capital	17.73**	0.2459	0.129	14.76*	0.2021	0.0702	16.95*	0.2339	0.113
	(8.786)		(0.138)	(8.380)		(0.135)	(8.724)		(0.139)
size	1.910**	0.0265	0.0409***	2.001*	0.0274	0.0428***	2.022**	0.0279	0.0412***
	(0.929)		(0.011)	(1.148)		(0.015)	(0.857)		(0.011)
sizesq	-0.0235**	-0.0003	-0.0004***	-0.0267**	-0.0004	-0.0005***	-0.0235**	-0.0003	-0.0004***
	(0.011)		(0.001)	(0.013)		(0.001)	(0.010)		(0.001)
constant	-120.2***	-1.6674	-1.675***	-122.7***	-1.6804	-1.676***	-123.9***	-1.7094	-1.718***
Tobit Sigma	72.09***			73.02***			72.48***		
Observations	448			442			450		

Source: Stata regression outputs

Clustered robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

[a] Detailed regression results are presented in Appendix A5.2

For the Probit model, the dummy variable *exporter*, taking the value of one for exporting firms and zero for non-exporters, is used as dependent variable. As shown in Table 5.3, the estimates appear to be quite similar, indicating that the Tobit model is appropriate for the estimation of the firm's export performance.

Similar to the approach adapted in Chapter IV, we additionally investigate if correlation between innovation variables (although the correlation matrix does not indicate any problems with multicollinearity) has an influence on the estimated results. In Table 5.4 below we present the estimation results of the Specification 1 (includes *procinn* and *novelty* variables) and two alternative specifications: Specification (1a) includes only *procinn*; and Specification (1b) only *novelty*.

As presented in Table 5.4 in all three estimated model specifications, sign and significance of innovation variables are not affected, whereas the estimates of other variables have only slightly changed, keeping the same sign and significance. Thus, it provides additional robustness evidence that product and process innovation have separate effects on firm's export performance.

Additionally, we also investigate if there is a possible outlier effect, since some firms have reported introduction of more than 30 new products (goods or services) over the previous 36 months. The Tobit estimation for the dataset excluding firms with more than 30 products shows that the estimates are not affected as compared to the original estimation. These results are not presented here.

Table 5.4 Tobit estimation of the alternative model specifications with only product or process innovation variables[a]

	Tobit parameters		
Alternative model specifications	Specification 1	Specification 1a	Specification 1b
novelty	20.58**		15.56*
	(9.808)		(8.163)
procinn	-18.81	-13.22	
	(15.500)	(13.413)	
weaklaw	-6.126	-5.474	-5.126
	(10.366)	(10.913)	(10.551)
costfin	20.10	20.78	21.43
	(14.692)	(15.570)	(15.666)
macobst	30.34**	32.12**	30.68**
	(14.390)	(14.013)	(13.957)
uni	0.3380	0.353***	0.318***
	(0.117)	(0.112)	(0.117)
busass	-6.223	-7.699	-7.069
	(15.909)	(15.677)	(15.985)
foreign	0.474	0.499	0.468
	(0.345)	(0.352)	(0.334)
sectorspill	0.549	0.625	0.499
	(0.439)	(0.456)	(0.410)
capital	17.73**	17.67**	15.53*
	(8.786)	(8.592)	(8.572)
size	1.910**	2.279**	1.766*
	(0.929)	(0.964)	(1.013)
sizesq	-0.0235**	-0.0259**	-0.0228*
	(0.011)	(0.012)	(0.012)
Constant	-120.2***	-124.4***	-121.3***
Sigma	72.09***	72.52***	72.55***
	(4.975)	(5.121)	(5.323)
Observations	448	450	448

Source: Stata regression outputs
Clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
[a] For detailed regression results of alternative specifications (1a and 1b) see Appendix A5.3

Furthermore, as there is a large percentage of firms in the trade sector in the sample, and there is the potential for misreporting of the number of new introduced products by firms in this sector (it is difficult to define or understand the notion of ‘new’ products in the trade sector), additional estimation for Specification 2 of the Tobit model is undertaken only for firms belonging to the production and service sectors. By excluding trade sector firms, the number of sector clusters in six regions will of course decrease. This also affects the number of firms in the sectoral clusters in the regions. Due to reduced clusters of sectors, it would no longer be possible to cluster the standard errors and control for the common unobservable characteristics of firms because the number of clusters becomes equal to the number of variables (Statcorp, 2009). In order to run the regression, using clustered standard errors, number of variables should be higher than number of sector clusters. To fulfil this condition, the variable *sectorspill* which appeared insignificant in all estimations has been dropped in the estimation process. Excluding the trade sector from the sample reduces the sample size significantly, thus it might affect the precision of the results. The results are shown in Table 5.5.

Table 5.5 Tobit estimation - Specification 2 whole sample and production and services sector sample

Dataset	Whole sample	Production and Services Sector sample
prodno	1.479***	2.032***
	(0.329)	(0.536)
procinn	-13.56	-3.208
	(14.005)	(11.406)
weaklaw	-2.644	7.169
	(9.606)	(7.353)
costfin	24.09	13.10*
	(17.055)	(7.354)
macobst	31.09**	40.11*
	(14.905)	(20.637)
uni	0.370***	0.358***
	(0.125)	(0.121)
busass	-4.123	-24.97
	(16.063)	(21.313)
foreign	0.446	0.731**
	(0.339)	(0.357)
capital	15.63*	18.08*
	(8.287)	(10.339)
size	2.123*	3.999***
	(1.123)	(0.898)
sizesq	-0.0274**	-0.0493***
	(0.013)	(0.010)
Constant	-103.3***	-118.9***
Sigma	73.35***	62.79***
No of observations	445	277

Source: Stata regression outputs
Clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
[a] For detailed regression results see Appendix A5.4

The estimates of the variable *prodno* (number of new or significantly improved products) shows similar sign and significance for both alternative samples (whole sample compared to the selected sample), indicating that misreporting problem is not an issue. Moreover, estimates of other variables appear quite similar in terms of sign and significance. The only notable difference in the smaller sample is related to size, foreign ownership and cost of finance estimates. Size become more significant (from previous marginal significance) and while foreign ownership and cost of finance estimate become significant (from previous insignificance). Also, the significance of the macroeconomic obstacles variable is slightly reduced. Due to a reduced number of observations in the selected sample these results should be interpreted with caution.

5.6.2 Main findings

Because the Tobit regression coefficients are not directly interpretable, as in the analysis in Chapter IV, the unconditional marginal effects of the estimates are presented for interpretation as they account for the effect of both, the propensity and intensity of exports without considering the censoring problem due to the linear conditional mean of the population. The unconditional marginal effects are presented in Table 5.6 below. The conditional marginal effects where coefficients are of similar size and only slightly larger are not interpreted.

Innovation

Each of the three model specifications contain only one of the product innovation indicators. They are all positive and significant, similar to the findings in Chapter IV for other TEs. The indicator of product innovation novelty shows the least statistical significance, only at 10 percent confidence level, while it has the highest unconditional marginal effect compared to other two product innovation indicators. The unconditional marginal effect suggests that, ceteris paribus, if a firm has introduced new products to the market over the previous 36 months prior to the survey, on average, its export intensity is likely to increase by 3.9 percentage points compared to firms that have not introduced any new products. In the alternative model specification, innovation variable *prodinn* (new or significantly improved products) is statistically significant at 5 percent confidence level but its unconditional marginal impact is slightly smaller (3 %).

Table 5.6 Unconditional marginal effects

	Model Specifications		
VARIABLES	Model specification 1	Model Specification 2	Model Specification 3
Innovation			
prodinn			3.01**
			(1.263)
procinn	-2.89	-1.97	-3.08
	(2.316)	(1.923)	(1.933)
prodno		0.37***	
		(0.114)	
novelty	3.91*		
	(2.098)		
Business environment factors			
macobst	5.15**	4.67**	5.34***
	(2.098)	(2.080)	(2.020)
weaklaw	-1.01	-0.65	-1.01
	(1.805)	(1.497)	(1.841)
costfin	3.38	3.20	3.59
	(2.923)	(2.760)	(3.072)
Other factors			
uni	0.06***	0.05***	0.06***
	(0.015)	(0.015)	(0.013)
busass	-0.99	-0.96	-1.31
	(2.424)	(2.206)	(2.380)
foreign	0.08	0.08	0.08
	(0.052)	(0.056)	(0.053)
sectorspill	0.09	0.07	0.08
	(0.069)	(0.061)	(0.072)
capital	3.19***	2.45**	3.03**
	(1.214)	(1.017)	(1.245)
Control variable			
size	0.32***	0.30***	0.34***
	(0.087)	(0.093)	(0.071)
sizesq	-0.004***	-0.004***	-0.004***
	(0.001)	(0.001)	(0.001)

Source: Stata regression outputs
Clustered robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
[a] For detailed regression results see Appendix A5.2

The quantitative variable reflecting the number of new or significantly improved products also appears positive and highly significant. Its unconditional marginal effect suggests that, ceteris paribus, if a firm increases the number of new or significantly improved products by 1, on average, its export intensity is likely to increase by 0.37 percentage points. The suggested effect is lower than the effect of other two qualitative indicators of product innovation, which shows that firms' export intensity increases with the increased assortment of new products.

Similar to the findings in Chapter IV for other TEs, the impact of product innovation on the export performance increases if products have a relatively higher degree of novelty. The size of the impact of the product innovation indicator (the qualitative indicators) is also quite similar and within the range of the significant impact shown in Chapter IV (between around 1.5 and 4 percentage points across the three transition group of countries).[71] This finding is also in line with the Damijan, et al. (2015) suggestion that the increased export sales of TEs have a positive correlation with the introduction of higher value goods in these countries. It seems that despite the overall transition challenges Kosovo exporting firms are catching up in terms of innovation.

In line with findings in Chapter IV and other studies (Cassiman and Golovko, 2007; Becker and Eger, 2013) process innovation does not seem to exert a significant impact on export performance.

Business environment factors

The estimated coefficients of the variable *macobst* is highly significant in all three model specifications, at 5 percent confidence level in the first two model specifications, and at 1 percent confidence level in the third model specification. Its unconditional marginal effects suggest that, ceteris paribus, if firms perceive their domestic macroeconomic environment as uncertain, they are likely to increase their export intensity by around 5 percentage points (between 4.67% in Specification 1 and 5.34% in Specification 3). This finding supports the hypothesis that an uncertain business environment can lead to firms shifting their attention to the export markets as suggested initially by Johanson and Vahlne (1977) and then by Higgon and Driffield (2011) for the UK and Dimitratos, et al. (2004) for Greece. Results are also in line with the findings in Chapter IV, where the macroeconomic obstacle indicator appeared positive in all groups of transition countries, although highly significant only in the advanced transition group.

[71] See Chapter IV, Table 4.6.

The weakness of the rule of law as measured by firms' perceived obstacles related to the anticompetitive practices and contract violations by competitors indicates a negative impact on firms' export intensity, though it does not appear to be significant in any of the model specifications. This insignificant impact is also found by Holzner and Peci (2010a) investigating factors influencing growth of the Kosovo exporting SMEs. The estimated coefficient of the cost of finance as another business environment factor also appears insignificant but surprisingly positive, similar to those in Chapter IV.

Overall, the macroeconomic uncertainty seems to increase the likelihood of firms increasing export sales. One likely interpretation is that firms in Kosovo may perceive foreign markets as a market segment that mitigates their business risk in case of a potential worsening of the economic situation in the country.

Other factors

First, the variable representing the share of university graduates in a firm appears positive and highly significant, at 1 percent confidence level, in all three specifications, as expected. Its unconditional marginal effect suggests that, ceteris paribus, if a firm increases the share of staff with a university degree or higher by 1 percentage point, their export intensity is likely to increase between 0.05 and 0.06 percentage points. In a laggard transition context such as Kosovo, firms that employ highly skilled employees have a higher likelihood of performing better in foreign markets where competition is more intense and market requirements are stricter compared to the domestic market. As Chandler and Hanks (1998) postulate, the educated staff can also act as a substitute for firm financial capital, an issue often appearing as an obstacle to business operations of firms in developing economies. This finding is in line with the results of Chapter IV, as well as with the previous studies (Wagner, 2001; Higon and Driffield, 2011; Gashi, et al., 2014).

Second, as a measure of agglomeration, *capital* shows to be positive and statistically highly significant, between 1 percent and 5 percent confidence level across the three specifications. Unconditional marginal effects suggest that, ceteris paribus, if a firm is located in the capital city region, it is likely to increase its export intensity by around 3 percentage points.

Third, contrary to the findings in Chapter IV, the knowledge spillover variable *sectorspill* measuring the share of innovative firms in a sector appears positive, but statistically insignificant. As argued previously, it seems that there are no significant knowledge spillovers between firms across Kosovo, probably due to the weak or non-existent sector clusters.

Fourth, contrary to the findings in Chapter IV, membership in business associations and foreign ownership do not seem to have a statistically significant impact on firm's export performance, although their impact is positive. For the former, the explanation can be that Kosovo business associations are still weak and they are generally focused on a domestic market with no close linkages to the international market. For the latter, the small percentage of foreign investors in Kosovo, consequently small percentage of observations in the dataset, reduces its statistical impact, although the magnitude of the impact shown by the unconditional marginal effect is similar to the effect of the foreign ownership on firms' export intensity in the laggard transition group of countries estimated in Chapter IV.

Fifth, size appears statistically highly significant, at 1 percent confidence level, in all three estimated model specifications. As expected, the relationship does not appear to be linear, but rather an inverse U-shaped relationship, suggesting that export sales will increase with size up to a certain point when firm size starts to marginally exert a diminishing effect on export sales.

Finally, the results of the alternative Tobit estimation for the sample of micro and small firms (for reason of brevity results are presented in Appendix A5.5) suggests that, the effects of variables are consistent both in terms of sign and significance, while the unconditional marginal effects are slightly larger compared to the whole sample estimation. This finding indicates a catching-up effect of smaller firms which is in line with the indications discussed earlier in the chapter that, the share of medium and large firms in the Kosovo economy has been gradually increasing. This finding suggests for policies that will in particular facilitate exporting of micro and small firms. In addition, as Bangwayo-Skeete and Moore (2015) postulate, improved export performance of firms in countries in transition (developing economies) is likely to facilitate their catching-up with more competitive foreign firms.

5.7 Conclusions

This Chapter reviewed the development of the Kosovo's economy since the start of the transition to a market economy. It was shown how, compared to 1999 when the modern institutions were being established from scratch, Kosovo has made significant progress towards building a market economy and almost managed to reach the standards of an industrial economy in terms of price liberalisation and trade policies. However, Kosovo still lags behind in many other areas. Drawing on the evidence from the firm level survey data collected in 2013 by Riinvest Institute, the chapter focused on the factors affecting export performance of firms in Kosovo, and particularly examines the impact of innovation and business environment related factors.

The empirical investigation of factors affecting the firm's export performance undertaken in this chapter provides an added value to the literature as it employs measures of the degree of novelty of innovation (products introduced as new to the market), not used in previous studies investigating the impact of innovation on firm's export performance, as well as it introduces a new quantitative indicator of product innovation as measured by the number of new products introduced by firms. Moreover, it presents the first study to analyse the effect of innovation and business environment factors on export performance of firms for the case of Kosovo.

Among innovation variables, product innovation shows a positive and significant impact on export performance. The effect appears to be stronger if the new products are new to the market. Process innovation does not seem to be a significant factor, suggesting that new production processes do not act as means of increasing firm’s competitiveness or performance in the export markets. The results suggest that investment in innovation is likely to have a higher return when spent on product innovation, especially more novel products, and the sales in international markets are likely to be higher as well.

With respect to business environment factors, macroeconomic uncertainty shows a significant and positive effect on firm’s export performance. If Kosovo firms perceive the macroeconomic environment as uncertain, it is likely that their risk mitigation strategy will lead them to engage more intensively in foreign markets. Further, the quality of human capital, represented by the proportion of employees with university education shows a positive impact on firms’ sales in foreign markets. The location of firms in the capital city appears to be a significant and positive factor as well. Contrary to expectations, foreign ownership does not seem to have a significant effect on export performance. In line with findings in Chapter IV, larger firms are likely to have better export performance, though the relationship is a non-linear one, an inverted U-shaped. Finally, the effect of export performance determinants seems to be larger when accounting only for micro and small firms, suggesting a catching-up of smaller firms.

In sum, consistent with findings in Chapter IV, the results show that the effect of the individual variables is rather small, so a set of more comprehensive policies is required to influence the export sales of Kosovo firms. The policy recommendations will be discussed in detail in the concluding chapter of this thesis.

Finally, similar to the BEEPS dataset, Kosovo firm level dataset used in this empirical analysis has some limitations. First, it is based on subjective opinions of firm managers. And second, the dynamics of innovation and its impact on export performance have not been captured due to the cross-section nature of data.

In the next chapter we provide main conclusions of this thesis as well as policy recommendations and suggestions for future research.

Chapter VI

Conclusions and policy implications

Contents

6.1 Introduction

This thesis has investigated the process of innovation and its impact on firm performance, in terms of both sales performance as well as export performance of firms in transition economies, accounting for novelty of innovation, open innovation practices, business environment factors and the stages of transition. A vast amount of empirical literature has explored the innovation related theories in countries at the technological frontier (the developed economies) which are considered as owners of the innovation process and technological leaders capable of introducing radical innovations that give competitive advantage to firms in domestic and foreign markets. The transition countries have attracted much less attention due to limited internal firm capabilities; the innovation process leading mainly to incremental innovations (imitated products and processes, largely of imitation type and new to the firm only). The possibility of attaining new knowledge through external sources has been less explored in these countries and the effects of broader cooperation with other actors outside the firm has not been studied at all. Furthermore, the continuous transition reforms and changes make the business environment less certain, particularly in terms of macroeconomic and regulatory policies, which as the Uppsala view of international trade suggests, may motivate firms to increase exporting activities as a measure of domestic risk adjustment, an issue also not considered in the literature. Moreover, the differences in the transition progress achieved across countries have created a heterogeneous reforming environment. While the literature generally provided one size fits all policy recommendations for the countries in transition, it has not explored the possibility of a moderating role of the transition stage (or the degree of progress in transition) on the determinants of firm performance.

The identified gaps- in the literature formed the basis of three objectives of the thesis. The first objective (Chapter III) aimed to assess the impact of the breadth of open innovation on the effectiveness of radical innovations (sales of products new to the market) and the relationship between innovations (both radical and incremental innovation sales) and firm performance (sales growth). The second objective aimed at exploring the relevance of radical innovations on firms' export performance (Chapter IV) and investigating if the degrees of novelty of product innovation ('newly introduced products' as opposed to 'significantly improved products') affects export intensity of firms. In addition, it also explored if in the condition of an uncertain business environment firms would increase exporting activities as a risk balancing mechanism. To account for the moderating effect of transition reforms, the determinants of export performance are assessed across three stages of transition (advanced, medium and laggard reforming stages). The third objective aimed at exploring if the determinants of export performance have similar effects for firms in Kosovo (Chapter V), while controlling for the products introduced as new to the market, the first study of its kind undertaken for Kosovo.

To achieve the objectives of the thesis, we used a variety of econometric models, including Heckman two-step approach and Heckman Full Information Maximum Likelihood (FIML) estimator and Three Stage Least Squares estimator (Objective 1 – Chapter III), Tobit Corner Solution and Probit models (Objective 2 and 3 – Chapter IV and V). The empirical investigations were conducted using three large scale firm level datasets - the Eurostat's Community Innovation Surveys (CIS), the World Bank and EBRD's Business Environment and Enterprise Performance Surveys (BEEPS) and Riinvest Institute's Business Performance Survey of firms in Kosovo where the author played a part.

The plan of this chapter is as follows. In section 6.2 we summarize the main findings of different chapters of the thesis. In section 6.3 we present a set of policy recommendations for the relevant institutions in transition economies. In section 6.4 we discuss the main contributions to knowledge. In section 6.5 we indicate the main limitations of the thesis. We conclude the chapter with the elaboration of the areas for future research.

6.2 Main findings

While the theory of innovation, from Schumpeter onwards predicts a positive effect on the productivity, therefore their improved performance (including exporting), of firms, the empirical evidence on the impact of innovation activities has been less conclusive. In Chapter II we critically reviewed the theoretical and empirical literature, identifying the shortcomings of the previous studies and formulating the areas on which the thesis will focus.

The effect of radical innovations on the firm growth through the “creative destruction” suggested by Schumpeter (1942) has not received much attention in the literature on transition economies. Following a resource based approach, the literature on countries in transition identified firms’ internal capacities for innovation as limited, making the introduction of radical innovations less likely and therefore restricting them to mainly incremental innovations. The literature has also not fully explored the effects of open innovation on the effectiveness of radical innovations which is a more recent view put forward by Chesbrough (2003), arguing that the more specialised knowledge and resources may be found outside the firm and suggesting a shift towards an integrated cooperative innovation approach. This is particularly important for firms that would not alone be able to go beyond imitation of what has already been introduced by their competition. These shortcomings framed Objective One of the thesis which aimed to explore the relevance of novelty and open innovation in the innovation and firm performance relationship (Chapter III).

In addition, the literature has not fully explored the technology gap view (Krugman, 1979), in particular its implicit suggestion that products new to the export market will facilitate firms’ competitiveness in the respective markets, presenting another gap in the literature. For countries in transition, with an on-going process of market and institutional reforms aiming to reach the norms of industrialised economies and followed by lots of challenges and uncertainties, the earlier view by the Uppsala model of international trade (Johanson and Vahlne, 1979), which suggests that an uncertain domestic environment pushes firms towards relatively safer export markets, became relevant. In most of the previous studies for developed economies the business environment was not considered much of an issue, while for countries in transition it is a relevant feature that has not been assessed, a gap that is addressed in this thesis. Furthermore, due to different initial conditions and different dynamics in adopting and implementing reforms, some countries have been able to attain advanced progress, while others are still at an intermediate or even a laggard stage of transition. The reforming of institutions and the implementation of market and firm related reform policies is followed by an increased capacity for innovation. As countries advance with transition reforms, changes in the market environment moderate the effects of various firm performance factors, implying a more specific approach and the consideration of stages of transition, which were not accounted for in the previous literature, presenting another gap. These gaps in the literature have set the scene for the investigation of Objectives Two and Three of the thesis investigating the impact of innovation on export performance across 28 transition economies and for Kosovo alone in Chapters IV and V, respectively.

In Chapter III we used the Eurostat's Community Innovation Survey datasets for 2004 and 2006 for seven transition economies to conduct an empirical investigation on the relationship between innovation and firm performance applying the multistage CDM model to answer the research questions related of Objective One (*i, ii, iii, iv*).[72] In the first step of the model we used a

[72] Research questions in this chapter refer to the main research questions as defined in Chapter I.

Heckman two stage approach and Heckman FIML estimator for the first two equations of the model (propensity to innovate and innovation investment) in order to account for the selectivity bias, while in the second step we estimate the simultaneous system of the third and fourth equations of the model using the 3SLS estimator in order to account for the simultaneity between innovation and firm performance. The dependent variable in Stage one is a dummy variable expressing the firms' propensity to innovate. The dependent variable in Stage two represents the innovation effort measured by the natural logarithm of innovation expenditure. Stage three expresses innovation output measured by the natural logarithm of sales of new products, both new to the firm and new to the market, while in Stage four, the dependent variable expresses the firm performance as measured by sales growth over the two years prior to the survey.

The main findings suggest that open innovation practices increase the innovation investments (Research question *i*). Furthermore, the degree of open innovation, measured by the breadth of cooperation, significantly increases the sales of radical innovations (products new to the market) (Research question *ii*), while the internal firm capacities for innovation influence only incremental innovations (products new to the firm) (Research question *iii*). This finding suggests that the recent concept of open innovation defined by Chesbrough (2003) is an effective approach for innovation in countries with limited knowledge and internal firm capacities. Furthermore, the findings do not confirm the effect of innovation sales in the current period on the firms' sales growth over a two-year period (Research question *iv*). This is in line with the suggestion of Barlet, et al. (2000) that, due to an 'inertia effect', the newly introduced products become successful only gradually, particularly in markets with little technological opportunities such as the case of transition economies. Nevertheless, product and process innovation effects in the last three years significantly increase the firms' sales growth. Among other findings, public subsidies for innovation are not efficiently converted into innovation output, but significantly increase sales growth of firms that have introduced radical innovations, another suggestion for the importance of radical innovations. The effect of other factors such as the presence in foreign markets, being member of a foreign group, access to information, size, and business environment obstacles are shown to be in line with the literature suggestions.

In Chapter IV we investigated if the degree of novelty of innovations (newly introduced products as opposed to significantly improved products) affect the performance, this time in terms of the export intensity. We employed a Tobit model to estimate the impact of innovation on export performance of firms in 28 transition economies, using cross-sectional BEEPS data for 2002, 2005 and 2008. To address the gaps in the literature we accounted for the degrees of product novelty and business environment factors, among others. Moreover, to account for the heterogeneity of transition reforms, we grouped countries into laggard, medium and advanced reformers based on the EBRD transition index scores. To obtain larger samples for each group and higher precision of coefficients we pooled the datasets, a pooled cross section for BEEPS 2002 and 2005 datasets and one for all three datasets. We accounted for the business environment obstacles that expressed firms' perceptions of the domestic environment, in terms of macroeconomic and regulatory policy uncertainty, infrastructure, rule of law and access to finance. Several estimations testing the sensitivity of results with respect to different innovation indicators as well as the sensitivity of results related to the stages of transition confirmed the robustness of results.

The main findings suggest that the novelty of innovation is highly important and that products with higher degree of novelty (new products as opposed to significantly improved products) increase the export intensity of firms and the effect increases with the stages of transition (Research question *v*). The effect is higher in more advanced stages of transition suggesting the moderating effect of reforms. The findings show that firms perceiving their domestic market environment as uncertain tend to increase their export intensity and the effect is significant in countries at the advanced stage of transition (Research question *vi*). The findings suggest that the stage of transition reforms largely moderates the effect of the determinants of export performance, which tends to increase in more advanced stages of transition (Research question *vii*). Among other findings, the weakness of rule of law has a negative effect on exporting activities, particularly in higher stages of transition. The university education of employees facilitates firms' export intensity in all transition stages, but the specialised skills are effective only at the advanced stage of transition. Similarly, access to information on export markets through business associations as compared to only being a member of an association becomes more effective in advanced stages of transition. Among other factors, foreign ownership and knowledge spillover related factors increase firm's export intensity in all stages of transition.

In Chapter V we estimate a Tobit model of the export performance for firms in Kosovo. We used the survey data for 600 Kosovo firms undertaken by Riinvest Institute in 2013 with the support of the author. For the first time the survey gathers information on firm innovation classified by the degree of novelty (products new to the market as opposed to products new to the firm only). We included also a question on the number of new products introduced by firms in the three years prior to the survey to provide additional robustness checks with respect to the effect of innovation. Through several sensitivity regressions we showed that the results were robust.

The findings show that, products introduced as new to the market have the highest positive effect compared to other innovation indicators, confirming again the importance of innovation novelty for export performance (Research question *viii*). The export intensity also increases with number of new introduced products, an innovation indicator introduced to the literature for the first time. The Uppsala view of international trade is confirmed for the case of Kosovo as well, suggesting that an uncertain domestic environment influences firms to increase exporting activities (Research question *ix*). In addition, firms can enhance their export performance by increasing the share of employees with tertiary education. Firms in the capital city are more likely to be better performers in export markets, suggesting that proximity between firms as well as with other institutions can effectively enhance exporting activities. Finally, the findings suggest that small firms are catching-up as the same factors show to exercise a relatively higher effect on export intensity of micro and small firms. Overall the findings for Kosovo are broadly in line with findings for other transition economies (Chapter IV) but in addition imply that exporting activities of smaller firms should be supported particularly (Research question *x*).

To sum up, the findings of this thesis show that, despite limitations in terms of internal capacity for innovations, firms in transition economies can increase effectiveness of radical innovations through external cooperation, particularly by increasing the breadth of cooperation. Radical innovating firms were also shown to be more effective in utilising innovation subsidies for their sales growth, supporting policies that particularly support these firms. To further confirm the relevance of innovation novelty, we find that, the higher the degree of novelty the higher the influence on export intensity of firms. Firms also tend to increase exporting activities if the domestic business environment is perceived as uncertain. The effect of export performance determinants is largely moderated by the stages of transition. These findings imply a set of policy implications which we discuss in the next section.

6.3 Policy recommendations

The main findings of this thesis suggest several policy implications for governments in transition economies in order to facilitate firms' innovation and exporting activities.

First, to create a supportive environment for innovation, the transition countries should develop policy measures that will provide additional incentives for firms to invest in innovation. Findings in Chapter III suggest that subsidies have a positive effect on the level of R&D spending by firms. In a meta-regression analysis of the literature on innovation subsidies Dimos and Pugh (2016) find weak evidence to indicate a positive effect of innovation subsidies on additional firm investment in research. As an alternative to subsidies, tax related incentives such as tax deductible investments in research and development, or tax deductible commercial loans for R&D activities, which lower the cost of investment and may attract more innovative firms to increase their investment in innovation, should be considered. Subsidizing corporate borrowing for R&D increases the probability of supporting the most successful projects, as the outcome is left to market oriented decision makers or commercial banks (Tassey, 2007).

Second, to encourage radical innovation several policy measures can be introduced. First, to increase the effectiveness of conversion of subsidies into radical innovation output, governments can design support schemes that would subsidize costs related to intellectual property rights. As Chesbrough and Vanhaverbeke (2011) suggest, transition countries that want to promote innovation should have a supportive system to protect property rights to enhance the private firms' motivation to invest in new and patentable products or processes. Second, the establishment of public-private innovation centres that support open innovation. Such centres would act as hubs in interlinking private sector, institutions and other relevant stakeholders.[73] Such centres can facilitate sectoral technological spillovers and firms' access to information. Governments should in general put more effort in promoting and facilitating research and development in the universities by providing specific budget for industrial research.

Third, findings also suggest the usefulness of policies that may facilitate access to market and other technical information as a significant driver behind innovation and exporting. Chesbrough and Vanhaverbeke (2011) argue that open data platforms can be facilitated by the public sector, providing up to date information on the domestic and export markets and technologies. The availability of free online access to economic and technological data will particularly support smaller firms that have less resources to engage in specialised research.

Fourth, to support the internal knowledge and skills at the firm level, public policies should provide incentives for firms to invest in education and specialization of their employees. As EBRD (2014) suggests, countries need to invest in education and specialized skills in order for firms to be able to absorb new technologies. Alternatively, exchange visits of researches and industry representatives with foreign countries and institutions can also support the sharing of new ideas and knowledge. In addition, a specific emphasis should be put on vocational education as countries progress with their transition reforms.

Fifth, in terms of the market and institutional environment, finding suggest that government should promote policies that reduce informality and enforce rule of law, especially the enforcement of contracts. As Bessant and Tidd (2007) suggest, in fairly competitive markets firms are motivated to innovate. In addition, improving the overall business environment and establishing a more stable environment will lead to a decrease in the overall risk of doing business which would eventually

[73] Verhoest (2007) suggests that, the establishment of innovation centres in Estonia, such as the centre of the Technical University of Talin which supports linkages between R&D centres and businesses, is a good example to follow.

lower the cost of finance and induce investment in innovation. On the other hand, with respect to the domestic market uncertainty and its effect on export performance, the findings suggest that governments should develop support schemes for exporters, which not only provide incentives to exporting firms, but will also act as a counter measure to an uncertain business environment.

Sixth, the findings imply that the impact of innovation on firms' export performance increases with the degree of product novelty across the stages of transition, suggesting that firms in countries at the lower stages of transition are less effective in terms of introducing radical innovation or products with a higher degree of novelty. This indicates that governments in more laggard reforming countries should support research programmes and the development of human capital. However, as this is a long-term process, to benefit from international experiences in a shorter period, exchange programmes with more developed countries, involving mixed groups of researchers and firms interested to invest in innovation, should be supported. In addition, and hand in hand with the human capacity building programmes, governments can introduce tax incentives for investments in new technologies in order to motivate firms to invest in process innovations which, as suggested by empirical findings in Chapter III, increases firms' sales growth of both incremental and radical innovators.

Seventh, in terms of other export support measures, as OECD (2012) suggests, a systemic and continuous support for facilitation of business linkages with international companies, including the participation in international fairs, as measures that can enhance firms' exporting. Easier access to export markets will allow enterprises to learn, access new markets and decrease their market risk portfolio. Findings suggest that as countries progress with transition reforms, governments should support business associations to establish specialised departments that can provide firms with information on export markets.

Eighth, a consistent positive impact of foreign ownership on innovation, firm performance and exporting suggests that policies that will attract foreign investments in the transition economies should be strengthened. In the case of Kosovo where the number and share of FDIs are rather small and the effect appears insignificant, the government should promote FDIs and establish supportive policies in order to increase the number of foreign businesses in the country. As Lang (2010) suggests, one of the ways to do this is through the export processing zones or free trade zones, where enterprises working in those specific locations would have preferential tax and duty treatment as well as a liberal regulatory environment. Wang and Wei (2010) indicate that similar zones have proved successful in the case of China. Establishment of mixed export processing zones for both domestic and foreign companies of different sectors could as well facilitate knowledge sharing. For countries like Kosovo with a high proportion of emigrants who present a potential pool of investors, export processing zones may target diaspora investors in particular.

In the next section we discuss the original contributions of this thesis.

6.4 Contribution to knowledge

This thesis makes several contributions to the economic literature on innovation and firm performance on the one hand and the literature investigating the impact of innovation on export performance of firms in transition economies on the other hand. In addition, for the first time it empirically analyses the impact of innovation on export performance of firms in Kosovo using recently collected new data.

First, it extends the literature on innovation and firm performance relationship in transition economies using the multistage CDM model by exploring the relevance of the degree of novelty. To our knowledge, it presents the first study to investigate the degrees of innovation novelty and its relationship with firm performance in a multistage model in transition economies. It shows that firms relying only on internal resources for innovation are more prone to incremental innovation, or imitating their competitors while firms relying on open innovation methods are more likely to engage in radical innovation.

Second, with respect to open innovation it adds another method of investigation by using the number of external partners for innovation as an alternative to indicators of different types of cooperation. It shows that the degree or the breadth of external cooperation drives the commercial success of products new to the market, which is not the case with products new to the firm (or incremental innovation, implying that firms should try to synergize the external knowledge through multiparty cooperation types rather than engaging in bilateral cooperation with specific organisations.

Third, it meaningfully extends the literature on innovation and firms' export performance by specifically examining the effect of the degree of novelty on export performance of firms in transition economies. It provides several sensitivity regressions to show the robustness of the results and the relevance of the degree of novelty. Findings show that previous studies combining the innovation indicators provide inaccurate interpretation of the innovation effects with, in turn, misleading policy recommendation. The effect of innovation increases with the degree of product novelty, suggesting that specific attention should be paid to the promotion of product innovation with higher degree of novelty.

Fourth, it contributes to the empirical literature by investigating the effects of domestic environment uncertainty on the export performance of firms in transition economies as hypothesised by the Uppsala model of international trade. It shows that an uncertain environment can also be utilised from a positive perspective. While policies aiming to establish a stable environment generally have a positive effect on both innovation and firm performance, findings suggest that export promotion policies and reforms in improving business environment should go hand in hand with one another in order to balance any losses from a potentially uncertain market environment.

Fifth, it is the first comprehensive analysis on the export performance of firms in transition economies that accounts for the heterogeneity of countries in terms of the progress of transition. We group countries based on the EBRD transition progress score which allows for large samples for each group of countries in order to increase the precision of results and controlling for the heterogeneous country effects within each group. Findings suggest that divergences in transition progress moderate the effects of most of the variables, implying that one cannot generalize results across all transition countries.

Sixth, for the purpose of this research, we have contributed to the development of the questionnaire for the survey of 600 firms in Kosovo undertaken by Riinvest Institute in 2013. We follow the CIS questionnaire to develop questions related to innovation output with respect to the degree of novelty (products new to the market and products new to the firm) and introduce a new quantitative measure of innovation expressing the number of new products introduced by firms in previous 36 months prior to the survey. The resulting dataset has enabled us to investigate the impact of innovation on export performance in Kosovo for the first time, accounting for the impact of products new to the market. In line with the findings for other transition economies, the results confirm the consistent effect of product innovation and also confirm the stronger effect of products new to the market. Additionally, we also investigate the effects of domestic macroeconomic uncertainty in terms of regulatory policies, which in line with the findings in the empirical investigation for other transition economies suggest that domestic environment uncertainty acts as a push factor behind export performance.

The next section discusses main limitations of this thesis.

6.5 Limitations

In conducting the research for this thesis we faced several limitations. First, the qualitative nature of survey data which is based on subjective responses of firms' managers provides the most important limitation of the empirical work. We note that the answers related to the overall business environment can be subject to their pessimistic or optimistic viewpoints so require cautious interpretation. However, as the perceptions of the environment shape the decisions of firms' managers, it is very important to account for their subjective viewpoints

Second, due to the cross-sectional nature of data used in this thesis we were not able to investigate the dynamic effects of innovation over a longer period as well as the feedback effects from innovation to performance and exporting. Although BEEPS dataset provides a panel of survey data conducted each three years since 1999, we were not able to use it due to the limited number of firms from each country included in the panel especially as our investigation involved splitting then data into different groupings of countries in transition. In addition, some questions have changed from one survey to another meaning that some the variables of interest would be omitted from the analysis.

Third, the firm performance measure in Chapter III was limited to one indicator alone, the sales growth, as the data on productivity and profit related measures were not available. Although the sales growth measure has been used by other authors as well, having other indicators of performance would have contributed to the robustness of results and enabled a more detailed examination of the relationship between innovation sales and performance. Provided that the data for transition economies is available, a study utilising different performance indicators should further investigate the relationship between innovation and firm performance accounting for the relevance of degrees of novelty.

Fourth, due to the absence of data in the CIS, BEEPS and Kosovo datasets, we could not further explore the relevance of export destination for the innovation-export performance relationship. In addition, there was no information on the creative efforts of managers and staff for innovation related activities. Information on the interactive inter-departmental engagement of staff for innovation, through brainstorming and other forms of creative idea finding would shed more light on the effects of joint internal team efforts on innovation. As some of these aspects go beyond the quantitative nature of this research, future research should complement it with qualitative investigations, adding a number of new questions of interest in the future surveys at the firm level.

6.6 Suggestions for future research

Despite a vast amount of literature on innovation and firm performance and on innovation and export performance, the complex process of innovation has not been completely explored in the context of transition economies. Due to data limitations and the scope of the thesis empirical contributions in Chapters III, IV and V only partially address the unexplored aspects. Consequently, we provide a set of recommendations for future research on the relationship between innovation and firm performance as well as export performance in the transition economies.

First, because the relationship between innovation and firm performance is dynamic and continuous, panel data should be utilised to explore the causality between innovation and firm performance, as well as innovation and export performance. As the CIS has been conducted in several rounds now, future research should try to establish a panel of CIS data that would add value to literature on innovation and firm performance. On the other hand, with the forthcoming BEEPS survey rounds, the BEEPS panel dataset will also increase in size, so future studies should try to utilise it, although this implies that studies would have to rely on a limited number of indicators common in all survey rounds.

Second, as the number of studies applying the CDM model of innovation and firm performance is increasing, and the inconclusiveness of some of the results continues, a meta-regression analysis along the methodological approach of Dimos and Pugh (2016) may provide a better insight into the relationships governing different stages of innovation and firm performance. By combining the results of research in different countries using different indicators it would shed more light on the robustness of the findings.

Third, with respect to the survey questionnaires, questions related to the managerial and creativity aspects of innovation should be included in the future surveys as they would add value to the analysis and enable investigation of the behavioural aspects and the role of managers/entrepreneurs in the innovation process. In the absence of such surveys, if possible, future studies should attempt to merge CIS and other survey data that provides additional information on the managerial and creativity aspects of innovation.

Fourth, despite the importance of quantitative analysis, a mixture of qualitative and quantitative research would shed more light on the process of innovation as well as the engagement of firms in the export markets. This would allow for the assessment of entrepreneurial behaviour with respect to innovation, exporting and overall firm performance. In a qualitative approach one can also investigate the effects of export promotion policies, an important information for policy makers to asses these policies and their effects. Alternatively, future firm level surveys should also include indicators expressing the effects of the export promotion policies.

Fifth, for the economy of Kosovo and countries at similar stage of economic development and reforms, where remittances and external financial income play a crucial role in sustaining their development, future studies should explore the effects of the Diaspora investments with respect to innovation and export market linkages. This would inform policymakers on how to better promote the transmission of diaspora financial and knowledge support into productive economic activity.

Finally, as up to date studies provide ambiguous findings with respect to learning by exporting which is indicated to depend on the relative development of export market, future surveys should identify exporting markets. Having such information, future studies can explore in more details the relationship between export performance and innovation. In addition, due to complexity of creating longitudinal data at the firm level, in future surveys export and innovation related questions should reflect different time lags in order to avoid any endogeneity bias.

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APPENDICES

Chapter III Appendices

Innovation and firm performance in transition economies: the relevance of novelty and open innovation

Chapter III Appendices

A3.1 Missing observations and collinearity diagnostics

A3.1.1 Whole sample variables - missing observations CIS 2004

```
. mdesc firmgr groupeu groupother eumarket othermarkets national abinn trademark marketdom
costfact knowfact nodemand small medium manuf services if y04==1
```

Variable	Missing	Total	Percent Missing
firmgr	0	35,120	0.00
groupeu	0	35,120	0.00
groupother	0	35,120	0.00
eumarket	1	35,120	0.00
othermarkets	1	35,120	0.00
national	2	35,120	0.01
abinn	11	35,120	0.03
trademark	11	35,120	0.03
marketdom	80	35,120	0.23
costfact	82	35,120	0.23
knowfact	73	35,120	0.21
nodemand	72	35,120	0.21
small	0	35,120	0.00
medium	0	35,120	0.00
manuf	0	35,120	0.00
services	0	35,120	0.00

A3.1.2 Whole sample variables - missing observations CIS 2006

```
. mdesc firmgr groupeu groupother eumarket othermarkets national abinn trademark marketdom
costfact knowfact nodemand small medium manuf services if y06==1
```

Variable	Missing	Total	Percent Missing
firmgr	0	40,245	0.00
groupeu	0	40,245	0.00
groupother	0	40,245	0.00
eumarket	28	40,245	0.07
othermarkets	28	40,245	0.07
national	28	40,245	0.07
abinn	28	40,245	0.07
trademark	29	40,245	0.07
marketdom	28	40,245	0.07
costfact	28	40,245	0.07
knowfact	28	40,245	0.07
nodemand	30	40,245	0.07
small	0	40,245	0.00
medium	0	40,245	0.00
manuf	0	40,245	0.00
services	0	40,245	0.00

A3.1.3 Data collinearity diagnostics

A3.1.3.a CDM Input stage variables – collinearity diagnostics

```
. collin coop fineu fingov groupeu groupother eumarket othermarket national abinn trademark
marketdom costfact knowfact nodemand small medium manuf services bg ee hu lt ro sk if prob==0
(obs=70,569)
                        SQRT                   R-
  Variable      VIF     VIF    Tolerance    Squared
----------------------------------------------------
      coop      1.54    1.24    0.6496      0.3504
     fineu      1.13    1.06    0.8845      0.1155
    fingov      1.24    1.12    0.8043      0.1957
   groupeu      1.17    1.08    0.8545      0.1455
groupother      1.04    1.02    0.9632      0.0368
  eumarket      1.37    1.17    0.7274      0.2726
othermarkets    1.22    1.11    0.8186      0.1814
  national      1.05    1.03    0.9498      0.0502
     abinn      1.47    1.21    0.6824      0.3176
 trademark      1.09    1.04    0.9158      0.0842
 marketdom      1.22    1.10    0.8195      0.1805
  costfact      1.15    1.07    0.8685      0.1315
  knowfact      1.14    1.07    0.8748      0.1252
  nodemand      1.05    1.02    0.9522      0.0478
     small      3.24    1.80    0.3091      0.6909
    medium      2.75    1.66    0.3641      0.6359
     manuf      1.78    1.33    0.5631      0.4369
  services      1.69    1.30    0.5929      0.4071
        bg      2.29    1.51    0.4369      0.5631
        ee      1.33    1.15    0.7538      0.2462
        hu      1.58    1.26    0.6326      0.3674
        lt      1.29    1.14    0.7726      0.2274
        ro      2.06    1.43    0.4856      0.5144
        sk      1.33    1.16    0.7491      0.2509
----------------------------------------------------
  Mean VIF      1.51
```

A3.1.3.b CDM Output stage variables – collinearity diagnostics

```
. collin innintern abinn prodivers skills cocus couni colab cocom cosu patapp designreg copyright
marinfo associnfo small medium manuf service groupeu groupother procesef costfact knowfact fineu
fingov if loginsale!=.
(obs=11,872)
                        SQRT                   R-
  Variable      VIF     VIF    Tolerance    Squared
----------------------------------------------------
 innintern      1.16    1.08    0.8600      0.1400
     abinn      1.15    1.07    0.8688      0.1312
 prodivers      1.11    1.06    0.8980      0.1020
    skills      1.09    1.05    0.9155      0.0845
     cocus      2.00    1.42    0.4989      0.5011
     couni      1.87    1.37    0.5350      0.4650
     colab      2.08    1.44    0.4801      0.5199
     cocom      1.93    1.39    0.5194      0.4806
      cosu      2.23    1.49    0.4484      0.5516
    patapp      1.25    1.12    0.7997      0.2003
 designreg      1.23    1.11    0.8153      0.1847
 copyright      1.10    1.05    0.9072      0.0928
   marinfo      1.12    1.06    0.8908      0.1092
 associnfo      1.03    1.02    0.9691      0.0309
     small      2.01    1.42    0.4966      0.5034
```

```
    medium      1.73    1.32    0.5780      0.4220
     manuf      2.12    1.46    0.4719      0.5281
  services      2.01    1.42    0.4975      0.5025
   groupeu      1.15    1.07    0.8703      0.1297
groupother      1.05    1.02    0.9539      0.0461
  procesef      1.26    1.12    0.7955      0.2045
  costfact      1.08    1.04    0.9294      0.0706
  knowfact      1.10    1.05    0.9132      0.0868
     fineu      1.11    1.05    0.9001      0.0999
    fingov      1.18    1.09    0.8486      0.1514
----------------------------------------------------
  Mean VIF      1.45
```

A3.2 CDM Input stage - the restricted model estimation

A3.2.1 Heckit two-step - the restricted model estimation CIS 2004

```
. heckman lninninv groupeu groupother eumarket othermarket national abinn trademark costfact
marketdom knowfact small medium manuf services bg ee hu lt ro sk if y04==1, twostep select(innact
= groupeu groupother eumarket othermarket national abinn trademark costfact marketdom knowfact
nodemand small medium manuf services bg ee hu lt ro sk) rhosigma

Heckman selection model -- two-step estimates   Number of obs     =     33,023
(regression model with sample selection)        Censored obs      =     25,420
                                                Uncensored obs    =      7,603
                                                Wald chi2(20)     =    2538.88
                                                Prob > chi2       =     0.0000
------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lninninv    |
     groupeu |   .6874184    .060538    11.36   0.000     .5687662    .8060707
  groupother |   .7458277   .1319111     5.65   0.000     .4872867    1.004369
    eumarket |   .2642058    .065849     4.01   0.000     .1351441    .3932675
othermarkets |   .4322465   .0606053     7.13   0.000     .3134623    .5510308
    national |   .3161812   .0691506     4.57   0.000     .1806486    .4517138
       abinn |   .6505348   .1039927     6.26   0.000     .4467129    .8543568
   trademark |   .4115588   .0582354     7.07   0.000     .2974195    .5256982
    costfact |  -.1801202   .0460516    -3.91   0.000    -.2703796   -.0898607
   marketdom |  -.0282472   .0218583    -1.29   0.196    -.0710887    .0145943
    knowfact |   -.097905   .0959586    -1.02   0.308    -.2859803    .0901703
       small |  -2.371325   .0649402   -36.52   0.000    -2.498605   -2.244044
      medium |  -1.255474   .0561103   -22.38   0.000    -1.365448     -1.1455
       manuf |   .1804583   .0736978     2.45   0.014     .0360132    .3249034
    services |   .3505383   .0785618     4.46   0.000     .1965601    .5045165
          bg |   -.872223   .0772501   -11.29   0.000     -1.02363   -.7208156
          ee |  -.1468898   .1078746    -1.36   0.173    -.3583201    .0645405
          hu |  -.1690813   .0818106    -2.07   0.039    -.3294272   -.0087355
          lt |  -.7578125   .1010047    -7.50   0.000    -.9557781    -.559847
          ro |  -.6892193   .0614522   -11.22   0.000    -.8096633   -.5687752
          sk |  -.1186163   .0853966    -1.39   0.165    -.2859905     .048758
       _cons |   11.51046   .1602968    71.81   0.000     11.19628    11.82463
-------------+----------------------------------------------------------------
innact       |
     groupeu |   .3517248   .0346653    10.15   0.000      .283782    .4196676
  groupother |   .4015927     .08477     4.74   0.000     .2354465    .5677389
    eumarket |   .3719876    .028274    13.16   0.000     .3165715    .4274036
othermarkets |   .4136935   .0330148    12.53   0.000     .3489856    .4784014
    national |    .385722   .0268719    14.35   0.000     .3330539      .43839
       abinn |   3.898989   .1463263    26.65   0.000     3.612194    4.185783
   trademark |   .8999072   .0348383    25.83   0.000     .8316253    .9681891
```

```
    costfact |   .0554676   .0225496     2.46   0.014     .0112712     .099664
   marketdom |   .2027301   .0094842    21.38   0.000     .1841415    .2213187
    knowfact |  -1.118522   .0333593   -33.53   0.000    -1.183905   -1.053139
    nodemand |  -.6600263    .038624   -17.09   0.000     -.735728   -.5843247
       small |  -.5676293   .0321832   -17.64   0.000    -.6307073   -.5045514
      medium |  -.2960299   .0311706    -9.50   0.000    -.3571231   -.2349367
       manuf |   .1890451   .0291973     6.47   0.000     .1318195    .2462708
    services |   .1958571   .0320474     6.11   0.000     .1330453     .258669
          bg |   -.526389   .0318323   -16.54   0.000    -.5887791   -.4639989
          ee |   .3265473   .0552157     5.91   0.000     .2183265     .434768
          hu |  -.4882514     .04023   -12.14   0.000    -.5671007   -.4094021
          lt |   -.344066    .052309    -6.58   0.000    -.4465898   -.2415422
          ro |  -.1625822    .029906    -5.44   0.000    -.2211969   -.1039675
          sk |  -.2794465   .0453498    -6.16   0.000    -.3683304   -.1905626
       _cons |  -.9926921    .046671   -21.27   0.000    -1.084166   -.9012186
-------------+----------------------------------------------------------------
mills        |
      lambda |   .1462574   .0824086     1.77   0.076    -.0152606    .3077754
-------------+----------------------------------------------------------------
         rho |    0.07885
       sigma |  1.8548393
------------------------------------------------------------------------------
```

A3.2.2 Heckit two-step - the restricted model estimation CIS 2006

```
. heckman lninninv groupeu groupother eumarket othermarket national abinn trademark costfact
marketdom knowfact small medium manuf services bg ee hu lt ro sk if y06==1, twostep select(innact
= groupeu groupother eumarket othermarket national abinn trademark costfact marketdom knowfact
nodemand small medium manuf services bg ee hu lt ro sk) rhosigma

Heckman selection model -- two-step estimates   Number of obs     =     37,555
(regression model with sample selection)        Censored obs      =     29,012
                                                Uncensored obs    =      8,543
                                                Wald chi2(20)     =    2389.51
                                                Prob > chi2       =     0.0000
------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lninninv    |
     groupeu |   .6142835   .0584671    10.51   0.000       .49969     .728877
  groupother |   .9005543   .1283539     7.02   0.000     .6489852    1.152123
    eumarket |    .059984   .0606282     0.99   0.322     -.058845    .1788131
othermarkets |   .2380703    .057325     4.15   0.000     .1257154    .3504253
    national |   .1355985   .0703985     1.93   0.054    -.0023801    .2735771
       abinn |   .5753448   .1020627     5.64   0.000     .3753056     .775384
   trademark |   .3760968   .0574009     6.55   0.000      .263593    .4886006
    costfact |  -.1735547    .044327    -3.92   0.000    -.2604339   -.0866754
   marketdom |  -.0028576   .0204947    -0.14   0.889    -.0430264    .0373112
    knowfact |  -.0994124   .0938496    -1.06   0.289    -.2833542    .0845294
       small |  -2.296306   .0635193   -36.15   0.000    -2.420802   -2.171811
      medium |  -1.242327   .0548657   -22.64   0.000    -1.349862   -1.134792
       manuf |   .0202376   .0676583     0.30   0.765    -.1123703    .1528455
    services |   .1810697   .0720233     2.51   0.012     .0399066    .3222329
          bg |  -.6580204   .0748624    -8.79   0.000    -.8047481   -.5112928
          ee |   .1727649    .087592     1.97   0.049     .0010878     .344442
          hu |  -.4200841   .0803205    -5.23   0.000    -.5775094   -.2626588
          lt |  -.6610461   .0967499    -6.83   0.000    -.8506723   -.4714198
          ro |  -.4686783   .0624589    -7.50   0.000    -.5910954   -.3462612
          sk |   .0040722   .0870797     0.05   0.963    -.1666009    .1747453
       _cons |   11.87717   .1366661    86.91   0.000      11.6093    12.14503
-------------+----------------------------------------------------------------
innact       |
     groupeu |   .2771351   .0325528     8.51   0.000     .2133328    .3409374
  groupother |   .2666332   .0792908     3.36   0.001     .1112261    .4220404
    eumarket |  -.0162109   .0288255    -0.56   0.574    -.0727077     .040286
```

```
othermarkets |   .1801436   .0313085     5.75   0.000     .1187802    .2415071
    national |   .2420746    .033234     7.28   0.000     .1769372     .307212
       abinn |   4.320119    .225276    19.18   0.000     3.878586    4.761651
   trademark |   .8572027   .0331933    25.82   0.000      .792145    .9222603
    costfact |   .0866849   .0214516     4.04   0.000     .0446405    .1287292
   marketdom |   .1582001   .0091248    17.34   0.000     .1403159    .1760843
    knowfact |  -1.155088   .0301249   -38.34   0.000    -1.214132   -1.096045
    nodemand |  -.6447484   .0354359   -18.19   0.000    -.7142016   -.5752953
       small |   -.624891    .031122   -20.08   0.000    -.6858889   -.5638931
      medium |  -.3068887   .0303452   -10.11   0.000    -.3663643   -.2474131
       manuf |   .2703618   .0268477    10.07   0.000     .2177414    .3229823
    services |   .2107999   .0295803     7.13   0.000     .1528236    .2687762
          bg |  -.5949622   .0306023   -19.44   0.000    -.6549416   -.5349827
          ee |   .3081832   .0474722     6.49   0.000     .2151394    .4012269
          hu |  -.6444963   .0384805   -16.75   0.000    -.7199168   -.5690758
          lt |  -.5414074   .0478407   -11.32   0.000    -.6351735   -.4476413
          ro |  -.2100505   .0291832    -7.20   0.000    -.2672486   -.1528525
          sk |   -.389309   .0414266    -9.40   0.000    -.4705036   -.3081144
       _cons |  -.5848012   .0423025   -13.82   0.000    -.6677126   -.5018899
-------------+----------------------------------------------------------------
mills        |
      lambda |   .1951183   .0807382     2.42   0.016     .0368744    .3533622
-------------+----------------------------------------------------------------
         rho |    0.10567
       sigma |  1.8464146
```

A3.2.3 Heckit two-step - the restricted model estimation CIS Pooled

```
. heckman lninninv groupeu groupother eumarket othermarket national abinn trademark costfact
marketdom knowfact small medium manuf services bg ee hu lt ro sk y06, twostep select(innact =
groupeu groupother eumarket othermarket national abinn trademark costfact marketdom knowfact
nodemand small medium manuf services bg ee hu lt ro sk) rhosigma

Heckman selection model -- two-step estimates   Number of obs     =     70,578
(regression model with sample selection)        Censored obs      =     54,432
                                                Uncensored obs    =     16,146
                                                Wald chi2(21)     =    4870.67
                                                Prob > chi2       =     0.0000
------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lninninv    |
     groupeu |    .641157   .0418982    15.30   0.000      .559038    .7232759
  groupother |   .8173958   .0920927     8.88   0.000     .6368974    .9978941
    eumarket |   .1012691   .0345409     2.93   0.003     .0335702    .1689681
othermarkets |   .3127457   .0392984     7.96   0.000     .2357221    .3897692
    national |   .0924628    .032001     2.89   0.004      .029742    .1551837
       abinn |   .6154857   .0732674     8.40   0.000     .4718843     .759087
   trademark |   .4050915   .0410855     9.86   0.000     .3245654    .4856177
    costfact |  -.1814919   .0319327    -5.68   0.000    -.2440789   -.1189049
   marketdom |  -.0136793   .0150087    -0.91   0.362    -.0430958    .0157371
    knowfact |  -.0976398   .0671082    -1.45   0.146    -.2291695      .03389
       small |  -2.328015   .0454787   -51.19   0.000    -2.417151   -2.238878
      medium |  -1.249761   .0392539   -31.84   0.000    -1.326697   -1.172825
       manuf |   .1340523   .0465447     2.88   0.004     .0428264    .2252782
    services |   .2976946   .0506288     5.88   0.000     .1984641    .3969252
          bg |  -.7530004    .053009   -14.21   0.000    -.8568962   -.6491046
          ee |   .0220274   .0641396     0.34   0.731    -.1036838    .1477386
          hu |  -.2958318   .0559083    -5.29   0.000    -.4054101   -.1862536
          lt |  -.6912764   .0688962   -10.03   0.000    -.8263104   -.5562424
          ro |  -.5651038   .0431572   -13.09   0.000    -.6496904   -.4805171
          sk |  -.0470842   .0604923    -0.78   0.436     -.165647    .0714786
         y06 |   .1748034   .0295274     5.92   0.000     .1169308     .232676
       _cons |   11.63947   .1008514   115.41   0.000      11.4418    11.83714
-------------+----------------------------------------------------------------
```

```
innact       |
     groupeu |   .3119911   .0236009    13.22   0.000     .2657342     .358248
  groupother |   .3218582   .0577953     5.57   0.000     .2085815    .4351349
    eumarket |   .1278715    .016304     7.84   0.000     .0959162    .1598269
othermarkets |   .2709932    .021756    12.46   0.000     .2283523    .3136342
    national |   .1449083   .0150628     9.62   0.000     .1153856    .1744309
       abinn |   4.063107    .121345    33.48   0.000     3.825276    4.300939
   trademark |   .8915785   .0239713    37.19   0.000     .8445956    .9385614
    costfact |   .0554272   .0153427     3.61   0.000      .025356    .0854984
   marketdom |   .1854636   .0065076    28.50   0.000     .1727091    .1982182
    knowfact |  -1.130334   .0223108   -50.66   0.000    -1.174062   -1.086605
    nodemand |  -.6454533   .0260294   -24.80   0.000      -.69647   -.5944366
       small |  -.6023926   .0222746   -27.04   0.000      -.64605   -.5587352
      medium |  -.3030903   .0216692   -13.99   0.000    -.3455612   -.2606194
       manuf |   .2341474   .0191167    12.25   0.000     .1966794    .2716154
    services |   .2016205   .0212377     9.49   0.000     .1599954    .2432456
          bg |  -.5570625   .0217877   -25.57   0.000    -.5997657   -.5143593
          ee |   .3547228   .0349077    10.16   0.000     .2863049    .4231407
          hu |  -.5382584   .0274616   -19.60   0.000    -.5920821   -.4844347
          lt |  -.4184151   .0350212   -11.95   0.000    -.4870554   -.3497748
          ro |  -.1799801   .0206842    -8.70   0.000    -.2205204   -.1394399
          sk |  -.3371199   .0303488   -11.11   0.000    -.3966024   -.2776374
       _cons |  -.7210558   .0302345   -23.85   0.000    -.7803143   -.6617972
-------------+----------------------------------------------------------------
mills        |
      lambda |   .1778563   .0577903     3.08   0.002     .0645893    .2911233
-------------+----------------------------------------------------------------
         rho |    0.09588
       sigma |   1.854941
------------------------------------------------------------------------------
```

A3.2.4 Heckman FIML – the restricted model estimation CIS 2004

```
. heckman lninninv groupeu groupother eumarket othermarket national knowabs trademark marketdom
costfact knowfact small medium manuf services bg ee hu lt ro sk if y04==1, select(innact =
groupeu groupother eumarket othermarket national abinn trademark marketdom costfact knowfact
nodemand small medium manuf services bg ee hu lt ro sk) vce(robust)

Iteration 0:   log pseudolikelihood = -25251.717
Iteration 1:   log pseudolikelihood = -25251.679
Iteration 2:   log pseudolikelihood = -25251.679
Heckman selection model                         Number of obs     =     33,023
(regression model with sample selection)        Censored obs      =     25,420
                                                Uncensored obs    =      7,603
                                                Wald chi2(20)     =    2398.40
Log pseudolikelihood = -25251.68                Prob > chi2       =     0.0000
------------------------------------------------------------------------------
             |               Robust
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lninninv    |
     groupeu |   .6859513     .06196    11.07   0.000      .564512    .8073906
  groupother |   .7446238   .1418804     5.25   0.000     .4665433    1.022704
    eumarket |   .2616226   .0662927     3.95   0.000     .1316914    .3915538
othermarkets |   .4300543   .0613397     7.01   0.000     .3098306    .5502779
    national |    .313594   .0695065     4.51   0.000     .1773637    .4498243
       abinn |   .6360655    .097164     6.55   0.000     .4456277    .8265034
   trademark |   .4076595   .0582758     7.00   0.000     .2934411     .521878
   marketdom |  -.0292644    .021653    -1.35   0.177    -.0717035    .0131747
    costfact |  -.1803898   .0452411    -3.99   0.000    -.2690606   -.0917189
    knowfact |  -.0920848   .0917697    -1.00   0.316    -.2719501    .0877805
       small |  -2.368416   .0661491   -35.80   0.000    -2.498066   -2.238767
      medium |  -1.254285   .0591557   -21.20   0.000    -1.370229   -1.138342
       manuf |   .1791613   .0730515     2.45   0.014     .0359829    .3223397
    services |   .3488773   .0793782     4.40   0.000     .1932989    .5044557
          bg |  -.8686234   .0721325   -12.04   0.000    -1.010001   -.7272462
          ee |  -.1484159   .1036327    -1.43   0.152    -.3515323    .0547004
```

```
          hu |  -.1665076   .0804897    -2.07   0.039    -.3242645   -.0087507
          lt |   -.756014   .1012792    -7.46   0.000    -.9545176   -.5575105
          ro |  -.6881195   .0638697   -10.77   0.000    -.8133019   -.5629371
          sk |  -.1169487   .0861654    -1.36   0.175    -.2858297    .0519324
       _cons |   11.52904   .1531103    75.30   0.000     11.22895    11.82914
-------------+----------------------------------------------------------------
innact       |
     groupeu |   .3512921   .0349526    10.05   0.000     .2827862    .4197979
  groupother |   .4045045   .0933185     4.33   0.000     .2216036    .5874054
    eumarket |   .3722757   .0285069    13.06   0.000     .3164032    .4281482
othermarkets |   .4131321   .0334328    12.36   0.000     .3476051    .4786591
    national |   .3851982   .0266793    14.44   0.000     .3329077    .4374887
       abinn |   3.893874   .1852796    21.02   0.000     3.530732    4.257015
   trademark |   .8998288   .0352517    25.53   0.000     .8307368    .9689208
   marketdom |   .2029511   .0093155    21.79   0.000     .1846931    .2212091
    costfact |   .0546122   .0230643     2.37   0.018      .009407    .0998174
    knowfact |  -1.116956   .0349073   -32.00   0.000    -1.185373   -1.048539
    nodemand |  -.6596424   .0418273   -15.77   0.000    -.7416225   -.5776624
       small |  -.5697366   .0321315   -17.73   0.000    -.6327131   -.5067601
      medium |  -.2969447   .0309213    -9.60   0.000    -.3575494   -.2363399
       manuf |   .1876619   .0290774     6.45   0.000     .1306712    .2446525
    services |   .1965761   .0318727     6.17   0.000     .1341068    .2590453
          bg |    -.52763   .0320479   -16.46   0.000    -.5904428   -.4648173
          ee |   .3240073   .0561622     5.77   0.000     .2139313    .4340832
          hu |  -.4903942   .0400231   -12.25   0.000    -.5688381   -.4119503
          lt |  -.3449771   .0525107    -6.57   0.000    -.4478961    -.242058
          ro |  -.1662806   .0302672    -5.49   0.000    -.2256033    -.106958
          sk |   -.283721   .0451016    -6.29   0.000    -.3721185   -.1953235
       _cons |  -.9886782   .0472191   -20.94   0.000    -1.081226   -.8961306
-------------+----------------------------------------------------------------
     /athrho |   .0720982   .0396649     1.82   0.069    -.0056437    .1498401
    /lnsigma |   .6176156   .0082613    74.76   0.000     .6014238    .6338074
-------------+----------------------------------------------------------------
         rho |   .0719735   .0394595                     -.0056436    .1487286
       sigma |   1.854501   .0153206                      1.824715    1.884773
      lambda |   .1334749   .0733662                     -.0103202    .2772701
------------------------------------------------------------------------------
Wald test of indep. eqns. (rho = 0): chi2(1) =     3.30   Prob > chi2 = 0.0691
```

A3.2.5 Heckman FIML – the restricted model estimation CIS 2006

```
. heckman lninninv groupeu groupother eumarket othermarket national abinn trademark marketdom
costfact knowfact small medium manuf services bg ee hu lt ro sk if y06==1, select(innact = groupeu
groupother eumarket othermarket national abinn trademark marketdom costfact knowfact nodemand small
medium manuf services bg ee hu lt ro sk) vce(robust)

Iteration 0:   log pseudolikelihood = -28886.858
Iteration 1:   log pseudolikelihood = -28886.811
Iteration 2:   log pseudolikelihood = -28886.811

Heckman selection model                         Number of obs     =     37,555
(regression model with sample selection)        Censored obs      =     29,012
                                                Uncensored obs    =      8,543
                                                Wald chi2(20)     =    2321.37
Log pseudolikelihood = -28886.81                Prob > chi2       =     0.0000
------------------------------------------------------------------------------
             |               Robust
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lninninv    |
     groupeu |   .6128472   .0611613    10.02   0.000     .4929732    .7327212
  groupother |   .8996912   .1451226     6.20   0.000     .6152561    1.184126
    eumarket |   .0600076    .061833     0.97   0.332    -.0611828    .1811979
othermarkets |   .2373136   .0579064     4.10   0.000     .1238191    .3508081
    national |   .1336724   .0710968     1.88   0.060    -.0056748    .2730196
       abinn |   .5588317   .0946426     5.90   0.000     .3733356    .7443278
   trademark |   .3714044    .056947     6.52   0.000     .2597903    .4830184
```

```
   marketdom |  -.0038534    .020138    -0.19   0.848    -.0433232    .0356164
    costfact |  -.1739431   .0436705    -3.98   0.000    -.2595358   -.0883504
    knowfact |  -.0918958   .0885909    -1.04   0.300    -.2655308    .0817392
       small |  -2.292643   .0639681   -35.84   0.000    -2.418018   -2.167268
      medium |  -1.240799   .0576521   -21.52   0.000    -1.353795   -1.127803
       manuf |   .0184993   .0654866     0.28   0.778     -.109852    .1468506
    services |   .1794218   .0720427     2.49   0.013     .0382207    .3206228
          bg |  -.6536233   .0721437    -9.06   0.000    -.7950223   -.5122243
          ee |   .1716935   .0834294     2.06   0.040     .0081749    .3352121
          hu |  -.4165885   .0787257    -5.29   0.000    -.5708881    -.262289
          lt |  -.6578224   .1014718    -6.48   0.000    -.8567035   -.4589413
          ro |  -.4671644   .0640129    -7.30   0.000    -.5926274   -.3417014
          sk |   .0063713   .0855133     0.07   0.941    -.1612317    .1739742
       _cons |   11.89532   .1315093    90.45   0.000     11.63756    12.15307
-------------+----------------------------------------------------------------
innact       |
     groupeu |   .2765068   .0322792     8.57   0.000     .2132408    .3397728
  groupother |   .2687664   .0800765     3.36   0.001     .1118193    .4257135
    eumarket |  -.0154479   .0285119    -0.54   0.588    -.0713302    .0404343
othermarkets |    .180975   .0311492     5.81   0.000     .1199236    .2420264
    national |    .240748   .0330872     7.28   0.000     .1758983    .3055977
       abinn |   4.302912   .2673417    16.10   0.000     3.778932    4.826892
   trademark |   .8603668   .0331626    25.94   0.000     .7953693    .9253644
   marketdom |   .1587026   .0091868    17.28   0.000     .1406969    .1767083
    costfact |   .0865816   .0221219     3.91   0.000     .0432235    .1299397
    knowfact |  -1.155063   .0305362   -37.83   0.000    -1.214912   -1.095213
    nodemand |   -.642209   .0378429   -16.97   0.000    -.7163798   -.5680382
       small |  -.6246673   .0312353   -20.00   0.000    -.6858874   -.5634472
      medium |  -.3071264   .0301631   -10.18   0.000    -.3662449   -.2480079
       manuf |   .2697321   .0268458    10.05   0.000     .2171153     .322349
    services |   .2114167   .0297043     7.12   0.000     .1531973    .2696361
          bg |  -.5974806   .0308744   -19.35   0.000    -.6579932   -.5369679
          ee |   .3045426   .0477132     6.38   0.000     .2110265    .3980586
          hu |   -.646697   .0384654   -16.81   0.000    -.7220877   -.5713063
          lt |  -.5447295   .0472607   -11.53   0.000    -.6373587   -.4521003
          ro |  -.2124912   .0295664    -7.19   0.000    -.2704402   -.1545422
          sk |  -.3910031   .0406374    -9.62   0.000     -.470651   -.3113552
       _cons |  -.5835517   .0421276   -13.85   0.000    -.6661202   -.5009833
-------------+----------------------------------------------------------------
     /athrho |   .0981786   .0395629     2.48   0.013     .0206367    .1757205
    /lnsigma |    .612944   .0079891    76.72   0.000     .5972856    .6286024
-------------+----------------------------------------------------------------
         rho |   .0978644    .039184                      .0206337     .173934
       sigma |   1.845858   .0147468                      1.817179    1.874988
      lambda |   .1806437   .0727093                       .038136    .3231513
------------------------------------------------------------------------------
Wald test of indep. eqns. (rho = 0): chi2(1) =     6.16   Prob > chi2 = 0.0131
```

A3.2.6 Heckman FIML – the restricted model estimation CIS Pooled

```
. heckman lninninv groupeu groupother eumarket othermarket national abinn trademark marketdom
costfact knowfact small medium manuf services y06 bg ee hu lt ro sk, select(innact = groupeu
groupother eumarket othermarket national abinn trademark marketdom costfact knowfact nodemand
small medium manuf services y06 bg ee hu lt ro sk) vce(robust)
Iteration 0:   log pseudolikelihood = -54292.459
Iteration 1:   log pseudolikelihood = -54292.385
Iteration 2:   log pseudolikelihood = -54292.385

Heckman selection model                         Number of obs     =     70,578
(regression model with sample selection)        Censored obs      =     54,432
                                                Uncensored obs    =     16,146
                                                Wald chi2(21)     =    4604.41
Log pseudolikelihood = -54292.38                Prob > chi2       =     0.0000
------------------------------------------------------------------------------
             |               Robust
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lninninv    |
     groupeu |   .6384765   .0434163    14.71   0.000     .5533821    .7235709
  groupother |   .8156503    .101915     8.00   0.000     .6159005      1.0154
    eumarket |   .0993057   .0346379     2.87   0.004     .0314166    .1671948
othermarkets |   .3101686   .0397816     7.80   0.000      .232198    .3881392
    national |   .0906401   .0319349     2.84   0.005     .0280488    .1532314
       abinn |   .5873958   .0685315     8.57   0.000     .4530764    .7217151
   trademark |   .3973098   .0409408     9.70   0.000     .3170673    .4775523
   marketdom |  -.0156354   .0148101    -1.06   0.291    -.0446626    .0133917
    costfact |  -.1815542   .0314477    -5.77   0.000    -.2431905   -.1199179
    knowfact |  -.0856228   .0639354    -1.34   0.181    -.2109339    .0396883
       small |  -2.322234   .0460847   -50.39   0.000    -2.412558    -2.23191
      medium |  -1.247467    .041383   -30.14   0.000    -1.328577   -1.166358
       manuf |   .1307181    .045175     2.89   0.004     .0421768    .2192595
    services |   .2941951   .0506874     5.80   0.000     .1948495    .3935406
         y06 |   .1799412   .0296898     6.06   0.000     .1217503    .2381321
          bg |   -.746311   .0501863   -14.87   0.000    -.8446744   -.6479476
          ee |   .0186024   .0603368     0.31   0.758    -.0996555    .1368603
          hu |   -.291467    .055037    -5.30   0.000    -.3993375   -.1835964
          lt |  -.6878737   .0707993    -9.72   0.000    -.8266378   -.5491097
          ro |  -.5634148   .0444232   -12.68   0.000    -.6504826    -.476347
          sk |  -.0439941    .059902    -0.73   0.463    -.1613999    .0734116
       _cons |   11.67038   .0975167   119.68   0.000     11.47925    11.86151
-------------+----------------------------------------------------------------
innact       |
     groupeu |    .311758   .0236355    13.19   0.000     .2654334    .3580827
  groupother |   .3236605   .0614524     5.27   0.000     .2032161     .444105
    eumarket |   .1265123   .0164151     7.71   0.000     .0943394    .1586853
othermarkets |   .2676652   .0219304    12.21   0.000     .2246825    .3106479
    national |   .1516712   .0152628     9.94   0.000     .1217566    .1815859
       abinn |   4.057267   .1510006    26.87   0.000     3.761311    4.353222
   trademark |   .8931383   .0240755    37.10   0.000     .8459512    .9403253
   marketdom |   .1844599   .0064493    28.60   0.000     .1718194    .1971003
    costfact |   .0607342   .0157122     3.87   0.000     .0299388    .0915296
    knowfact |  -1.131647   .0229699   -49.27   0.000    -1.176667   -1.086627
    nodemand |  -.6444711   .0279705   -23.04   0.000    -.6992922   -.5896499
       small |  -.6077532   .0223264   -27.22   0.000    -.6515121   -.5639944
      medium |  -.3072213    .021537   -14.26   0.000    -.3494329   -.2650096
       manuf |    .228162   .0191108    11.94   0.000     .1907055    .2656185
    services |   .1961922   .0212607     9.23   0.000      .154522    .2378624
         y06 |   .0690654   .0138515     4.99   0.000     .0419171    .0962138
          bg |  -.5627039   .0219533   -25.63   0.000    -.6057316   -.5196762
          ee |    .346259   .0352106     9.83   0.000     .2772475    .4152704
          hu |  -.5458716   .0273884   -19.93   0.000    -.5995518   -.4921914
          lt |  -.4282274   .0352064   -12.16   0.000    -.4972307   -.3592241
          ro |  -.1866813   .0209241    -8.92   0.000    -.2276919   -.1456708
          sk |  -.3448783   .0299496   -11.52   0.000    -.4035784   -.2861782
       _cons |  -.7453185   .0305332   -24.41   0.000    -.8051623   -.6854746
-------------+----------------------------------------------------------------
```

```
    /athrho |   .0828282    .028209     2.94   0.003     .0275396    .1381169
   /lnsigma |   .6174175   .0057352   107.65   0.000     .6061767    .6286583
-------------+----------------------------------------------------------------
         rho |   .0826393   .0280164                      .0275326    .1372453
       sigma |   1.854134   .0106338                      1.833408    1.875093
      lambda |   .1532244   .0521326                      .0510463    .2554025
------------------------------------------------------------------------------
Wald test of indep. eqns. (rho = 0): chi2(1) =     8.62   Prob > chi2 = 0.0033
```

A3.3 CDM input stage - Probit estimation

A3.3.1 Probit estimation CIS 2004

```
. probit innact groupeu groupother eumarket othermarkets national abinn trademark costfact
marketdom knowfact nodemand small medium manuf services bg ee hu lt ro sk if y04==1, vce (robust)

Iteration 0:   log pseudolikelihood = -17817.834
Iteration 1:   log pseudolikelihood = -9881.1833
Iteration 2:   log pseudolikelihood = -9786.4323
Iteration 3:   log pseudolikelihood = -9776.3398
Iteration 4:   log pseudolikelihood =  -9776.125
Iteration 5:   log pseudolikelihood = -9776.1249

Probit regression                               Number of obs     =     33,023
                                                Wald chi2(21)     =    3691.18
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -9776.1249               Pseudo R2         =     0.4513
------------------------------------------------------------------------------
             |               Robust
      innact |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     groupeu |   .3517248    .034934    10.07   0.000     .2832553    .4201942
  groupother |   .4015927   .0932517     4.31   0.000     .2188227    .5843627
    eumarket |   .3719876   .0285131    13.05   0.000      .316103    .4278721
othermarkets |   .4136935   .0334408    12.37   0.000     .3481507    .4792362
    national |    .385722   .0266747    14.46   0.000     .3334404    .4380035
       abinn |   3.898984   .1859196    20.97   0.000     3.534588    4.263379
   trademark |   .8999072   .0352404    25.54   0.000     .8308372    .9689772
    costfact |   .0554676   .0230675     2.40   0.016     .0102562     .100679
   marketdom |   .2027301   .0093171    21.76   0.000     .1844689    .2209913
    knowfact |  -1.118522   .0348989   -32.05   0.000    -1.186923   -1.050122
    nodemand |  -.6600263   .0418523   -15.77   0.000    -.7420553   -.5779974
       small |  -.5676293    .032097   -17.68   0.000    -.6305383   -.5047203
      medium |  -.2960299   .0309144    -9.58   0.000     -.356621   -.2354388
       manuf |   .1890452   .0290474     6.51   0.000     .1321133     .245977
    services |   .1958571   .0318904     6.14   0.000     .1333531    .2583611
          bg |   -.526389   .0320385   -16.43   0.000    -.5891834   -.4635946
          ee |   .3265472   .0561571     5.81   0.000     .2164813    .4366131
          hu |  -.4882514   .0400343   -12.20   0.000    -.5667172   -.4097856
          lt |   -.344066   .0524904    -6.55   0.000    -.4469453   -.2411868
          ro |  -.1625822   .0300839    -5.40   0.000    -.2215456   -.1036188
          sk |  -.2794465   .0449887    -6.21   0.000    -.3676227   -.1912703
       _cons |  -.9926921   .0471011   -21.08   0.000    -1.085008   -.9003757
------------------------------------------------------------------------------
```

A3.3.1.a Test for correct classification

```
. estat classification

Probit model for innact

              -------- True --------
Classified |         D            ~D  |      Total
-----------+--------------------------+-----------
     +     |      4137           466  |       4603
     -     |      3466         24954  |      28420
-----------+--------------------------+-----------
   Total   |      7603         25420  |      33023

Classified + if predicted Pr(D) >= .5
True D defined as innact != 0
--------------------------------------------------
Sensitivity                     Pr( +| D)   54.41%
Specificity                     Pr( -|~D)   98.17%
Positive predictive value       Pr( D| +)   89.88%
Negative predictive value       Pr(~D| -)   87.80%
--------------------------------------------------
False + rate for true ~D        Pr( +|~D)    1.83%
False - rate for true D         Pr( -| D)   45.59%
False + rate for classified +   Pr(~D| +)   10.12%
False - rate for classified -   Pr( D| -)   12.20%
--------------------------------------------------
Correctly classified                        88.09%
```

A3.3.1.b Test for correct specification

```
. linktest

Iteration 0:   log likelihood = -17817.834
Iteration 1:   log likelihood = -9836.2098
Iteration 2:   log likelihood = -9782.0911
Iteration 3:   log likelihood = -9776.2237
Iteration 4:   log likelihood = -9776.1246
Iteration 5:   log likelihood = -9776.1246

Probit regression                               Number of obs     =     33,023
                                                LR chi2(2)        =   16083.42
                                                Prob > chi2       =     0.0000
Log likelihood = -9776.1246                     Pseudo R2         =     0.4513

------------------------------------------------------------------------------
      innact |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   .9997064   .0194864    51.30   0.000     .9615137    1.037899
      _hatsq |  -.0002276   .0098968    -0.02   0.982    -.0196249    .0191697
       _cons |   .0000267   .0167204     0.00   0.999    -.0327447    .0327981
```

A3.3.2 Probit estimation CIS 2006

```
. probit innact groupeu groupother eumarket othermarkets national abinn trademark costfact
marketdom knowfact nodemand small medium manuf services bg ee hu lt ro sk if y06==1, vce (robust)

Iteration 0:   log pseudolikelihood = -20137.481
Iteration 1:   log pseudolikelihood = -11675.155
Iteration 2:   log pseudolikelihood = -11562.977
Iteration 3:   log pseudolikelihood = -11547.505
Iteration 4:   log pseudolikelihood = -11546.691
Iteration 5:   log pseudolikelihood = -11546.691

Probit regression                               Number of obs     =     37,555
                                                Wald chi2(21)     =    4225.63
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -11546.691               Pseudo R2         =     0.4266
------------------------------------------------------------------------------
             |               Robust
      innact |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     groupeu |   .2771351    .032262     8.59   0.000     .2139028    .3403674
  groupother |   .2666332   .0799269     3.34   0.001     .1099794     .423287
    eumarket |  -.0162109   .0285229    -0.57   0.570    -.0721147     .039693
othermarkets |   .1801436   .0311656     5.78   0.000     .1190602    .2412271
    national |   .2420746   .0330878     7.32   0.000     .1772236    .3069256
       abinn |   4.320085   .2725118    15.85   0.000     3.785971    4.854198
   trademark |   .8572027   .0331113    25.89   0.000     .7923058    .9220996
    costfact |   .0866849   .0221402     3.92   0.000     .0432909    .1300789
   marketdom |   .1582001   .0091934    17.21   0.000     .1401813    .1762189
    knowfact |  -1.155088   .0305631   -37.79   0.000    -1.214991   -1.095186
    nodemand |  -.6447484   .0378262   -17.05   0.000    -.7188863   -.5706104
       small |   -.624891   .0312377   -20.00   0.000    -.6861157   -.5636663
      medium |  -.3068887   .0301545   -10.18   0.000    -.3659905   -.2477869
       manuf |   .2703618   .0268525    10.07   0.000     .2177318    .3229917
    services |   .2107998   .0297319     7.09   0.000     .1525264    .2690733
          bg |  -.5949622   .0308859   -19.26   0.000    -.6554974   -.5344269
          ee |   .3081831   .0476636     6.47   0.000     .2147642    .4016021
          hu |  -.6444963   .0385101   -16.74   0.000    -.7199747   -.5690179
          lt |  -.5414074   .0472886   -11.45   0.000    -.6340915   -.4487234
          ro |  -.2100506    .029544    -7.11   0.000    -.2679556   -.1521455
          sk |   -.389309    .040643    -9.58   0.000    -.4689677   -.3096503
       _cons |  -.5848011   .0421433   -13.88   0.000    -.6674004   -.5022019
```

A3.3.2.a Test for correct classification

```
. estat classification

Probit model for innact

              -------- True --------
Classified |         D            ~D  |      Total
-----------+--------------------------+-----------
     +     |      4325           558  |       4883
     -     |      4218         28454  |      32672
-----------+--------------------------+-----------
   Total   |      8543         29012  |      37555

Classified + if predicted Pr(D) >= .5
True D defined as innact != 0
--------------------------------------------------
Sensitivity                     Pr( +| D)   50.63%
Specificity                     Pr( -|~D)   98.08%
Positive predictive value       Pr( D| +)   88.57%
```

```
Negative predictive value       Pr(~D| -)   87.09%
--------------------------------------------------
False + rate for true ~D        Pr( +|~D)    1.92%
False - rate for true D         Pr( -| D)   49.37%
False + rate for classified +   Pr(~D| +)   11.43%
False - rate for classified -   Pr( D| -)   12.91%
--------------------------------------------------
Correctly classified                        87.28%
```

A3.3.2.b Test for correct specification

```
. linktest

Iteration 0:   log likelihood = -20137.481
Iteration 1:   log likelihood = -11604.551
Iteration 2:   log likelihood = -11558.187
Iteration 3:   log likelihood =   -11546.9
Iteration 4:   log likelihood = -11545.986
Iteration 5:   log likelihood = -11545.982
Iteration 6:   log likelihood = -11545.982
Probit regression                               Number of obs     =     37,555
                                                LR chi2(2)        =   17183.00
                                                Prob > chi2       =     0.0000
Log likelihood = -11545.982                     Pseudo R2         =     0.4266

------------------------------------------------------------------------------
      innact |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   1.023256   .0253112    40.43   0.000     .9736472    1.072865
      _hatsq |   .0145365   .0125171     1.16   0.246    -.0099967    .0390696
       _cons |   .0034132   .0164429     0.21   0.836    -.0288142    .0356406
```

A3.3.3 Probit estimation - CIS Pooled

```
. probit innact groupeu groupother eumarket othermarkets national abinn trademark costfact
marketdom knowfact nodemand small medium manuf services bg ee hu lt ro sk y06, vce (robust)

Iteration 0:   log pseudolikelihood = -37955.692
Iteration 1:   log pseudolikelihood = -21677.161
Iteration 2:   log pseudolikelihood = -21463.347
Iteration 3:   log pseudolikelihood = -21438.376
Iteration 4:   log pseudolikelihood = -21437.452
Iteration 5:   log pseudolikelihood = -21437.446
Iteration 6:   log pseudolikelihood = -21437.446
Probit regression                               Number of obs     =     70,578
                                                Wald chi2(22)     =    7724.40
                                                Prob > chi2       =     0.0000
Log pseudolikelihood = -21437.446               Pseudo R2         =     0.4352
------------------------------------------------------------------------------
             |               Robust
      innact |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     groupeu |   .3122409   .0236238    13.22   0.000      .265939    .3585428
  groupother |   .3208974   .0613676     5.23   0.000     .2006191    .4411758
    eumarket |   .1260936   .0164288     7.68   0.000     .0938937    .1582935
othermarkets |   .2675017   .0219366    12.19   0.000     .2245069    .3104966
    national |   .1525359   .0152599    10.00   0.000     .1226269    .1824448
       abinn |    4.06654   .1522582    26.71   0.000      3.76812    4.364961
   trademark |    .891713   .0240712    37.04   0.000     .8445343    .9388918
    costfact |   .0612243   .0157212     3.89   0.000     .0304113    .0920373
   marketdom |   .1841111   .0064517    28.54   0.000     .1714661    .1967561
    knowfact |  -1.132485    .022975   -49.29   0.000    -1.177515   -1.087455
    nodemand |  -.6458602   .0279708   -23.09   0.000    -.7006819   -.5910384
```

```
       small |  -.6067613    .022333   -27.17   0.000    -.6505332   -.5629894
      medium |   -.306628   .0215335   -14.24   0.000    -.3488328   -.2644232
       manuf |   .2290426   .0191069    11.99   0.000     .1915938    .2664914
    services |    .195378   .0212741     9.18   0.000     .1536816    .2370745
          bg |  -.5608261   .0219494   -25.55   0.000    -.6038461   -.5178061
          ee |   .3491859   .0351875     9.92   0.000     .2802197    .4181522
          hu |  -.5435122   .0274055   -19.83   0.000     -.597226   -.4897983
          lt |  -.4261625   .0352094   -12.10   0.000    -.4951716   -.3571534
          ro |   -.183509   .0208621    -8.80   0.000     -.224398   -.1426201
          sk |    -.34201   .0299252   -11.43   0.000    -.4006623   -.2833577
         y06 |    .070575   .0138351     5.10   0.000     .0434587    .0976912
       _cons |  -.7487693   .0304982   -24.55   0.000    -.8085447    -.688994
```

A3.3.3.a Test for correct classification

```
. estat classification

Probit model for innact

              -------- True --------
Classified |         D            ~D  |      Total
-----------+--------------------------+-----------
     +     |      8432           979  |       9411
     -     |      7714         53453  |      61167
-----------+--------------------------+-----------
   Total   |     16146         54432  |      70578

Classified + if predicted Pr(D) >= .5
True D defined as innact != 0
--------------------------------------------------
Sensitivity                     Pr( +| D)   52.22%
Specificity                     Pr( -|~D)   98.20%
Positive predictive value       Pr( D| +)   89.60%
Negative predictive value       Pr(~D| -)   87.39%
--------------------------------------------------
False + rate for true ~D        Pr( +|~D)    1.80%
False - rate for true D         Pr( -| D)   47.78%
False + rate for classified +   Pr(~D| +)   10.40%
False - rate for classified -   Pr( D| -)   12.61%
--------------------------------------------------
Correctly classified                        87.68%
```

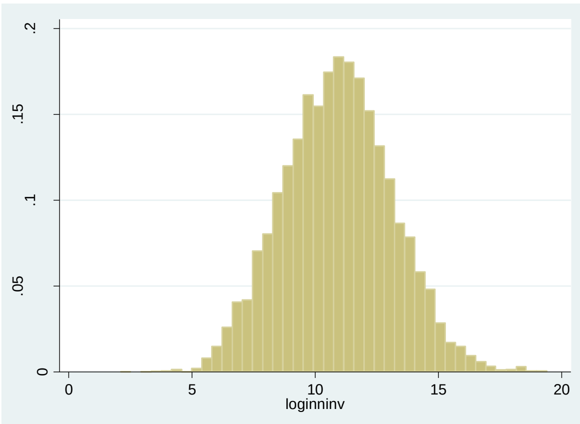
A3.3.3.b Test for correct specification

```
. linktest

Iteration 0:   log likelihood = -37955.692
Iteration 1:   log likelihood = -21554.327
Iteration 2:   log likelihood = -21453.653
Iteration 3:   log likelihood = -21437.604
Iteration 4:   log likelihood =   -21437.2
Iteration 5:   log likelihood = -21437.199

Probit regression                               Number of obs     =     70,578
                                                LR chi2(2)        =   33036.99
                                                Prob > chi2       =     0.0000
Log likelihood = -21437.199                     Pseudo R2         =     0.4352

------------------------------------------------------------------------------
      innact |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
```

```
        _hat |   1.00757   .0152383    66.12   0.000     .9777039    1.037437
      _hatsq |   .005338   .0076741     0.70   0.487    -.0097029    .0203789
       _cons |  .0002326   .0116505     0.02   0.984     -.022602    .0230671
```

A3.4 Heckman FIML estimation - CDM input stage

A3.4.0 Histogram - natural logarithm of innovation investments (*lninninv*)



A3.4.1 Heckman FIML CIS 2004

```
. heckman lninninv coop fineu fingov groupeu groupother eumarket othermarket national abinn
trademark marketdom costfact knowfact small medium manuf services bg ee hu lt ro sk if y04==1,
select(innact = groupeu groupother eumarket othermarket national abinn trademark marketdom
costfact knowfact nodemand small medium manuf services bg ee hu lt ro sk) vce(robust)

Iteration 0:   log pseudolikelihood = -25099.995
Iteration 1:   log pseudolikelihood = -25099.972
Iteration 2:   log pseudolikelihood = -25099.972
Heckman selection model                         Number of obs     =     33,019
(regression model with sample selection)        Censored obs      =     25,420
                                                Uncensored obs    =      7,599
                                                Wald chi2(23)     =    2818.95
Log pseudolikelihood = -25099.97                Prob > chi2       =     0.0000
------------------------------------------------------------------------------
             |               Robust
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lninninv    |
        coop |   .4123384   .0463624     8.89   0.000     .3214698     .503207
       fineu |   .5600309   .0878789     6.37   0.000     .3877915    .7322703
      fingov |   .6684777   .0665223    10.05   0.000     .5380963    .7988591
     groupeu |   .7081475   .0618481    11.45   0.000     .5869275    .8293675
  groupother |   .7693306   .1414002     5.44   0.000     .4921914     1.04647
    eumarket |    .233336   .0650233     3.59   0.000     .1058927    .3607793
othermarkets |   .3837604   .0599219     6.40   0.000     .2663156    .5012053
    national |     .30222   .0684786     4.41   0.000     .1680044    .4364356
       abinn |    .472542   .0960837     4.92   0.000     .2842214    .6608626
   trademark |   .3326758   .0572814     5.81   0.000     .2204063    .4449453
   marketdom |  -.0377702   .0212065    -1.78   0.075    -.0793343    .0037939
    costfact |  -.1817393   .0443895    -4.09   0.000    -.2687411   -.0947374
    knowfact |  -.0973115   .0895822    -1.09   0.277    -.2728895    .0782665
       small |  -2.235314   .0656747   -34.04   0.000    -2.364034   -2.106593
      medium |  -1.189353   .0583275   -20.39   0.000    -1.303672   -1.075033
       manuf |   .1818992    .071671     2.54   0.011     .0414265    .3223719
    services |   .2830077   .0777889     3.64   0.000     .1305442    .4354712
          bg |   -.716694   .0724171    -9.90   0.000    -.8586289    -.574759
          ee |  -.0855593   .1024418    -0.84   0.404    -.2863415     .115223
          hu |  -.2456469   .0790554    -3.11   0.002    -.4005928   -.0907011
          lt |   -.715466   .0998725    -7.16   0.000    -.9112124   -.5197195
          ro |  -.5566809   .0635447    -8.76   0.000    -.6812263   -.4321355
          sk |   -.028612   .0851815    -0.34   0.737    -.1955647    .1383407
       _cons |    11.2738   .1509304    74.70   0.000     10.97798    11.56962
```

```
-------------+----------------------------------------------------------------
innact       |
     groupeu |   .3502466   .0349567    10.02   0.000     .2817326    .4187605
  groupother |   .4042451   .0933249     4.33   0.000     .2213317    .5871584
    eumarket |   .3725069   .0285177    13.06   0.000     .3166133    .4284005
othermarkets |   .4131791   .0334408    12.36   0.000     .3476365    .4787218
    national |    .385301   .0266887    14.44   0.000     .3329921    .4376099
       abinn |   3.894785   .1853608    21.01   0.000     3.531484    4.258085
   trademark |   .9005065   .0352444    25.55   0.000     .8314287    .9695844
   marketdom |    .202795   .0093179    21.76   0.000     .1845322    .2210578
    costfact |   .0543828    .023071     2.36   0.018     .0091644    .0996012
    knowfact |  -1.116638   .0349088   -31.99   0.000    -1.185058   -1.048219
    nodemand |  -.6596096   .0418268   -15.77   0.000    -.7415886   -.5776305
       small |  -.5682795   .0321384   -17.68   0.000    -.6312697   -.5052894
      medium |  -.2951125    .030927    -9.54   0.000    -.3557283   -.2344968
       manuf |   .1881687   .0290926     6.47   0.000     .1311483    .2451892
    services |   .1962747   .0318921     6.15   0.000     .1337674     .258782
          bg |   -.527209     .03204   -16.45   0.000    -.5900062   -.4644119
          ee |   .3248064   .0561657     5.78   0.000     .2147238    .4348891
          hu |  -.4897938   .0400222   -12.24   0.000    -.5682359   -.4113516
          lt |  -.3443727   .0525021    -6.56   0.000    -.4472749   -.2414705
          ro |  -.1670033   .0302241    -5.53   0.000    -.2262413   -.1077652
          sk |  -.2825978   .0450734    -6.27   0.000    -.3709401   -.1942555
       _cons |   -.990686   .0471983   -20.99   0.000    -1.083193   -.8981789
-------------+----------------------------------------------------------------
     /athrho |   .0568595    .039709     1.43   0.152    -.0209687    .1346877
    /lnsigma |   .5989983   .0082814    72.33   0.000     .5827672    .6152295
-------------+----------------------------------------------------------------
         rho |   .0567983   .0395809                     -.0209657    .1338791
       sigma |   1.820295   .0150745                      1.790988    1.850081
      lambda |   .1033896   .0721666                     -.0380543    .2448336
------------------------------------------------------------------------------
Wald test of indep. eqns. (rho = 0): chi2(1) =     2.05   Prob > chi2 = 0.1522
```

A3.4.2 Heckman FIML CIS 2006

```
. heckman lninninv coop fineu fingov groupeu groupother eumarket othermarket national abinn
trademark marketdom costfact knowfact small medium manuf services bg ee hu lt ro sk if y06==1,
select(innact= groupeu groupother eumarket othermarket national abinn trademark marketdom
costfact knowfact nodemand small medium manuf services bg ee hu lt ro sk) vce(robust)

Iteration 0:   log pseudolikelihood = -28713.203
Iteration 1:   log pseudolikelihood = -28713.125
Iteration 2:   log pseudolikelihood = -28713.125
Heckman selection model                         Number of obs     =     37,550
(regression model with sample selection)        Censored obs      =     29,012
                                                Uncensored obs    =      8,538
                                                Wald chi2(23)     =    2849.16
Log pseudolikelihood = -28713.12                Prob > chi2       =     0.0000
------------------------------------------------------------------------------
             |               Robust
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lninninv    |
        coop |   .3640371   .0446445     8.15   0.000     .2765354    .4515387
       fineu |   .4925997   .0717717     6.86   0.000     .3519298    .6332697
      fingov |   .6956325   .0608487    11.43   0.000     .5763712    .8148939
     groupeu |   .6482641   .0603258    10.75   0.000     .5300277    .7665005
  groupother |   .9122401   .1438678     6.34   0.000     .6302645    1.194216
    eumarket |   .0571975     .06076     0.94   0.347      -.06189    .1762849
othermarkets |   .1929109   .0569083     3.39   0.001     .0813728     .304449
    national |   .1201246   .0699566     1.72   0.086    -.0169877     .257237
       abinn |   .4130694   .0897591     4.60   0.000     .2371447     .588994
   trademark |   .2927226   .0556606     5.26   0.000     .1836298    .4018154
   marketdom |  -.0137963   .0196747    -0.70   0.483    -.0523581    .0247654
    costfact |  -.1727361   .0428665    -4.03   0.000    -.2567528   -.0887193
    knowfact |  -.1005107    .085826    -1.17   0.242    -.2687266    .0677052
```

```
       small |  -2.165613   .0626135   -34.59   0.000    -2.288333   -2.042893
      medium |  -1.171623   .0564945   -20.74   0.000     -1.28235   -1.060896
       manuf |  -.0465692   .0648514    -0.72   0.473    -.1736755    .0805372
    services |   .0981912   .0708797     1.39   0.166    -.0407305    .2371129
          bg |  -.5016096   .0722723    -6.94   0.000    -.6432606   -.3599586
          ee |   .2316035   .0829409     2.79   0.005     .0690424    .3941646
          hu |  -.4859635   .0766459    -6.34   0.000    -.6361866   -.3357403
          lt |  -.6187956   .0988877    -6.26   0.000     -.812612   -.4249792
          ro |  -.3463587   .0634259    -5.46   0.000    -.4706712   -.2220462
          sk |   .0908014   .0841965     1.08   0.281    -.0742207    .2558235
       _cons |   11.66706   .1280329    91.13   0.000     11.41612      11.918
-------------+----------------------------------------------------------------
innact       |
     groupeu |   .2771214   .0322751     8.59   0.000     .2138635    .3403794
  groupother |   .2685549   .0800569     3.35   0.001     .1116462    .4254636
    eumarket |  -.0151814    .028513    -0.53   0.594    -.0710658    .0407031
othermarkets |   .1800794   .0311625     5.78   0.000     .1190021    .2411568
    national |   .2410921   .0330866     7.29   0.000     .1762435    .3059407
       abinn |   4.303627   .2676841    16.08   0.000     3.778976    4.828279
   trademark |   .8606298   .0331752    25.94   0.000     .7956076    .9256521
   marketdom |    .158227   .0091906    17.22   0.000     .1402139    .1762402
    costfact |   .0861295    .022132     3.89   0.000     .0427516    .1295075
    knowfact |  -1.154327   .0305359   -37.80   0.000    -1.214176   -1.094478
    nodemand |  -.6425966   .0378287   -16.99   0.000    -.7167396   -.5684537
       small |  -.6246464   .0312439   -19.99   0.000    -.6858832   -.5634095
      medium |  -.3074581   .0301651   -10.19   0.000    -.3665807   -.2483356
       manuf |   .2689911   .0268481    10.02   0.000     .2163699    .3216123
    services |   .2107181   .0297077     7.09   0.000      .152492    .2689442
          bg |  -.5966614   .0308733   -19.33   0.000     -.657172   -.5361508
          ee |   .3050365    .047701     6.39   0.000     .2115442    .3985288
          hu |  -.6456027   .0384652   -16.78   0.000     -.720993   -.5702123
          lt |  -.5432332    .047256   -11.50   0.000    -.6358532   -.4506131
          ro |  -.2128983   .0295667    -7.20   0.000    -.2708479   -.1549486
          sk |  -.3901289   .0406287    -9.60   0.000    -.4697596   -.3104982
       _cons |  -.5830807   .0421256   -13.84   0.000    -.6656454   -.5005159
-------------+----------------------------------------------------------------
     /athrho |   .0867057   .0375581     2.31   0.021     .0130932    .1603181
    /lnsigma |   .5938098     .00798    74.41   0.000     .5781693    .6094503
-------------+----------------------------------------------------------------
         rho |    .086489   .0372771                      .0130924    .1589586
       sigma |   1.810874   .0144508                      1.782772     1.83942
      lambda |   .1566208   .0677874                      .0237599    .2894817
------------------------------------------------------------------------------
Wald test of indep. eqns. (rho = 0): chi2(1) =     5.33   Prob > chi2 = 0.0210
```

A3.4.3 Heckman FIML CIS Pooled

```
. heckman lninninv coop fineu fingov groupeu groupother eumarket othermarket national abinn
trademark marketdom costfact knowfact small medium manuf services y06 bg ee hu lt ro sk,
select(innact = groupeu groupother eumarket othermarket national abinn trademark marketdom
costfact knowfact nodemand small medium manuf services y06 bg ee hu lt ro sk) vce(robust)
Iteration 0:   log pseudolikelihood = -53970.066
Iteration 1:   log pseudolikelihood = -53969.988
Iteration 2:   log pseudolikelihood = -53969.988
Heckman selection model                         Number of obs     =     70,569
(regression model with sample selection)        Censored obs      =     54,432
                                                Uncensored obs    =     16,137
                                                Wald chi2(24)     =    5539.94
Log pseudolikelihood = -53969.99                Prob > chi2       =     0.0000
------------------------------------------------------------------------------
             |               Robust
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lninninv    |
        coop |    .385922   .0322046    11.98   0.000     .3228023    .4490418
       fineu |   .5021313   .0554115     9.06   0.000     .3935268    .6107357
      fingov |   .6902306    .044915    15.37   0.000     .6021988    .7782625
```

groupeu	.6674759	.0430406	15.51	0.000	.5831179	.751834
groupother	.8343085	.1013134	8.23	0.000	.6357379	1.032879
eumarket	.0838367	.0339809	2.47	0.014	.0172354	.1504381
othermarkets	.2648458	.0389158	6.81	0.000	.1885721	.3411194
national	.0831246	.0314355	2.64	0.008	.0215121	.144737
abinn	.435376	.0661776	6.58	0.000	.3056703	.5650816
trademark	.3208567	.0400968	8.00	0.000	.2422684	.3994449
marketdom	-.0249746	.0144691	-1.73	0.084	-.0533334	.0033843
costfact	-.181421	.0308634	-5.88	0.000	-.2419122	-.1209298
knowfact	-.0928223	.0621724	-1.49	0.135	-.2146781	.0290334
small	-2.192455	.0454496	-48.24	0.000	-2.281534	-2.103375
medium	-1.180681	.0406864	-29.02	0.000	-1.260425	-1.100938
manuf	.101362	.0446135	2.27	0.023	.0139212	.1888029
services	.2261848	.0498747	4.54	0.000	.1284321	.3239374
y06	.1630289	.0291805	5.59	0.000	.1058362	.2202215
bg	-.5940209	.0503804	-11.79	0.000	-.6927645	-.4952772
ee	.0679085	.0599541	1.13	0.257	-.0495994	.1854163
hu	-.3676428	.0536743	-6.85	0.000	-.4728425	-.262443
lt	-.6503984	.0693176	-9.38	0.000	-.7862585	-.5145383
ro	-.4354763	.044085	-9.88	0.000	-.5218813	-.3490712
sk	.0427167	.0590655	0.72	0.470	-.0730497	.158483
_cons	11.43223	.0953098	119.95	0.000	11.24542	11.61903
innact						
groupeu	.3115095	.0236337	13.18	0.000	.2651883	.3578307
groupother	.3234466	.061444	5.26	0.000	.2030186	.4438746
eumarket	.1268271	.0164193	7.72	0.000	.0946458	.1590084
othermarkets	.2672083	.0219366	12.18	0.000	.2242134	.3102032
national	.1518025	.0152637	9.95	0.000	.1218862	.1817188
abinn	4.058087	.151103	26.86	0.000	3.761931	4.354244
trademark	.8935708	.0240808	37.11	0.000	.8463733	.9407683
marketdom	.1841179	.0064514	28.54	0.000	.1714735	.1967623
costfact	.0604402	.0157192	3.84	0.000	.0296311	.0912492
knowfact	-1.131082	.0229691	-49.24	0.000	-1.176101	-1.086064
nodemand	-.6446431	.0279651	-23.05	0.000	-.6994537	-.5898326
small	-.6071601	.0223315	-27.19	0.000	-.6509291	-.563391
medium	-.3066101	.0215398	-14.23	0.000	-.3488273	-.2643929
manuf	.2279662	.0191159	11.93	0.000	.1904997	.2654327
services	.1957689	.0212683	9.20	0.000	.1540837	.2374541
y06	.0693476	.0138541	5.01	0.000	.0421941	.0965011
bg	-.5620501	.0219492	-25.61	0.000	-.6050698	-.5190305
ee	.3466735	.0352052	9.85	0.000	.2776726	.4156743
hu	-.5450328	.027385	-19.90	0.000	-.5987064	-.4913592
lt	-.4271839	.0352014	-12.14	0.000	-.4961774	-.3581903
ro	-.1872366	.0209119	-8.95	0.000	-.2282231	-.14625
sk	-.3439715	.0299343	-11.49	0.000	-.4026416	-.2853014
_cons	-.7460784	.0305226	-24.44	0.000	-.8059016	-.6862551
/athrho	.0703794	.0273867	2.57	0.010	.0167025	.1240563
/lnsigma	.5987426	.0057433	104.25	0.000	.587486	.6099991
rho	.0702634	.0272515			.016701	.1234237
sigma	1.819829	.0104518			1.799459	1.84043
lambda	.1278674	.0497244			.0304093	.2253255

Wald test of indep. eqns. (rho = 0): chi2(1) = 6.60 Prob > chi2 = 0.0102

A3.5 3SLS estimation – CDM output stage

A3.5.1 3SLS Main specification (CIS Pooled: lninsale)

```
. reg3 (lninsale = lninninv invmills firmgr innintern abinn prodivers skills codeg patapp
designreg copyright marinfo associnfo small medium manuf service fineu fingov groupeu groupother
y06 bg ee hu lt ro sk) (firmgr = lninsale innintern abinn prodivers procesef costfact knowfact
marinfo associnfo small medium manuf service fineu fingov groupeu groupother y06 bg ee hu lt ro
sk)

Three-stage least-squares regression
----------------------------------------------------------------------------
Equation             Obs   Parms        RMSE    "R-sq"       chi2        P
----------------------------------------------------------------------------
lninsale         11,869      28    2.062989    0.1321    7837.29   0.0000
firmgr            11,869      24    .7039423    0.0480     684.66   0.0000
----------------------------------------------------------------------------

--------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+------------------------------------------------------------------
 lninsale    |
    lninninv |   .6881715   .0712253     9.66   0.000     .5485724    .8277706
    invmills |  -.0254027   .0456694    -0.56   0.578    -.1149131    .0641077
      firmgr |   2.379114   .3539526     6.72   0.000      1.68538    3.072849
   innintern |   .1776058   .0410752     4.32   0.000        .0971    .2581116
       abinn |  -.1242004    .067932    -1.83   0.068    -.2573447     .008944
   prodivers |   .2332204   .0441318     5.28   0.000     .1467237    .3197172
      skills |  -.0065821   .0434152    -0.15   0.879    -.0916744    .0785102
       codeg |   .0324684   .0095476     3.40   0.001     .0137555    .0511812
      patapp |   .2363919   .0552041     4.28   0.000     .1281939      .34459
   designreg |   .0475072   .0527454     0.90   0.368     -.055872    .1508863
   copyright |    .084466   .0678517     1.24   0.213     -.048521     .217453
     marinfo |   .1547252   .0391937     3.95   0.000      .077907    .2315434
   associnfo |   .1207195   .0790895     1.53   0.127    -.0342931    .2757321
       small |  -1.593031   .1812151    -8.79   0.000    -1.948206   -1.237855
      medium |  -.8129846   .1052261    -7.73   0.000    -1.019224   -.6067453
       manuf |  -.7261993    .063705   -11.40   0.000    -.8510587   -.6013398
    services |  -.9520437   .0735643   -12.94   0.000    -1.096227   -.8078602
       fineu |  -.1951256   .0841131    -2.32   0.020    -.3599843    -.030267
      fingov |  -.5376948   .0806395    -6.67   0.000    -.6957453   -.3796443
     groupeu |   .1986116   .0777218     2.56   0.011     .0462797    .3509436
  groupother |   .3879527   .1310622     2.96   0.003     .1310755      .64483
         y06 |  -.4090454   .0701441    -5.83   0.000    -.5465253   -.2715655
          bg |  -1.134387   .1027535   -11.04   0.000     -1.33578   -.9329934
          ee |  -.9645985   .0877094   -11.00   0.000    -1.136506   -.7926913
          hu |   .2363838   .0813548     2.91   0.004     .0769314    .3958363
          lt |  -.5959019   .1202283    -4.96   0.000    -.8315451   -.3602588
          ro |  -.3345062    .069035    -4.85   0.000    -.4698124   -.1992001
          sk |   .0351764   .0842857     0.42   0.676    -.1300204    .2003733
       _cons |   6.941549   .8453809     8.21   0.000     5.284633    8.598465
-------------+------------------------------------------------------------------
firmgr       |
    lninsale |   -.010515   .0267364    -0.39   0.694    -.0629174    .0418875
   innintern |   .0132918   .0150651     0.88   0.378    -.0162352    .0428187
       abinn |  -.0249669   .0155795    -1.60   0.109    -.0555022    .0055685
   prodivers |   .0499409   .0168861     2.96   0.003     .0168447    .0830371
    procesef |   .0980826   .0156505     6.27   0.000     .0674083     .128757
    costfact |  -.0664378   .0140414    -4.73   0.000    -.0939585   -.0389171
    knowfact |  -.0225267   .0202805    -1.11   0.267    -.0622758    .0172223
     marinfo |   .0008173   .0144311     0.06   0.955    -.0274671    .0291018
   associnfo |     -.0359   .0274218    -1.31   0.190    -.0896457    .0178457
       small |   .0880174   .0823827     1.07   0.285    -.0734498    .2494846
      medium |   .0490505   .0453571     1.08   0.280    -.0398478    .1379488
       manuf |  -.0536988   .0289162    -1.86   0.063    -.1103735    .0029759
```

```
    services |   .0559744   .0292194     1.92   0.055    -.0012946    .1132434
       fineu |  -.0189385   .0261406    -0.72   0.469    -.0701732    .0322962
      fingov |   .0314347    .021595     1.46   0.145    -.0108908    .0737601
     groupeu |   .0898305   .0303174     2.96   0.003     .0304095    .1492515
  groupother |   .1034209   .0512414     2.02   0.044     .0029897    .2038521
         y06 |    .166937   .0134328    12.43   0.000     .1406093    .1932648
          bg |   .2054367   .0340437     6.03   0.000     .1387122    .2721612
          ee |   .0986522   .0313785     3.14   0.002     .0371514     .160153
          hu |  -.1081858   .0249528    -4.34   0.000    -.1570924   -.0592791
          lt |   .1836014   .0347681     5.28   0.000     .1154573    .2517456
          ro |   .0255383   .0262227     0.97   0.330    -.0258573     .076934
          sk |  -.0775868   .0273895    -2.83   0.005    -.1312693   -.0239044
       _cons |    .226348   .4068954     0.56   0.578    -.5711524    1.023848
------------------------------------------------------------------------------
Endogenous variables:  lninsale firmgr
Exogenous variables:   lninninv invmills innintern abinn prodivers skills
     codeg patapp designreg copyright marinfo associnfo small medium manuf
     services fineu fingov groupeu groupother y06 bg ee hu lt ro sk procesef
     costfact knowfact
------------------------------------------------------------------------------
```

A3.5.1.a Hansan-Sargan test of over-identification

```
. overid
Number of equations : 2
Total number of exogenous variables in system : 31
Number of estimated coefficients : 54
Hansen-Sargan overidentification statistic :    10.270
Under H0, distributed as Chi-sq(8), pval = 0.2466
```

A3.5.1.b Test for heteroskedasticity

```
==================================================
* System Heteroscedasticity Tests (3sls)
==================================================
*** Single Equation Heteroscedasticity Tests:
  Ho: Homoscedasticity - Ha: Heteroscedasticity

 Eq. lninsale: Engle LM ARCH Test: E2 = E2_1= 16.5334P-Value > Chi2(1) 0.0000
 Eq. lninsale: Hall-Pagan LM Test: E2 = Yh = 2.0e+03 P-Value > Chi2(1) 0.0000
 Eq. lninsale: Hall-Pagan LM Test: E2 = Yh2= 2.9e+03 P-Value > Chi2(1) 0.0000
 Eq. lninsale: Hall-Pagan LM Test: E2 = LYh2= 1.3e+03P-Value > Chi2(1) 0.0000
------------------------------------------------------------------------------
 Eq. firmgr: Engle LM ARCH Test: E2 = E2_1  = 24.2875 P-Value > Chi2(1) 0.0000
 Eq. firmgr: Hall-Pagan LM Test: E2 = Yh    =125.5998 P-Value > Chi2(1) 0.0000
 Eq. firmgr: Hall-Pagan LM Test: E2 = Yh2   =123.5186 P-Value > Chi2(1) 0.0000
 Eq. firmgr: Hall-Pagan LM Test: E2 = LYh2  = 80.7810 P-Value > Chi2(1) 0.0000
------------------------------------------------------------------------------
*** Overall System Heteroscedasticity Tests:
 Ho: No Overall System Heteroscedasticity

- Breusch-Pagan LM Test         =5206.2710       P-Value > Chi2(1)   0.0000
- Likelihood Ratio LR Test      =6853.1701       P-Value > Chi2(1)   0.0000
- Wald Test                     = 1.12e+04       P-Value > Chi2(1)   0.0000
------------------------------------------------------------------------------
```

A3.5.2 3SLS bootstrapped SE - Main specification (CIS Pooled: lninsale)

```
. bootstrap, reps(50) :reg3 (lninsale = lninninv invmills firmgr innintern abinn prodivers skills
codeg patapp designreg copyright marinfo associnfo small medium manuf service fineu fingov
groupeu groupother y06 bg ee hu lt ro sk) (firmgr = lninsale innintern abinn prodivers procesef
costfact knowfact marinfo associnfo small medium manuf service fineu fingov groupeu groupother
y06 bg ee hu lt ro sk)
(running reg3 on estimation sample)

Bootstrap replications (50)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................    50

Three-stage least-squares regression
----------------------------------------------------------------------
Equation          Obs  Parms        RMSE    "R-sq"       chi2        P
----------------------------------------------------------------------
lninsale        11869     28    2.062987    0.1321    7837.30   0.0000
firmgr          11869     24    .7039423    0.0480     684.66   0.0000
----------------------------------------------------------------------
------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lninsale    |
    lninninv |   .6881733   .0857848     8.02   0.000     .5200382    .8563084
    invmills |  -.0254023   .0434563    -0.58   0.559    -.1105751    .0597705
      firmgr |   2.379112   .4199536     5.67   0.000     1.556018    3.202205
   innintern |    .177606   .0442892     4.01   0.000     .0908007    .2644113
       abinn |  -.1242009    .075565    -1.64   0.100    -.2723056    .0239038
   prodivers |   .2332206   .0430347     5.42   0.000     .1488741     .317567
      skills |  -.0065819    .043937    -0.15   0.881    -.0926967     .079533
       codeg |   .0324682   .0079586     4.08   0.000     .0168697    .0480668
      patapp |   .2363921     .05548     4.26   0.000     .1276533    .3451308
   designreg |   .0475067   .0571241     0.83   0.406    -.0644544    .1594678
   copyright |   .0844657   .0767167     1.10   0.271    -.0658962    .2348277
     marinfo |   .1547252   .0508175     3.04   0.002     .0551247    .2543258
   associnfo |   .1207193   .0804618     1.50   0.134    -.0369829    .2784216
       small |  -1.593026   .2339519    -6.81   0.000    -2.051564   -1.134489
      medium |  -.8129823   .1324629    -6.14   0.000    -1.072605   -.5533598
       manuf |  -.7261995   .0732451    -9.91   0.000    -.8697571   -.5826418
    services |  -.9520438   .0790193   -12.05   0.000    -1.106919   -.7971689
       fineu |  -.1951265    .092461    -2.11   0.035    -.3763467   -.0139063
      fingov |  -.5376959   .0811517    -6.63   0.000    -.6967503   -.3786416
     groupeu |   .1986107   .0805808     2.46   0.014     .0406753    .3565461
  groupother |   .3879513   .1664348     2.33   0.020     .0617451    .7141575
         y06 |  -.4090452   .0768162    -5.32   0.000    -.5596023   -.2584881
          bg |  -1.134385   .1154803    -9.82   0.000    -1.360722   -.9080479
          ee |  -.9645988   .0880883   -10.95   0.000    -1.137249   -.7919489
          hu |   .2363838   .0754878     3.13   0.002     .0884305    .3843371
          lt |  -.5959006   .1129652    -5.28   0.000    -.8173084   -.3744928
          ro |  -.3345054   .0653495    -5.12   0.000     -.462588   -.2064228
          sk |   .0351759   .0784628     0.45   0.654    -.1186083    .1889601
       _cons |   6.941528   1.018951     6.81   0.000     4.944421    8.938635
-------------+----------------------------------------------------------------
firmgr       |
    lninsale |  -.0105149   .0296582    -0.35   0.723     -.068644    .0476142
   innintern |   .0132917   .0159583     0.83   0.405     -.017986    .0445695
       abinn |  -.0249669   .0145767    -1.71   0.087    -.0535367    .0036029
   prodivers |   .0499409   .0183388     2.72   0.006     .0139974    .0858843
    procesef |   .0980826   .0172636     5.68   0.000     .0642467    .1319186
    costfact |  -.0664377    .016597    -4.00   0.000    -.0989672   -.0339083
    knowfact |  -.0225267   .0229001    -0.98   0.325    -.0674101    .0223566
     marinfo |   .0008173   .0167719     0.05   0.961     -.032055    .0336896
   associnfo |     -.0359   .0294413    -1.22   0.223    -.0936039    .0218038
       small |   .0880177   .0910901     0.97   0.334    -.0905157    .2665511
      medium |   .0490506   .0484943     1.01   0.312    -.0459965    .1440978
       manuf |  -.0536987   .0282358    -1.90   0.057    -.1090399    .0016424
```

```
    services |   .0559745   .0278739     2.01   0.045     .0013426    .1106064
       fineu |  -.0189385   .0293557    -0.65   0.519    -.0764747    .0385977
      fingov |   .0314347   .0213933     1.47   0.142    -.0104954    .0733648
     groupeu |   .0898304   .0345323     2.60   0.009     .0221484    .1575124
  groupother |   .1034208   .0577981     1.79   0.074    -.0098614    .2167029
         y06 |    .166937    .012313    13.56   0.000     .1428041      .19107
          bg |   .2054368   .0360436     5.70   0.000     .1347926     .276081
          ee |   .0986522   .0282039     3.50   0.000     .0433737    .1539308
          hu |  -.1081858   .0214011    -5.06   0.000    -.1501311   -.0662405
          lt |   .1836015   .0349636     5.25   0.000     .1150741    .2521288
          ro |   .0255384   .0206703     1.24   0.217    -.0149746    .0660514
          sk |  -.0775868   .0246772    -3.14   0.002    -.1259532   -.0292204
       _cons |   .2263466   .4477201     0.51   0.613    -.6511687    1.103862
------------------------------------------------------------------------------
Endogenous variables:  lninsale firmgr
Exogenous variables:   lninninv invmills innintern abinn prodivers skills
     codeg patapp designreg copyright marinfo associnfo small medium manuf
     services fineu fingov groupeu groupother y06 bg ee hu lt ro sk procesef
     costfact knowfact
------------------------------------------------------------------------------
```

A3.5.2.a Hansan-Sargan test for over-identification

```
. overid

Number of equations : 2
Total number of exogenous variables in system : 31
Number of estimated coefficients : 49
Net of 5 linear constraints / dependencies
Hansen-Sargan overidentification statistic :    10.270
Under H0, distributed as Chi-sq(13), pval = 0.6718
```

A3.5.3 3SLS bootstrapped SE - Alternative specification (CIS Pooled: lninsale)

```
. bootstrap, reps(50) :reg3 (lninsale = lninninv invmills firmgr innintern abinn prodivers skills
cocus couni colab cocom cosu patapp designreg copyright marinfo associnfo small medium manuf
service fineu fingov groupeu groupother y06 bg ee hu lt ro sk) (firmgr = lninsale innintern abinn
prodivers procesef costfact knowfact marinfo associnfo small medium manuf service fineu fingov
groupeu groupother y06 bg ee hu lt ro sk)
(running reg3 on estimation sample)

Bootstrap replications (50)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................    50

Three-stage least-squares regression
----------------------------------------------------------------------
Equation             Obs   Parms        RMSE    "R-sq"       chi2        P
----------------------------------------------------------------------
lninsale          11,869      32    2.027907    0.1614    8022.73   0.0000
firmgr            11,869      24    .7039182    0.0480     684.68   0.0000
----------------------------------------------------------------------
------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lninsale    |
    lninninv |   .7647256   .0571152    13.39   0.000      .652782    .8766693
    invmills |  -.0092232   .0423308    -0.22   0.828    -.0921901    .0737437
      firmgr |    2.30767   .3948456     5.84   0.000     1.533787    3.081553
   innintern |    .181082   .0434924     4.16   0.000     .0958384    .2663255
       abinn |  -.1377572   .0662801    -2.08   0.038    -.2676637   -.0078506
```

prodivers	.2407594	.0437323	5.51	0.000	.1550457	.326473
skills	-.0017136	.0437449	-0.04	0.969	-.087452	.0840249
cocus	-.0379828	.0508781	-0.75	0.455	-.1377019	.0617364
couni	.0120784	.0537098	0.22	0.822	-.093191	.1173477
colab	.1936807	.051188	3.78	0.000	.0933541	.2940073
cocom	.0127887	.0550535	0.23	0.816	-.0951142	.1206915
cosu	-.0437816	.049505	-0.88	0.376	-.1408098	.0532465
patapp	.2295492	.0483838	4.74	0.000	.1347186	.3243798
designreg	.0395193	.0478911	0.83	0.409	-.0543455	.1333841
copyright	.0774113	.0573448	1.35	0.177	-.0349825	.1898052
marinfo	.1589259	.0361633	4.39	0.000	.0880472	.2298045
associnfo	.1218386	.071924	1.69	0.090	-.0191299	.2628071
small	-1.409148	.1691901	-8.33	0.000	-1.740754	-1.077541
medium	-.7151597	.1002738	-7.13	0.000	-.9116927	-.5186266
manuf	-.7382604	.0696997	-10.59	0.000	-.8748693	-.6016516
services	-.9600738	.0782591	-12.27	0.000	-1.113459	-.8066888
fineu	-.2366874	.0699173	-3.39	0.001	-.3737229	-.099652
fingov	-.589953	.0762186	-7.74	0.000	-.7393387	-.4405673
groupeu	.1607516	.0714509	2.25	0.024	.0207104	.3007927
groupother	.3359257	.1224608	2.74	0.006	.095907	.5759445
y06	-.4079812	.0711753	-5.73	0.000	-.5474822	-.2684801
bg	-1.09166	.0926633	-11.78	0.000	-1.273276	-.9100429
ee	-.9723163	.0800031	-12.15	0.000	-1.12912	-.8155131
hu	.2368338	.0755083	3.14	0.002	.0888403	.3848273
lt	-.5410563	.1188327	-4.55	0.000	-.7739641	-.3081484
ro	-.3158697	.0654068	-4.83	0.000	-.4440647	-.1876747
sk	.0197474	.0712809	0.28	0.782	-.1199607	.1594554
_cons	6.055423	.6544342	9.25	0.000	4.772756	7.338091
firmgr						
lninsale	-.0103847	.0240495	-0.43	0.666	-.0575208	.0367514
innintern	.0127691	.0145278	0.88	0.379	-.015705	.0412431
abinn	-.0251894	.0150552	-1.67	0.094	-.054697	.0043182
prodivers	.0495737	.0142225	3.49	0.000	.0216982	.0774492
procesef	.1000492	.0116471	8.59	0.000	.0772212	.1228771
costfact	-.0643827	.0134002	-4.80	0.000	-.0906465	-.0381189
knowfact	-.0237737	.0199252	-1.19	0.233	-.0628264	.015279
marinfo	.000449	.0164405	0.03	0.978	-.0317738	.0326719
associnfo	-.0362348	.0254075	-1.43	0.154	-.0860325	.0135629
small	.0883829	.0725196	1.22	0.223	-.053753	.2305188
medium	.0493083	.0386147	1.28	0.202	-.0263752	.1249917
manuf	-.0537571	.0272626	-1.97	0.049	-.1071908	-.0003234
services	.0560094	.0283689	1.97	0.048	.0004074	.1116114
fineu	-.0190031	.0224342	-0.85	0.397	-.0629733	.0249671
fingov	.0314049	.0195449	1.61	0.108	-.0069024	.0697122
groupeu	.0899552	.0286962	3.13	0.002	.0337116	.1461988
groupother	.103445	.0517006	2.00	0.045	.0021136	.2047764
y06	.1671036	.01331	12.55	0.000	.1410165	.1931908
bg	.205643	.0304748	6.75	0.000	.1459135	.2653726
ee	.0986794	.029494	3.35	0.001	.0408722	.1564867
hu	-.1083241	.0202113	-5.36	0.000	-.1479375	-.0687106
lt	.183423	.0381671	4.81	0.000	.1086169	.2582291
ro	.0252137	.0211478	1.19	0.233	-.0162352	.0666626
sk	-.0776585	.0152181	-5.10	0.000	-.1074854	-.0478316
_cons	.2238013	.3652244	0.61	0.540	-.4920254	.939628

Endogenous variables: lninsale firmgr
Exogenous variables: lninninv invmills innintern abinn prodivers skills cocus couni colab cocom cosu patapp designreg copyright marinfo associnfo small medium manuf services fineu fingov groupeu groupother y06 bg ee hu lt ro sk procesef costfact knowfact

A3.5.3.a Hansan-Sargan test for over-identification

```
. overid

Number of equations : 2
Total number of exogenous variables in system : 35
Number of estimated coefficients : 49
Net of 9 linear constraints / dependencies
Hansen-Sargan overidentification statistic :    10.872
Under H0, distributed as Chi-sq(21), pval = 0.9652
```

A3.5.4 3SLS bootstrapped SE - Main specification (CIS Pooled: lnnewmktsale)

```
. bootstrap, reps(50) :reg3 (lnnewmktsale = lninninv invmills firmgr innintern abinn prodivers
skills codeg patapp designreg copyright marinfo associnfo small medium manuf service fineu fingov
groupeu groupother y06 bg ee hu lt ro sk) (firmgr = lnnewmktsale innintern abinn prodivers
procesef costfact knowfact marinfo associnfo small medium manuf service fineu fingov groupeu
groupother y06 bg ee hu lt ro sk)
(running reg3 on estimation sample)

Bootstrap replications (50)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................    50

Three-stage least-squares regression
----------------------------------------------------------------------
Equation            Obs   Parms        RMSE    "R-sq"       chi2        P
----------------------------------------------------------------------
lnnewmktsale       7,091      28    2.421691   -0.2401    3156.01   0.0000
firmgr             7,091      24    .6847654    0.0358     416.49   0.0000
----------------------------------------------------------------------
------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnnewmktsale |
    lninninv |    .562975   .1217174     4.63   0.000     .3244133    .8015367
    invmills |  -.0527082    .064945    -0.81   0.417    -.1799982    .0745817
      firmgr |   3.111645   .5555704     5.60   0.000     2.022747    4.200543
   innintern |   .0582837   .0636907     0.92   0.360    -.0665477    .1831151
       abinn |  -.1726839   .1104996    -1.56   0.118    -.3892592    .0438914
   prodivers |    .211914   .0623129     3.40   0.001      .089783    .3340449
      skills |  -.0811549   .0581407    -1.40   0.163    -.1951085    .0327987
       codeg |   .0344226   .0113845     3.02   0.002     .0121094    .0567359
      patapp |   .1905589   .0521528     3.65   0.000     .0883413    .2927765
   designreg |   .0454203   .0647338     0.70   0.483    -.0814556    .1722961
   copyright |  -.0086715   .0807299    -0.11   0.914    -.1668992    .1495561
     marinfo |   .1466615   .0650477     2.25   0.024     .0191703    .2741528
   associnfo |   .2336425   .1192596     1.96   0.050    -.0001021     .467387
       small |  -2.010171   .3348101    -6.00   0.000    -2.666387   -1.353956
      medium |  -1.045814   .1915077    -5.46   0.000    -1.421162   -.6704652
       manuf |  -.8018514    .094421    -8.49   0.000    -.9869131   -.6167897
    services |  -1.073682   .1234762    -8.70   0.000    -1.315691    -.831673
       fineu |  -.2541562   .1386019    -1.83   0.067     -.525811    .0174986
      fingov |  -.6226136   .1122793    -5.55   0.000    -.8426769   -.4025502
     groupeu |   .2367176   .0994784     2.38   0.017     .0417437    .4316916
  groupother |   .4468654   .2047638     2.18   0.029     .0455358    .8481951
         y06 |  -.4752147    .093309    -5.09   0.000     -.658097   -.2923325
          bg |  -1.061148    .189002    -5.61   0.000    -1.431586   -.6907113
          ee |  -.9749183   .1003665    -9.71   0.000    -1.171633   -.7782035
          hu |   .3238723   .1070294     3.03   0.002     .1140985     .533646
          lt |   -.702113   .2191788    -3.20   0.001    -1.131696   -.2725304
          ro |  -.3129884    .100547    -3.11   0.002    -.5100568   -.1159199
```

```
          sk |   .1584655   .1132768     1.40   0.162    -.0635529     .380484
       _cons |   8.268808   1.403592     5.89   0.000     5.517818     11.0198
-------------+----------------------------------------------------------------
firmgr       |
 lnnewmktsale |  -.0298121   .0532841    -0.56   0.576     -.134247    .0746227
    innintern |   .0137922   .0195118     0.71   0.480    -.0244502    .0520347
        abinn |  -.0165285   .0177178    -0.93   0.351    -.0512547    .0181978
    prodivers |   .0475169   .0278682     1.71   0.088    -.0071038    .1021377
     procesef |    .093593   .0223497     4.19   0.000     .0497884    .1373976
     costfact |  -.0749572   .0212313    -3.53   0.000    -.1165698   -.0333446
     knowfact |  -.0081536   .0184523    -0.44   0.659    -.0443196    .0280123
      marinfo |    .017636   .0194255     0.91   0.364    -.0204373    .0557093
    associnfo |  -.0466353   .0318891    -1.46   0.144    -.1091367    .0158661
        small |   .0385929   .1630623     0.24   0.813    -.2810033     .358189
       medium |   .0354752    .083012     0.43   0.669    -.1272252    .1981757
        manuf |  -.0469197    .043215    -1.09   0.278    -.1316195    .0377801
     services |   .0677697   .0390441     1.74   0.083    -.0087554    .1442948
        fineu |  -.0284011   .0310171    -0.92   0.360    -.0891936    .0323914
       fingov |   .0427381    .019279     2.22   0.027     .0049518    .0805243
      groupeu |   .0888031   .0485988     1.83   0.068    -.0064489    .1840551
   groupother |   .1451737   .0876767     1.66   0.098    -.0266694    .3170169
          y06 |   .1581416   .0175914     8.99   0.000      .123663    .1926201
           bg |   .2185817    .045754     4.78   0.000     .1289056    .3082579
           ee |   .0557946   .0416884     1.34   0.181    -.0259133    .1375024
           hu |  -.0797836   .0302391    -2.64   0.008     -.139051   -.0205161
           lt |   .1664977   .0427696     3.89   0.000     .0826709    .2503245
           ro |   .0360982   .0320576     1.13   0.260    -.0267336    .0989301
           sk |  -.0540858    .028132    -1.92   0.055    -.1092235     .001052
        _cons |   .4746656   .7915655     0.60   0.549    -1.076774    2.026106
------------------------------------------------------------------------------
Endogenous variables:  lnnewmktsale firmgr
Exogenous variables:   lninninv invmills innintern abinn prodivers skills
     codeg patapp designreg copyright marinfo associnfo small medium manuf
     services fineu fingov groupeu groupother y06 bg ee hu lt ro sk procesef
     costfact knowfact
------------------------------------------------------------------------------
```

A3.5.4.a Hansan-Sargan test for over-identification

```
. overid

Number of equations : 2
Total number of exogenous variables in system : 31
Number of estimated coefficients : 49
Net of 5 linear constraints / dependencies
Hansen-Sargan overidentification statistic :     6.505
Under H0, distributed as Chi-sq(13), pval = 0.9258
```

A3.5.5 3SLS bootstrapped SE - Alternative specification (CIS Pooled: lnnewmktsale)

```
. bootstrap, reps(50) :reg3 (lnnewmktsale = lninninv invmills firmgr innintern abinn prodivers
skills codeg patapp designreg copyright marinfo associnfo small medium manuf service fineu fingov
groupeu groupother y06 bg ee hu lt ro sk) (firmgr = lnnewmktsale innintern abinn prodivers
procesef costfact knowfact marinfo associnfo small medium manuf service fineu fingov groupeu
groupother y06 bg ee hu lt ro sk)
(running reg3 on estimation sample)

Bootstrap replications (50)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................    50

Three-stage least-squares regression
----------------------------------------------------------------------
Equation             Obs   Parms        RMSE    "R-sq"       chi2        P
```

lnnewmktsale	7,091	28	2.421691	-0.2401	3156.01	0.0000
firmgr	7,091	24	.6847654	0.0358	416.49	0.0000

	Observed Coef.	Bootstrap Std. Err.	z	P>|z|	Normal-based [95% Conf.	Interval]
lnnewmktsale						
lninninv	.562975	.1217174	4.63	0.000	.3244133	.8015367
invmills	-.0527082	.064945	-0.81	0.417	-.1799982	.0745817
firmgr	3.111645	.5555704	5.60	0.000	2.022747	4.200543
innintern	.0582837	.0636907	0.92	0.360	-.0665477	.1831151
abinn	-.1726839	.1104996	-1.56	0.118	-.3892592	.0438914
prodivers	.211914	.0623129	3.40	0.001	.089783	.3340449
skills	-.0811549	.0581407	-1.40	0.163	-.1951085	.0327987
codeg	.0344226	.0113845	3.02	0.002	.0121094	.0567359
patapp	.1905589	.0521528	3.65	0.000	.0883413	.2927765
designreg	.0454203	.0647338	0.70	0.483	-.0814556	.1722961
copyright	-.0086715	.0807299	-0.11	0.914	-.1668992	.1495561
marinfo	.1466615	.0650477	2.25	0.024	.0191703	.2741528
associnfo	.2336425	.1192596	1.96	0.050	-.0001021	.467387
small	-2.010171	.3348101	-6.00	0.000	-2.666387	-1.353956
medium	-1.045814	.1915077	-5.46	0.000	-1.421162	-.6704652
manuf	-.8018514	.094421	-8.49	0.000	-.9869131	-.6167897
services	-1.073682	.1234762	-8.70	0.000	-1.315691	-.831673
fineu	-.2541562	.1386019	-1.83	0.067	-.525811	.0174986
fingov	-.6226136	.1122793	-5.55	0.000	-.8426769	-.4025502
groupeu	.2367176	.0994784	2.38	0.017	.0417437	.4316916
groupother	.4468654	.2047638	2.18	0.029	.0455358	.8481951
y06	-.4752147	.093309	-5.09	0.000	-.658097	-.2923325
bg	-1.061148	.189002	-5.61	0.000	-1.431586	-.6907113
ee	-.9749183	.1003665	-9.71	0.000	-1.171633	-.7782035
hu	.3238723	.1070294	3.03	0.002	.1140985	.533646
lt	-.702113	.2191788	-3.20	0.001	-1.131696	-.2725304
ro	-.3129884	.100547	-3.11	0.002	-.5100568	-.1159199
sk	.1584655	.1132768	1.40	0.162	-.0635529	.380484
_cons	8.268808	1.403592	5.89	0.000	5.517818	11.0198
firmgr						
lnnewmktsale	-.0298121	.0532841	-0.56	0.576	-.134247	.0746227
innintern	.0137922	.0195118	0.71	0.480	-.0244502	.0520347
abinn	-.0165285	.0177178	-0.93	0.351	-.0512547	.0181978
prodivers	.0475169	.0278682	1.71	0.088	-.0071038	.1021377
procesef	.093593	.0223497	4.19	0.000	.0497884	.1373976
costfact	-.0749572	.0212313	-3.53	0.000	-.1165698	-.0333446
knowfact	-.0081536	.0184523	-0.44	0.659	-.0443196	.0280123
marinfo	.017636	.0194255	0.91	0.364	-.0204373	.0557093
associnfo	-.0466353	.0318891	-1.46	0.144	-.1091367	.0158661
small	.0385929	.1630623	0.24	0.813	-.2810033	.358189
medium	.0354752	.083012	0.43	0.669	-.1272252	.1981757
manuf	-.0469197	.043215	-1.09	0.278	-.1316195	.0377801
services	.0677697	.0390441	1.74	0.083	-.0087554	.1442948
fineu	-.0284011	.0310171	-0.92	0.360	-.0891936	.0323914
fingov	.0427381	.019279	2.22	0.027	.0049518	.0805243
groupeu	.0888031	.0485988	1.83	0.068	-.0064489	.1840551
groupother	.1451737	.0876767	1.66	0.098	-.0266694	.3170169
y06	.1581416	.0175914	8.99	0.000	.123663	.1926201
bg	.2185817	.045754	4.78	0.000	.1289056	.3082579
ee	.0557946	.0416884	1.34	0.181	-.0259133	.1375024
hu	-.0797836	.0302391	-2.64	0.008	-.139051	-.0205161
lt	.1664977	.0427696	3.89	0.000	.0826709	.2503245
ro	.0360982	.0320576	1.13	0.260	-.0267336	.0989301
sk	-.0540858	.028132	-1.92	0.055	-.1092235	.001052
_cons	.4746656	.7915655	0.60	0.549	-1.076774	2.026106

Endogenous variables: lnnewmktsale firmgr
Exogenous variables: lninninv invmills innintern abinn prodivers skills codeg patapp designreg copyright marinfo associnfo small medium manuf services fineu fingov groupeu groupother y06 bg ee hu lt ro sk procesef

```
     costfact knowfact
------------------------------------------------------------------------------
```

A3.5.5.a Hansan-Sargan test for over-identification

```
. overid

Number of equations : 2
Total number of exogenous variables in system : 31
Number of estimated coefficients : 49
Net of 5 linear constraints / dependencies
Hansen-Sargan overidentification statistic :     6.505
Under H0, distributed as Chi-sq(13), pval = 0.9258
```

A3.5.6 3SLS bootstrapped SE - Main specification (CIS Pooled: lnnewfrmsale)

```
. bootstrap, reps(50) :reg3 (lnnewfrmsale = lninninv invmills firmgr innintern abinn prodivers
skills codeg patapp designreg copyright marinfo associnfo small medium manuf service fineu fingov
groupeu groupother y06 bg ee hu lt ro sk) (firmgr = lnnewfrmsale innintern abinn prodivers
procesef costfact knowfact marinfo associnfo small medium manuf service fineu fingov groupeu
groupother y06 bg ee hu lt ro sk)
(running reg3 on estimation sample)
Bootstrap replications (50)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................    50
Three-stage least-squares regression
----------------------------------------------------------------------
Equation          Obs  Parms        RMSE    "R-sq"       chi2        P
----------------------------------------------------------------------
lnnewfrmsale    9,246     28     1.96452    0.1576    5878.28   0.0000
firmgr          9,246     24    .7281506    0.0312     553.15   0.0000
----------------------------------------------------------------------

------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnnewfrmsale |
    lninninv |   .6757895   .0821603     8.23   0.000     .5147582    .8368208
    invmills |   .0104678   .0575104     0.18   0.856    -.1022504    .1231861
      firmgr |   2.137468     .46263     4.62   0.000      1.23073    3.044206
   innintern |   .0842075   .0479546     1.76   0.079    -.0097819    .1781969
       abinn |  -.1060199   .0857588    -1.24   0.216    -.2741041    .0620643
   prodivers |   .1733996    .063951     2.71   0.007     .0480581    .2987412
      skills |  -.0428051   .0440303    -0.97   0.331     -.129103    .0434927
       codeg |   .0015409   .0118596     0.13   0.897    -.0217034    .0247852
      patapp |    .230533   .0649121     3.55   0.000     .1033077    .3577583
   designreg |   .0274567     .06706     0.41   0.682    -.1039785     .158892
   copyright |  -.0902199   .0792437    -1.14   0.255    -.2455347    .0650949
     marinfo |   .1436038   .0448764     3.20   0.001     .0556476      .23156
   associnfo |   .0491023   .0987339     0.50   0.619    -.1444125    .2426172
       small |  -1.619261   .2223507    -7.28   0.000     -2.05506   -1.183461
      medium |  -.8469537   .1318658    -6.42   0.000    -1.105406   -.5885015
       manuf |  -.5796944   .0741074    -7.82   0.000    -.7249422   -.4344467
    services |   -.782766   .0951978    -8.22   0.000    -.9693502   -.5961817
       fineu |  -.2450508   .0956274    -2.56   0.010    -.4324771   -.0576246
      fingov |  -.4661204   .0706296    -6.60   0.000    -.6045518    -.327689
     groupeu |   .2470885   .0937287     2.64   0.008     .0633837    .4307934
  groupother |   .3140735   .1620393     1.94   0.053    -.0035177    .6316648
         y06 |  -.3250526   .0921976    -3.53   0.000    -.5057566   -.1443485
          bg |  -1.052374   .1407773    -7.48   0.000    -1.328292   -.7764551
```

```
          ee |  -.7196359   .0941057    -7.65   0.000    -.9040796   -.5351921
          hu |   .3893926   .1045592     3.72   0.000     .1844603    .5943248
          lt |  -.4531568   .1411168    -3.21   0.001    -.7297407    -.176573
          ro |  -.1440205   .0637577    -2.26   0.024    -.2689832   -.0190578
          sk |   .0159498   .0904335     0.18   0.860    -.1612967    .1931962
       _cons |   6.724935   .9310908     7.22   0.000     4.900031    8.549839
-------------+----------------------------------------------------------------
firmgr       |
 lnnewfrmsale |  -.0374502   .0433875    -0.86   0.388    -.1224881    .0475877
   innintern |   .0292126   .0171855     1.70   0.089    -.0044703    .0628955
       abinn |  -.0326767    .014577    -2.24   0.025     -.061247   -.0041064
   prodivers |   .0725775   .0227533     3.19   0.001     .0279818    .1171731
    procesef |   .0983741   .0193841     5.07   0.000      .060382    .1363661
    costfact |  -.0816193   .0213539    -3.82   0.000    -.1234722   -.0397665
    knowfact |  -.0157643   .0247998    -0.64   0.525    -.0643709    .0328424
     marinfo |   .0108061   .0173678     0.62   0.534     -.023234    .0448463
   associnfo |  -.0476639   .0300587    -1.59   0.113    -.1065778      .01125
       small |   .0131287   .1334341     0.10   0.922    -.2483972    .2746547
      medium |   .0130378   .0747166     0.17   0.861    -.1334041    .1594796
       manuf |  -.0894119   .0393926    -2.27   0.023    -.1666199   -.0122038
    services |   .0416499   .0364882     1.14   0.254    -.0298656    .1131655
       fineu |   -.012082   .0358156    -0.34   0.736    -.0822792    .0581153
      fingov |   .0199281   .0185271     1.08   0.282    -.0163844    .0562406
     groupeu |   .1202155   .0401304     3.00   0.003     .0415614    .1988697
  groupother |   .1405648   .0654284     2.15   0.032     .0123275    .2688021
         y06 |   .1725977   .0179432     9.62   0.000     .1374298    .2077657
          bg |   .1868138   .0455286     4.10   0.000     .0975793    .2760483
          ee |   .0754383   .0322429     2.34   0.019     .0122435    .1386331
          hu |  -.1202572   .0266203    -4.52   0.000     -.172432   -.0680824
          lt |    .181641   .0375342     4.84   0.000     .1080754    .2552066
          ro |  -.0007096   .0325151    -0.02   0.983     -.064438    .0630188
          sk |  -.0771343   .0292624    -2.64   0.008    -.1344876    -.019781
       _cons |   .6390455   .6508186     0.98   0.326    -.6365356    1.914627
------------------------------------------------------------------------------
Endogenous variables:  lnnewfrmsale firmgr
Exogenous variables:   lninninv invmills innintern abinn prodivers skills
     codeg patapp designreg copyright marinfo associnfo small medium manuf
     services fineu fingov groupeu groupother y06 bg ee hu lt ro sk procesef
     costfact knowfact
-----------------------------------------------------------------------------
```

A3.5.6.a Hansan-Sargan test for over-identification

```
. overid

Number of equations : 2
Total number of exogenous variables in system : 31
Number of estimated coefficients : 49
Net of 5 linear constraints / dependencies
Hansen-Sargan overidentification statistic :     9.276
Under H0, distributed as Chi-sq(13), pval = 0.7518
```

A3.5.7 3SLS bootstrapped SE - Alternative specification (CIS Pooled: lnnewmktsale)

```
. bootstrap, reps(50) :reg3 (lnnewfrmsale = lninninv invmills firmgr innintern abinn prodivers
skills cocus couni colab cocom cosu patapp designreg copyright marinfo associnfo small medium
manuf service fineu fingov groupeu groupother y06 bg ee hu lt ro sk) (firmgr = lnnewfrmsale
innintern abinn prodivers procesef costfact knowfact marinfo associnfo small medium manuf service
fineu fingov groupeu groupother y06 bg ee hu lt ro sk)
(running reg3 on estimation sample)

Bootstrap replications (50)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................    50

Three-stage least-squares regression
----------------------------------------------------------------------
Equation             Obs   Parms        RMSE    "R-sq"       chi2        P
----------------------------------------------------------------------
lnnewfrmsale       9,246      32    1.921511    0.1941    6120.14   0.0000
firmgr             9,246      24     .725408    0.0385     556.68   0.0000
----------------------------------------------------------------------

------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnnewfrmsale |
    lninninv |   .7632971   .0893913     8.54   0.000     .5880933    .9385008
    invmills |   .0306334   .0482432     0.63   0.525    -.0639216    .1251884
      firmgr |     2.0497    .436092     4.70   0.000     1.194975    2.904424
   innintern |   .0880864   .0474542     1.86   0.063    -.0049222     .181095
       abinn |  -.1215439    .079537    -1.53   0.126    -.2774336    .0343458
   prodivers |   .1818968   .0557754     3.26   0.001     .0725791    .2912145
      skills |  -.0353956   .0427985    -0.83   0.408    -.1192791    .0484879
       cocus |  -.1261535    .048421    -2.61   0.009    -.2210569   -.0312502
       couni |  -.0243131   .0605421    -0.40   0.688    -.1429735    .0943472
       colab |   .2240283   .0526795     4.25   0.000     .1207784    .3272781
       cocom |  -.0260153   .0489605    -0.53   0.595     -.121976    .0699455
        cosu |    -.10501   .0481305    -2.18   0.029    -.1993442   -.0106759
      patapp |   .2140172   .0620547     3.45   0.001     .0923923    .3356422
   designreg |   .0175458   .0547388     0.32   0.749    -.0897402    .1248318
   copyright |  -.0982492   .0683061    -1.44   0.150    -.2321266    .0356282
     marinfo |   .1511321    .051242     2.95   0.003     .0506996    .2515646
   associnfo |    .049232   .1074598     0.46   0.647    -.1613853    .2598494
       small |  -1.402769   .2362678    -5.94   0.000    -1.865845   -.9396923
      medium |  -.7288894   .1332215    -5.47   0.000    -.9899987   -.4677801
       manuf |  -.5982226   .0699255    -8.56   0.000    -.7352742   -.4611711
    services |  -.7967444   .0890715    -8.95   0.000    -.9713213   -.6221676
       fineu |  -.2952987   .0810226    -3.64   0.000       -.4541   -.1364974
      fingov |   -.532611   .0911038    -5.85   0.000    -.7111712   -.3540508
     groupeu |   .1921227   .0860108     2.23   0.026     .0235445    .3607008
  groupother |   .2398425   .1525196     1.57   0.116    -.0590905    .5387754
         y06 |  -.3229643   .0804113    -4.02   0.000    -.4805675   -.1653612
          bg |  -1.007181   .1123304    -8.97   0.000    -1.227344   -.7870171
          ee |   -.729342   .1006662    -7.25   0.000    -.9266441     -.53204
          hu |   .3866113   .0837263     4.62   0.000     .2225107    .5507119
          lt |  -.3878322    .156979    -2.47   0.013    -.6955054    -.080159
          ro |  -.1292695   .0770558    -1.68   0.093     -.280296    .0217571
          sk |   -.002175   .0764842    -0.03   0.977    -.1520813    .1477313
       _cons |   5.720181   1.047963     5.46   0.000     3.666211    7.774152
-------------+----------------------------------------------------------------
firmgr       |
lnnewfrmsale |  -.0286549   .0397217    -0.72   0.471     -.106508    .0491983
   innintern |    .027497   .0171364     1.60   0.109    -.0060897    .0610837
       abinn |  -.0343522   .0202799    -1.69   0.090    -.0741001    .0053957
   prodivers |   .0693866   .0197539     3.51   0.000     .0306696    .1081035
    procesef |   .0983849   .0178016     5.53   0.000     .0634945    .1332754
    costfact |  -.0771051   .0196179    -3.93   0.000    -.1155555   -.0386548
```

```
    knowfact |  -.0166511   .0249149    -0.67   0.504    -.0654834    .0321812
     marinfo |   .0090205   .0200547     0.45   0.653    -.0302861     .048327
   associnfo |  -.0478663   .0373437    -1.28   0.200    -.1210585     .025326
       small |   .0393079   .1148562     0.34   0.732    -.1858062     .264422
      medium |   .0268528   .0598912     0.45   0.654    -.0905318    .1442373
       manuf |  -.0841151   .0409242    -2.06   0.040    -.1643251   -.0039051
    services |   .0459061   .0376668     1.22   0.223    -.0279195    .1197318
       fineu |  -.0132387    .027024    -0.49   0.624    -.0662048    .0397274
      fingov |   .0189268   .0225401     0.84   0.401    -.0252511    .0631047
     groupeu |   .1124218   .0430136     2.61   0.009     .0281167    .1967269
  groupother |   .1305898   .0633806     2.06   0.039     .0063661    .2548136
         y06 |   .1716055   .0134003    12.81   0.000     .1453414    .1978696
          bg |   .1953284   .0498728     3.92   0.000     .0975794    .2930773
          ee |   .0786909    .036775     2.14   0.032     .0066132    .1507685
          hu |    -.11996   .0214398    -5.60   0.000    -.1619813   -.0779387
          lt |   .1842598   .0420212     4.38   0.000     .1018997    .2666199
          ro |   .0026436   .0271288     0.10   0.922    -.0505279    .0558151
          sk |  -.0766552   .0184957    -4.14   0.000    -.1129061   -.0404044
       _cons |    .507985    .589651     0.86   0.389    -.6477098     1.66368
------------------------------------------------------------------------------
Endogenous variables:  lnnewfrmsale firmgr
Exogenous variables:   lninninv invmills innintern abinn prodivers skills
     cocus couni colab cocom cosu patapp designreg copyright marinfo
     associnfo small medium manuf services fineu fingov groupeu groupother
     y06 bg ee hu lt ro sk procesef costfact knowfact
------------------------------------------------------------------------------
```

A3.5.7.a Hansan-Sargan test for over-identification

```
. overid

Number of equations : 2
Total number of exogenous variables in system : 35
Number of estimated coefficients : 49
Net of 9 linear constraints / dependencies
Hansen-Sargan overidentification statistic :    10.304
Under H0, distributed as Chi-sq(21), pval = 0.9747
```

A3.5.8 3SLS bootstrapped SE - Main specification (CIS 2006: lninsale)

```
. bootstrap, reps(50) :reg3 (lninsale = lninninv06 invmills06 firmgr innintern abinn prodivers
skills codeg patapp designreg copyright marinfo associnfo small medium manuf service fineu fingov
groupeu groupother bg ee hu lt ro sk) (firmgr = lninsale innintern abinn prodivers procesef
costfact knowfact marinfo associnfo small medium manuf service fineu fingov groupeu groupother bg
ee hu lt ro sk) if y06==1(running reg3 on estimation sample)
Bootstrap replications (50)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................    50

Three-stage least-squares regression
----------------------------------------------------------------------
Equation             Obs   Parms        RMSE    "R-sq"       chi2        P
----------------------------------------------------------------------
lninsale           6,304      27     1.80292    0.3622    5475.24   0.0000
firmgr             6,304      23    .7404759    0.0351     264.60   0.0000
----------------------------------------------------------------------

------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lninsale    |
```

lninninv06	.7386207	.1002742	7.37	0.000	.5420868	.9351547
invmills06	.0486618	.0682583	0.71	0.476	-.085122	.1824456
firmgr	1.729728	.5013333	3.45	0.001	.747133	2.712323
innintern	.1984257	.0525668	3.77	0.000	.0953966	.3014547
abinn	-.1142789	.0910133	-1.26	0.209	-.2926616	.0641038
prodivers	.2285525	.0504683	4.53	0.000	.1296364	.3274687
skills	.0394933	.0505818	0.78	0.435	-.0596452	.1386319
codeg	.0362261	.0110778	3.27	0.001	.0145141	.0579382
patapp	.1697222	.0672686	2.52	0.012	.0378782	.3015662
designreg	.0233435	.0765386	0.30	0.760	-.1266694	.1733565
copyright	.1240819	.0808315	1.54	0.125	-.0343449	.2825087
marinfo	.2320171	.0363022	6.39	0.000	.160866	.3031681
associnfo	-.0334246	.1097458	-0.30	0.761	-.2485223	.1816732
small	-1.513213	.2549148	-5.94	0.000	-2.012837	-1.013589
medium	-.7082798	.1426275	-4.97	0.000	-.9878246	-.428735
manuf	-.8320689	.0841148	-9.89	0.000	-.9969309	-.667207
services	-1.023153	.1067745	-9.58	0.000	-1.232427	-.8138786
fineu	-.2384877	.0877831	-2.72	0.007	-.4105394	-.0664359
fingov	-.6030216	.0974038	-6.19	0.000	-.7939295	-.4121137
groupeu	.1890649	.1096927	1.72	0.085	-.0259289	.4040587
groupother	.4025142	.1812772	2.22	0.026	.0472174	.757811
bg	-1.121867	.1136024	-9.88	0.000	-1.344524	-.8992103
ee	-.6060192	.1037607	-5.84	0.000	-.8093864	-.402652
hu	.2732325	.1272016	2.15	0.032	.0239219	.5225431
lt	-.2916744	.1170354	-2.49	0.013	-.5210596	-.0622893
ro	-.5175816	.0844785	-6.13	0.000	-.6831563	-.3520069
sk	-.0331272	.11216	-0.30	0.768	-.2529568	.1867024
_cons	6.167362	1.147345	5.38	0.000	3.918608	8.416117
firmgr						
lninsale	-.0076186	.0400088	-0.19	0.849	-.0860345	.0707973
innintern	.0054966	.0222863	0.25	0.805	-.0381836	.0491769
abinn	-.0351283	.0261444	-1.34	0.179	-.0863705	.0161138
prodivers	.0694853	.0264369	2.63	0.009	.0176699	.1213006
procesef	.0941286	.0211059	4.46	0.000	.0527618	.1354954
costfact	-.0863554	.0232448	-3.72	0.000	-.1319144	-.0407965
knowfact	-.0289313	.0357442	-0.81	0.418	-.0989886	.041126
marinfo	-.0255357	.0190502	-1.34	0.180	-.0628734	.011802
associnfo	-.0014875	.0390807	-0.04	0.970	-.0780843	.0751092
small	.0735306	.1206197	0.61	0.542	-.1628797	.3099408
medium	.0397041	.0661443	0.60	0.548	-.0899362	.1693445
manuf	-.0460028	.0496533	-0.93	0.354	-.1433214	.0513158
services	.1075346	.0478502	2.25	0.025	.01375	.2013193
fineu	.0176387	.0384009	0.46	0.646	-.0576256	.092903
fingov	.0337252	.028504	1.18	0.237	-.0221416	.0895919
groupeu	.1025135	.0473267	2.17	0.030	.009755	.1952721
groupother	.0539414	.0725321	0.74	0.457	-.0882189	.1961017
bg	.1593756	.0627391	2.54	0.011	.0364093	.282342
ee	.0455923	.0411756	1.11	0.268	-.0351104	.1262949
hu	-.177493	.0321038	-5.53	0.000	-.2404153	-.1145708
lt	.0187664	.0496692	0.38	0.706	-.0785835	.1161163
ro	.0820611	.0365262	2.25	0.025	.0104711	.1536511
sk	-.1469413	.0356687	-4.12	0.000	-.2168507	-.0770319
_cons	.3886024	.6203257	0.63	0.531	-.8272136	1.604418

Endogenous variables: lninsale firmgr
Exogenous variables: lninninv06 invmills06 innintern abinn prodivers skills codeg patapp designreg copyright marinfo associnfo small medium manuf services fineu fingov groupeu groupother bg ee hu lt ro sk procesef costfact knowfact

A3.5.8.a Hansan-Sargan test for over-identification

```
. overid

Number of equations : 2
Total number of exogenous variables in system : 30
Number of estimated coefficients : 49
Net of 3 linear constraints / dependencies
Hansen-Sargan overidentification statistic :     7.839
Under H0, distributed as Chi-sq(11), pval = 0.7277
```

3.5.9 3SLS bootstrapped SE - Alternative specification (CIS 2006: lninsale)

```
. bootstrap, reps(50) :reg3 (lninsale = lninninv06 invmills06 firmgr innintern abinn prodivers
skills cocus couni colab cocom cosu patapp designreg copyright marinfo associnfo small medium
manuf service fineu fingov groupeu groupother bg ee hu lt ro sk) (firmgr = lninsale innintern
abinn prodivers procesef costfact knowfact marinfo associnfo small medium manuf service fineu
fingov groupeu groupother bg ee hu lt ro sk) if y06==1(running reg3 on estimation sample)
Bootstrap replications (50)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................    50

Three-stage least-squares regression
----------------------------------------------------------------------
Equation             Obs   Parms        RMSE    "R-sq"       chi2        P
----------------------------------------------------------------------
lninsale           6,304      31    1.766073    0.3880    5697.55   0.0000
firmgr             6,304      23    .7388791    0.0393     265.65   0.0000
----------------------------------------------------------------------

------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lninsale    |
  lninninv06 |   .8320449   .1320054     6.30   0.000     .5733189    1.090771
  invmills06 |   .0714856   .0514409     1.39   0.165    -.0293367    .1723079
      firmgr |   1.641002   .5050826     3.25   0.001     .6510581    2.630946
   innintern |   .2030662   .0592926     3.42   0.001     .0868548    .3192775
       abinn |  -.1250529   .1154843    -1.08   0.279    -.3513979    .1012921
   prodivers |   .2408513   .0608078     3.96   0.000     .1216703    .3600324
      skills |   .0439034   .0453342     0.97   0.333    -.0449499    .1327567
       cocus |  -.0538198   .0575585    -0.94   0.350    -.1666324    .0589928
       couni |  -.0612059   .0557017    -1.10   0.272    -.1703793    .0479674
       colab |   .2054381   .0673284     3.05   0.002      .073477    .3373993
       cocom |   .0619236   .0647352     0.96   0.339    -.0649551    .1888022
        cosu |  -.0250896   .0759547    -0.33   0.741    -.1739582    .1237789
      patapp |   .1721885    .062399     2.76   0.006     .0498887    .2944884
   designreg |   .0125689   .0701825     0.18   0.858    -.1249862     .150124
   copyright |   .1185573   .1122847     1.06   0.291    -.1015165    .3386312
     marinfo |   .2316381   .0461353     5.02   0.000     .1412146    .3220615
   associnfo |  -.0258305   .1016185    -0.25   0.799     -.224999    .1733381
       small |  -1.300061   .3251026    -4.00   0.000     -1.93725   -.6628715
      medium |  -.5973276   .1702683    -3.51   0.000    -.9310474   -.2636078
       manuf |  -.8305571   .0859899    -9.66   0.000    -.9990943   -.6620199
    services |  -1.016704   .1072085    -9.48   0.000    -1.226829    -.806579
       fineu |  -.2805315   .1058245    -2.65   0.008    -.4879437   -.0731193
      fingov |  -.6553907   .1180624    -5.55   0.000    -.8867887   -.4239927
     groupeu |    .147699   .1338884     1.10   0.270    -.1147175    .4101154
  groupother |   .3297889   .1623928     2.03   0.042     .0115049     .648073
          bg |  -1.083951   .1208355    -8.97   0.000    -1.320784   -.8471173
          ee |  -.6415582   .1019029    -6.30   0.000    -.8412842   -.4418323
          hu |   .2786647   .1282019     2.17   0.030     .0273936    .5299357
```

```
          lt |  -.2514564   .1233593    -2.04   0.042    -.4932362   -.0096767
          ro |  -.4914745   .0959797    -5.12   0.000    -.6795911   -.3033578
          sk |  -.0730726   .1299773    -0.56   0.574    -.3278235    .1816783
       _cons |   5.081012   1.567762     3.24   0.001     2.008254    8.153769
-------------+----------------------------------------------------------------
firmgr       |
   lninsale |  -.0013747   .0356481    -0.04   0.969    -.0712438    .0684943
   innintern |   .0037643   .0190489     0.20   0.843    -.0335708    .0410995
       abinn |  -.0364134   .0257256    -1.42   0.157    -.0868347    .0140079
   prodivers |   .0668353   .0189594     3.53   0.000     .0296756    .1039951
    procesef |   .0946932   .0203302     4.66   0.000     .0548467    .1345398
    costfact |  -.0831236   .0268107    -3.10   0.002    -.1356716   -.0305755
    knowfact |  -.0296677   .0293998    -1.01   0.313    -.0872903    .0279549
     marinfo |  -.0270863   .0228762    -1.18   0.236    -.0719227    .0177501
   associnfo |   -.001952   .0405708    -0.05   0.962    -.0814693    .0775654
       small |   .0929479   .1198038     0.78   0.438    -.1418632    .3277591
      medium |   .0495777   .0643239     0.77   0.441    -.0764948    .1756503
       manuf |  -.0402814   .0444128    -0.91   0.364    -.1273289    .0467661
    services |   .1122256   .0504313     2.23   0.026     .0133821    .2110691
       fineu |   .0161849   .0354582     0.46   0.648    -.0533119    .0856816
      fingov |   .0331455   .0296888     1.12   0.264    -.0250434    .0913344
     groupeu |   .0971877   .0414788     2.34   0.019     .0158909    .1784846
  groupother |   .0464425   .0666921     0.70   0.486    -.0842717    .1771566
          bg |   .1668322   .0486869     3.43   0.001     .0714077    .2622567
          ee |    .046844   .0376601     1.24   0.214    -.0269684    .1206564
          hu |  -.1756029   .0318083    -5.52   0.000    -.2379461   -.1132596
          lt |   .0217313   .0532751     0.41   0.683    -.0826859    .1261486
          ro |   .0857926   .0381214     2.25   0.024     .0110761    .1605091
          sk |  -.1463604    .030875    -4.74   0.000    -.2068742   -.0858465
       _cons |   .2911315   .5614863     0.52   0.604    -.8093615    1.391625
------------------------------------------------------------------------------
Endogenous variables:  lninsale firmgr
Exogenous variables:   lninninv06 invmills06 innintern abinn prodivers skills
     cocus couni colab cocom cosu patapp designreg copyright marinfo
     associnfo small medium manuf services fineu fingov groupeu groupother
     bg ee hu lt ro sk procesef costfact knowfact
------------------------------------------------------------------------------
```

A3.5.9.a Hansan-Sargan test for over-identification

```
. overid

Number of equations : 2
Total number of exogenous variables in system : 34
Number of estimated coefficients : 49
Net of 7 linear constraints / dependencies
Hansen-Sargan overidentification statistic :    10.820
Under H0, distributed as Chi-sq(19), pval = 0.9297
```

A3.5.10 3SLS bootstrapped SE - Main specification (CIS 2006: lnnewmktsale)

```
.
. bootstrap, reps(50) :reg3 (lnnewmktsale = lninninv06 invmills06 firmgr innintern abinn
prodivers skills codeg patapp designreg copyright marinfo associnfo small medium manuf service
fineu fingov groupeu groupother bg ee hu lt ro sk) (firmgr = lnnewmktsale innintern abinn
prodivers procesef costfact knowfact marinfo associnfo small medium manuf service fineu fingov
groupeu groupother bg ee hu lt ro sk) if y06==1(running reg3 on estimation sample)
Bootstrap replications (50)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................    50

Three-stage least-squares regression
--------------------------------------------------------------------------
```

```
Equation             Obs   Parms        RMSE    "R-sq"       chi2        P
----------------------------------------------------------------------------
lnnewmktsale       3,623      27    1.841276    0.2985    2715.60   0.0000
firmgr             3,623      23    .7059801    0.0538     178.12   0.0000
----------------------------------------------------------------------------

------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnnewmktsale |
  lninninv06 |   .5477607   .1384562     3.96   0.000     .2763915    .8191299
  invmills06 |  -.0472791   .0865743    -0.55   0.585    -.2169616    .1224033
      firmgr |   1.858457   .5839222     3.18   0.001     .7139902    3.002923
   innintern |   .1071609   .0608904     1.76   0.078    -.0121821    .2265039
       abinn |  -.1888672    .121954    -1.55   0.121    -.4278927    .0501582
   prodivers |   .2492674   .0767996     3.25   0.001      .098743    .3997918
      skills |  -.0997229   .0779745    -1.28   0.201    -.2525502    .0531044
       codeg |   .0363925   .0194163     1.87   0.061    -.0016628    .0744478
      patapp |   .1883467   .0733723     2.57   0.010     .0445396    .3321538
   designreg |  -.0259633   .0842958    -0.31   0.758    -.1911801    .1392536
   copyright |   .0116611   .1112927     0.10   0.917    -.2064686    .2297909
     marinfo |   .2531735   .0641937     3.94   0.000     .1273561    .3789908
   associnfo |   .0637433   .1269232     0.50   0.616    -.1850215    .3125082
       small |  -1.897058   .3529305    -5.38   0.000    -2.588789   -1.205327
      medium |  -.8924333    .188433    -4.74   0.000    -1.261755   -.5231115
       manuf |  -.9108548   .0926934    -9.83   0.000     -1.09253   -.7291791
    services |  -1.137894   .1475774    -7.71   0.000    -1.427141    -.848648
       fineu |  -.2436699    .127998    -1.90   0.057    -.4945413    .0072015
      fingov |  -.6227601   .1182851    -5.26   0.000    -.8545947   -.3909255
     groupeu |   .3324425   .1137967     2.92   0.003     .1094051    .5554798
  groupother |   .8019055   .1960345     4.09   0.000     .4176849    1.186126
          bg |  -1.041519   .1822538    -5.71   0.000     -1.39873   -.6843085
          ee |  -.5949286   .1279885    -4.65   0.000    -.8457815   -.3440757
          hu |   .3613914   .1452905     2.49   0.013     .0766273    .6461554
          lt |  -.3527201   .1603058    -2.20   0.028    -.6669137   -.0385265
          ro |  -.5708661   .1325255    -4.31   0.000    -.8306112   -.3111209
          sk |   .0673689   .1361656     0.49   0.621    -.1995109    .3342486
       _cons |   8.325976   1.675104     4.97   0.000     5.042832    11.60912
-------------+----------------------------------------------------------------
firmgr       |
lnnewmktsale |   .0155536   .0445683     0.35   0.727    -.0717986    .1029058
   innintern |  -.0226954   .0256511    -0.88   0.376    -.0729707    .0275798
       abinn |  -.0145009   .0231405    -0.63   0.531    -.0598555    .0308537
   prodivers |   .0352163   .0275826     1.28   0.202    -.0188447    .0892772
    procesef |   .1004132   .0300076     3.35   0.001     .0415994    .1592269
    costfact |  -.0889611   .0304703    -2.92   0.004    -.1486818   -.0292404
    knowfact |  -.0265562   .0377705    -0.70   0.482     -.100585    .0474727
     marinfo |  -.0136061   .0282173    -0.48   0.630     -.068911    .0416988
   associnfo |  -.0342311   .0473119    -0.72   0.469    -.1269607    .0584985
       small |   .1547708   .1395098     1.11   0.267    -.1186634    .4282049
      medium |   .0915362   .0667917     1.37   0.171     -.039373    .2224454
       manuf |   .0177548   .0488179     0.36   0.716    -.0779266    .1134362
    services |   .1560346   .0603192     2.59   0.010     .0378111    .2742582
       fineu |  -.0041458   .0403555    -0.10   0.918    -.0832411    .0749496
      fingov |   .0607131    .032943     1.84   0.065    -.0038541    .1252803
     groupeu |   .0616333   .0497342     1.24   0.215    -.0358439    .1591106
  groupother |   .0264123   .0821386     0.32   0.748    -.1345763    .1874009
          bg |   .2446483   .0614777     3.98   0.000     .1241542    .3651425
          ee |   .0340289   .0530756     0.64   0.521    -.0699972    .1380551
          hu |   -.149327   .0400563    -3.73   0.000    -.2278359   -.0708181
          lt |   .0474814    .068759     0.69   0.490    -.0872838    .1822467
          ro |     .13818   .0535986     2.58   0.010     .0331287    .2432314
          sk |  -.1088881   .0434084    -2.51   0.012    -.1939669   -.0238093
       _cons |  -.0389863   .6786437    -0.06   0.954    -1.369103    1.291131
------------------------------------------------------------------------------
Endogenous variables:  lnnewmktsale firmgr
Exogenous variables:   lninninv06 invmills06 innintern abinn prodivers skills
     codeg patapp designreg copyright marinfo associnfo small medium manuf
     services fineu fingov groupeu groupother bg ee hu lt ro sk procesef
     costfact knowfact
-----------------------------------------------------------------------------
```

A3.5.10.a Hansan-Sargan test for over-identification

```
. overid

Number of equations : 2
Total number of exogenous variables in system : 30
Number of estimated coefficients : 49
Net of 3 linear constraints / dependencies
Hansen-Sargan overidentification statistic :     7.090
Under H0, distributed as Chi-sq(11), pval = 0.7918
```

A3.5.11 3SLS bootstrapped SE - Alternative specification (CIS 2006: *lnnewmktsale*)

```
. bootstrap, reps(50) :reg3 (lnnewmktsale = lninninv06 invmills06 firmgr innintern abinn
prodivers skills cocus couni colab cocom cosu patapp designreg copyright marinfo associnfo small
medium manuf service fineu fingov groupeu groupother bg ee hu lt ro sk) (firmgr = lnnewmktsale
innintern abinn prodivers procesef costfact knowfact marinfo associnfo small medium manuf service
fineu fingov groupeu groupother bg ee hu lt ro sk) if y06==1(running reg3 on estimation sample)
Bootstrap replications (50)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................    50
Three-stage least-squares regression
----------------------------------------------------------------------
Equation             Obs   Parms        RMSE    "R-sq"       chi2        P
----------------------------------------------------------------------
lnnewmktsale       3,623      31    1.809798    0.3223    2855.29   0.0000
firmgr             3,623      23    .7037429    0.0598     180.04   0.0000
----------------------------------------------------------------------

------------------------------------------------------------------------------
             |  Observed   Bootstrap                         Normal-based
             |     Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnnewmktsale |
  lninninv06 |   .6474793   .1442192     4.49   0.000     .3648149    .9301436
  invmills06 |   -.005008   .0728606    -0.07   0.945    -.1478121    .1377961
      firmgr |   1.786724    .582439     3.07   0.002     .6451644    2.928283
   innintern |   .1115045   .0605936     1.84   0.066    -.0072567    .2302657
       abinn |  -.1746026   .1399831    -1.25   0.212    -.4489644    .0997592
   prodivers |    .259508   .0847726     3.06   0.002     .0933567    .4256592
      skills |  -.0934971   .0702458    -1.33   0.183    -.2311763    .0441821
       cocus |  -.0348408   .0787156    -0.44   0.658    -.1891206     .119439
       couni |  -.2192867   .0935164    -2.34   0.019    -.4025755   -.0359978
       colab |   .2462049   .1094524     2.25   0.024      .031682    .4607277
       cocom |   .1486648   .0871259     1.71   0.088    -.0220988    .3194284
        cosu |   -.034113   .0806389    -0.42   0.672    -.1921624    .1239363
      patapp |   .2051488   .0674272     3.04   0.002     .0729939    .3373036
   designreg |  -.0372698   .0874477    -0.43   0.670    -.2086642    .1341245
   copyright |   .0084196   .1044533     0.08   0.936     -.196305    .2131442
     marinfo |   .2542899   .0603879     4.21   0.000     .1359317    .3726481
   associnfo |   .0674248   .1151452     0.59   0.558    -.1582557    .2931053
       small |  -1.680574   .3501124    -4.80   0.000    -2.366782   -.9943663
      medium |  -.7797542   .1918789    -4.06   0.000     -1.15583   -.4036784
       manuf |  -.8927493   .1145763    -7.79   0.000    -1.117315   -.6681838
    services |  -1.125717   .1303201    -8.64   0.000     -1.38114   -.8702945
       fineu |  -.2800225   .1262701    -2.22   0.027    -.5275072   -.0325377
      fingov |   -.650956   .1309815    -4.97   0.000     -.907675   -.3942369
     groupeu |   .2847505   .1369553     2.08   0.038      .016323    .5531779
  groupother |   .7433749   .2029115     3.66   0.000     .3456757    1.141074
          bg |  -1.003057   .1873788    -5.35   0.000    -1.370312    -.635801
          ee |  -.6292978   .1319888    -4.77   0.000    -.8879912   -.3706045
          hu |   .3958323   .1421553     2.78   0.005     .1172131    .6744514
          lt |  -.3231302   .1505527    -2.15   0.032    -.6182082   -.0280523
          ro |    -.53458   .1459698    -3.66   0.000    -.8206756   -.2484844
          sk |   .0207217   .1581996     0.13   0.896    -.2893437    .3307872
       _cons |   7.123442   1.642476     4.34   0.000     3.904248    10.34264
-------------+----------------------------------------------------------------
firmgr       |
```

```
 lnnewmktsale |   .0329932   .0454285     0.73   0.468    -.0560451    .1220315
    innintern |  -.0242707   .0280625    -0.86   0.387    -.0792723    .0307309
        abinn |   -.017122   .0289858    -0.59   0.555    -.0739331    .0396891
    prodivers |   .0289091   .0280178     1.03   0.302    -.0260047    .0838229
     procesef |   .0972605   .0275518     3.53   0.000     .0432599    .1512611
     costfact |  -.0827868   .0273116    -3.03   0.002    -.1363166   -.029257
     knowfact |  -.0291934   .0404926    -0.72   0.471    -.1085576    .0501707
      marinfo |  -.0178914   .0258928    -0.69   0.490    -.0686404    .0328576
    associnfo |  -.0357707   .0472749    -0.76   0.449    -.1284278    .0568864
        small |   .2074697   .1423826     1.46   0.145     -.071595    .4865344
       medium |   .1173559   .0727485     1.61   0.107    -.0252285    .2599404
        manuf |   .0334939   .0602694     0.56   0.578    -.0846319    .1516197
     services |   .1696138   .0632174     2.68   0.007     .0457099    .2935176
        fineu |  -.0057485   .0389541    -0.15   0.883     -.082097    .0706001
       fingov |   .0610775   .0356665     1.71   0.087    -.0088276    .1309826
      groupeu |   .0465399   .0539747     0.86   0.389    -.0592486    .1523284
   groupother |    .001707   .0887891     0.02   0.985    -.1723166    .1757305
           bg |   .2599705   .0575377     4.52   0.000     .1471987    .3727423
           ee |   .0390113   .0463782     0.84   0.400    -.0518883    .1299109
           hu |  -.1474043   .0377187    -3.91   0.000    -.2213317   -.073477
           lt |   .0555541   .0707047     0.79   0.432    -.0830245    .1941328
           ro |   .1469686   .0473038     3.11   0.002     .0542549    .2396823
           sk |  -.1092145   .0390752    -2.79   0.005    -.1858005   -.0326285
        _cons |  -.3040578   .7050699    -0.43   0.666    -1.685969    1.077854
------------------------------------------------------------------------------
Endogenous variables:  lnnewmktsale firmgr
Exogenous variables:   lninninv06 invmills06 innintern abinn prodivers skills
     cocus couni colab cocom cosu patapp designreg copyright marinfo
     associnfo small medium manuf services fineu fingov groupeu groupother
     bg ee hu lt ro sk procesef costfact knowfact
------------------------------------------------------------------------------
```

A3.5.11.a Hansan-Sargan test for over-identification

```
. overid

Number of equations : 2
Total number of exogenous variables in system : 34
Number of estimated coefficients : 49
Net of 7 linear constraints / dependencies
Hansen-Sargan overidentification statistic :    10.082
Under H0, distributed as Chi-sq(19), pval = 0.9509
```

A3.5.12 3SLS bootstrapped SE - Main specification (CIS 2006: lnnewfrmsale)

```
. bootstrap, reps(50) :reg3 (lnnewfrmsale = lninninv06 invmills06 firmgr innintern abinn
prodivers skills codeg patapp designreg copyright marinfo associnfo small medium manuf service
fineu fingov groupeu groupother bg ee hu lt ro sk) (firmgr = lnnewfrmsale innintern abinn
prodivers procesef costfact knowfact marinfo associnfo small medium manuf service fineu fingov
groupeu groupother bg ee hu lt ro sk) if y06==1(running reg3 on estimation sample)
Bootstrap replications (50)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................    50

Three-stage least-squares regression
----------------------------------------------------------------------
Equation          Obs   Parms        RMSE    "R-sq"       chi2        P
----------------------------------------------------------------------
lnnewfrmsale    4,938      27     1.64372    0.4339    4748.88   0.0000
firmgr          4,938      23    .7627215    0.0353     213.55   0.0000
----------------------------------------------------------------------
------------------------------------------------------------------------------
```

	Observed Coef.	Bootstrap Std. Err.	z	P>|z|	Normal-based [95% Conf.	Interval]
lnnewfrmsale						
lninninv06	.7646397	.1225248	6.24	0.000	.5244954	1.004784
invmills06	.1591616	.0661008	2.41	0.016	.0296063	.2887168
firmgr	1.321082	.4576833	2.89	0.004	.4240392	2.218125
innintern	.1492214	.0641317	2.33	0.020	.0235257	.2749172
abinn	-.0776208	.108712	-0.71	0.475	-.2906923	.1354508
prodivers	.2285935	.0632163	3.62	0.000	.1046918	.3524952
skills	-.0080795	.0559843	-0.14	0.885	-.1178067	.1016478
codeg	-.0014724	.013418	-0.11	0.913	-.0277712	.0248264
patapp	.1628188	.0759134	2.14	0.032	.0140313	.3116063
designreg	.0599987	.0826334	0.73	0.468	-.1019598	.2219572
copyright	-.1190542	.0956181	-1.25	0.213	-.3064623	.0683539
marinfo	.161934	.04893	3.31	0.001	.0660329	.257835
associnfo	-.0889637	.1338212	-0.66	0.506	-.3512484	.1733211
small	-1.50999	.3118229	-4.84	0.000	-2.121152	-.8988286
medium	-.7194776	.1891059	-3.80	0.000	-1.090118	-.3488368
manuf	-.7343834	.0902218	-8.14	0.000	-.9112148	-.5575519
services	-.8202423	.1153038	-7.11	0.000	-1.046234	-.5942509
fineu	-.3415944	.1004213	-3.40	0.001	-.5384165	-.1447722
fingov	-.4984242	.1081652	-4.61	0.000	-.7104241	-.2864243
groupeu	.2141135	.107267	2.00	0.046	.0038741	.424353
groupother	.2124236	.1861723	1.14	0.254	-.1524675	.5773146
bg	-.9647105	.129652	-7.44	0.000	-1.218824	-.7105972
ee	-.3728819	.118893	-3.14	0.002	-.6059079	-.1398559
hu	.3777229	.1127896	3.35	0.001	.1566593	.5987865
lt	-.1075334	.1096826	-0.98	0.327	-.3225074	.1074405
ro	-.2653884	.0862961	-3.08	0.002	-.4345257	-.0962511
sk	-.0487269	.1387584	-0.35	0.725	-.3206883	.2232345
_cons	5.600434	1.440843	3.89	0.000	2.776433	8.424435
firmgr						
lnnewfrmsale	-.0101551	.0623773	-0.16	0.871	-.1324124	.1121022
innintern	.0133651	.0274922	0.49	0.627	-.0405187	.0672488
abinn	-.0572602	.0275842	-2.08	0.038	-.1113243	-.0031962
prodivers	.0828882	.0348834	2.38	0.017	.014518	.1512584
procesef	.0791302	.0241444	3.28	0.001	.0318081	.1264524
costfact	-.1001952	.0311537	-3.22	0.001	-.1612554	-.039135
knowfact	-.0094073	.0464121	-0.20	0.839	-.1003733	.0815586
marinfo	-.0188492	.0220809	-0.85	0.393	-.062127	.0244286
associnfo	-.0138888	.0502311	-0.28	0.782	-.11234	.0845625
small	.0687017	.2061189	0.33	0.739	-.3352839	.4726873
medium	.0440549	.1073246	0.41	0.681	-.1662974	.2544072
manuf	-.0666487	.0730717	-0.91	0.362	-.2098666	.0765693
services	.1035043	.0673532	1.54	0.124	-.0285056	.2355142
fineu	.0391566	.0407529	0.96	0.337	-.0407176	.1190309
fingov	.0065285	.0311606	0.21	0.834	-.0545453	.0676022
groupeu	.122478	.0593477	2.06	0.039	.0061587	.2387973
groupother	.0665533	.0834159	0.80	0.425	-.0969388	.2300454
bg	.1436885	.0722334	1.99	0.047	.0021135	.2852634
ee	.0261398	.0452568	0.58	0.564	-.0625618	.1148415
hu	-.188982	.0356557	-5.30	0.000	-.2588658	-.1190982
lt	.0439264	.0446508	0.98	0.325	-.0435876	.1314404
ro	.0684689	.0348481	1.96	0.049	.0001679	.1367699
sk	-.1600362	.0437317	-3.66	0.000	-.2457487	-.0743237
_cons	.454604	.9626343	0.47	0.637	-1.432125	2.341333

Endogenous variables: lnnewfrmsale firmgr
Exogenous variables: lninninv06 invmills06 innintern abinn prodivers skills codeg patapp designreg copyright marinfo associnfo small medium manuf services fineu fingov groupeu groupother bg ee hu lt ro sk procesef costfact knowfact

A3.5.12.a Hansan-Sargan test for over-identification

```
. overid

Number of equations : 2
Total number of exogenous variables in system : 30
Number of estimated coefficients : 49
Net of 3 linear constraints / dependencies
Hansen-Sargan overidentification statistic :     7.552
Under H0, distributed as Chi-sq(11), pval = 0.7528
```

A3.5.13 3SLS bootstrapped SE - Alternative specification (CIS 2006: lnnewfrmsale)

```
. bootstrap, reps(50) :reg3 (lnnewfrmsale = lninninv06 invmills06 firmgr innintern abinn
prodivers skills cocus couni colab cocom cosu patapp designreg copyright marinfo associnfo small
medium manuf service fineu fingov groupeu groupother bg ee hu lt ro sk) (firmgr = lnnewfrmsale
innintern abinn prodivers procesef costfact knowfact marinfo associnfo small medium manuf service
fineu fingov groupeu groupother bg ee hu lt ro sk) if y06==1
(running reg3 on estimation sample)
Bootstrap replications (50)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................    50

Three-stage least-squares regression
----------------------------------------------------------------------
Equation             Obs   Parms        RMSE    "R-sq"       chi2        P
----------------------------------------------------------------------
lnnewfrmsale       4,938      31    1.602097    0.4622    5028.36   0.0000
firmgr             4,938      23    .7586097    0.0457     215.99   0.0000
----------------------------------------------------------------------
------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnnewfrmsale |
  lninninv06 |    .878225   .1240193     7.08   0.000     .6351516    1.121298
  invmills06 |   .1834048   .0764486     2.40   0.016     .0335684    .3332413
      firmgr |   1.203109   .3860894     3.12   0.002      .446388    1.959831
   innintern |   .1524378   .0576499     2.64   0.008      .039446    .2654297
       abinn |  -.1000738   .1057114    -0.95   0.344    -.3072643    .1071168
   prodivers |   .2449662    .064766     3.78   0.000     .1180272    .3719052
      skills |  -.0025376   .0592741    -0.04   0.966    -.1187128    .1136375
       cocus |  -.1460167   .0601731    -2.43   0.015    -.2639538   -.0280795
       couni |  -.0774997   .0700178    -1.11   0.268     -.214732    .0597326
       colab |   .2423598     .07961     3.04   0.002      .086327    .3983925
       cocom |   -.017315   .0656054    -0.26   0.792    -.1458991    .1112692
        cosu |  -.1018689   .0773097    -1.32   0.188    -.2533932    .0496554
      patapp |   .1529354   .0913885     1.67   0.094    -.0261828    .3320537
   designreg |   .0476342   .0751748     0.63   0.526    -.0997056    .1949741
   copyright |  -.1265501   .1031813    -1.23   0.220    -.3287817    .0756816
     marinfo |    .165856    .050249     3.30   0.001     .0673699    .2643422
   associnfo |  -.0847044   .1068253    -0.79   0.428    -.2940781    .1246693
       small |  -1.238735   .3108406    -3.99   0.000    -1.847972   -.6294989
      medium |  -.5726051   .1927629    -2.97   0.003    -.9504135   -.1947968
       manuf |  -.7380623   .0843251    -8.75   0.000    -.9033363   -.5727882
    services |  -.8161522   .0900688    -9.06   0.000    -.9926839   -.6396205
       fineu |  -.3963839   .1100195    -3.60   0.000    -.6120181   -.1807496
      fingov |  -.5797193   .1188383    -4.88   0.000    -.8126381   -.3468004
     groupeu |     .14668   .0970448     1.51   0.131    -.0435243    .3368842
  groupother |   .1073001    .174938     0.61   0.540    -.2355721    .4501724
          bg |  -.9227786   .0954481    -9.67   0.000    -1.109854   -.7357037
```

```
          ee |  -.4197863   .0973696    -4.31   0.000    -.6106272   -.2289455
          hu |   .3738019   .1070251     3.49   0.000     .1640366    .5835673
          lt |  -.0513957   .1284731    -0.40   0.689    -.3031983    .2004069
          ro |  -.2394936   .0987311    -2.43   0.015     -.433003   -.0459842
          sk |  -.1000768   .1430685    -0.70   0.484    -.3804859    .1803322
       _cons |   4.294263   1.465657     2.93   0.003     1.421628    7.166899
-------------+----------------------------------------------------------------
firmgr       |
 lnnewfrmsale |   .0066559   .0486969     0.14   0.891    -.0887884    .1021001
   innintern |   .0103021   .0259325     0.40   0.691    -.0405247    .0611289
       abinn |  -.0583961   .0234822    -2.49   0.013    -.1044204   -.0123719
   prodivers |   .0766139   .0277398     2.76   0.006     .0222448    .1309829
    procesef |   .0785362   .0208637     3.76   0.000      .037644    .1194283
    costfact |  -.0945623   .0270909    -3.49   0.000    -.1476595   -.0414651
    knowfact |  -.0084532   .0423596    -0.20   0.842    -.0914766    .0745702
     marinfo |  -.0216568   .0233738    -0.93   0.354    -.0674685    .0241549
   associnfo |  -.0129043   .0562579    -0.23   0.819    -.1231677    .0973591
       small |   .1215923   .1580312     0.77   0.442    -.1881433    .4313278
      medium |   .0710465    .080068     0.89   0.375     -.085884    .2279769
       manuf |  -.0525747   .0517394    -1.02   0.310     -.153982    .0488326
    services |   .1138638   .0507932     2.24   0.025      .014311    .2134166
       fineu |   .0368118     .04025     0.91   0.360    -.0420768    .1157003
      fingov |   .0044443   .0329818     0.13   0.893    -.0601989    .0690874
     groupeu |   .1080089   .0539776     2.00   0.045     .0022148     .213803
  groupother |   .0495567   .0800832     0.62   0.536    -.1074034    .2065169
          bg |   .1617009   .0550236     2.94   0.003     .0538568    .2695451
          ee |   .0263764   .0455156     0.58   0.562    -.0628326    .1155854
          hu |  -.1867686   .0370244    -5.04   0.000     -.259335   -.1142022
          lt |    .049248   .0496362     0.99   0.321    -.0480372    .1465332
          ro |   .0754615   .0416317     1.81   0.070    -.0061352    .1570581
          sk |  -.1585427   .0402036    -3.94   0.000    -.2373404   -.0797451
       _cons |   .1971981   .7417303     0.27   0.790    -1.256567    1.650963
------------------------------------------------------------------------------
Endogenous variables:  lnnewfrmsale firmgr
Exogenous variables:   lninninv06 invmills06 innintern abinn prodivers skills
     cocus couni colab cocom cosu patapp designreg copyright marinfo
     associnfo small medium manuf services fineu fingov groupeu groupother
     bg ee hu lt ro sk procesef costfact knowfact
------------------------------------------------------------------------------
```

A3.5.13.a Hansan-Sargan test for overidentification

```
. overid

Number of equations : 2
Total number of exogenous variables in system : 34
Number of estimated coefficients : 49
Net of 7 linear constraints / dependencies
Hansen-Sargan overidentification statistic :     9.816
Under H0, distributed as Chi-sq(19), pval = 0.9573
```

A3.5.14 3SLS bootstrapped SE - Main specification (CIS 2004: lninsale)

```
. bootstrap, reps(50) :reg3 (lninsale = lninninv04 invmills04 firmgr innintern abinn prodivers
skills codeg patapp designreg copyright marinfo associnfo small medium manuf service fineu fingov
groupeu groupother bg ee hu lt ro sk) (firmgr = lninsale innintern abinn prodivers procesef
costfact knowfact marinfo associnfo small medium manuf service fineu fingov groupeu groupother bg
ee hu lt ro sk) if y04==1(running reg3 on estimation sample)

Bootstrap replications (50)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
```

.... 50

Three-stage least-squares regression

Equation	Obs	Parms	RMSE	"R-sq"	chi2	P
lninsale	5,565	27	2.056675	0.0969	3519.88	0.0000
firmgr	5,565	23	.6558621	0.0430	368.51	0.0000

	Observed Coef.	Bootstrap Std. Err.	z	P>|z|	Normal-based [95% Conf.	Interval]
lninsale						
lninninv04	.6061711	.0927943	6.53	0.000	.4242975	.7880447
invmills04	-.1329419	.0785933	-1.69	0.091	-.286982	.0210982
firmgr	2.550126	.6366006	4.01	0.000	1.302412	3.79784
innintern	.1933833	.07202	2.69	0.007	.0522267	.3345399
abinn	-.168249	.1099192	-1.53	0.126	-.3836866	.0471887
prodivers	.337332	.0555259	6.08	0.000	.2285032	.4461608
skills	-.0934356	.0704976	-1.33	0.185	-.2316083	.0447372
codeg	.035764	.0136594	2.62	0.009	.008992	.0625359
patapp	.3301611	.0748545	4.41	0.000	.1834489	.4768733
designreg	.0604926	.0755527	0.80	0.423	-.0875879	.2085732
copyright	.022894	.0969775	0.24	0.813	-.1671785	.2129665
marinfo	.0392425	.0674527	0.58	0.561	-.0929624	.1714473
associnfo	.2728665	.112996	2.41	0.016	.0513984	.4943346
small	-1.714641	.2839302	-6.04	0.000	-2.271134	-1.158148
medium	-.9377157	.1743507	-5.38	0.000	-1.279437	-.5959947
manuf	-.9784451	.108025	-9.06	0.000	-1.19017	-.7667201
services	-1.11087	.1240295	-8.96	0.000	-1.353964	-.867777
fineu	-.1279719	.1293221	-0.99	0.322	-.3814385	.1254948
fingov	-.3963645	.1183378	-3.35	0.001	-.6283023	-.1644267
groupeu	.3261028	.1043651	3.12	0.002	.121551	.5306547
groupother	.356941	.1864803	1.91	0.056	-.0085537	.7224358
bg	-1.073734	.1860363	-5.77	0.000	-1.438359	-.7091098
ee	-1.521154	.1683747	-9.03	0.000	-1.851163	-1.191146
hu	.0767786	.1097178	0.70	0.484	-.1382643	.2918216
lt	-1.01212	.2898603	-3.49	0.000	-1.580236	-.4440044
ro	-.0329028	.0832508	-0.40	0.693	-.1960714	.1302659
sk	.0159265	.0794675	0.20	0.841	-.139827	.17168
_cons	8.118551	1.120847	7.24	0.000	5.921732	10.31537
firmgr						
lninsale	-.0280424	.0344544	-0.81	0.416	-.0955718	.039487
innintern	.0118479	.0219148	0.54	0.589	-.0311044	.0548001
abinn	-.0120805	.0235311	-0.51	0.608	-.0582007	.0340396
prodivers	.0124006	.0211495	0.59	0.558	-.0290517	.0538529
procesef	.1160514	.0190884	6.08	0.000	.0786388	.153464
costfact	-.0637356	.0214898	-2.97	0.003	-.1058547	-.0216164
knowfact	-.0213632	.0292257	-0.73	0.465	-.0786445	.0359182
marinfo	.0409179	.0200142	2.04	0.041	.0016907	.080145
associnfo	-.0596732	.0326264	-1.83	0.067	-.1236198	.0042733
small	.0605533	.1050799	0.58	0.564	-.1453995	.2665061
medium	.034316	.0609589	0.56	0.573	-.0851613	.1537934
manuf	-.0258974	.0461463	-0.56	0.575	-.1163425	.0645477
services	.0223558	.0461999	0.48	0.628	-.0681943	.1129059
fineu	-.0596951	.0330147	-1.81	0.071	-.1244027	.0050126
fingov	.027418	.0311939	0.88	0.379	-.0337209	.0885569
groupeu	.0823587	.041922	1.96	0.049	.0001931	.1645244
groupother	.1792693	.0710643	2.52	0.012	.0399859	.3185527
bg	.2450428	.038625	6.34	0.000	.1693392	.3207463
ee	.160202	.0512881	3.12	0.002	.0596791	.2607248
hu	-.0354982	.0265806	-1.34	0.182	-.0875952	.0165988
lt	.3604855	.0510779	7.06	0.000	.2603746	.4605964
ro	-.0708883	.0291907	-2.43	0.015	-.128101	-.0136757
sk	-.0129712	.0303573	-0.43	0.669	-.0724704	.046528
_cons	.4321537	.5217106	0.83	0.407	-.5903804	1.454688

Endogenous variables: lninsale firmgr

```
Exogenous variables:   lninninv04 invmills04 innintern abinn prodivers skills
     codeg patapp designreg copyright marinfo associnfo small medium manuf
     services fineu fingov groupeu groupother bg ee hu lt ro sk procesef
     costfact knowfact
------------------------------------------------------------------------------
```

A3.5.14.a Hansan-Sargan test for over-identification

```
. overid

Number of equations : 2
Total number of exogenous variables in system : 30
Number of estimated coefficients : 49
Net of 3 linear constraints / dependencies
Hansen-Sargan overidentification statistic :    16.771
Under H0, distributed as Chi-sq(11), pval = 0.1148
```

A3.5.15 3SLS bootstrapped SE - Alternative specification (CIS 2004: lninsale)

```
. bootstrap, reps(50) :reg3 (lninsale = lninninv04 invmills04 firmgr innintern abinn prodivers
skills cocus couni colab cocom cosu patapp designreg copyright marinfo associnfo small medium
manuf service fineu fingov groupeu groupother bg ee hu lt ro sk) (firmgr = lninsale innintern
abinn prodivers procesef costfact knowfact marinfo associnfo small medium manuf service fineu
fingov groupeu groupother bg ee hu lt ro sk) if y04==1
(running reg3 on estimation sample)
Bootstrap replications (50)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................    50

Three-stage least-squares regression
----------------------------------------------------------------------
Equation             Obs   Parms        RMSE    "R-sq"       chi2        P
----------------------------------------------------------------------
lninsale           5,565      31    2.039876    0.1116    3550.79   0.0000
firmgr             5,565      23    .6563312    0.0417     368.17   0.0000
----------------------------------------------------------------------

------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lninsale    |
  lninninv04 |   .6599438   .0879655     7.50   0.000     .4875346    .8323529
  invmills04 |  -.1236155   .0568563    -2.17   0.030    -.2350518   -.0121792
      firmgr |   2.515107    .390117     6.45   0.000     1.750492    3.279722
   innintern |   .1948764   .0596641     3.27   0.001      .077937    .3118159
       abinn |  -.1837046   .0964919    -1.90   0.057    -.3728253    .0054161
   prodivers |    .338144   .0507387     6.66   0.000      .238698    .4375899
      skills |  -.0875527   .0654353    -1.34   0.181    -.2158036    .0406982
       cocus |   -.009392   .0789438    -0.12   0.905     -.164119     .145335
       couni |   .1349178   .0714996     1.89   0.059    -.0052188    .2750544
       colab |    .166488   .0739459     2.25   0.024     .0215568    .3114192
       cocom |   -.038963   .0749573    -0.52   0.603    -.1858766    .1079506
        cosu |  -.0571287   .0737044    -0.78   0.438    -.2015867    .0873293
      patapp |   .3138281   .0682591     4.60   0.000     .1800428    .4476134
   designreg |   .0526225   .0825748     0.64   0.524    -.1092211     .214466
   copyright |   .0201864   .0988765     0.20   0.838    -.1736079    .2139807
     marinfo |   .0466813   .0584133     0.80   0.424    -.0678066    .1611691
   associnfo |   .2682813   .1243611     2.16   0.031      .024538    .5120245
       small |  -1.580063   .2441141    -6.47   0.000    -2.058518   -1.101608
```

```
      medium |  -.8660018   .1399877    -6.19   0.000    -1.140373   -.5916309
       manuf |  -.9883134   .1205606    -8.20   0.000    -1.224608   -.7520189
    services |  -1.116061    .131991    -8.46   0.000    -1.374759   -.8573633
       fineu |  -.1649677   .1147542    -1.44   0.151    -.3898818    .0599464
      fingov |  -.4441835   .1015929    -4.37   0.000    -.6433019    -.245065
     groupeu |   .2998166   .1040597     2.88   0.004     .0958633      .50377
  groupother |   .3255238   .1885593     1.73   0.084    -.0440457    .6950933
          bg |  -1.040089   .1553632    -6.69   0.000    -1.344595   -.7355826
          ee |   -1.51183   .1432204   -10.56   0.000    -1.792537   -1.231123
          hu |   .0750506   .1097776     0.68   0.494    -.1401095    .2902107
          lt |   -.956783   .2333677    -4.10   0.000    -1.414175   -.4993907
          ro |  -.0243774   .0876461    -0.28   0.781    -.1961606    .1474058
          sk |    .022626   .0842568     0.27   0.788    -.1425143    .1877664
       _cons |   7.497698   1.052533     7.12   0.000     5.434772    9.560624
-------------+----------------------------------------------------------------
firmgr       |
    lninsale |  -.0296932   .0341854    -0.87   0.385    -.0966954     .037309
   innintern |   .0118387   .0212399     0.56   0.577    -.0297908    .0534682
       abinn |  -.0117605    .019978    -0.59   0.556    -.0509167    .0273958
   prodivers |   .0127692   .0227211     0.56   0.574    -.0317634    .0573018
    procesef |   .1180345   .0235017     5.02   0.000     .0719721    .1640969
    costfact |  -.0622294   .0155973    -3.99   0.000    -.0927995   -.0316593
    knowfact |  -.0215759   .0293726    -0.73   0.463    -.0791452    .0359935
     marinfo |   .0409057   .0192513     2.12   0.034     .0031739    .0786375
   associnfo |  -.0597883   .0358513    -1.67   0.095    -.1300556     .010479
       small |   .0556216    .103823     0.54   0.592    -.1478678    .2591111
      medium |   .0317138     .05175     0.61   0.540    -.0697143     .133142
       manuf |  -.0275646    .043708    -0.63   0.528    -.1132306    .0581015
    services |   .0209102   .0481861     0.43   0.664    -.0735329    .1153533
       fineu |  -.0594809   .0277462    -2.14   0.032    -.1138623   -.0050994
      fingov |   .0276327   .0249119     1.11   0.267    -.0211936    .0764591
     groupeu |   .0842737   .0426813     1.97   0.048     .0006199    .1679275
  groupother |   .1816308   .0719484     2.52   0.012     .0406146    .3226471
          bg |   .2435736   .0375524     6.49   0.000     .1699723    .3171749
          ee |   .1582128   .0479797     3.30   0.001     .0641743    .2522513
          hu |  -.0358711   .0333464    -1.08   0.282    -.1012288    .0294865
          lt |   .3597595   .0544749     6.60   0.000     .2529906    .4665284
          ro |   -.072336   .0299389    -2.42   0.016    -.1310152   -.0136567
          sk |  -.0130858   .0309521    -0.42   0.672    -.0737509    .0475793
       _cons |   .4568327   .5088554     0.90   0.369    -.5405056    1.454171
------------------------------------------------------------------------------
Endogenous variables:  lninsale firmgr
Exogenous variables:   lninninv04 invmills04 innintern abinn prodivers skills
     cocus couni colab cocom cosu patapp designreg copyright marinfo
     associnfo small medium manuf services fineu fingov groupeu groupother
     bg ee hu lt ro sk procesef costfact knowfact
------------------------------------------------------------------------------
```

A3.5.15.a Hansan-Sargan test for over-identification

```
. overid

Number of equations : 2
Total number of exogenous variables in system : 34
Number of estimated coefficients : 49
Net of 7 linear constraints / dependencies
Hansen-Sargan overidentification statistic :    18.390
Under H0, distributed as Chi-sq(19), pval = 0.4966
```

A3.5.16 3SLS bootstrapped SE - Main specification (CIS 2004: lnnewmktsale)

```
.
. bootstrap, reps(50) :reg3 (lnnewmktsale = lninninv04 invmills04 firmgr innintern abinn
prodivers skills codeg patapp designreg copyright marinfo associnfo small medium manuf service
fineu fingov groupeu groupother bg ee hu lt ro sk) (firmgr = lnnewmktsale innintern abinn
prodivers procesef costfact knowfact marinfo associnfo small medium manuf service fineu fingov
groupeu groupother bg ee hu lt ro sk) if y04==1
(running reg3 on estimation sample)
Bootstrap replications (50)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................    50

Three-stage least-squares regression
----------------------------------------------------------------------
Equation             Obs   Parms        RMSE    "R-sq"       chi2        P
----------------------------------------------------------------------
lnnewmkts~e        3,468      27    2.785223   -0.6793    1161.70   0.0000
firmgr              3,468      23     .656921   -0.0045     198.03   0.0000
----------------------------------------------------------------------
------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lnnewmktsale |
   lninninv04 |   .5891476   .1571345     3.75   0.000     .2811696    .8971256
   invmills04 |  -.0798497   .0996198    -0.80   0.423    -.2751008    .1154014
       firmgr |    4.00399   1.024717     3.91   0.000     1.995582    6.012399
    innintern |   .0187071   .0873833     0.21   0.830    -.1525609    .1899752
        abinn |   -.186083   .1859975    -1.00   0.317    -.5506313    .1784653
    prodivers |    .287925   .0913841     3.15   0.002     .1088155    .4670345
       skills |   -.099361   .1117371    -0.89   0.374    -.3183616    .1196397
        codeg |    .037777   .0187322     2.02   0.044     .0010626    .0744914
       patapp |   .2312237   .1110003     2.08   0.037     .0136671    .4487803
    designreg |   .0753885   .0864378     0.87   0.383    -.0940265    .2448035
    copyright |  -.0580369   .1190236    -0.49   0.626    -.2913189    .1752451
      marinfo |  -.0100805   .0915281    -0.11   0.912    -.1894723    .1693114
    associnfo |   .3788987   .1668488     2.27   0.023     .0518811    .7059164
        small |  -2.091026   .4175555    -5.01   0.000     -2.90942   -1.272633
       medium |   -1.16497   .2502945    -4.65   0.000    -1.655538   -.6744012
        manuf |  -1.021125   .1319603    -7.74   0.000    -1.279762   -.7624876
     services |  -1.214692   .1896313    -6.41   0.000    -1.586363   -.8430217
        fineu |  -.2877598   .1802756    -1.60   0.110    -.6410935     .065574
       fingov |  -.5113222   .1639102    -3.12   0.002    -.8325803   -.1900641
      groupeu |   .2339806   .1724755     1.36   0.175    -.1040652    .5720264
   groupother |   -.045719   .3409098    -0.13   0.893     -.71389    .6224519
           bg |  -.9620286   .2966965    -3.24   0.001    -1.543543   -.3805141
           ee |  -1.574928   .2051981    -7.68   0.000    -1.977109   -1.172747
           hu |   .0305329   .2089776     0.15   0.884    -.3790556    .4401215
           lt |  -1.307081   .3705179    -3.53   0.000    -2.033282   -.5808788
           ro |   .2334644   .1624358     1.44   0.151    -.0849039    .5518327
           sk |   .1167139    .164442     0.71   0.478    -.2055865    .4390142
        _cons |   8.093531   1.823685     4.44   0.000     4.519174    11.66789
-------------+----------------------------------------------------------------
firmgr       |
 lnnewmktsale |  -.0646677   .0633524    -1.02   0.307    -.1888361    .0595006
    innintern |   .0407504   .0305415     1.33   0.182    -.0191099    .1006106
        abinn |  -.0192033   .0276066    -0.70   0.487    -.0733112    .0349047
    prodivers |    .036818   .0370703     0.99   0.321    -.0358385    .1094744
     procesef |   .0943277    .029155     3.24   0.001     .0371849    .1514706
     costfact |  -.0792965   .0276981    -2.86   0.004    -.1335838   -.0250093
     knowfact |   .0012861   .0320635     0.04   0.968    -.0615572    .0641293
      marinfo |   .0467662   .0230166     2.03   0.042     .0016545     .091878
    associnfo |  -.0436219   .0389888    -1.12   0.263    -.1200384    .0327947
        small |   -.045707   .1994819    -0.23   0.819    -.4366844    .3452703
       medium |  -.0114623   .1060624    -0.11   0.914    -.2193408    .1964163
        manuf |  -.0733754   .0713772    -1.03   0.304    -.2132723    .0665214
     services |   .0102921   .0593091     0.17   0.862    -.1059516    .1265358
```

```
        fineu |  -.0658218    .033422    -1.97   0.049    -.1313276   -.0003159
       fingov |   .0239374   .0286662     0.84   0.404    -.0322474    .0801222
      groupeu |   .0979867    .056574     1.73   0.083    -.0128964    .2088698
   groupother |   .2452693   .0949016     2.58   0.010     .0592656     .431273
           bg |   .2167725   .0356746     6.08   0.000     .1468514    .2866935
           ee |    .055277   .0792139     0.70   0.485    -.0999793    .2105333
           hu |  -.0029178   .0434039    -0.07   0.946     -.087988    .0821523
           lt |   .3052466   .0532556     5.73   0.000     .2008675    .4096257
           ro |  -.0706241   .0337026    -2.10   0.036    -.1366801   -.0045682
           sk |   .0046715   .0370365     0.13   0.900    -.0679187    .0772617
        _cons |   .9778791   .9486777     1.03   0.303    -.8814949    2.837253
------------------------------------------------------------------------------
Endogenous variables:  lnnewmktsale firmgr
Exogenous variables:   lninninv04 invmills04 innintern abinn prodivers skills
     codeg patapp designreg copyright marinfo associnfo small medium manuf
     services fineu fingov groupeu groupother bg ee hu lt ro sk procesef
     costfact knowfact
------------------------------------------------------------------------------
```

A3.5.16.a Hansan-Sargan test for overidentification

```
. overid

Number of equations : 2
Total number of exogenous variables in system : 30
Number of estimated coefficients : 49
Net of 3 linear constraints / dependencies
Hansen-Sargan overidentification statistic :    15.475
Under H0, distributed as Chi-sq(11), pval = 0.1618
```

A3.5.17 3SLS bootstrapped SE - Alternative specification (CIS 2004: lnnewmktsale)

```
. bootstrap, reps(50) :reg3 (lnnewmktsale = lninninv04 invmills04 firmgr innintern abinn
prodivers skills cocus couni colab cocom cosu patapp designreg copyright marinfo associnfo small
medium manuf service fineu fingov groupeu groupother bg ee hu lt ro sk) (firmgr = lnnewmktsale
innintern abinn prodivers procesef costfact knowfact marinfo associnfo small medium manuf service
fineu fingov groupeu groupother bg ee hu lt ro sk) if y04==1
(running reg3 on estimation sample)
Bootstrap replications (50)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................    50

Three-stage least-squares regression
----------------------------------------------------------------------
Equation             Obs   Parms        RMSE    "R-sq"       chi2        P
----------------------------------------------------------------------
lnnewmktsale       3,468      31     2.80197   -0.6996    1144.48   0.0000
firmgr             3,468      23    .6565084   -0.0032     198.04   0.0000
----------------------------------------------------------------------

------------------------------------------------------------------------------
             |  Observed   Bootstrap                         Normal-based
             |     Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lnnewmktsale |
   lninninv04 |   .6204633     .18708     3.32   0.001     .2537933    .9871334
   invmills04 |  -.0767451   .1080058    -0.71   0.477    -.2884325    .1349424
       firmgr |   4.037042   1.367001     2.95   0.003     1.357768    6.716315
    innintern |   .0187205   .1113464     0.17   0.866    -.1995144    .2369555
        abinn |  -.2002286   .1811795    -1.11   0.269    -.5553339    .1548766
    prodivers |   .2824428    .103344     2.73   0.006     .0798923    .4849933
```

```
       skills |   -.093405   .1348527    -0.69   0.489    -.3577113    .1709014
        cocus |  -.0725369   .0957363    -0.76   0.449    -.2601766    .1151028
        couni |   .2412838   .1051991     2.29   0.022     .0350974    .4474702
        colab |   .0507602   .1197103     0.42   0.672    -.1838677    .2853881
        cocom |  -.0979929   .0978126    -1.00   0.316    -.2897021    .0937163
         cosu |   .0698404   .1218245     0.57   0.566    -.1689313    .3086122
       patapp |   .2136017   .1064079     2.01   0.045      .005046    .4221574
    designreg |   .0685941   .0972007     0.71   0.480    -.1219158     .259104
    copyright |  -.0526742   .1094263    -0.48   0.630    -.2671459    .1617974
      marinfo |  -.0019723   .1059821    -0.02   0.985    -.2096934    .2057487
    associnfo |   .3758867   .2117468     1.78   0.076    -.0391294    .7909027
        small |  -2.010816   .5302923    -3.79   0.000    -3.050169   -.9714617
       medium |  -1.121956   .3031138    -3.70   0.000    -1.716048   -.5278641
        manuf |  -1.029881   .1849438    -5.57   0.000    -1.392365   -.6673982
     services |  -1.219427    .216743    -5.63   0.000    -1.644235   -.7946184
        fineu |  -.3006932   .2147016    -1.40   0.161    -.7215006    .1201143
       fingov |    -.54417   .1699472    -3.20   0.001    -.8772604   -.2110796
      groupeu |   .2203196   .1925944     1.14   0.253    -.1571586    .5977977
   groupother |   -.063245   .4050403    -0.16   0.876    -.8571093    .7306193
           bg |  -.9547435   .3985408    -2.40   0.017    -1.735869   -.1736179
           ee |  -1.565513   .2120176    -7.38   0.000     -1.98106   -1.149966
           hu |   .0303125   .1497637     0.20   0.840     -.263219     .323844
           lt |  -1.276653    .605661    -2.11   0.035    -2.463726    -.089579
           ro |   .2429365   .1565611     1.55   0.121    -.0639176    .5497905
           sk |   .1407397   .1818376     0.77   0.439    -.2156555    .4971348
        _cons |   7.727564   2.172149     3.56   0.000     3.470229     11.9849
-------------+----------------------------------------------------------------
firmgr       |
 lnnewmktsale |    -.06371   .0576867    -1.10   0.269    -.1767739     .049354
    innintern |   .0405029   .0281218     1.44   0.150    -.0146148    .0956206
        abinn |  -.0194777   .0259355    -0.75   0.453    -.0703104     .031355
   prodivers |   .0364106   .0330822     1.10   0.271    -.0284293    .1012505
     procesef |   .0943971   .0333359     2.83   0.005       .02906    .1597343
     costfact |  -.0776751   .0239251    -3.25   0.001    -.1245674   -.0307828
     knowfact |   .0016125   .0347755     0.05   0.963    -.0665462    .0697713
      marinfo |   .0464818   .0211248     2.20   0.028      .005078    .0878856
    associnfo |   -.043932   .0494175    -0.89   0.374    -.1407885    .0529245
        small |  -.0429596   .1729132    -0.25   0.804    -.3818631     .295944
       medium |  -.0100113   .0970858    -0.10   0.918    -.2002959    .1802733
        manuf |  -.0726298   .0661991    -1.10   0.273    -.2023777    .0571181
     services |   .0109644    .057776     0.19   0.849    -.1022745    .1242033
        fineu |  -.0657383   .0399984    -1.64   0.100    -.1441338    .0126571
       fingov |   .0238269   .0290889     0.82   0.413    -.0331862      .08084
      groupeu |   .0974159    .057168     1.70   0.088    -.0146314    .2094631
   groupother |   .2443858   .0893648     2.73   0.006     .0692339    .4195376
           bg |   .2171056   .0380153     5.71   0.000     .1425969    .2916143
           ee |   .0560938   .0686993     0.82   0.414    -.0785543    .1907419
           hu |  -.0029917   .0377023    -0.08   0.937    -.0768869    .0709035
           lt |   .3054006   .0670193     4.56   0.000     .1740452     .436756
           ro |   -.070541   .0377243    -1.87   0.061    -.1444793    .0033974
           sk |   .0044739   .0413951     0.11   0.914    -.0766591    .0856068
        _cons |   .9632886   .8568218     1.12   0.261    -.7160513    2.642628
------------------------------------------------------------------------------
Endogenous variables:  lnnewmktsale firmgr
Exogenous variables:   lninninv04 invmills04 innintern abinn prodivers skills
     cocus couni colab cocom cosu patapp designreg copyright marinfo
     associnfo small medium manuf services fineu fingov groupeu groupother
     bg ee hu lt ro sk procesef costfact knowfact
```

A3.5.17.a Hansan-Sargan test for over-identification

```
. overid

Number of equations : 2
Total number of exogenous variables in system : 34
Number of estimated coefficients : 49
Net of 7 linear constraints / dependencies
Hansen-Sargan overidentification statistic :    18.471
Under H0, distributed as Chi-sq(19), pval = 0.4912
```

A3.5.18 3SLS bootstrapped SE - Main specification (CIS 2004: lnnewfrmsale)

```
. bootstrap, reps(50) :reg3 (lnnewfrmsale = lninninv04 invmills04 firmgr innintern abinn
prodivers skills codeg patapp designreg copyright marinfo associnfo small medium manuf service
fineu fingov groupeu groupother bg ee hu lt ro sk) (firmgr = lnnewfrmsale innintern abinn
prodivers procesef costfact knowfact marinfo associnfo small medium manuf service fineu fingov
groupeu groupother bg ee hu lt ro sk) if y04==1(running reg3 on estimation sample)

Bootstrap replications (50)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................    50

Three-stage least-squares regression
----------------------------------------------------------------------
Equation             Obs   Parms        RMSE    "R-sq"       chi2        P
----------------------------------------------------------------------
lnnewfrmsale       4,308      27    2.040884    0.0444    2330.55   0.0000
firmgr             4,308      23    .6758454    0.0178     319.17   0.0000
----------------------------------------------------------------------
------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnnewfrmsale |
  lninninv04 |   .5455079   .0915604     5.96   0.000     .3660527     .724963
  invmills04 |  -.1843783   .0776552    -2.37   0.018    -.3365797    -.032177
      firmgr |   2.473082   .6282614     3.94   0.000     1.241713    3.704452
   innintern |   .0392992   .0751959     0.52   0.601    -.1080821    .1866806
       abinn |  -.1934828   .1117523    -1.73   0.083    -.4125133    .0255477
   prodivers |    .241307   .0623475     3.87   0.000     .1191082    .3635059
      skills |  -.1189544   .0875538    -1.36   0.174    -.2905566    .0526479
       codeg |    .009492   .0152997     0.62   0.535    -.0204949    .0394789
      patapp |   .3209029   .1000494     3.21   0.001     .1248096    .5169962
   designreg |  -.0066977   .1006629    -0.07   0.947    -.2039934     .190598
   copyright |  -.0796058   .1068537    -0.74   0.456    -.2890352    .1298235
     marinfo |   .0949946   .0734895     1.29   0.196    -.0490422    .2390314
   associnfo |   .1705554   .1307541     1.30   0.192    -.0857179    .4268288
       small |   -1.80864   .2373083    -7.62   0.000    -2.273756   -1.343524
      medium |  -1.018001   .1524124    -6.68   0.000    -1.316724   -.7192781
       manuf |  -.7771647   .1506331    -5.16   0.000      -1.0724   -.4819294
    services |  -.9457653   .1471651    -6.43   0.000    -1.234204    -.657327
       fineu |  -.0543756   .1227283    -0.44   0.658    -.2949187    .1861675
      fingov |  -.3830126   .1072266    -3.57   0.000    -.5931729   -.1728524
     groupeu |   .4149651   .1097174     3.78   0.000      .199923    .6300072
  groupother |   .4056544   .2737178     1.48   0.138    -.1308226    .9421314
          bg |  -1.122272   .2405606    -4.67   0.000    -1.593762   -.6507818
          ee |    -1.2729   .1809387    -7.03   0.000    -1.627533   -.9182661
          hu |   .2752542   .1263571     2.18   0.029     .0275988    .5229096
          lt |  -.9494748   .2849652    -3.33   0.001    -1.507996   -.3909533
          ro |   .0819543   .1132261     0.72   0.469    -.1399648    .3038733
          sk |  -.0549502   .1123467    -0.49   0.625    -.2751457    .1652453
```

```
       _cons |   8.512794   1.100423     7.74   0.000     6.356005    10.66958
-------------+----------------------------------------------------------------
firmgr       |
 lnnewfrmsale |   -.067264   .0518938    -1.30   0.195    -.1689739     .034446
   innintern |   .0302243   .0183081     1.65   0.099     -.005659    .0661076
       abinn |  -.0001326   .0236641    -0.01   0.996    -.0465134    .0462483
   prodivers |   .0320373   .0269277     1.19   0.234    -.0207401    .0848146
    procesef |   .1314438   .0292762     4.49   0.000     .0740635     .188824
    costfact |  -.0822443   .0302155    -2.72   0.006    -.1414655    -.023023
    knowfact |   -.022616   .0356846    -0.63   0.526    -.0925566    .0473246
     marinfo |   .0533341   .0250466     2.13   0.033     .0042438    .1024245
   associnfo |  -.0608853   .0435235    -1.40   0.162    -.1461897    .0244192
       small |  -.0441997   .1466505    -0.30   0.763    -.3316295      .24323
      medium |  -.0259993   .0906062    -0.29   0.774    -.2035842    .1515857
       manuf |  -.0564228    .050715    -1.11   0.266    -.1558225    .0429768
    services |   .0090003   .0468338     0.19   0.848    -.0827922    .1007929
       fineu |  -.0725312   .0335168    -2.16   0.030    -.1382229   -.0068395
      fingov |   .0260277   .0269706     0.97   0.335    -.0268337    .0788892
     groupeu |   .1173729   .0599189     1.96   0.050     -.000066    .2348117
  groupother |   .2308796   .0980908     2.35   0.019     .0386252     .423134
          bg |   .2552222   .0620084     4.12   0.000      .133688    .3767565
          ee |   .1371544   .0690389     1.99   0.047     .0018405    .2724682
          hu |  -.0426249   .0373814    -1.14   0.254    -.1158911    .0306412
          lt |   .3377263    .058658     5.76   0.000     .2227587    .4526938
          ro |  -.1039305    .038661    -2.69   0.007    -.1797046   -.0281564
          sk |  -.0000117   .0344717    -0.00   1.000     -.067575    .0675516
       _cons |   1.000903   .7684172     1.30   0.193     -.505167    2.506973
------------------------------------------------------------------------------
Endogenous variables:  lnnewfrmsale firmgr
Exogenous variables:   lninninv04 invmills04 innintern abinn prodivers skills
     codeg patapp designreg copyright marinfo associnfo small medium manuf
     services fineu fingov groupeu groupother bg ee hu lt ro sk procesef
     costfact knowfact
-----------------------------------------------------------------------------
```

A3.5.18.a Hansan-Sargan test for over-identification

```
. overid

Number of equations : 2
Total number of exogenous variables in system : 30
Number of estimated coefficients : 49
Net of 3 linear constraints / dependencies
Hansen-Sargan overidentification statistic :     6.265
Under H0, distributed as Chi-sq(11), pval = 0.8551
```

A3.5.19 3SLS bootstrapped SE - Alternative specification (CIS 2004: lnnewfrmsale)

```
. bootstrap, reps(50) :reg3 (lnnewfrmsale = lninninv04 invmills04 firmgr innintern abinn
prodivers skills cocus couni colab cocom cosu patapp designreg copyright marinfo associnfo small
medium manuf service fineu fingov groupeu groupother bg ee hu lt ro sk) (firmgr = lnnewfrmsale
innintern abinn prodivers procesef costfact knowfact marinfo associnfo small medium manuf service
fineu fingov groupeu groupother bg ee hu lt ro sk) if y04==1(running reg3 on estimation sample)

Bootstrap replications (50)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................    50
Three-stage least-squares regression
----------------------------------------------------------------------
Equation          Obs   Parms        RMSE    "R-sq"       chi2        P
----------------------------------------------------------------------
lnnewfrmsale     4,308     31     2.02035    0.0635    2379.05   0.0000
firmgr           4,308     23    .6724592    0.0276     322.26   0.0000
----------------------------------------------------------------------
------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lnnewfrmsale |
  lninninv04 |   .6088439   .1096442     5.55   0.000     .3939452    .8237427
  invmills04 |  -.1660402   .0868183    -1.91   0.056     -.336201    .0041206
      firmgr |   2.430946   .5811682     4.18   0.000     1.291877    3.570015
   innintern |   .0419636   .0684138     0.61   0.540     -.092125    .1760522
       abinn |  -.2018332   .1050296    -1.92   0.055    -.4076874     .004021
   prodivers |   .2394046    .063009     3.80   0.000     .1159093    .3628999
      skills |  -.1069659   .0841513    -1.27   0.204    -.2718994    .0579676
       cocus |  -.0931582   .0951425    -0.98   0.328    -.2796341    .0933176
       couni |   .0853171    .080451     1.06   0.289    -.0723639    .2429981
       colab |   .1852296   .0752052     2.46   0.014     .0378301     .332629
       cocom |    -.03386   .0807341    -0.42   0.675    -.1920959    .1243759
        cosu |  -.1154784   .0960821    -1.20   0.229    -.3037958     .072839
      patapp |   .2934578   .0769447     3.81   0.000     .1426491    .4442666
   designreg |  -.0170407   .1046182    -0.16   0.871    -.2220886    .1880071
   copyright |  -.0853611   .1057859    -0.81   0.420    -.2926977    .1219755
     marinfo |   .1038562   .0526281     1.97   0.048      .000707    .2070054
   associnfo |   .1681717   .1219291     1.38   0.168     -.070805    .4071485
       small |  -1.649133   .2698539    -6.11   0.000    -2.178037   -1.120229
      medium |  -.9313112   .1473426    -6.32   0.000    -1.220097   -.6425249
       manuf |  -.7899825   .1144145    -6.90   0.000    -1.014231   -.5657342
    services |  -.9558638   .1379791    -6.93   0.000    -1.226298   -.6854298
       fineu |  -.1010036   .1117191    -0.90   0.366    -.3199691    .1179618
      fingov |  -.4392572   .1345716    -3.26   0.001    -.7030127   -.1755017
     groupeu |   .3753696   .1257553     2.98   0.003     .1288938    .6218454
  groupother |   .3521661   .2591084     1.36   0.174    -.1556771    .8600092
          bg |  -1.085138    .207769    -5.22   0.000    -1.492358   -.6779187
          ee |   -1.26376   .1587909    -7.96   0.000    -1.574984   -.9525352
          hu |   .2749864   .1334177     2.06   0.039     .0134924    .5364803
          lt |  -.8888552   .2616207    -3.40   0.001    -1.401622   -.3760882
          ro |   .0840278   .1133063     0.74   0.458    -.1380484     .306104
          sk |  -.0476325   .1211664    -0.39   0.694    -.2851143    .1898493
       _cons |   7.782532   1.290598     6.03   0.000     5.253005    10.31206
-------------+----------------------------------------------------------------
firmgr       |
 lnnewfrmsale |    -.05812   .0522404    -1.11   0.266    -.1605093    .0442693
   innintern |   .0288471   .0214035     1.35   0.178    -.0131031    .0707973
       abinn |  -.0029135   .0229123    -0.13   0.899    -.0478208    .0419938
   prodivers |   .0291498   .0281271     1.04   0.300    -.0259782    .0842779
    procesef |   .1298692   .0266706     4.87   0.000     .0775958    .1821426
    costfact |  -.0780358    .019706    -3.96   0.000    -.1166588   -.0394128
    knowfact |  -.0224913   .0328817    -0.68   0.494    -.0869381    .0419556
     marinfo |   .0512865   .0218587     2.35   0.019     .0084443    .0941287
   associnfo |  -.0615747   .0428077    -1.44   0.150    -.1454762    .0223268
       small |  -.0182571    .152012    -0.12   0.904    -.3161952    .2796809
```

```
      medium |  -.0117325   .0846304    -0.14   0.890     -.177605      .15414
       manuf |  -.0504662   .0446086    -1.13   0.258    -.1378974    .0369651
    services |    .014806   .0503799     0.29   0.769    -.0839369    .1135489
       fineu |  -.0739177     .03099    -2.39   0.017     -.134657   -.0131785
      fingov |    .025039    .029336     0.85   0.393    -.0324585    .0825365
     groupeu |   .1085792   .0564856     1.92   0.055    -.0021306    .2192889
  groupother |   .2193736   .0924387     2.37   0.018      .038197    .4005502
          bg |   .2623565   .0562926     4.66   0.000      .152025     .372688
          ee |   .1440189   .0575585     2.50   0.012     .0312062    .2568315
          hu |  -.0434848   .0313362    -1.39   0.165    -.1049026     .017933
          lt |   .3402409   .0605975     5.61   0.000      .221472    .4590098
          ro |  -.1002142   .0414108    -2.42   0.016    -.1813779   -.0190504
          sk |   .0002542   .0365034     0.01   0.994    -.0712911    .0717995
       _cons |   .8656609   .7680915     1.13   0.260    -.6397708    2.371093
------------------------------------------------------------------------------
Endogenous variables:  lnnewfrmsale firmgr
Exogenous variables:   lninninv04 invmills04 innintern abinn prodivers skills
     cocus couni colab cocom cosu patapp designreg copyright marinfo
     associnfo small medium manuf services fineu fingov groupeu groupother
     bg ee hu lt ro sk procesef costfact knowfact
------------------------------------------------------------------------------
```

A3.5.19.a Hansan-Sargan test for over-identification

```
. overid

Number of equations : 2
Total number of exogenous variables in system : 34
Number of estimated coefficients : 49
Net of 7 linear constraints / dependencies
Hansen-Sargan overidentification statistic :     8.695
Under H0, distributed as Chi-sq(19), pval = 0.9782
```

A3.6 3SLS comparative results across CIS datasets

A3.6.1 Table 3.10 CDM Stage 3 (Innovation output) Main model

Dataset	CIS 2004			CIS 2006			CIS Pooled		
Specification	*lninsale*	*lnnewmktsale*	*lnnewfrmsale*	*lninsale*	*lnnewmktsale*	*lnnewfrmsale*	*lninsale*	*lnnewmktsale*	*lnnewfrmsale*
lninninv	0.606***	0.589***	0.546***	0.739***	0.548***	0.765***	0.688***	0.563***	0.676***
	(0.0928)	(0.157)	(0.0916)	(0.100)	(0.138)	(0.123)	(0.0676)	(0.122)	(0.0822)
invmills	-0.133*	-0.0798	-0.184**	0.0487	-0.0473	0.159**	-0.0254	-0.0527	0.0105
	(0.0786)	(0.0996)	(0.0777)	(0.0683)	(0.0866)	(0.0661)	(0.0452)	(0.0649)	(0.0575)
firmgr	2.550***	4.004***	2.473***	1.730***	1.858***	1.321***	2.379***	3.112***	2.137***
	(0.637)	(1.025)	(0.628)	(0.501)	(0.584)	(0.458)	(0.332)	(0.556)	(0.463)
innintern	0.193***	0.0187	0.0393	0.198***	0.107*	0.149**	0.178***	0.0583	0.0842*
	(0.0720)	(0.0874)	(0.0752)	(0.0526)	(0.0609)	(0.0641)	(0.0365)	(0.0637)	(0.0480)
abinn	-0.168	-0.186	-0.193*	-0.114	-0.189	-0.0776	-0.124*	-0.173	-0.106
	(0.110)	(0.186)	(0.112)	(0.0910)	(0.122)	(0.109)	(0.0695)	(0.110)	(0.0858)
prodivers	0.337***	0.288***	0.241***	0.229***	0.249***	0.229***	0.233***	0.212***	0.173***
	(0.0555)	(0.0914)	(0.0623)	(0.0505)	(0.0768)	(0.0632)	(0.0429)	(0.0623)	(0.0640)
skills	-0.0934	-0.0994	-0.119	0.0395	-0.0997	-0.00808	-0.00658	-0.0812	-0.0428
	(0.0705)	(0.112)	(0.0876)	(0.0506)	(0.0780)	(0.0560)	(0.0402)	(0.0581)	(0.0440)
codeg	0.0358***	0.0378**	0.00949	0.0362***	0.0364*	-0.00147	0.0325***	0.0344***	0.00154
	(0.0137)	(0.0187)	(0.0153)	(0.0111)	(0.0194)	(0.0134)	(0.00788)	(0.0114)	(0.0119)
patapp	0.330***	0.231**	0.321***	0.170**	0.188**	0.163**	0.236***	0.191***	0.231***
	(0.0749)	(0.111)	(0.100)	(0.0673)	(0.0734)	(0.0759)	(0.0533)	(0.0522)	(0.0649)
designreg	0.0605	0.0754	-0.00670	0.0233	-0.0260	0.0600	0.0475	0.0454	0.0275
	(0.0756)	(0.0864)	(0.101)	(0.0765)	(0.0843)	(0.0826)	(0.0478)	(0.0647)	(0.0671)
copyright	0.0229	-0.0580	-0.0796	0.124	0.0117	-0.119	0.0845	-0.00867	-0.0902
	(0.0970)	(0.119)	(0.107)	(0.0808)	(0.111)	(0.0956)	(0.0633)	(0.0807)	(0.0792)
marinfo	0.0392	-0.0101	0.0950	0.232***	0.253***	0.162***	0.155***	0.147**	0.144***
	(0.0675)	(0.0915)	(0.0735)	(0.0363)	(0.0642)	(0.0489)	(0.0375)	(0.0650)	(0.0449)
associnfo	0.273**	0.379**	0.171	-0.0334	0.0637	-0.0890	0.121	0.234*	0.0491
	(0.113)	(0.167)	(0.131)	(0.110)	(0.127)	(0.134)	(0.0785)	(0.119)	(0.0987)
small	-1.715***	-2.091***	-1.809***	-1.513***	-1.897***	-1.510***	-1.593***	-2.010***	-1.619***
	(0.284)	(0.418)	(0.237)	(0.255)	(0.353)	(0.312)	(0.165)	(0.335)	(0.222)
medium	-0.938***	-1.165***	-1.018***	-0.708***	-0.892***	-0.719***	-0.813***	-1.046***	-0.847***
	(0.174)	(0.250)	(0.152)	(0.143)	(0.188)	(0.189)	(0.0959)	(0.192)	(0.132)
manuf	-0.978***	-1.021***	-0.777***	-0.832***	-0.911***	-0.734***	-0.726***	-0.802***	-0.580***
	(0.108)	(0.132)	(0.151)	(0.0841)	(0.0927)	(0.0902)	(0.0648)	(0.0944)	(0.0741)
services	-1.111***	-1.215***	-0.946***	-1.023***	-1.138***	-0.820***	-0.952***	-1.074***	-0.783***
	(0.124)	(0.190)	(0.147)	(0.107)	(0.148)	(0.115)	(0.0787)	(0.123)	(0.0952)
fineu	-0.128	-0.288	-0.0544	-0.238***	-0.244*	-0.342***	-0.195**	-0.254*	-0.245**
	(0.129)	(0.180)	(0.123)	(0.0878)	(0.128)	(0.100)	(0.0829)	(0.139)	(0.0956)
fingov	-0.396***	-0.511***	-0.383***	-0.603***	-0.623***	-0.498***	-0.538***	-0.623***	-0.466***
	(0.118)	(0.164)	(0.107)	(0.0974)	(0.118)	(0.108)	(0.0766)	(0.112)	(0.0706)
groupeu	0.326***	0.234	0.415***	0.189*	0.332***	0.214**	0.199**	0.237**	0.247***
	(0.104)	(0.172)	(0.110)	(0.110)	(0.114)	(0.107)	(0.0795)	(0.0995)	(0.0937)
groupother	0.357*	-0.0457	0.406	0.403**	0.802***	0.212	0.388***	0.447**	0.314*
	(0.186)	(0.341)	(0.274)	(0.181)	(0.196)	(0.186)	(0.149)	(0.205)	(0.162)
y06							-0.409***	-0.475***	-0.325***
							(0.0686)	(0.0933)	(0.0922)
_cons	8.119***	8.094***	8.513***	6.167***	8.326***	5.600***	6.942***	8.269***	6.725***
	(1.121)	(1.824)	(1.100)	(1.147)	(1.675)	(1.441)	(0.774)	(1.404)	(0.931)
N	5565	3468	4308	6304	3623	4938	11869	7091	9246
Bootstraped standard errors in parentheses									
* p<0.1 ** p<0.5 *** p<0.01									
Country dummies included									

A3.6.2 Table 3.11 CDM Stage 3 (Firm performance) Main model

Dataset	CIS 2004			CIS 2006			CIS Pooled		
Specification	Innovation Sales	New to the market	New to the firm	Innovation Sales	New to the market	New to the firm	Innovation Sales	New to the market	New to the firm
	firmgr	*firmgr*	*firmgr*	*firmgr*	*firmgr*	*firmgr*	*firmgr*	*firmgr*	*firmgr*
lninsale	-0.0280			-0.00762			-0.0105		
	(0.0345)			(0.0400)			(0.0262)		
lnnewmktsale		-0.0647			0.0156			-0.0298	
		(0.0634)			(0.0446)			(0.0533)	
lnnewfrmsale			-0.0673			-0.0102			-0.0375
			(0.0519)			(0.0624)			(0.0434)
innintern	0.0118	0.0408	0.0302*	0.00550	-0.0227	0.0134	0.0133	0.0138	0.0292*
	(0.0219)	(0.0305)	(0.0183)	(0.0223)	(0.0257)	(0.0275)	(0.0151)	(0.0195)	(0.0172)
abinn	-0.0121	-0.0192	-0.000133	-0.0351	-0.0145	-0.0573**	-0.0250*	-0.0165	-0.0327**
	(0.0235)	(0.0276)	(0.0237)	(0.0261)	(0.0231)	(0.0276)	(0.0149)	(0.0177)	(0.0146)
prodivers	0.0124	0.0368	0.0320	0.0695***	0.0352	0.0829**	0.0499***	0.0475*	0.0726***
	(0.0211)	(0.0371)	(0.0269)	(0.0264)	(0.0276)	(0.0349)	(0.0166)	(0.0279)	(0.0228)
procesef	0.116***	0.0943***	0.131***	0.0941***	0.100***	0.0791***	0.0981***	0.0936***	0.0984***
	(0.0191)	(0.0292)	(0.0293)	(0.0211)	(0.0300)	(0.0241)	(0.0134)	(0.0223)	(0.0194)
costfact	-0.0637***	-0.0793***	-0.0822***	-0.0864***	-0.0890***	-0.100***	-0.0664***	-0.0750***	-0.0816***
	(0.0215)	(0.0277)	(0.0302)	(0.0232)	(0.0305)	(0.0312)	(0.0139)	(0.0212)	(0.0214)
knowfact	-0.0214	0.00129	-0.0226	-0.0289	-0.0266	-0.00941	-0.0225	-0.00815	-0.0158
	(0.0292)	(0.0321)	(0.0357)	(0.0357)	(0.0378)	(0.0464)	(0.0185)	(0.0185)	(0.0248)
marinfo	0.0409**	0.0468**	0.0533**	-0.0255	-0.0136	-0.0188	0.000817	0.0176	0.0108
	(0.0200)	(0.0230)	(0.0250)	(0.0191)	(0.0282)	(0.0221)	(0.0157)	(0.0194)	(0.0174)
associnfo	-0.0597*	-0.0436	-0.0609	-0.00149	-0.0342	-0.0139	-0.0359	-0.0466	-0.0477
	(0.0326)	(0.0390)	(0.0435)	(0.0391)	(0.0473)	(0.0502)	(0.0253)	(0.0319)	(0.0301)
small	0.0606	-0.0457	-0.0442	0.0735	0.155	0.0687	0.0880	0.0386	0.0131
	(0.105)	(0.199)	(0.147)	(0.121)	(0.140)	(0.206)	(0.0790)	(0.163)	(0.133)
medium	0.0343	-0.0115	-0.0260	0.0397	0.0915	0.0441	0.0491	0.0355	0.0130
	(0.0610)	(0.106)	(0.0906)	(0.0661)	(0.0668)	(0.107)	(0.0425)	(0.0830)	(0.0747)
manuf	-0.0259	-0.0734	-0.0564	-0.0460	0.0178	-0.0666	-0.0537**	-0.0469	-0.0894**
	(0.0461)	(0.0714)	(0.0507)	(0.0497)	(0.0488)	(0.0731)	(0.0251)	(0.0432)	(0.0394)
services	0.0224	0.0103	0.00900	0.108**	0.156***	0.104	0.0560**	0.0678*	0.0416
	(0.0462)	(0.0593)	(0.0468)	(0.0479)	(0.0603)	(0.0674)	(0.0260)	(0.0390)	(0.0365)
fineu	-0.0597*	-0.0658**	-0.0725**	0.0176	-0.00415	0.0392	-0.0189	-0.0284	-0.0121
	(0.0330)	(0.0334)	(0.0335)	(0.0384)	(0.0404)	(0.0408)	(0.0245)	(0.0310)	(0.0358)
fingov	0.0274	0.0239	0.0260	0.0337	0.0607*	0.00653	0.0314*	0.0427**	0.0199
	(0.0312)	(0.0287)	(0.0270)	(0.0285)	(0.0329)	(0.0312)	(0.0171)	(0.0193)	(0.0185)
groupeu	0.0824**	0.0980*	0.117*	0.103**	0.0616	0.122**	0.0898***	0.0888*	0.120***
	(0.0419)	(0.0566)	(0.0599)	(0.0473)	(0.0497)	(0.0593)	(0.0284)	(0.0486)	(0.0401)
groupother	0.179**	0.245***	0.231**	0.0539	0.0264	0.0666	0.103**	0.145*	0.141**
	(0.0711)	(0.0949)	(0.0981)	(0.0725)	(0.0821)	(0.0834)	(0.0516)	(0.0877)	(0.0654)
y06							0.167***	0.158***	0.173***
							(0.0129)	(0.0176)	(0.0179)
_cons	0.432	0.978	1.001	0.389	-0.0390	0.455	0.226	0.475	0.639
	(0.522)	(0.949)	(0.768)	(0.620)	(0.679)	(0.963)	(0.400)	(0.792)	(0.651)
N	5565	3468	4308	6304	3623	4938	11869	7091	9246
Bootstraped standard errors in parentheses									
* p<0.1 ** p<0.5 *** p<0.01									
Country dummies included									

CHAPTER IV APPENDICES

Innovation and export performance of firms in transition countries: the relevance of the business environment and the stage of transition

Chapter IV Appendices

A4.1 EBRD Transition index by country

	2002	2005	2008
ALBANIA	3.2	3.3	3.4
ARMENIA	3.3	3.5	3.5
AZERBAIJAN	2.8	2.9	2.9
BELARUS	1.8	1.9	2.1
BOSNIA AND HERZEGOVINA	2.5	2.7	3.0
BULGARIA	3.4	3.6	3.7
CROATIA	3.4	3.6	3.6
CZECH REPUBLIC	3.9	3.9	4.3
ESTONIA	3.9	4.0	4.1
FYR MACEDONIA	3.2	3.4	3.5
GEORGIA	3.3	3.4	3.5
HUNGARY	3.9	4.0	4.0
KAZAKHSTAN	3.1	3.1	3.1
KYRGYZ REPUBLIC	3.3	3.4	3.4
LATVIA	3.6	3.8	3.8
LITHUANIA	3.8	3.9	3.9
MOLDOVA	3.1	3.2	3.3
MONTENEGRO	2.6	2.9	3.1
POLAND	3.8	3.9	3.9
ROMANIA	3.3	3.4	3.6
RUSSIAN FEDERATION	3.2	3.2	3.2
SERBIA	2.5	2.8	3.1
SLOVAK REPUBLIC	3.9	4.0	4.0
SLOVENIA	3.6	3.6	3.6
TAJIKISTAN	2.7	2.8	2.8
TURKMENISTAN	1.4	1.4	1.7
UKRAINE	3.1	3.2	3.3
UZBEKISTAN	2.3	2.3	2.3

A4.2 Factor analysis of business environment factors using POOLED1

```
Factor analysis/correlation                      Number of obs    =    11884
Method: principal factors                        Retained factors =        4
Rotation: (unrotated)                            Number of params =       30
--------------------------------------------------------------------------
Factor     Eigenvalue   Difference        Proportion   Cumulative
-------------+------------------------------------------------------------
Factor1       2.67978      1.60624            0.7342       0.7342
Factor2       1.07354      0.51646            0.2941       1.0283
Factor3       0.55709      0.32896            0.1526       1.1810
Factor4       0.22813      0.35631            0.0625       1.2435
Factor5      -0.12818      0.03417           -0.0351       1.2083
Factor6      -0.16235      0.02427           -0.0445       1.1639
Factor7      -0.18663      0.01452           -0.0511       1.1127
Factor8      -0.20114      0.00918           -0.0551       1.0576
Factor9      -0.21033            .           -0.0576       1.0000
--------------------------------------------------------------------------
LR test: independent vs. saturated:  chi2(36) = 3.3e+04 Prob>chi2 = 0.0000

Factor loadings (pattern matrix) and unique variances
---------------------------------------------------------------------
Variable    Factor1    Factor2    Factor3    Factor4    Uniqueness
```

```
-------------+----------------------------------------+--------------
acfin     0.5474           -0.4483                0.4580
fincos    0.5915           -0.4116                0.4247
telcom    0.5271   0.4963                         0.4736
electr    0.4933   0.5374                         0.4650
transp    0.4998   0.4661                         0.5318
policyunc 0.6075                                  0.4393
macins    0.6108                                  0.4435
antcomp   0.5139                                  0.6055
contrvio  0.5030                                  0.6199
---------------------------------------------------------------------
(blanks represent abs(loading)<.4)

. rotate, blanks(0.4)

Factor analysis/correlation                    Number of obs    =    11884
Method: principal factors                      Retained factors =        4
Rotation: orthogonal varimax (Kaiser off)      Number of params =       30
--------------------------------------------------------------------------
Factor       Variance   Difference        Proportion   Cumulative
-------------+------------------------------------------------------------
Factor1       1.54672      0.23718           0.4238       0.4238
Factor2       1.30955      0.14008           0.3588       0.7826
Factor3       1.16947      0.65667           0.3204       1.1030
Factor4       0.51280            .           0.1405       1.2435
--------------------------------------------------------------------------
LR test: independent vs. saturated:  chi2(36) = 3.3e+04 Prob>chi2 = 0.0000

Rotated factor loadings (pattern matrix) and unique variances
---------------------------------------------------------------------
Variable  Factor1   Factor2   Factor3   Factor4    Uniqueness
-------------+----------------------------------------+--------------
acfin                         0.7034                  0.4580
fincos                        0.7060                  0.4247
telcom    0.7041                                      0.4736
electr    0.7217                                      0.4650
transp    0.6617                                      0.5318
policyunc          0.6993                             0.4393
macins             0.6979                             0.4435
antcomp                                 0.4736        0.6055
contrvio                                0.4766        0.6199
---------------------------------------------------------------------
(blanks represent abs(loading)<.4)


Factor rotation matrix
--------------------------------------------------
          Factor1  Factor2  Factor3  Factor4
-------------+------------------------------------
Factor1   0.5461   0.5825   0.5159   0.3104
Factor2   0.8334  -0.4411  -0.3079  -0.1268
Factor3   0.0246   0.5088  -0.7965   0.3258
Factor4  -0.0813  -0.4553   0.0682   0.8840
```

A4.3. Descriptive statistics by the transition stage

A4.3.1. Descriptive statistics by the transition stage - POOLED1

Variable	Transition Stage	Obs	Mean	Std. Err.	[95% Conf.	Interval]
Expint	Laggard	2743	8.459	0.411	7.652	9.265
	Medium	7370	10.513	0.291	9.942	11.084
	Advanced	3686	11.468	0.408	10.669	12.267
newprod	Laggard	2744	0.374	0.009	0.355	0.392
	Medium	7373	0.381	0.006	0.370	0.392
	Advanced	3690	0.341	0.008	0.326	0.356
upprod	Laggard	2745	0.506	0.010	0.487	0.525
	Medium	7369	0.526	0.006	0.515	0.537
	Advanced	3690	0.503	0.008	0.487	0.519
procinn	Laggard	2712	0.334	0.009	0.316	0.352
	Medium	7335	0.331	0.005	0.320	0.342
	Advanced	3658	0.266	0.007	0.252	0.281
uni	Laggard	2711	31.744	0.562	30.643	32.846
	Medium	7262	33.446	0.370	32.721	34.171
	Advanced	3596	22.127	0.459	21.227	23.026
skilled	Laggard	2721	47.754	0.555	46.665	48.843
	Medium	7311	45.192	0.363	44.481	45.903
	Advanced	3616	55.547	0.525	54.518	56.575
forown	Laggard	2755	10.544	0.529	9.507	11.581
	Medium	7388	10.412	0.322	9.780	11.043
	Advanced	3698	10.360	0.469	9.441	11.279
busass	Laggard	2755	0.344	0.009	0.327	0.362
	Medium	7388	0.393	0.006	0.382	0.404
	Advanced	3698	0.358	0.008	0.343	0.374
businf	Laggard	2633	0.068	0.005	0.059	0.078
	Medium	7114	0.078	0.003	0.072	0.084
	Advanced	3565	0.082	0.005	0.073	0.092
largecity	Laggard	2755	0.560	0.009	0.542	0.579
	Medium	7388	0.537	0.006	0.526	0.549
	Advanced	3698	0.476	0.008	0.460	0.492
impint	Laggard	2638	18.078	0.638	16.826	19.329
	Medium	7077	16.519	0.380	15.775	17.264
	Advanced	3572	13.660	0.470	12.739	14.581
accessfin	Laggard	2564	0.106	0.006	0.094	0.118
	Medium	6860	0.106	0.004	0.098	0.113
	Advanced	3465	0.131	0.006	0.120	0.142
infrastruct	Laggard	2659	0.022	0.003	0.016	0.027
	Medium	7189	0.044	0.002	0.039	0.048
	Advanced	3653	0.050	0.004	0.043	0.057
weaklaw	Laggard	2527	0.211	0.008	0.195	0.227
	Medium	7032	0.252	0.005	0.242	0.262
	Advanced	3411	0.318	0.008	0.302	0.333
macobst	Laggard	2544	0.358	0.010	0.340	0.377
	Medium	7143	0.386	0.006	0.375	0.397
	Advanced	3586	0.405	0.008	0.389	0.421
size	Laggard	2746	124.855	7.047	111.037	138.673
	Medium	7374	120.984	5.211	110.769	131.198
	Advanced	3689	106.459	7.280	92.186	120.731
age	Laggard	2755	14.879	0.340	14.212	15.547
	Medium	7387	14.595	0.208	14.188	15.003
	Advanced	3693	15.510	0.288	14.945	16.075
sectorspill	Laggard	2755	0.644	0.004	0.637	0.651

	Medium	7388	0.645	0.002	0.641	0.649
	Advanced	3698	0.608	0.003	0.603	0.613
gdpcap1	Laggard	2755	1346.765	17.905	1311.657	1381.873
	Medium	7388	2850.710	33.952	2784.155	2917.265
	Advanced	3698	7215.011	37.662	7141.171	7288.852
y05	Laggard	2755	0.532	0.010	0.514	0.551
	Medium	7388	0.519	0.006	0.507	0.530
	Advanced	3698	0.646	0.008	0.631	0.662
LAGGARD TRANSITION Countries						
blr	Laggard	2755	0.192	0.008	0.177	0.207
tjk	Laggard	2755	0.128	0.006	0.116	0.141
uzb	Laggard	2755	0.193	0.008	0.178	0.208
bih	Laggard	2755	0.139	0.007	0.126	0.152
aze	Laggard	2755	0.164	0.007	0.150	0.178
ser	Laggard	2755	0.170	0.007	0.156	0.184
mne	Laggard	2755	0.014	0.002	0.009	0.018
MEDIUM TRANSITION Countries						
alb	Medium	7388	0.042	0.002	0.037	0.046
bul	Medium	7388	0.062	0.003	0.057	0.068
hrv	Medium	7388	0.049	0.003	0.044	0.054
geo	Medium	7388	0.043	0.002	0.038	0.047
ukr	Medium	7388	0.123	0.004	0.116	0.131
rus	Medium	7388	0.144	0.004	0.136	0.152
rom	Medium	7388	0.107	0.004	0.100	0.114
kaz	Medium	7388	0.105	0.004	0.098	0.112
mda	Medium	7388	0.067	0.003	0.061	0.072
mkd	Medium	7388	0.045	0.002	0.041	0.050
arm	Medium	7388	0.064	0.003	0.058	0.070
kgz	Medium	7388	0.045	0.002	0.041	0.050
hun	Medium	7388	0.034	0.002	0.030	0.038
lva	Medium	7388	0.024	0.002	0.020	0.027
svn	Medium	7388	0.045	0.002	0.041	0.050
ADVANCED TRANSITION Countries						
pol	Advanced	3698	0.377	0.008	0.362	0.393
est	Advanced	3698	0.087	0.005	0.077	0.096
cze	Advanced	3698	0.155	0.006	0.143	0.167
hun	Advanced	3698	0.149	0.006	0.137	0.160
lva	Advanced	3698	0.041	0.003	0.034	0.047
ltu	Advanced	3698	0.094	0.005	0.085	0.104
svk	Advanced	3698	0.098	0.005	0.088	0.107

A4.3.2 Descriptive statistics by the transition stage - POOLED2

Variable	Transition Stage	Obs	Mean	Std. Err.	[95%Conf.	Interval]
expint	Laggard	4121	7.199	0.315	6.582	7.816
	Medium	13723	10.027	0.210	9.615	10.440
	Advanced	6135	12.741	0.339	12.077	13.406
newprod	Laggard	4120	0.401	0.008	0.386	0.416
	Medium	13720	0.464	0.004	0.456	0.472
	Advanced	6122	0.430	0.006	0.417	0.442
upprod	Laggard	4113	0.567	0.008	0.552	0.583
	Medium	13684	0.632	0.004	0.624	0.640
	Advanced	6105	0.592	0.006	0.580	0.604
uni	Laggard	4044	30.829	0.436	29.974	31.685
	Medium	13358	30.982	0.259	30.474	31.489
	Advanced	5892	20.015	0.335	19.359	20.671
forown	Laggard	4110	9.393	0.408	8.594	10.192
	Medium	13705	8.752	0.220	8.320	9.184
	Advanced	6112	10.953	0.376	10.215	11.690
largecity	Laggard	4134	0.537	0.008	0.522	0.553
	Medium	13765	0.552	0.004	0.543	0.560
	Advanced	6155	0.427	0.006	0.415	0.439
accessfin	Laggard	3887	0.259	0.007	0.245	0.273
	Medium	13053	0.274	0.004	0.266	0.282
	Advanced	5830	0.252	0.006	0.241	0.263
infrastruct	Laggard	4017	0.040	0.003	0.034	0.046
	Medium	13430	0.066	0.002	0.062	0.071
	Advanced	6056	0.052	0.003	0.046	0.057
weaklaw	Laggard	3899	0.192	0.006	0.179	0.204
	Medium	13285	0.242	0.004	0.235	0.250
	Advanced	5967	0.249	0.006	0.238	0.260
size	Laggard	4120	112.770	5.131	102.711	122.830
	Medium	13695	122.083	4.572	113.121	131.045
	Advanced	6100	109.500	5.924	97.886	121.114
age	Laggard	4116	13.159	0.239	12.690	13.628
	Medium	13601	14.499	0.143	14.218	14.781
	Advanced	6082	15.070	0.201	14.675	15.464
sectorspill	Laggard	4134	0.672	0.003	0.666	0.678
	Medium	13611	0.714	0.001	0.711	0.717
	Advanced	6155	0.676	0.002	0.672	0.680
gdpcap1	Laggard	4134	1683.286	21.401	1641.329	1725.243
	Medium	13765	4385.197	35.813	4314.999	4455.394
	Advanced	6155	9406.880	49.375	9310.087	9503.673
y02	Laggard	4134	0.312	0.007	0.297	0.326
	Medium	13765	0.258	0.004	0.251	0.266
	Advanced	6155	0.213	0.005	0.202	0.223
y05	Laggard	4134	0.355	0.007	0.340	0.369
	Medium	13765	0.278	0.004	0.271	0.286
	Advanced	6155	0.388	0.006	0.376	0.400
y08	Laggard	4134	0.334	0.007	0.319	0.348
	Medium	13765	0.463	0.004	0.455	0.472
	Advanced	6155	0.399	0.006	0.387	0.411
LAGGARD TRANSITION Countries						
tjk		4134	0.172	0.006	0.161	0.184
uzb		4134	0.217	0.006	0.205	0.230
bih		4134	0.092	0.005	0.084	0.101
aze		4134	0.201	0.006	0.189	0.213
ser		4134	0.113	0.005	0.104	0.123
mne		4134	0.009	0.001	0.006	0.012

MEDIUM TRANSITION Countries						
alb		13765	0.035	0.002	0.032	0.038
bul		13765	0.033	0.002	0.030	0.036
hrv		13765	0.038	0.002	0.035	0.041
geo		13765	0.050	0.002	0.046	0.054
ukr		13765	0.128	0.003	0.122	0.134
rus		13765	0.169	0.003	0.162	0.175
rom		13765	0.097	0.003	0.092	0.102
kaz		13765	0.096	0.003	0.091	0.101
mda		13765	0.062	0.002	0.058	0.066
bih		13765	0.026	0.001	0.024	0.029
mkd		13765	0.051	0.002	0.047	0.055
arm		13765	0.062	0.002	0.058	0.066
kgz		13765	0.041	0.002	0.038	0.045
hun		13765	0.018	0.001	0.016	0.020
lva		13765	0.013	0.001	0.011	0.015
svn		13765	0.044	0.002	0.041	0.048
ser		13765	0.028	0.001	0.025	0.031
mne		13765	0.008	0.001	0.007	0.010
ADVANCED TRANSITION Countries						
bul		6155	0.047	0.003	0.042	0.052
pol		6155	0.313	0.006	0.302	0.325
est		6155	0.096	0.004	0.089	0.104
cze		6155	0.134	0.004	0.125	0.142
hun		6155	0.137	0.004	0.128	0.145
lva		6155	0.068	0.003	0.062	0.075
ltu		6155	0.102	0.004	0.094	0.109
svk		6155	0.103	0.004	0.096	0.111

A4.4 Correlation matrices of explanatory variables

A4.4.1 Correlation Matrix – POOLED1

No	Variable	1	2	3	4	5	6	7	9	11	12	13	14	15	16	17	18	19	20	21
1	expint	1.00																		
2	newprod	0.11	1.00																	
3	upprod	0.12	0.43	1.00																
4	procinn	0.11	0.37	0.34	1.00															
5	uni	0.01	0.09	0.03	0.02	1.00														
6	skilled	0.04	-0.02	0.05	0.04	-0.39	1.00													
7	size	0.14	0.07	0.08	0.08	-0.02	0.03	1.00												
9	age	0.11	0.02	0.04	0.05	-0.07	0.04	0.23	1.00											
11	forown	0.24	0.07	0.06	0.02	0.15	-0.07	0.06	-0.06	1.00										
12	busass	0.20	0.11	0.12	0.11	0.00	-0.01	0.14	0.16	0.11	1.00									
13	businf	0.13	0.07	0.09	0.08	0.04	0.00	0.08	0.07	0.08	0.40	1.00								
14	largecity	-0.02	0.07	0.02	0.02	0.26	2.91	0.05	-0.01	0.10	0.00	0.04	1.00							
15	impint	0.23	0.13	0.07	0.07	0.16	-0.08	0.05	0.00	0.30	0.15	0.09	0.11	1.00						
16	infrastruct	0.01	0.03	0.01	0.03	-0.01	0.01	-0.02	-0.01	0.00	0.04	0.04	-0.02	0.01	1.00					
17	accessfin	0.02	0.02	0.02	0.02	-0.04	0.02	-0.01	0.00	-0.02	0.03	-0.01	-0.02	-0.01	0.02	1.00				
18	weaklaw	-0.04	0.01	0.02	0.01	-0.04	0.02	-0.03	0.02	-0.02	0.06	0.03	-0.01	-0.01	0.12	0.08	1.00			
19	macobst	0.04	0.06	0.08	0.04	-0.01	0.02	-0.03	0.03	0.01	0.04	0.01	0.00	0.01	0.11	0.14	0.31	1.00		
20	sectorspill	0.17	0.25	0.32	0.25	-0.06	0.13	0.08	0.11	0.03	0.07	0.05	0.03	0.04	0.00	0.03	0.03	0.10	1.00	
21	gdpcap1	0.07	-0.08	-0.04	-0.07	-0.21	0.11	-0.02	0.05	-0.01	0.16	0.02	-0.12	0.00	0.00	0.01	0.03	-0.06	-0.20	1

A4.4.2 Correlation Matrix – POOLED2

No	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
1	expint	1.00												
2	newprod	0.09	1.00											
3	upprod	0.09	0.45	1.00										
4	uni	-0.02	0.06	0.01	1.00									
5	size	0.11	0.06	0.06	-0.02	1.00								
6	age	0.10	0.02	0.03	-0.08	0.21	1.00							
7	forown	0.23	0.06	0.04	0.12	0.08	-0.04	1.00						
8	largecity	-0.04	0.05	0.02	0.27	0.05	-0.02	0.09	1.00					
9	gdpcap1	0.09	0.08	0.11	-0.21	0.01	0.06	0.01	-0.13	1.00				
10	infrastruct	-0.01	0.04	0.04	0.01	-0.01	-0.01	-0.01	-0.01	0.03	1.00			
11	accessfin	-0.01	0.03	0.03	-0.02	-0.02	0.01	-0.07	0.01	-0.03	0.08	1.00		
12	weaklaw	-0.06	0.04	0.05	-0.03	-0.01	0.01	-0.03	-0.01	0.06	0.10	0.17	1.00	
13	sectorspill	0.12	0.29	0.37	-0.06	0.05	0.07	0.01	0.02	0.18	0.05	0.05	0.09	1.00

A4.5 Comparison between Tobit estimates and Probit estimates – POOLED2

POOLED2 (BEEPS 2002/2005/2008)									
	LAGGARD TRANSITION			MEDIUM TRANSITION			ADVANCED TRANSITION		
VARIABLES	TOBIT	TOBIT/Sigma	PROBIT	TOBIT	TOBIT/Sigma	PROBIT	TOBIT	TOBIT /Sigma	PROBIT
newprod	9.280**	0.15428	0.194**	11.66***	0.19003	0.284***	12.83***	0.23361	0.354***
upprod	3.798	0.06314	0.0932*	7.965***	0.12981	0.165***	6.180***	0.11253	0.128**
uni	0.173**	0.00288	0.00383***	0.170***	0.00277	0.00367***	0.113**	0.00206	0.00402***
size	0.0855***	0.00142	0.00176***	0.0498***	0.00081	0.00104***	0.0314***	0.00057	0.000665***
sizesq	-1.77e-05***	0.00000	-3.45e-07***	-5.51e-06***	0.00000	-1.11e-07***	-4.36e-06***	0.00000	-8.96e-08***
age	0.371*	0.00617	0.00877*	0.563***	0.00918	0.0105***	0.636***	0.01158	0.0150***
agesq	-0.00293	-0.00005	-4.80e-05	-0.00260**	-0.00004	-3.86e-05*	-0.00408***	-0.00007	-7.93e-05***
forown	0.535***	0.00889	0.00882***	0.467***	0.00761	0.00771***	0.456***	0.00830	0.00750***
largecity	-1.653	-0.02748	-0.0310	-0.0766	-0.00125	0.0464	-4.885*	-0.08895	-0.0240
infrastruct	2.097	0.03486	0.0639	0.140	0.00228	-0.0139	-1.516	-0.02760	-0.0366
accessfin	5.916*	0.09835	0.122**	1.532	0.02497	-0.00425	5.051**	0.09197	0.0749
weaklaw	0.783	0.01302	0.0374	-8.309***	-0.13541	-0.0840**	-11.48***	-0.20903	-0.187***
sectorspill	29.54**	0.49111	0.597**	81.52***	1.32855	1.414***	105.4***	1.91916	2.018***
gdpcap1	-0.0195	-0.00032	-0.000348	-0.000483	-0.00001	-1.19e-05	0.00100	0.00002	4.06e-06
gdpcap1sq	3.12e-06	0.00000	5.40e-08	-2.78e-08	0.00000	-2.43e-10	-2.89e-08	0.00000	-5.25e-10
y05	4.825	0.08022	0.0740	-0.637	-0.01038	-0.0199	3.307	0.06021	0.0441
y08	-8.821	-0.14665	-0.111	-14.45	-0.23550	-0.300	-14.78	-0.26912	-0.255
Tobit Sigma	60.15***			61.36***			54.92***		
Observations	3,526			11,720			5,268		

A4.6 Chow test for structural break

A4.6.1 Chow test for structural break – POOLED1

```
. tobit expint newprod upprod procinn uni skilled size age forown busass businf largecity impint
infrastruct accessfin weaklaw macobst y05 ynewprod yupprod yprocinn yuni yskilled ysize yage yforown
ybusass ybusinf ylargecity yimpint yinfrastruct yaccessfin yweaklaw ymacobst, ll vce(robust)

Tobit regression                                  Number of obs   =      10609
                                                  F(  33,  10576) =      64.42
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -18249.966                 Pseudo R2       =     0.0520
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     newprod |   8.413317   2.496653     3.37   0.001     3.519407    13.30723
      upprod |   13.70583   2.540041     5.40   0.000     8.726868    18.68479
     procinn |   4.879144   2.500288     1.95   0.051    -.0218905    9.780178
         uni |   .0482142   .0397844     1.21   0.226    -.0297707    .1261991
     skilled |   .1010094   .0391172     2.58   0.010     .0243323    .1776865
        size |   .0080245   .0017516     4.58   0.000      .004591    .0114581
         age |   .4033491   .0427618     9.43   0.000     .3195279    .4871703
      forown |   .3603916   .0354184    10.18   0.000     .2909648    .4298183
      busass |   23.50879   2.379397     9.88   0.000     18.84472    28.17286
      businf |   11.38589   3.550501     3.21   0.001     4.426236    18.34554
   largecity |  -2.677406   2.240613    -1.19   0.232     -7.06943    1.714617
      impint |   .3837602   .0328038    11.70   0.000     .3194587    .4480617
 infrastruct |  -1.671298   5.799479    -0.29   0.773    -13.03937    9.696773
   accessfin |   4.826361    3.30288     1.46   0.144    -1.647906    11.30063
     weaklaw |  -5.634006   2.560144    -2.20   0.028    -10.65237   -.6156421
     macobst |   1.924993   2.320084     0.83   0.407    -2.622808    6.472794
         y05 |  -8.615374   4.862597    -1.77   0.076    -18.14698    .9162315
    ynewprod |   .0873809    3.40326     0.03   0.980     -6.58365    6.758412
     yupprod |  -5.751078   3.420379    -1.68   0.093    -12.45567    .9535086
    yprocinn |   1.566577   3.366521     0.47   0.642    -5.032438    8.165591
        yuni |    .013094   .0581691     0.23   0.822    -.1009283    .1271164
    yskilled |   .0908041    .053612     1.69   0.090    -.0142856    .1958937
       ysize |   .0060817   .0035319     1.72   0.085    -.0008415    .0130049
        yage |  -.0203955   .0656807    -0.31   0.756     -.149142     .108351
     yforown |   .0493872   .0524665     0.94   0.347    -.0534571    .1522315
     ybusass |  -.3203347   3.341818    -0.10   0.924    -6.870928    6.230259
     ybusinf |   .3084285   4.857331     0.06   0.949    -9.212854    9.829711
  ylargecity |    -4.1331   3.042399    -1.36   0.174    -10.09678    1.830576
     yimpint |   .0609044   .0456008     1.34   0.182    -.0284818    .1502907
yinfrastruct |  -.6570639   7.987839    -0.08   0.934    -16.31473     15.0006
  yaccessfin |     1.7598    4.48664     0.39   0.695     -7.03486    10.55446
    yweaklaw |  -2.220819   3.529185    -0.63   0.529    -9.138685    4.697048
    ymacobst |   8.544186   3.222468     2.65   0.008     2.227542    14.86083
       _cons |   -81.6645   3.588165   -22.76   0.000    -88.69798   -74.63102
-------------+----------------------------------------------------------------
      /sigma |   56.62714   .7869987                      55.08448    58.16981
------------------------------------------------------------------------------
  Obs. summary:       7795  left-censored observations at expint<=0
                      2814     uncensored observations
                         0 right-censored observations

.
end of do-file

. do "C:\Users\Fisnik\AppData\Local\Temp\STD0o000000.tmp"

. testparm y05 ynewprod yupprod yprocinn yuni yskilled ysize yage yforown ybusass ybusinf ylargecity
yimpint yinfrastruct yaccessfin yweaklaw ymacobst
```

```
 ( 1)  [model]y05 = 0
 ( 2)  [model]ynewprod = 0
 ( 3)  [model]yupprod = 0
 ( 4)  [model]yprocinn = 0
 ( 5)  [model]yuni = 0
 ( 6)  [model]yskilled = 0
 ( 7)  [model]ysize = 0
 ( 8)  [model]yage = 0
 ( 9)  [model]yforown = 0
 (10)  [model]ybusass = 0
 (11)  [model]ybusinf = 0
 (12)  [model]ylargecity = 0
 (13)  [model]yimpint = 0
 (14)  [model]yinfrastruct = 0
 (15)  [model]yaccessfin = 0
 (16)  [model]yweaklaw = 0
 (17)  [model]ymacobst = 0

       F( 17, 10576) =    1.45
            Prob > F =    0.1015
```

A4.6.2 Chow test for structural break – POOLED2

```
. tobit expint newprod upprod uni size age forown largecity infrastruct accessfin weaklaw y08
ynewprod yupprod yuni ysize yage yforown ylargecity yinfrastruct yaccessfin yweaklaw if y05==0, ll
vce(robust)

Tobit regression                                  Number of obs   =      13828
                                                  F(  21,  13807) =      73.44
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -24111.993                 Pseudo R2       =     0.0280
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     newprod |   16.48827   2.429333     6.79   0.000     11.72644    21.25009
      upprod |   15.84839   2.505582     6.33   0.000     10.93711    20.75967
         uni |   .0696104   .0365057     1.91   0.057    -.0019458    .1411666
        size |    .012439     .00228     5.46   0.000     .0079699    .0169081
         age |   .5252609    .044966    11.68   0.000     .4371214    .6134003
      forown |   .5493153   .0324419    16.93   0.000     .4857248    .6129059
   largecity |  -.4508212   2.282983    -0.20   0.843    -4.925779    4.024136
 infrastruct |   .0627211   6.409266     0.01   0.992    -12.50031    12.62575
   accessfin |   3.557851   2.547797     1.40   0.163    -1.436178     8.55188
     weaklaw |  -9.410381    2.89543    -3.25   0.001    -15.08582   -3.734946
         y08 |   10.91505   3.723603     2.93   0.003     3.616282    18.21382
    ynewprod |   1.869037   3.247366     0.58   0.565    -4.496242    8.234316
     yupprod |  -6.174409   3.638838    -1.70   0.090    -13.30703    .9582075
        yuni |  -.2881575   .0540221    -5.33   0.000    -.3940482   -.1822668
       ysize |   -.002416   .0046302    -0.52   0.602    -.0114919    .0066599
        yage |   .0258073   .0711228     0.36   0.717     -.113603    .1652175
     yforown |    .008755   .0456296     0.19   0.848    -.0806852    .0981952
  ylargecity |   -9.83093   2.982146    -3.30   0.001    -15.67634    -3.98552
yinfrastruct |  -1.354302   7.176659    -0.19   0.850    -15.42153    12.71293
  yaccessfin |  -4.762311    3.30845    -1.44   0.150    -11.24732      1.7227
    yweaklaw |  -1.747647   3.552371    -0.49   0.623    -8.710778    5.215483
       _cons |  -72.91472   2.749888   -26.52   0.000    -78.30487   -67.52456
-------------+----------------------------------------------------------------
      /sigma |   62.94486   .7646018                      61.44614    64.44358
------------------------------------------------------------------------------
  Obs. summary:      10229  left-censored observations at expint<=0
                      3599     uncensored observations
                         0 right-censored observations

. testparm y08 ynewprod yupprod yuni ysize yage yforown ylargecity yinfrastruct yaccessfin yweaklaw
```

```
 ( 1)  [model]y08 = 0
 ( 2)  [model]ynewprod = 0
 ( 3)  [model]yupprod = 0
 ( 4)  [model]yuni = 0
 ( 5)  [model]ysize = 0
 ( 6)  [model]yage = 0
 ( 7)  [model]yforown = 0
 ( 8)  [model]ylargecity = 0
 ( 9)  [model]yinfrastruct = 0
 (10)  [model]yaccessfin = 0
 (11)  [model]yweaklaw = 0
       F( 11, 13807) =    7.46
            Prob > F =    0.0000
```

A4.7 Test for equal variances across transition groupings

A4.7.1 Test for equal variances – POOLED1 advanced and medium transition samples

```
. tobit expint newprod upprod procinn uni skilled size sizesq age agesq forown busass businf largecity impint infrastruct accessfin weaklaw macobst sectorspill gdpcap1 gdpcap1sq highref highnewprod highupprod highprocinn highuni highsize highsizesq highage highagesq highforown highbusass highbusinf highlargecity highimpint highinfrastr highaccessfin highweaklaw highmacobst highsectorspill highgdpcap1 highgdpcap1sq if lowref==0, ll vce(cluster countrysect)

Tobit regression                                  Number of obs   =       8576
                                                  F(  42,   8534) =      37.01
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -14854.856                 Pseudo R2       =     0.0678

                          (Std. Err. adjusted for 155 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     newprod |   4.971099   2.331613     2.13   0.033     .4005726    9.541625
      upprod |   4.165215   2.720391     1.53   0.126     -1.16741    9.497839
     procinn |   6.086957   2.909054     2.09   0.036     .3845069    11.78941
         uni |   .1719755   .0487294     3.53   0.000     .0764541    .2674969
     skilled |   .0766593   .0346338     2.21   0.027     .0087688    .1445499
        size |   .0307227   .0040558     7.57   0.000     .0227722    .0386731
      sizesq |  -3.19e-06   6.19e-07    -5.15   0.000    -4.40e-06   -1.98e-06
         age |   .5058428    .129481     3.91   0.000     .2520287     .759657
       agesq |  -.0019402   .0010203    -1.90   0.057    -.0039402    .0000599
      forown |   .3462984   .0538563     6.43   0.000     .2407271    .4518697
      busass |   23.95176   2.972978     8.06   0.000       18.124    29.77951
      businf |   12.26627   2.968416     4.13   0.000     6.447454    18.08508
   largecity |   .3833202   2.592464     0.15   0.882    -4.698537    5.465177
      impint |   .3807553   .0438291     8.69   0.000     .2948398    .4666709
 infrastruct |   5.051454   4.079993     1.24   0.216    -2.946319    13.04923
   accessfin |   4.730151   3.181146     1.49   0.137    -1.505666    10.96597
     weaklaw |   -7.35509   3.022515    -2.43   0.015    -13.27995    -1.43023
     macobst |   3.830538   2.225881     1.72   0.085    -.5327269    8.193803
 sectorspill |   79.68378   11.65207     6.84   0.000      56.8429    102.5247
     gdpcap1 |   .0023314   .0006037     3.86   0.000      .001148    .0035149
   gdpcap1sq |   7.45e-09   2.23e-09     3.34   0.001     3.08e-09    1.18e-08
     highref |  -2.250942   31.97638    -0.07   0.944    -64.93238     60.4305
 highnewprod |    4.88937    4.42282     1.11   0.269    -3.780427    13.55917
  highupprod |   .1412072   3.925957     0.04   0.971    -7.554619    7.837033
 highprocinn |  -2.879723   4.072102    -0.71   0.479    -10.86203    5.102583
     highuni |  -.0765375   .0793253    -0.96   0.335    -.2320342    .0789593
    highsize |  -.0079603   .0083209    -0.96   0.339    -.0242713    .0083507
  highsizesq |   1.32e-07   1.18e-06     0.11   0.911    -2.18e-06    2.45e-06
     highage |  -.0446014   .2659986    -0.17   0.867     -.566023    .4768201
   highagesq |  -.0009139   .0022495    -0.41   0.685    -.0053235    .0034957
```

```
   highforown |  -.0495417   .0836913    -0.59   0.554     -.213597    .1145135
   highbusass |  -11.96482   5.538691    -2.16   0.031    -22.82199   -1.107643
   highbusinf |    2.83872   5.892888     0.48   0.630    -8.712767    14.39021
 highlargec~y |  -7.858075   4.300914    -1.83   0.068    -16.28891    .5727575
   highimpint |   .1834102   .0653922     2.80   0.005     .0552256    .3115948
 highinfrastr |  -10.45026   8.349703    -1.25   0.211     -26.8177     5.91718
 highaccess~n |  -1.978376   4.456931    -0.44   0.657    -10.71504    6.758288
  highweaklaw |   .4872153   3.592065     0.14   0.892    -6.554101    7.528532
  highmacobst |    8.45159   3.499527     2.42   0.016     1.591671    15.31151
 highsector~l |  -8.922699   21.42118    -0.42   0.677    -50.91339    33.06799
  highgdpcap1 |   .0062663   .0059661     1.05   0.294    -.0054287    .0179614
 highgdpcap~q |  -3.91e-07   3.67e-07    -1.06   0.288    -1.11e-06    3.30e-07
        _cons |  -147.9076   9.975133   -14.83   0.000    -167.4612   -128.3539
-------------+----------------------------------------------------------------
       /sigma |   54.05908   1.993379                      50.15157    57.96658
------------------------------------------------------------------------------
  Obs. summary:       6241  left-censored observations at expint<=0
                      2335     uncensored observations
                         0 right-censored observations

. testparm highref highnewprod highupprod highprocinn highuni highsize highsizesq highage highagesq
highforown highbusass highbusinf highlargecity highimpint highinfrastr highaccessfin highweaklaw
highmacobst highsectorspill highgdpcap1 highgdpcap1sq

 ( 1)  [model]highref = 0
 ( 2)  [model]highnewprod = 0
 ( 3)  [model]highupprod = 0
 ( 4)  [model]highprocinn = 0
 ( 5)  [model]highuni = 0
 ( 6)  [model]highsize = 0
 ( 7)  [model]highsizesq = 0
 ( 8)  [model]highage = 0
 ( 9)  [model]highagesq = 0
 (10)  [model]highforown = 0
 (11)  [model]highbusass = 0
 (12)  [model]highbusinf = 0
 (13)  [model]highlargecity = 0
 (14)  [model]highimpint = 0
 (15)  [model]highinfrastr = 0
 (16)  [model]highaccessfin = 0
 (17)  [model]highweaklaw = 0
 (18)  [model]highmacobst = 0
 (19)  [model]highsectorspill = 0
 (20)  [model]highgdpcap1 = 0
 (21)  [model]highgdpcap1sq = 0

       F( 21,  8534) =    4.44
            Prob > F =    0.0000
```

A4.7.2 Test for equal variances – POOLED1 advanced and laggard transition samples

```
. tobit expint newprod upprod procinn uni skilled size sizesq age agesq forown busass businf
largecity impint infrastruct accessfin weaklaw macobst sectorspill gdpcap1 gdpcap1sq highref
highnewprod highupprod highprocinn highuni highsize highsizesq highage highagesq highforown
highbusass highbusinf highlargecity highimpint highinfrastr highaccessfin highweaklaw highmacobst
highsectorspill highgdpcap1 highgdpcap1sq if medref==0, ll vce(cluster countrysect)

Tobit regression                                  Number of obs   =       4818
                                                  F(  42,   4776) =      30.50
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -8731.4494                 Pseudo R2       =     0.0572

                          (Std. Err. adjusted for 100 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     newprod |   3.347363   5.461122     0.61   0.540    -7.358953    14.05368
      upprod |   8.598094   3.034879     2.83   0.005     2.648332    14.54786
     procinn |  -.7586181   3.378724    -0.22   0.822    -7.382475    5.865239
         uni |   .2322159   .0719641     3.23   0.001     .0911331    .3732986
     skilled |   .0949996   .0387533     2.45   0.014     .0190253    .1709739
        size |   .0577743   .0106247     5.44   0.000      .036945    .0786036
      sizesq |  -.0000118   2.70e-06    -4.36   0.000    -.0000171   -6.48e-06
         age |   .3057163   .2379925     1.28   0.199    -.1608587    .7722913
       agesq |  -.0021279   .0018863    -1.13   0.259    -.0058259    .0015702
      forown |   .4040808    .093524     4.32   0.000     .2207306     .587431
      busass |   20.58135   4.329682     4.75   0.000     12.09317    29.06952
      businf |  -.4030509   5.608278    -0.07   0.943    -11.39786    10.59176
   largecity |  -6.243024   3.645855    -1.71   0.087    -13.39058    .9045315
      impint |   .1980098   .0551768     3.59   0.000     .0898379    .3061817
 infrastruct |  -15.93402   14.06091    -1.13   0.257    -43.49989    11.63184
   accessfin |   3.828015    3.84629     1.00   0.320    -3.712485    11.36852
     weaklaw |  -4.506928   4.260237    -1.06   0.290    -12.85896      3.8451
     macobst |   6.476565   4.203123     1.54   0.123    -1.763494    14.71662
 sectorspill |   44.85326   22.69529     1.98   0.048     .3600386    89.34648
     gdpcap1 |    .005279   .0135026     0.39   0.696    -.0211923    .0317503
   gdpcap1sq |  -1.55e-06   3.91e-06    -0.40   0.693    -9.21e-06    6.12e-06
     highref |  -31.13324   33.99756    -0.92   0.360    -97.78412    35.51764
 highnewprod |    6.12824   6.562192     0.93   0.350     -6.73668    18.99316
  highupprod |  -4.525001   4.152368    -1.09   0.276    -12.66556    3.615554
 highprocinn |   3.839852   4.400074     0.87   0.383    -4.786321    12.46603
     highuni |  -.1336909   .0962181    -1.39   0.165    -.3223228     .054941
    highsize |   -.035745   .0129435    -2.76   0.006    -.0611202   -.0103698
  highsizesq |   8.82e-06   2.88e-06     3.06   0.002     3.17e-06    .0000145
     highage |   .1359932   .3274479     0.42   0.678    -.5059555    .7779419
   highagesq |  -.0006236   .0026547    -0.23   0.814     -.005828    .0045809
  highforown |  -.1140657   .1134953    -1.01   0.315    -.3365687    .1084374
  highbusass |  -9.113111   6.244442    -1.46   0.145    -21.35509    3.128873
  highbusinf |    15.0079   7.320649     2.05   0.040     .6560592    29.35975
highlargec~y |  -1.136368   5.016924    -0.23   0.821    -10.97185    8.699115
  highimpint |   .3462791   .0767545     4.51   0.000     .1958049    .4967534
highinfrastr |   10.80242   15.71604     0.69   0.492    -20.00826    41.61311
highaccess~n |  -1.214127   4.996108    -0.24   0.808     -11.0088    8.580547
 highweaklaw |  -2.200218   4.738173    -0.46   0.642    -11.48922    7.088785
 highmacobst |   5.408272   5.023969     1.08   0.282    -4.441022    15.25757
highsector~l |   23.02999    28.6854     0.80   0.422    -33.20662    79.26659
 highgdpcap1 |   .0030034   .0146559     0.20   0.838     -.025729    .0317358
highgdpcap~q |   1.18e-06   3.93e-06     0.30   0.764    -6.52e-06    8.88e-06
       _cons |  -113.2088   16.98061    -6.67   0.000    -146.4987   -79.91901
-------------+----------------------------------------------------------------
      /sigma |   51.10416   2.205113                      46.78113     55.4272
------------------------------------------------------------------------------
  Obs. summary:       3431  left-censored observations at expint<=0
                      1387     uncensored observations
                         0 right-censored observations
```

```
. testparm highref highnewprod highupprod highprocinn highuni highsize highsizesq highage highagesq
highforown highbusass highbusinf highlargecity highimpint highinfrastr highaccessfin highweaklaw
highmacobst highsectorspill highgdpcap1 highgdpcap1sq

 ( 1)  [model]highref = 0
 ( 2)  [model]highnewprod = 0
 ( 3)  [model]highupprod = 0
 ( 4)  [model]highprocinn = 0
 ( 5)  [model]highuni = 0
 ( 6)  [model]highsize = 0
 ( 7)  [model]highsizesq = 0
 ( 8)  [model]highage = 0
 ( 9)  [model]highagesq = 0
 (10)  [model]highforown = 0
 (11)  [model]highbusass = 0
 (12)  [model]highbusinf = 0
 (13)  [model]highlargecity = 0
 (14)  [model]highimpint = 0
 (15)  [model]highinfrastr = 0
 (16)  [model]highaccessfin = 0
 (17)  [model]highweaklaw = 0
 (18)  [model]highmacobst = 0
 (19)  [model]highsectorspill = 0
 (20)  [model]highgdpcap1 = 0
 (21)  [model]highgdpcap1sq = 0

       F( 21,  4776) =    4.87
            Prob > F =    0.0000
```

A4.7.3 Test for equal variances – POOLED1 medium and laggard transition samples

```
. tobit expint newprod upprod procinn uni skilled size sizesq age agesq forown busass businf
largecity impint infrastruct accessfin weaklaw macobst sectorspill gdpcap1 gdpcap1sq medref
mednewprod medupprod medprocinn meduni medsize medsizesq medage medagesq medforown medbusass
medbusinf medlargecity medimpint medinfrastr medaccessfin medweaklaw medmacobst medsectorspill
medgdpcap1 medgdpcap1sq if highref==0, ll vce(cluster countrysect)

Tobit regression                                  Number of obs   =       7824
                                                  F(  42,   7782) =      28.59
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -12378.805                 Pseudo R2       =     0.0681

                          (Std. Err. adjusted for 164 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     newprod |   3.679106   5.847121     0.63   0.529    -7.782823    15.14104
      upprod |   9.579232   3.267587     2.93   0.003     3.173883    15.98458
     procinn |  -.9494622   3.660238    -0.26   0.795    -8.124513    6.225588
         uni |   .2425198   .0793059     3.06   0.002      .087059    .3979806
     skilled |   .0680258   .0412354     1.65   0.099    -.0128066    .1488582
        size |   .0625866   .0114414     5.47   0.000     .0401583    .0850149
      sizesq |  -.0000127   2.89e-06    -4.40   0.000    -.0000184   -7.05e-06
         age |   .3498116   .2588207     1.35   0.177    -.1575465    .8571697
       agesq |  -.0024153   .0020627    -1.17   0.242    -.0064589    .0016282
      forown |   .4343549   .0993464     4.37   0.000     .2396093    .6291005
      busass |   22.41659   4.645333     4.83   0.000     13.31049    31.52269
      businf |  -.5477432   6.027968    -0.09   0.928    -12.36418     11.2687
   largecity |  -6.648859   3.939395    -1.69   0.091    -14.37113    1.073413
      impint |   .2169906   .0597055     3.63   0.000     .0999517    .3340295
 infrastruct |  -17.54658    15.2721    -1.15   0.251      -47.484    12.39084
   accessfin |   4.189267   4.188837     1.00   0.317     -4.02198    12.40051
     weaklaw |   -4.64945   4.609607    -1.01   0.313    -13.68552    4.386618
     macobst |   7.085315   4.570335     1.55   0.121    -1.873771     16.0444
 sectorspill |   48.99969   24.59409     1.99   0.046     .7886511    97.21073
     gdpcap1 |   .0064575   .0145748     0.44   0.658    -.0221131    .0350281
   gdpcap1sq |  -1.82e-06   4.23e-06    -0.43   0.667    -.0000101    6.47e-06
```

```
      medref |  -29.87116   20.90971    -1.43   0.153    -70.85981    11.11749
  mednewprod |   1.597152   6.364319     0.25   0.802    -10.87863    14.07293
   medupprod |  -5.177973   4.259775    -1.22   0.224    -13.52828    3.172331
  medprocinn |   7.257211     4.7586     1.53   0.127    -2.070923    16.58535
      meduni |  -.0659088   .0956541    -0.69   0.491    -.2534165    .1215989
     medsize |   -.030763    .012061    -2.55   0.011    -.0544059   -.0071201
   medsizesq |   9.42e-06   2.94e-06     3.20   0.001     3.65e-06    .0000152
      medage |   .1774292   .2930729     0.61   0.545    -.3970726     .751931
    medagesq |   .0003906   .0023317     0.17   0.867    -.0041801    .0049613
   medforown |  -.0769933   .1101076    -0.70   0.484    -.2928337    .1388471
   medbusass |   2.609538   5.613915     0.46   0.642    -8.395245    13.61432
   medbusinf |   13.30043   6.697755     1.99   0.047     .1710322    26.42984
medlargecity |   7.220371   4.782854     1.51   0.131    -2.155308    16.59605
   medimpint |   .1788498   .0751686     2.38   0.017     .0314992    .3262004
 medinfrastr |   22.67144   15.86947     1.43   0.153    -8.436991    53.77988
medaccessfin |   .6371475   5.341427     0.12   0.905    -9.833485    11.10778
  medweaklaw |  -2.864288   5.560509    -0.52   0.606    -13.76438    8.035804
  medmacobst |   -3.16357   5.094943    -0.62   0.535    -13.15103    6.823888
medsectors~l |   33.90134   27.38231     1.24   0.216    -19.77535    87.57803
  medgdpcap1 |   -.004028   .0145799    -0.28   0.782    -.0326085    .0245525
medgdpcap1sq |   1.83e-06   4.23e-06     0.43   0.665    -6.46e-06    .0000101
       _cons |  -125.1877   18.64969    -6.71   0.000    -161.7461   -88.62927
-------------+----------------------------------------------------------------
      /sigma |   57.15711     2.1716                       52.9002    61.41403
------------------------------------------------------------------------------
  Obs. summary:       5918  left-censored observations at expint<=0
                      1906     uncensored observations
                         0 right-censored observations

. testparm medref mednewprod medupprod medprocinn meduni medsize medsizesq medage medagesq
medforown medbusass medbusinf medlargecity medimpint medinfrastr medaccessfin medweaklaw
medmacobst medsectorspill medgdpcap1 medgdpcap1sq

 ( 1)  [model]medref = 0
 ( 2)  [model]mednewprod = 0
 ( 3)  [model]medupprod = 0
 ( 4)  [model]medprocinn = 0
 ( 5)  [model]meduni = 0
 ( 6)  [model]medsize = 0
 ( 7)  [model]medsizesq = 0
 ( 8)  [model]medage = 0
 ( 9)  [model]medagesq = 0
 (10)  [model]medforown = 0
 (11)  [model]medbusass = 0
 (12)  [model]medbusinf = 0
 (13)  [model]medlargecity = 0
 (14)  [model]medimpint = 0
 (15)  [model]medinfrastr = 0
 (16)  [model]medaccessfin = 0
 (17)  [model]medweaklaw = 0
 (18)  [model]medmacobst = 0
 (19)  [model]medsectorspill = 0
 (20)  [model]medgdpcap1 = 0
 (21)  [model]medgdpcap1sq = 0

       F( 21,  7782) =    6.68
            Prob > F =    0.0000
```

A4.7.4 test for equal variances – POOLED2 advanced and medium transition samples

```
. tobit expint newprod upprod uni size sizesq age agesq forown largecity infrastruct accessfin
weaklaw sectorspill gdpcap1 gdpcap1sq highref highnewprod highupprod highuni highsize highsizesq
highage highagesq highforown highlarge city highinfrastruct highaccessfin highweaklaw
highsectorspill highgdpcap1 highgdpcap1sq if lowref==0, ll vce(cluster countrysect)

Tobit regression                                  Number of obs   =      16988
                                                  F(  31,  16957) =      30.04
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -29942.525                 Pseudo R2       =     0.0365

                          (Std. Err. adjusted for 182 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     newprod |   12.06021   2.208448     5.46   0.000     7.731422      16.389
      upprod |   5.983917   1.878983     3.18   0.001     2.300915    9.666919
         uni |   .0498621   .0526322     0.95   0.343    -.0533026    .1530267
        size |   .0429192   .0046075     9.32   0.000      .033888    .0519504
      sizesq |  -4.82e-06   7.56e-07    -6.38   0.000    -6.30e-06   -3.34e-06
         age |   .8093404   .1264561     6.40   0.000     .5614732    1.057208
       agesq |  -.0039013   .0010538    -3.70   0.000    -.0059669   -.0018357
      forown |   .5372366   .0406019    13.23   0.000     .4576526    .6168206
   largecity |  -6.124361   2.515958    -2.43   0.015     -11.0559   -1.192821
 infrastruct |  -4.137706   3.418586    -1.21   0.226    -10.83849    2.563078
   accessfin |  -1.560757   2.048187    -0.76   0.446    -5.575415    2.453902
     weaklaw |  -11.39117   2.347463    -4.85   0.000    -15.99245   -6.789903
 sectorspill |   52.46178   14.80079     3.54   0.000     23.45069    81.47287
     gdpcap1 |     .00074   .0005836     1.27   0.205     -.000404     .001884
   gdpcap1sq |   9.61e-09   2.58e-09     3.72   0.000     4.55e-09    1.47e-08
     highref |   1.815657    28.3824     0.06   0.949     -53.8168    57.44811
 highnewprod |   .5728219    3.79893     0.15   0.880    -6.873476    8.019119
  highupprod |   .3424532   3.041185     0.11   0.910    -5.618586    6.303492
     highuni |   .0541407   .0761379     0.71   0.477    -.0950975    .2033789
    highsize |  -.0071796   .0082252    -0.87   0.383    -.0233017    .0089426
  highsizesq |   2.13e-08   1.40e-06     0.02   0.988    -2.73e-06    2.77e-06
     highage |  -.2298117   .1977278    -1.16   0.245    -.6173787    .1577552
   highagesq |   .0004651   .0015773     0.29   0.768    -.0026267    .0035568
  highforown |   -.037727   .0615718    -0.61   0.540    -.1584142    .0829602
highlargec~y |   .3673439   3.962821     0.09   0.926    -7.400198    8.134886
highinfras~t |   1.781537   7.811161     0.23   0.820    -13.52915    17.09222
highaccess~n |   6.788721   3.402298     2.00   0.046     .1198622    13.45758
 highweaklaw |   -2.97365     3.3813    -0.88   0.379     -9.60135     3.65405
highsector~l |   18.07828   23.55838     0.77   0.443     -28.0986    64.25516
 highgdpcap1 |    .000863   .0051238     0.17   0.866    -.0091802    .0109062
highgdpcap~q |  -8.09e-08   2.42e-07    -0.33   0.738    -5.55e-07    3.93e-07
       _cons |  -110.7789   11.38682    -9.73   0.000    -133.0983    -88.4596
-------------+----------------------------------------------------------------
      /sigma |   60.78812   1.625139                      57.60268    63.97356
------------------------------------------------------------------------------
  Obs. summary:      12462  left-censored observations at expint<=0
                      4526     uncensored observations
                         0 right-censored observations

. testparm highref highnewprod highupprod highuni highsize highsizesq highage highagesq highforown
highlargecity highinfrastruct highaccessfin highweaklaw highsectorspill highgdpcap1 highgdpcap1sq

 ( 1)  [model]highref = 0
 ( 2)  [model]highnewprod = 0
 ( 3)  [model]highupprod = 0
 ( 4)  [model]highuni = 0
 ( 5)  [model]highsize = 0
 ( 6)  [model]highsizesq = 0
 ( 7)  [model]highage = 0
 ( 8)  [model]highagesq = 0
 ( 9)  [model]highforown = 0
```

```
 (10)  [model]highlargecity = 0
 (11)  [model]highinfrastruct = 0
 (12)  [model]highaccessfin = 0
 (13)  [model]highweaklaw = 0
 (14)  [model]highsectorspill = 0
 (15)  [model]highgdpcap1 = 0
 (16)  [model]highgdpcap1sq = 0

       F( 16, 16957) =    2.15
            Prob > F =    0.0048
```

A4.7.5 test for equal variances – POOLED2 advanced and laggard transition samples

```
. tobit expint newprod upprod uni size sizesq age agesq forown largecity infrastruct accessfin
weaklaw sectorspill gdpcap1 gdpcap1sq highref highnewprod highupprod highuni highsize highsizesq
highage highagesq highforown highlarge city highinfrastruct highaccessfin highweaklaw
highsectorspill highgdpcap1 highgdpcap1sq if medref==0, ll vce(cluster countrysect)

Tobit regression                                  Number of obs   =       8794
                                                  F(  31,   8763) =      22.85
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -15722.178                 Pseudo R2       =     0.0402

                          (Std. Err. adjusted for 111 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     newprod |   8.689227   4.409406     1.97   0.049     .0457563     17.3327
      upprod |   4.081458   3.260754     1.25   0.211    -2.310385     10.4733
         uni |   .1529416   .0703016     2.18   0.030     .0151339    .2907492
        size |   .0790655   .0122839     6.44   0.000     .0549862    .1031449
      sizesq |  -.0000164   3.64e-06    -4.50   0.000    -.0000235   -9.25e-06
         age |   .5857341   .2470623     2.37   0.018     .1014341    1.070034
       agesq |   -.003854   .0020358    -1.89   0.058    -.0078447    .0001366
      forown |   .5477604   .0815541     6.72   0.000     .3878953    .7076256
   largecity |  -3.229679   3.835909    -0.84   0.400    -10.74896    4.289602
 infrastruct |  -1.627541   8.078551    -0.20   0.840     -17.4634    14.20832
   accessfin |   7.103914   3.396913     2.09   0.037     .4451659    13.76266
     weaklaw |  -2.354417    3.87508    -0.61   0.543    -9.950483    5.241649
 sectorspill |   29.64756   15.75238     1.88   0.060    -1.230793    60.52591
     gdpcap1 |    .018847   .0098809     1.91   0.056    -.0005218    .0382158
   gdpcap1sq |  -3.92e-06   2.27e-06    -1.73   0.084    -8.37e-06    5.32e-07
     highref |   12.04188   29.28504     0.41   0.681    -45.36367    69.44743
 highnewprod |   3.240453   5.266437     0.62   0.538       -7.083    13.56391
  highupprod |   1.913053    4.02668     0.48   0.635    -5.980186    9.806292
     highuni |  -.0569718   .0880692    -0.65   0.518    -.2296081    .1156644
    highsize |  -.0446536    .013811    -3.23   0.001    -.0717263   -.0175809
  highsizesq |   .0000118   3.79e-06     3.10   0.002     4.33e-06    .0000192
     highage |  -.0348059   .2903751    -0.12   0.905    -.6040092    .5343974
   highagesq |   .0005648   .0023427     0.24   0.810    -.0040275     .005157
  highforown |  -.0646039   .0931008    -0.69   0.488    -.2471034    .1178956
highlargec~y |  -2.471027   4.792634    -0.52   0.606    -11.86572    6.923661
highinfras~t |  -.5506658   10.56791    -0.05   0.958    -21.26625    20.16491
highaccess~n |  -2.077595   4.380565    -0.47   0.635    -10.66453    6.509342
 highweaklaw |  -11.49681   4.541408    -2.53   0.011    -20.39904   -2.594586
highsector~l |   38.18509   23.81472     1.60   0.109    -8.497343    84.86752
 highgdpcap1 |  -.0173068   .0110361    -1.57   0.117    -.0389401    .0043265
highgdpcap~q |   3.85e-06   2.28e-06     1.69   0.092    -6.25e-07    8.33e-06
       _cons |    -114.68   14.52328    -7.90   0.000     -143.149   -86.21095
-------------+----------------------------------------------------------------
      /sigma |   57.14118   1.703495                      53.80193    60.48043
------------------------------------------------------------------------------
  Obs. summary:       6381  left-censored observations at expint<=0
                      2413     uncensored observations
                         0 right-censored observations
```

```
. testparm highref highnewprod highupprod highuni highsize highsizesq highage highagesq highforown
highlargecity highinfrastruct highaccessfin highweaklaw highsectorspill highgdpcap1 highgdpcap1sq

 ( 1)  [model]highref = 0
 ( 2)  [model]highnewprod = 0
 ( 3)  [model]highupprod = 0
 ( 4)  [model]highuni = 0
 ( 5)  [model]highsize = 0
 ( 6)  [model]highsizesq = 0
 ( 7)  [model]highage = 0
 ( 8)  [model]highagesq = 0
 ( 9)  [model]highforown = 0
 (10)  [model]highlargecity = 0
 (11)  [model]highinfrastruct = 0
 (12)  [model]highaccessfin = 0
 (13)  [model]highweaklaw = 0
 (14)  [model]highsectorspill = 0
 (15)  [model]highgdpcap1 = 0
 (16)  [model]highgdpcap1sq = 0

       F( 16,  8763) =    2.98
            Prob > F =    0.0001
```

A4.7.6 test for equal variances – POOLED2 medium and laggard transition samples

```
. tobit expint newprod upprod uni size sizesq age agesq forown largecity infrastruct accessfin
weaklaw sectorspill gdpcap1 gdpcap1sq medref mednewprod medupprod meduni medsize medsizesq medage
medagesq medforown medlargecity medinfrastruct medaccessfin medweaklaw medsectorspill medgdpcap1
medgdpcap1sq if highref==0, ll vce(cluster countrysect)

Tobit regression                                  Number of obs   =      15246
                                                  F(  31,  15215) =      19.21
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -23746.122                 Pseudo R2       =     0.0385

                          (Std. Err. adjusted for 173 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     newprod |   9.527088   4.734126     2.01   0.044     .2476324    18.80654
      upprod |    4.58585   3.520003     1.30   0.193    -2.313777    11.48548
         uni |   .1685105   .0761768     2.21   0.027     .0191949    .3178262
        size |   .0853616   .0131452     6.49   0.000     .0595954    .1111279
      sizesq |  -.0000177   3.90e-06    -4.53   0.000    -.0000253    -.00001
         age |   .6569263   .2701806     2.43   0.015       .12734    1.186513
       agesq |  -.0042929   .0022298    -1.93   0.054    -.0086635    .0000777
      forown |   .5910176   .0861294     6.86   0.000     .4221936    .7598416
   largecity |  -3.389378   4.137823    -0.82   0.413    -11.50001    4.721251
 infrastruct |  -1.574045   8.853884    -0.18   0.859    -18.92872    15.78063
   accessfin |   7.850165   3.666822     2.14   0.032     .6627546    15.03758
     weaklaw |  -2.428506   4.189797    -0.58   0.562    -10.64101    5.783998
 sectorspill |   31.97415    17.0176     1.88   0.060    -1.382389    65.33068
     gdpcap1 |   .0209013    .010659     1.96   0.050     8.42e-06    .0417941
   gdpcap1sq |  -4.33e-06   2.45e-06    -1.77   0.077    -9.12e-06    4.64e-07
      medref |   12.34322   19.28293     0.64   0.522    -25.45364    50.14008
  mednewprod |   3.067437   5.284384     0.58   0.562     -7.29059    13.42546
   medupprod |   1.629754    3.92642     0.42   0.678      -6.0665    9.326008
      meduni |  -.1156741   .0943921    -1.23   0.220    -.3006939    .0693458
     medsize |   -.041183   .0136831    -3.01   0.003    -.0680036   -.0143625
   medsizesq |   .0000127   3.95e-06     3.21   0.001     4.95e-06    .0000204
      medage |   .1799291   .3118584     0.58   0.564    -.4313507    .7912089
    medagesq |    .000262   .0025883     0.10   0.919    -.0048114    .0053354
   medforown |  -.0388166    .090519    -0.43   0.668    -.2162447    .1386115
medlargecity |  -2.811606   4.862679    -0.58   0.563    -12.34304    6.719827
medinfrast~t |  -2.743071   9.625849    -0.28   0.776    -21.61089    16.12475
```

```
medaccessfin |  -9.519897   4.195451    -2.27   0.023    -17.74348    -1.29631
  medweaklaw |  -9.241491   4.799139    -1.93   0.054    -18.64838     .165396
medsectors~l |   21.98892    23.0336     0.95   0.340     -23.1597    67.13754
  medgdpcap1 |  -.0201247   .0106815    -1.88   0.060    -.0410617    .0008123
medgdpcap1sq |   4.34e-06   2.45e-06     1.77   0.076    -4.54e-07    9.13e-06
       _cons |   -128.018   16.07871    -7.96   0.000    -159.5342   -96.50178
-------------+----------------------------------------------------------------
      /sigma |   63.41724   1.876077                      59.73991    67.09458
------------------------------------------------------------------------------
  Obs. summary:      11733  left-censored observations at expint<=0
                      3513     uncensored observations
                         0 right-censored observations

. testparm medref mednewprod medupprod meduni medsize medsizesq medage medagesq medforown
medlargecity medinfrastruct medaccessfin medweaklaw medsectorspill medgdpcap1 medgdpcap1sq

 ( 1)  [model]medref = 0
 ( 2)  [model]mednewprod = 0
 ( 3)  [model]medupprod = 0
 ( 4)  [model]meduni = 0
 ( 5)  [model]medsize = 0
 ( 6)  [model]medsizesq = 0
 ( 7)  [model]medage = 0
 ( 8)  [model]medagesq = 0
 ( 9)  [model]medforown = 0
 (10)  [model]medlargecity = 0
 (11)  [model]medinfrastruct = 0
 (12)  [model]medaccessfin = 0
 (13)  [model]medweaklaw = 0
 (14)  [model]medsectorspill = 0
 (15)  [model]medgdpcap1 = 0
 (16)  [model]medgdpcap1sq = 0

       F( 16, 15215) =    2.96
            Prob > F =    0.0001
```

A4.8. Main model estimations

A4.8.1 Tobit estimation – POOLED1 Laggard transition sample

```
. tobit expint newprod upprod procinn uni skilled size sizesq age agesq forown busass businf
largecity impint infrastruct accessfin weaklaw macobst sectorspill gdpcap1 gdpcap1sq y05 blr tjk
uzb bih aze if trans<3, ll vce(cluster countrysect)

Tobit regression                                  Number of obs   =       2033
                                                  F(  27,   2006) =      24.07
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -3118.0134                 Pseudo R2       =     0.0572
                           (Std. Err. adjusted for 47 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     newprod |   4.007372   5.823106     0.69   0.491    -7.412596    15.42734
      upprod |   6.982508   2.609328     2.68   0.008     1.865232    12.09978
     procinn |   1.109013   4.844763     0.23   0.819    -8.392281    10.61031
         uni |   .2583399   .0831262     3.11   0.002     .0953171    .4213627
     skilled |   .0519271   .0572803     0.91   0.365     -.060408    .1642621
        size |   .0603162   .0126201     4.78   0.000     .0355664     .085066
      sizesq |  -.0000121   2.98e-06    -4.04   0.000    -.0000179   -6.21e-06
         age |   .3395848   .2087284     1.63   0.104    -.0697623    .7489319
       agesq |  -.0026547   .0017649    -1.50   0.133     -.006116    .0008067
      forown |    .408519   .1077479     3.79   0.000     .1972095    .6198285
```

```
      busass |   23.07752   5.153016     4.48   0.000      12.9717    33.18335
      businf |  -.5232909   6.056698    -0.09   0.931    -12.40137    11.35479
   largecity |  -3.901529   4.136193    -0.94   0.346    -12.01321    4.210156
      impint |   .2246138   .0593379     3.79   0.000     .1082435    .3409841
 infrastruct |   -16.8295   15.00288    -1.12   0.262    -46.25236    12.59336
   accessfin |   3.859505   3.945806     0.98   0.328      -3.8788    11.59781
     weaklaw |  -5.591944   4.815456    -1.16   0.246    -15.03576    3.851875
     macobst |   1.349784   3.638143     0.37   0.711    -5.785149    8.484717
 sectorspill |    54.0594    14.3489     3.77   0.000      25.9191     82.1997
     gdpcap1 |  -.1175136   .0485523    -2.42   0.016    -.2127318   -.0222953
   gdpcap1sq |   .0000234   9.60e-06     2.43   0.015     4.53e-06    .0000422
         y05 |   15.20242   13.81327     1.10   0.271    -11.88744    42.29227
         blr |   5.752209   12.87758     0.45   0.655    -19.50263    31.00704
         tjk |   -102.599    48.5132    -2.11   0.035    -197.7405   -7.457465
         uzb |  -85.09942     35.421    -2.40   0.016    -154.5652   -15.63361
         bih |   7.685774   8.363057     0.92   0.358    -8.715413    24.08696
         aze |  -60.78953   25.00013    -2.43   0.015    -109.8185    -11.7606
       _cons |   2.719951    55.3788     0.05   0.961     -105.886    111.3259
-------------+----------------------------------------------------------------
      /sigma |   55.23363   4.401502                      46.60164    63.86563
------------------------------------------------------------------------------
  Obs. summary:       1554  left-censored observations at expint<=0
                       479     uncensored observations
                         0 right-censored observations
```

A4.8.1.1 Tobit unconditional marginal effects – POOLED1 Laggard transition sample

```
. mfx compute, predict (ystar(0,.))

Marginal effects after tobit
      y  = E(expint*|expint>0) (predict, ystar(0,.))
         =  6.0374782
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
 newprod*|    .798219     1.14264    0.70   0.485  -1.44132  3.03776   .380718
  upprod*|   1.365449      .48937    2.79   0.005   .406293  2.32461   .538121
 procinn*|   .2191072      .96326    0.23   0.820  -1.66885  2.10706   .349729
     uni |   .0508228      .01434    3.55   0.000   .022726   .07892   30.9174
 skilled |   .0102155      .01157    0.88   0.377  -.012455  .032886   49.1028
    size |   .0118659      .00242    4.91   0.000   .007127  .016605   138.932
  sizesq |  -2.37e-06      .00000   -4.16   0.000  -3.5e-06 -1.3e-06    185190
     age |   .0668059      .04074    1.64   0.101  -.013044  .146656   15.3945
   agesq |  -.0005222      .00035   -1.50   0.133  -.001204  .000159   591.357
  forown |   .0803672      .02279    3.53   0.000   .035691  .125044   10.2041
  busass*|   5.089414     1.32789    3.83   0.000   2.48679  7.69204   .314806
  businf*|  -.1023625     1.18177   -0.09   0.931  -2.41859  2.21386   .074274
largec~y*|  -.7721176      .86507   -0.89   0.372  -2.46762  .923385   .557304
  impint |   .0441879      .01295    3.41   0.001   .018813  .069563   18.2297
infra~ct*|  -2.692447     1.95807   -1.38   0.169   -6.5302  1.14531   .024102
access~n*|   .7890487      .86738    0.91   0.363  -.910984  2.48908   .108706
 weaklaw*|   -1.05528      .86843   -1.22   0.224  -2.75737  .646815   .207083
 macobst*|   .2668931      .72776    0.37   0.714  -1.15949  1.69328   .353173
sector~l |   10.63501     2.76772    3.84   0.000   5.21037  16.0596   .656744
 gdpcap1 |  -.0231182      .01018   -2.27   0.023  -.043079 -.003157   1386.58
gdpcap~q |   4.60e-06      .00000    2.29   0.022   6.7e-07  8.5e-06   2.9e+06
    y05*|   2.955832     2.74807    1.08   0.282  -2.43028  8.34194   .540089
     blr*|   1.179742     2.77064    0.43   0.670  -4.25062   6.6101   .217413
     tjk*|  -9.541711     2.75348   -3.47   0.001  -14.9384   -4.145   .149041
     uzb*|  -8.843596     2.38876   -3.70   0.000  -13.5255  -4.1617   .157403
     bih*|   1.628006     1.84005    0.88   0.376  -1.97843  5.23444   .121987
     aze*|  -7.333145     2.02745   -3.62   0.000  -11.3069 -3.35942   .157403
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

A4.8.1.2 Tobit conditional marginal effects – POOLED1 Laggard transition sample

```
. mfx compute, predict (e(0,.))

Marginal effects after tobit
      y  = E(expint|expint>0) (predict, e(0,.))
         =  30.689433
```

variable	dy/dx	Std. Err.	z	P>|z|	[95%	C.I.]	X
newprod*	.8746489	1.26226	0.69	0.488	-1.59934	3.34864	.380718
upprod*	1.512112	.55028	2.75	0.006	.433586	2.59064	.538121
procinn*	.2412236	1.05655	0.23	0.819	-1.82959	2.31203	.349729
uni	.0560909	.01692	3.32	0.001	.02293	.089252	30.9174
skilled	.0112744	.01256	0.90	0.370	-.013351	.0359	49.1028
size	.0130959	.00263	4.98	0.000	.007937	.018254	138.932
sizesq	-2.62e-06	.00000	-4.18	0.000	-3.8e-06	-1.4e-06	185190
age	.0737309	.04502	1.64	0.101	-.014512	.161974	15.3945
agesq	-.0005764	.00038	-1.51	0.132	-.001326	.000173	591.357
forown	.0886979	.02375	3.73	0.000	.042142	.135254	10.2041
busass*	5.262277	1.23931	4.25	0.000	2.83327	7.69128	.314806
businf*	-.1133454	1.31048	-0.09	0.931	-2.68184	2.45514	.074274
largec~y*	-.8492141	.92122	-0.92	0.357	-2.65478	.956348	.557304
impint	.0487683	.01328	3.67	0.000	.022744	.074793	18.2297
infra~ct*	-3.359083	2.77012	-1.21	0.225	-8.78841	2.07025	.024102
access~n*	.851793	.89813	0.95	0.343	-.908503	2.61209	.108706
weaklaw*	-1.193137	1.00666	-1.19	0.236	-3.16616	.779886	.207083
macobst*	.2936949	.79538	0.37	0.712	-1.26523	1.85262	.353173
sector~l	11.73742	3.03514	3.87	0.000	5.78866	17.6862	.656744
gdpcap1	-.0255146	.01077	-2.37	0.018	-.04662	-.004409	1386.58
gdpcap~q	5.07e-06	.00000	2.39	0.017	9.1e-07	9.2e-06	2.9e+06
y05*	3.283309	3.00626	1.09	0.275	-2.60885	9.17546	.540089
blr*	1.271218	2.90507	0.44	0.662	-4.42261	6.96504	.217413
tjk*	-16.14463	5.81838	-2.77	0.006	-27.5484	-4.74081	.149041
uzb*	-14.12535	4.72199	-2.99	0.003	-23.3803	-4.87041	.157403
bih*	1.7224	1.90414	0.90	0.366	-2.00964	5.45444	.121987
aze*	-10.79718	3.73202	-2.89	0.004	-18.1118	-3.48256	.157403

(*) dy/dx is for discrete change of dummy variable from 0 to 1

A4.8.1.3 Probit estimation – POOLED1 Laggard transition sample

```
. probit expprob newprod upprod procinn uni skilled size sizesq age agesq forown busass businf
largecity impint infrastruct accessfin weaklaw macobst sectorspill gdpcap1 gdpcap1sq y05 blr tjk
uzb bih aze if trans<3, vce(cluster countrysect)

Iteration 0:   log pseudolikelihood = -1109.9559
Iteration 1:   log pseudolikelihood = -890.21328
Iteration 2:   log pseudolikelihood = -887.55825
Iteration 3:   log pseudolikelihood = -887.55286
Iteration 4:   log pseudolikelihood = -887.55286
Probit regression                                 Number of obs   =       2033
                                                  Wald chi2(27)   =    1136.88
                                                  Prob > chi2     =     0.0000
Log pseudolikelihood = -887.55286                 Pseudo R2       =     0.2004

                           (Std. Err. adjusted for 47 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
     expprob |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     newprod |    .109877   .0964865     1.14   0.255     -.079233     .298987
      upprod |   .1836701   .0560284     3.28   0.001     .0738565    .2934837
     procinn |  -.0451803   .1001612    -0.45   0.652    -.2414926    .1511319
         uni |   .0051883   .0014556     3.56   0.000     .0023354    .0080412
     skilled |   .0004481   .0011174     0.40   0.688     -.001742    .0026381
        size |   .0013171   .0003098     4.25   0.000     .0007098    .0019243
      sizesq |  -2.46e-07   6.93e-08    -3.55   0.000    -3.82e-07   -1.10e-07
         age |   .0092587    .004697     1.97   0.049     .0000528    .0184647
       agesq |  -.0000495   .0000451    -1.10   0.272    -.0001378    .0000388
      forown |   .0066856   .0018826     3.55   0.000     .0029958    .0103754
      busass |   .4540521   .0870294     5.22   0.000     .2834777    .6246266
      businf |  -.0220083   .1263238    -0.17   0.862    -.2695985    .2255818
   largecity |  -.0560354   .0869672    -0.64   0.519     -.226488    .1144173
      impint |   .0056329   .0014485     3.89   0.000     .0027939    .0084718
 infrastruct |  -.4273271   .2794883    -1.53   0.126     -.975114    .1204599
   accessfin |   .0930117   .0913739     1.02   0.309    -.0860779    .2721013
     weaklaw |  -.0543516   .1053468    -0.52   0.606    -.2608276    .1521244
     macobst |   .0312635   .0801522     0.39   0.696    -.1258319    .1883588
 sectorspill |    1.12255   .2977136     3.77   0.000     .5390424    1.706058
     gdpcap1 |  -.0019507   .0009762    -2.00   0.046    -.0038641   -.0000373
   gdpcap1sq |   3.84e-07   1.96e-07     1.96   0.050     5.30e-12    7.68e-07
         y05 |   .2420781   .2790865     0.87   0.386    -.3049214    .7890775
         blr |  -.0683627   .2433786    -0.28   0.779    -.5453761    .4086507
         tjk |  -1.972674   .9702507    -2.03   0.042     -3.87433   -.0710172
         uzb |  -1.584479   .7112724    -2.23   0.026    -2.978547   -.1904103
         bih |   .0743536   .1884936     0.39   0.693    -.2950871    .4437943
         aze |  -1.235421     .51304    -2.41   0.016    -2.240961   -.2298816
       _cons |  -.2236359   1.086588    -0.21   0.837    -2.353309    1.906037
```

A4.8.2 Tobit estimation – POOLED1 Medium transition sample

```
. tobit expint newprod upprod procinn uni skilled size sizesq age agesq forown busass businf
largecity impint infrastruct accessfin weaklaw macobst sectorspill gdpcap1 gdpcap1sq y05 bul alb
hrv geo ukr rus rom kaz mda mkd arm kgz hun lva if trans>=3 & trans<=3.7, ll vce(cluster
countrysect)

Tobit regression                                  Number of obs   =       5791
                                                  F(  36,   5755) =      29.56
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -9192.9669                 Pseudo R2       =     0.0780

                          (Std. Err. adjusted for 117 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     newprod |   3.766796   2.336915     1.61   0.107     -.814437     8.34803
      upprod |   5.540465   2.749044     2.02   0.044     .1513034    10.92963
     procinn |   6.312116   2.941989     2.15   0.032     .5447101    12.07952
         uni |   .1892735   .0505618     3.74   0.000     .0901533    .2883937
     skilled |   .0566431   .0442659     1.28   0.201    -.0301346    .1434208
        size |   .0323006   .0039604     8.16   0.000     .0245368    .0400645
      sizesq |  -3.32e-06   6.14e-07    -5.41   0.000    -4.53e-06   -2.12e-06
         age |    .519584   .1262778     4.11   0.000      .272032     .767136
       agesq |   -.001962   .0009712    -2.02   0.043    -.0038658   -.0000581
      forown |   .3524097   .0546966     6.44   0.000     .2451838    .4596356
      busass |   21.08054   2.645548     7.97   0.000     15.89428    26.26681
      businf |   13.94412   2.819744     4.95   0.000     8.416357    19.47187
   largecity |   3.514946   2.861655     1.23   0.219    -2.094973    9.124866
      impint |   .3652281   .0499463     7.31   0.000     .2673146    .4631416
 infrastruct |   4.408201   4.297106     1.03   0.305    -4.015744    12.83214
   accessfin |   5.095991   3.332858     1.53   0.126    -1.437666    11.62965
     weaklaw |  -8.473066   2.916214    -2.91   0.004    -14.18994   -2.756189
     macobst |   2.549444   2.220472     1.15   0.251    -1.803517    6.902404
 sectorspill |   92.70104   11.75725     7.88   0.000      69.6524    115.7497
     gdpcap1 |   .0074551    .005267     1.42   0.157    -.0028702    .0177805
   gdpcap1sq |  -1.96e-07   1.77e-07    -1.11   0.268    -5.44e-07    1.51e-07
         y05 |  -13.64703   6.318317    -2.16   0.031    -26.03331   -1.260752
         bul |   5.093677   30.08934     0.17   0.866    -53.89274     64.0801
         alb |   11.98175   32.91926     0.36   0.716    -52.55239    76.51589
         hrv |  -29.48274   17.49709    -1.69   0.092    -63.78362    4.818133
         geo |   15.13696   36.85019     0.41   0.681    -57.10327    87.37719
         ukr |   .5039812   35.92501     0.01   0.989    -69.92256    70.93052
         rus |  -11.92339   26.94894    -0.44   0.658    -64.75344    40.90667
         rom |   .0269675   29.00264     0.00   0.999    -56.82912    56.88305
         kaz |  -7.532904    30.1549    -0.25   0.803    -66.64785    51.58205
         mda |   25.25635    35.2142     0.72   0.473    -43.77673    94.28944
         mkd |   19.16954   31.92526     0.60   0.548    -43.41597    81.75506
         arm |   10.29298   38.12716     0.27   0.787    -64.45061    85.03656
         kgz |   2.526593   39.18663     0.06   0.949    -74.29395    79.34713
         hun |    528.244     481.45     1.10   0.273    -415.5792    1472.067
         lva |  -13.81107   26.76038    -0.52   0.606    -66.27149    38.64935
       _cons |  -164.2562   39.26163    -4.18   0.000    -241.2237   -87.28859
-------------+----------------------------------------------------------------
      /sigma |   56.32265   2.518553                      51.38534    61.25996
------------------------------------------------------------------------------
  Obs. summary:       4364  left-censored observations at expint<=0
                      1427     uncensored observations
                         0 right-censored observations
```

A4.8.2.1 Tobit unconditional marginal effects – POOLED1 Medium transition sample

```
. mfx compute, predict (ystar(0,.))

Marginal effects after tobit
      y  = E(expint*|expint>0) (predict, ystar(0,.))
         =  6.3244551
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
 newprod*|   .7649157      .47783    1.60   0.109   -.17161  1.70144   .387843
  upprod*|   1.109779      .56302    1.97   0.049   .006282  2.21327   .525471
 procinn*|   1.300718      .64305    2.02   0.043   .040368  2.56107   .341219
     uni |   .0380273      .01002    3.80   0.000   .018397  .057658   32.9411
 skilled |   .0113803      .00902    1.26   0.207 -.006301  .029062   45.4783
    size |   .0064896      .00085    7.63   0.000   .004824  .008156   121.747
  sizesq |  -6.67e-07      .00000   -5.21   0.000  -9.2e-07 -4.2e-07    216614
     age |   .1043906       .0251    4.16   0.000   .055202  .153579   14.9111
   agesq |  -.0003942      .00019   -2.02   0.043  -.000776 -.000012   561.125
  forown |   .0708033      .01152    6.14   0.000   .048217  .093389   10.3429
  busass*|   4.535043       .6735    6.73   0.000     3.215  5.85508   .379727
  businf*|    3.23334      .74922    4.32   0.000    1.7649  4.70179   .080642
largec~y*|    .703891       .5896    1.19   0.233  -.451706  1.85949    .53963
  impint |   .0733787      .01061    6.92   0.000   .052585  .094173   16.5262
infra~ct*|   .9310517      .95452    0.98   0.329  -.939782  2.80189   .040926
access~n*|   1.076117      .73542    1.46   0.143  -.365273  2.51751   .105163
 weaklaw*|  -1.614898      .53689   -3.01   0.003  -2.66719 -.562607   .246244
 macobst*|   .5161082       .4638    1.11   0.266  -.392929  1.42514   .381627
sector~l |   18.62474     2.18192    8.54   0.000   14.3483  22.9012   .642036
 gdpcap1 |   .0014978      .00106    1.41   0.159  -.000588  .003584   2877.89
gdpcap~q |  -3.95e-08      .00000   -1.10   0.270  -1.1e-07  3.1e-08   1.1e+08
     y05*|   -2.77467     1.15393   -2.40   0.016  -5.03634 -.513003   .526852
     bul*|   1.080093      6.6555    0.16   0.871  -11.9645  14.1246    .07149
     alb*|   2.753838     8.40591    0.33   0.743  -13.7214  19.2291   .041271
     hrv*|  -4.205746     1.93181   -2.18   0.029  -7.99203 -.419461   .037127
     geo*|   3.601506     9.99981    0.36   0.719  -15.9978  23.2008   .041444
     ukr*|   .1017296     7.27867    0.01   0.989  -14.1642  14.3677   .126576
     rus*|  -2.151065      4.4849   -0.48   0.631  -10.9413  6.63918   .135555
     rom*|   .0054195      5.8301    0.00   0.999  -11.4214  11.4322   .103264
     kaz*|  -1.406912     5.32095   -0.26   0.791  -11.8358  9.02197   .109998
     mda*|   6.616803       11.18    0.59   0.554  -15.2965  28.5301   .063374
     mkd*|   4.769093      9.3237    0.51   0.609   -13.505  23.0432   .039371
     arm*|   2.304085     9.30054    0.25   0.804  -15.9246  20.5328   .072872
     kgz*|   .5222427     8.29491    0.06   0.950  -15.7355    16.78   .045933
     hun*|   458.4065      463.71    0.99   0.323  -450.448  1367.26   .036609
     lva*|  -2.351962     3.93137   -0.60   0.550  -10.0573  5.35338   .022794
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

A4.8.2.2 Tobit conditional marginal effects – POOLED1 Medium transition sample

```
       . mfx compute, predict (e(0,.))

Marginal effects after tobit
      y  = E(expint|expint>0) (predict, e(0,.))
         =  31.478745
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
 newprod*|   .8289318      .51461    1.61   0.107  -.179688  1.83755   .387843
  upprod*|   1.212114      .60502    2.00   0.045   .026291  2.39794   .525471
 procinn*|   1.397793      .66609    2.10   0.036   .092288   2.7033   .341219
     uni |   .0414634      .01096    3.78   0.000   .019976  .062951   32.9411
```

```
 skilled |   .0124086      .00975    1.27   0.203  -.006705  .031522   45.4783
    size |    .007076      .00088    8.08   0.000   .005359  .008793   121.747
  sizesq |  -7.28e-07      .00000   -5.37   0.000  -9.9e-07 -4.6e-07    216614
     age |   .1138233      .02739    4.16   0.000   .060131  .167515   14.9111
   agesq |  -.0004298      .00021   -2.02   0.043  -.000846 -.000013   561.125
  forown |    .077201      .01209    6.39   0.000   .053512   .10089   10.3429
  busass*|   4.754619      .61712    7.70   0.000   3.54509  5.96415   .379727
  businf*|   3.253382      .69067    4.71   0.000   1.89969  4.60707   .080642
largec~y*|   .7689231      .63292    1.21   0.224  -.471582  2.00943    .53963
  impint |   .0800091      .01104    7.25   0.000   .058372  .101646   16.5262
infra~ct*|   .9866863      .98265    1.00   0.315  -.939273  2.91265   .040926
access~n*|   1.140533      .75909    1.50   0.133  -.347257  2.62832   .105163
 weaklaw*|  -1.815208      .61066   -2.97   0.003  -3.01208 -.618333   .246244
 macobst*|      .5603       .4941    1.13   0.257  -.408126  1.52873   .381627
sector~l |   20.30766     2.44348    8.31   0.000   15.5185  25.0968   .642036
 gdpcap1 |   .0016332      .00116    1.41   0.158  -.000633  .003899   2877.89
gdpcap~q |  -4.30e-08      .00000   -1.11   0.269  -1.2e-07  3.3e-08   1.1e+08
     y05*|  -3.004123     1.32599   -2.27   0.023  -5.60301 -.405234   .526852
     bul*|   1.142077     6.87311    0.17   0.868   -12.329  14.6131    .07149
     alb*|   2.784372     8.03411    0.35   0.729  -12.9622  18.5309   .041271
     hrv*|  -5.624678     3.03197   -1.86   0.064  -11.5672  .317869   .037127
     geo*|   3.573687     9.26349    0.39   0.700  -14.5824  21.7298   .041444
     ukr*|   .1106252     7.89822    0.01   0.989  -15.3696  15.5909   .126576
     rus*|  -2.496984     5.46211   -0.46   0.648  -13.2025  8.20856   .135555
     rom*|   .0059083     6.35495    0.00   0.999  -12.4496  12.4614   .103264
     kaz*|  -1.600338     6.25895   -0.26   0.798  -13.8676   10.667   .109998
     mda*|   6.241653     9.60299    0.65   0.516  -12.5799  25.0632   .063374
     mkd*|   4.621098     8.32839    0.55   0.579  -11.7022  20.9444   .039371
     arm*|   2.363663     9.10616    0.26   0.795  -15.4841  20.2114   .072872
     kgz*|    .560265      8.7797    0.06   0.949  -16.6476  17.7682   .045933
     hun*|    434.043      464.84    0.93   0.350   -477.03  1345.12   .036609
     lva*|  -2.825715     5.17083   -0.55   0.585  -12.9604  7.30892   .022794
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

A4.8.2.3 Probit estimation - POOLED1 Medium transition sample

```
. probit expprob newprod upprod procinn uni skilled size sizesq age agesq forown busass businf
largecity impint infrastruct accessfin weaklaw macobst sectorspill gdpcap1 gdpcap1sq y05 bul alb
hrv geo ukr rus rom kaz mda mkd arm kgz hun lva if trans>=3 & trans<=3.7, vce(cluster
countrysect)

Iteration 0:   log pseudolikelihood = -3233.4877
Iteration 1:   log pseudolikelihood = -2454.6729
Iteration 2:   log pseudolikelihood =  -2441.068
Iteration 3:   log pseudolikelihood = -2441.0342
Iteration 4:   log pseudolikelihood = -2441.0342

Probit regression                                 Number of obs   =       5791
                                                  Wald chi2(35)   =          .
                                                  Prob > chi2     =          .
Log pseudolikelihood = -2441.0342                 Pseudo R2       =     0.2451

                          (Std. Err. adjusted for 117 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
     expprob |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     newprod |   .1398859   .0456558     3.06   0.002     .0504022    .2293696
      upprod |   .1308868   .0488088     2.68   0.007     .0352234    .2265502
     procinn |   .0823165    .051462     1.60   0.110    -.0185472    .1831802
         uni |   .0036919   .0008382     4.40   0.000      .002049    .0053347
     skilled |   .0004541   .0008435     0.54   0.590    -.0011992    .0021075
        size |   .0007304   .0001187     6.15   0.000     .0004976    .0009631
      sizesq |  -7.15e-08   1.43e-08    -4.99   0.000    -9.96e-08   -4.34e-08
```

```
          age |   .0111018   .0024951     4.45   0.000     .0062116    .0159921
        agesq |  -.0000295   .0000215    -1.37   0.170    -.0000717    .0000127
       forown |   .0059892   .0009603     6.24   0.000     .0041071    .0078713
       busass |   .4175462   .0503898     8.29   0.000      .318784    .5163084
       businf |   .3269395   .0745015     4.39   0.000     .1809193    .4729597
   largecity |   .0938578   .0578953     1.62   0.105     -.019615    .2073305
       impint |   .0076094   .0008153     9.33   0.000     .0060113    .0092074
  infrastruct |   .0306001   .0824456     0.37   0.711    -.1309903    .1921905
    accessfin |   .0636532   .0678096     0.94   0.348    -.0692512    .1965575
      weaklaw |   -.091224    .064281    -1.42   0.156    -.2172124    .0347645
      macobst |   .0261338   .0465905     0.56   0.575    -.0651819    .1174494
  sectorspill |   1.818824   .2103273     8.65   0.000      1.40659    2.231058
      gdpcap1 |   .0000709   .0000954     0.74   0.458    -.0001161    .0002579
    gdpcap1sq |  -1.74e-09   3.42e-09    -0.51   0.611    -8.43e-09    4.96e-09
          y05 |  -.1979661   .1079238    -1.83   0.067    -.4094929    .0135607
          bul |  -.5894868   .5459497    -1.08   0.280    -1.659529     .480555
          alb |  -.5423699   .5997328    -0.90   0.366    -1.717825    .6330848
          hrv |  -.8001805   .3527656    -2.27   0.023    -1.491588   -.1087725
          geo |  -.4125963    .662811    -0.62   0.534    -1.711682    .8864894
          ukr |  -.6688478   .6548442    -1.02   0.307    -1.952319    .6146233
          rus |  -.7569411   .4855044    -1.56   0.119    -1.708512      .19463
          rom |  -.7030168   .5115941    -1.37   0.169    -1.705723    .2996893
          kaz |  -.6699206   .5424783    -1.23   0.217    -1.733158    .3933173
          mda |  -.3089919   .6560456    -0.47   0.638    -1.594818    .9768338
          mkd |  -.2729693   .5841402    -0.47   0.640    -1.417863    .8719243
          arm |   -.526639   .6702994    -0.79   0.432    -1.840402    .7871236
          kgz |  -.7256356   .7064268    -1.03   0.304    -2.110207    .6589355
          hun |   4.381498    9.20416     0.48   0.634    -13.65833    22.42132
          lva |   -.802211   .4787264    -1.68   0.094    -1.740497    .1360754
        _cons |  -2.455627   .7154029    -3.43   0.001    -3.857791   -1.053463
---------------------------------------------------------------------------------
```

A4.8.3 Tobit estimation – POOLED1 Advanced transition sample

```
. tobit expint newprod upprod procinn uni skilled size sizesq age agesq forown busass businf
largecity impint infrastruct accessfin weaklaw macobst sectorspill gdpcap1 gdpcap1sq y05 est cze
hun lva ltu svk if trans>3.7, ll vce(cluster countrysect)
Tobit regression                                  Number of obs   =       2785
                                                  F(  28,   2757) =      76.73
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -5551.7231                 Pseudo R2       =     0.0640

                           (Std. Err. adjusted for 53 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     newprod |   8.358458   3.057748     2.73   0.006     2.362749    14.35417
      upprod |   4.923065   2.331572     2.11   0.035     .3512601     9.49487
     procinn |   2.000492   2.583338     0.77   0.439     -3.06498    7.065964
         uni |   .1443413   .0590463     2.44   0.015     .0285618    .2601208
     skilled |   .1254632   .0480248     2.61   0.009     .0312951    .2196314
        size |   .0190064   .0074242     2.56   0.011     .0044488    .0335639
      sizesq |  -2.59e-06   1.01e-06    -2.57   0.010    -4.57e-06   -6.10e-07
         age |   .4932355   .1886388     2.61   0.009     .1233479    .8631231
       agesq |  -.0031669   .0017833    -1.78   0.076    -.0066636    .0003298
      forown |   .2688176   .0563369     4.77   0.000     .1583509    .3792844
      busass |   8.894127   4.416001     2.01   0.044     .2351228    17.55313
      businf |   15.73946   4.800281     3.28   0.001     6.326953    25.15197
   largecity |  -6.076488    3.15337    -1.93   0.054    -12.25969    .1067184
      impint |   .5105186   .0441735    11.56   0.000      .423902    .5971352
 infrastruct |  -5.194295    5.84518    -0.89   0.374    -16.65567    6.267078
   accessfin |   2.787431   2.749983     1.01   0.311    -2.604804    8.179666
     weaklaw |  -6.306421   1.789551    -3.52   0.000    -9.815417   -2.797425
     macobst |   14.10404   2.825167     4.99   0.000      8.56438    19.64369
 sectorspill |   104.2803   15.12242     6.90   0.000     74.62785    133.9327
     gdpcap1 |   .0186472   .0108308     1.72   0.085    -.0025902    .0398846
```

```
   gdpcap1sq |  -1.18e-06   5.66e-07    -2.09   0.037    -2.29e-06   -7.11e-08
         y05 |   4.251745   10.10505     0.42   0.674    -15.56249    24.06598
         est |    25.0239   8.653999     2.89   0.004     8.054927    41.99288
         cze |   29.15976   11.28553     2.58   0.010     7.030806     51.2887
         hun |   26.68342   10.49717     2.54   0.011     6.100305    47.26654
         lva |  -12.00868   7.207959    -1.67   0.096    -26.14223    2.124861
         ltu |   20.04671   17.76248     1.13   0.259    -14.78241    54.87583
         svk |  -6.938999   10.16671    -0.68   0.495    -26.87414    12.99615
       _cons |  -208.8038   35.56019    -5.87   0.000    -278.5311   -139.0765
-------------+----------------------------------------------------------------
      /sigma |   47.33615   1.815016                      43.77723    50.89508
------------------------------------------------------------------------------
  Obs. summary:       1877  left-censored observations at expint<=0
                       908     uncensored observations
                         0 right-censored observations
```

A4.8.3.1 Tobit unconditional marginal effects – POOLED1 Advanced transition sample

```
. mfx compute, predict (ystar(0,.))

Marginal effects after tobit
      y  = E(expint*|expint>0) (predict, ystar(0,.))
         =  8.6008268
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
 newprod*|   2.499678      .87443    2.86   0.004   .785819  4.21354   .352603
  upprod*|   1.424204      .69362    2.05   0.040   .064737  2.78367   .518133
 procinn*|   .5865038      .76622    0.77   0.444  -.915253  2.08826   .271454
     uni |   .0418376      .01642    2.55   0.011   .009655   .07402    21.349
 skilled |   .0363657       .0136    2.67   0.007   .009716  .063016   56.9803
    size |    .005509       .0022    2.51   0.012   .001206  .009812   99.7031
  sizesq |  -7.50e-07      .00000   -2.51   0.012  -1.3e-06 -1.6e-07    185241
     age |   .1429651      .05545    2.58   0.010   .034292  .251638   15.1759
   agesq |  -.0009179      .00052   -1.77   0.077  -.001935  .000099   519.844
  forown |   .0779172      .01807    4.31   0.000   .042501  .113334   10.1645
  busass*|   2.672176      1.3998    1.91   0.056  -.071388  5.41574   .340754
  businf*|    5.34008      1.8772    2.84   0.004   1.66083  9.01933   .086535
largec~y*|  -1.754174      .94176   -1.86   0.063  -3.59999  .091643   .470377
  impint |   .1479746      .01526    9.70   0.000   .118072  .177878   13.9867
infra~ct*|  -1.418847     1.50808   -0.94   0.347  -4.37464  1.53694    .04632
access~n*|   .8286185       .8492    0.98   0.329  -.835781  2.49302   .135368
 weaklaw*|  -1.775677      .50501   -3.52   0.000  -2.76547 -.785885   .313824
 macobst*|   4.208065       .9129    4.61   0.000   2.41882  5.99731   .423698
sector~l |    30.2258     3.98176    7.59   0.000   22.4217  38.0299    .60851
 gdpcap1 |   .0054049      .00327    1.65   0.099   -.00101   .01182   7168.97
gdpcap~q |  -3.42e-07      .00000   -1.99   0.046  -6.8e-07 -5.9e-09   5.7e+07
     y05*|   1.213411     2.80265    0.43   0.665  -4.27968   6.7065   .647756
     est*|   9.462569     3.95604    2.39   0.017   1.70887  17.2163    .04632
     cze*|   10.80289     4.92547    2.19   0.028   1.14915  20.4566    .14614
     hun*|   9.579688     4.28531    2.24   0.025   1.18063  17.9787   .166607
     lva*|   -3.02478     1.53964   -1.96   0.049  -6.04243 -.007131   .040575
     ltu*|      7.083     7.57167    0.94   0.350   -7.7572  21.9232   .087612
     svk*|  -1.875067     2.58585   -0.73   0.468  -6.94324  3.19311   .098384
```

A4.8.3.2 Tobit conditional marginal effects – POOLED1 Advanced transition sample

```
. mfx compute, predict (e(0,.))

Marginal effects after tobit
      y  = E(expint|expint>0) (predict, e(0,.))
         =  29.673209
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
 newprod*|   2.207747      .78728    2.80   0.005   .664704  3.75079   .352603
  upprod*|   1.278159      .61299    2.09   0.037   .076713   2.4796   .518133
 procinn*|   .5229431      .67919    0.77   0.441  -.808244  1.85413   .271454
     uni |    .037511      .01499    2.50   0.012   .008139  .066884    21.349
 skilled |   .0326051      .01229    2.65   0.008    .00851    .0567   56.9803
    size |   .0049393      .00194    2.54   0.011    .00113  .008749   99.7031
  sizesq |  -6.73e-07      .00000   -2.54   0.011  -1.2e-06 -1.5e-07    185241
     age |   .1281808      .04923    2.60   0.009     .0317  .224661   15.1759
   agesq |   -.000823      .00046   -1.78   0.076  -.001732  .000086   519.844
  forown |   .0698596      .01532    4.56   0.000   .039843  .099877   10.1645
  busass*|   2.354933     1.20125    1.96   0.050   .000517  4.70935   .340754
  businf*|   4.453295     1.47228    3.02   0.002   1.56767  7.33892   .086535
largec~y*|  -1.575935       .8311   -1.90   0.058  -3.20486  .052987   .470377
  impint |   .1326722        .012   11.05   0.000   .109147  .156198   13.9867
infra~ct*|   -1.31015      1.4332   -0.91   0.361  -4.11917  1.49887    .04632
access~n*|   .7339001      .73835    0.99   0.320  -.713232  2.18103   .135368
 weaklaw*|  -1.614978      .45612   -3.54   0.000  -2.50896 -.720996   .313824
 macobst*|   3.721372      .77069    4.83   0.000   2.21084   5.2319   .423698
sector~l |   27.10008     3.65957    7.41   0.000   19.9275  34.2727    .60851
 gdpcap1 |    .004846      .00287    1.69   0.092  -.000785  .010477   7168.97
gdpcap~q |  -3.07e-07      .00000   -2.04   0.041  -6.0e-07 -1.2e-08   5.7e+07
     y05*|   1.096247     2.56807    0.43   0.669  -3.93709  6.12958   .647756
     est*|   7.552955     2.95011    2.56   0.010   1.77084  13.3351    .04632
     cze*|   8.698758     3.74097    2.33   0.020   1.36659  16.0309    .14614
     hun*|   7.809178     3.32879    2.35   0.019   1.28488  14.3335   .166607
     lva*|  -2.912009     1.61817   -1.80   0.072  -6.08356  .259546   .040575
     ltu*|   5.807439     5.77165    1.01   0.314  -5.50479  17.1197   .087612
     svk*|  -1.740911     2.47631   -0.70   0.482  -6.59438  3.11256   .098384
```

A4.8.3.3 Probit estimation - POOLED1 Advanced transition sample

```
Probit regression                                 Number of obs   =       2785
                                                  Wald chi2(27)   =          .
                                                  Prob > chi2     =          .
Log pseudolikelihood = -1383.1917                 Pseudo R2       =     0.2133

                           (Std. Err. adjusted for 53 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
     expprob |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     newprod |   .2358128   .0653564     3.61   0.000     .1077166     .363909
      upprod |   .1297345   .0667754     1.94   0.052    -.0011429    .2606119
     procinn |   .0695381   .0715676     0.97   0.331    -.0707317     .209808
         uni |   .0047045   .0012436     3.78   0.000      .002267     .007142
     skilled |   .0022839    .001047     2.18   0.029     .0002317    .0043361
        size |   .0005399   .0002568     2.10   0.035     .0000367    .0010432
      sizesq |  -7.74e-08   3.54e-08    -2.19   0.029    -1.47e-07   -8.02e-09
         age |   .0143767    .004839     2.97   0.003     .0048924    .0238611
       agesq |  -.0000716   .0000447    -1.60   0.109    -.0001591     .000016
      forown |   .0042702   .0014134     3.02   0.003     .0014999    .0070405
      busass |    .218236   .0991269     2.20   0.028     .0239508    .4125211
```

```
     businf |   .4346689    .113715     3.82   0.000     .2117917    .6575461
 largecity |  -.0515872   .0845427    -0.61   0.542    -.2172879    .1141136
     impint |   .0130974   .0013815     9.48   0.000     .0103897     .015805
infrastruct |   -.132084   .1349134    -0.98   0.328    -.3965093    .1323413
  accessfin |   .0756163   .0759548     1.00   0.319    -.0732524     .224485
    weaklaw |   -.069619   .0520206    -1.34   0.181    -.1715774    .0323395
    macobst |   .2471163   .0514418     4.80   0.000     .1462922    .3479404
sectorspill |    2.41762    .357097     6.77   0.000     1.717723    3.117517
   gdpcap1 |   .0003481   .0002818     1.23   0.217    -.0002043    .0009005
  gdpcap1sq |  -2.28e-08   1.50e-08    -1.52   0.129    -5.22e-08    6.62e-09
        y05 |   .0664957   .2292501     0.29   0.772    -.3828263    .5158177
        est |   .3897577   .2366854     1.65   0.100    -.0741372    .8536526
        cze |   .7441822   .2661748     2.80   0.005     .2224891    1.265875
        hun |   .6376101   .2492138     2.56   0.011       .14916     1.12606
        lva |  -.3174567   .2049882    -1.55   0.121    -.7192261    .0843128
        ltu |   .3427641   .3545208     0.97   0.334    -.3520839    1.037612
        svk |  -.1286601   .2340497    -0.55   0.583     -.587389    .3300688
      _cons |  -4.520977   .9312353    -4.85   0.000    -6.346165   -2.695789
```

A4.8.4 Tobit estimation – POOLED2 Laggard transition sample

```
. tobit expint newprod upprod uni size sizesq age agesq forown largecity gdpcap1 gdpcap1sq
infrastruct accessfin weaklaw sectorspill y08 y05 blr tjk uzb bih aze if trans<3, ll vce(cluster
countrysect)

Tobit regression                                  Number of obs   =       3526
                                                  F(  22,   3504) =      19.22
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -4727.2895                 Pseudo R2       =     0.0508

                           (Std. Err. adjusted for 48 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     newprod |   9.279731   4.648286     2.00   0.046     .1661099    18.39335
      upprod |   3.797591    2.80077     1.36   0.175    -1.693714    9.288895
         uni |   .1730697   .0784195     2.21   0.027     .0193172    .3268221
        size |   .0855314   .0148015     5.78   0.000     .0565111    .1145518
      sizesq |  -.0000177   4.20e-06    -4.21   0.000    -.0000259   -9.44e-06
         age |   .3714927   .2168674     1.71   0.087    -.0537065    .7966919
       agesq |  -.0029253   .0019417    -1.51   0.132    -.0067323    .0008817
      forown |   .5345035   .0947458     5.64   0.000     .3487409    .7202661
   largecity |  -1.652753   3.784122    -0.44   0.662    -9.072059    5.766552
     gdpcap1 |  -.0195085   .0223413    -0.87   0.383    -.0633118    .0242948
   gdpcap1sq |   3.12e-06   4.22e-06     0.74   0.460    -5.15e-06    .0000114
 infrastruct |   2.096838   8.515235     0.25   0.806    -14.59848    18.79216
   accessfin |   5.915647   3.401858     1.74   0.082    -.7541758    12.58547
     weaklaw |   .7825444   3.893455     0.20   0.841    -6.851123    8.416212
 sectorspill |   29.54498   14.81738     1.99   0.046     .4934191    58.59655
         y08 |  -8.820983   17.50577    -0.50   0.614    -43.14353    25.50156
         y05 |   4.825237   7.907931     0.61   0.542    -10.67938    20.32985
         blr |  -1.513703   13.88856    -0.11   0.913    -28.74419    25.71678
         tjk |  -39.29215   25.16434    -1.56   0.119    -88.63039    10.04609
         uzb |  -29.64855   20.93203    -1.42   0.157    -70.68874    11.39165
         bih |   8.156476   11.11074     0.73   0.463     -13.6277    29.94065
         aze |   -33.2405   14.34456    -2.32   0.021    -61.36504    -5.11597
       _cons |  -67.61964   28.69705    -2.36   0.019    -123.8843   -11.35503
-------------+----------------------------------------------------------------
      /sigma |   60.14601   3.654813                      52.98023    67.31179
------------------------------------------------------------------------------
  Obs. summary:       2826  left-censored observations at expint<=0
                       700     uncensored observations
                         0 right-censored observations
```

A4.8.4.1 Tobit unconditional marginal effects - POOLED2 Laggard transition sample

```
. mfx compute, predict (ystar(0,.))

Marginal effects after tobit
      y  = E(expint*|expint>0) (predict, ystar(0,.))
         =  5.3307415
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
 newprod*|    1.58237      .76497    2.07   0.039   .083049  3.08169   .407544
  upprod*|   .6285644      .45301    1.39   0.165  -.259318  1.51645   .577141
     uni |   .0288491      .01178    2.45   0.014   .005768  .051931   30.6965
    size |   .0142573      .00262    5.44   0.000   .009123  .019392   116.588
  sizesq |  -2.95e-06      .00000   -4.01   0.000  -4.4e-06 -1.5e-06    132001
     age |   .0619244      .03517    1.76   0.078  -.007015  .130864   13.2791
   agesq |  -.0004876      .00032   -1.54   0.125   -.00111  .000135   421.757
  forown |   .0890967      .01786    4.99   0.000   .054101  .124092   9.14464
largec~y*|  -.2759071      .63828   -0.43   0.666  -1.52691  .975097   .534884
 gdpcap1 |  -.0032519      .00367   -0.89   0.375  -.010436  .003932   1669.04
gdpcap~q |   5.20e-07      .00000    0.75   0.451  -8.3e-07  1.9e-06   4.6e+06
infra~ct*|   .3580061     1.49167    0.24   0.810  -2.56562  3.28163   .040556
access~n*|   1.021896      .62558    1.63   0.102  -.204212    2.248   .260352
 weaklaw*|    .131251      .65311    0.20   0.841  -1.14882  1.41133   .183494
sector~l |   4.924873     2.45372    2.01   0.045   .115662  9.73408   .675298
     y08*|  -1.418839     2.67028   -0.53   0.595  -6.65248   3.8148   .332672
     y05*|   .8180102     1.37591    0.59   0.552  -1.87873  3.51475    .36245
     blr*|  -.2494303     2.26094   -0.11   0.912  -4.68079  4.18193   .194271
     tjk*|  -4.860054     2.30944   -2.10   0.035  -9.38648  -.33363   .178673
     uzb*|  -4.027276     2.29402   -1.76   0.079  -8.52347  .468915    .20987
     bih*|   1.478406     2.15052    0.69   0.492  -2.73653  5.69334   .086784
     aze*|  -4.380445     1.54368   -2.84   0.005  -7.40601 -1.35488   .201645
```

A4.8.4.2 Tobit conditional marginal effects - POOLED2 Laggard transition sample

```
. mfx compute, predict (e(0,.))

Marginal effects after tobit
      y  = E(expint|expint>0) (predict, e(0,.))
         =  31.979848
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
 newprod*|   1.900073      .93425    2.03   0.042   .068981  3.73116   .407544
  upprod*|   .7686055      .56052    1.37   0.170      -.33  1.86721   .577141
 -    uni |   .0351264      .01522    2.31   0.021   .005295  .064958   30.6965
    size |   .0173595      .00296    5.86   0.000   .011557  .023162   116.588
  sizesq |  -3.59e-06      .00000   -4.21   0.000  -5.3e-06 -1.9e-06    132001
     age |   .0753985       .0434    1.74   0.082   -.00966  .160457   13.2791
   agesq |  -.0005937      .00039   -1.52   0.128  -.001358  .000171   421.757
  forown |   .1084833      .01955    5.55   0.000   .070157  .146809   9.14464
largec~y*|  -.3356379      .77144   -0.44   0.664  -1.84763  1.17635   .534884
 gdpcap1 |  -.0039595       .0045   -0.88   0.379  -.012784  .004865   1669.04
gdpcap~q |   6.33e-07      .00000    0.75   0.456  -1.0e-06  2.3e-06   4.6e+06
infra~ct*|   .4296215     1.76255    0.24   0.807  -3.02491  3.88415   .040556
access~n*|   1.217642      .71589    1.70   0.089  -.185467  2.62075   .260352
 weaklaw*|   .1592121      .79215    0.20   0.841  -1.39337  1.71179   .183494
sector~l |   5.996476     2.98539    2.01   0.045    .14521  11.8477   .675298
     y08*|  -1.765279       3.431   -0.51   0.607  -8.48991  4.95935   .332672
     y05*|   .9858286     1.63166    0.60   0.546  -2.21217  4.18383    .36245
     blr*|  -.3058369      2.7928   -0.11   0.913  -5.77963  5.16795   .194271
     tjk*|  -7.105208     4.06676   -1.75   0.081  -15.0759  .865494   .178673
     uzb*|  -5.556565     3.61324   -1.54   0.124  -12.6384  1.52526    .20987
```

```
     bih*|   1.711653     2.39431    0.71   0.475   -2.9811  6.40441   .086784
     aze*|  -6.157416       2.439   -2.52   0.012  -10.9378 -1.37706   .201645
```

A4.8.4.3 Probit estimation - POOLED2 Laggard transition sample

```
. probit expprob newprod upprod uni size sizesq age agesq forown largecity gdpcap1 gdpcap1sq
infrastruct accessfin weaklaw sectorspill y08 y05 blr tjk uzb bih aze if trans<3, vce(cluster
countrysect)

Iteration 0:   log pseudolikelihood = -1757.1862
Iteration 1:   log pseudolikelihood = -1461.6595
Iteration 2:   log pseudolikelihood = -1458.2846
Iteration 3:   log pseudolikelihood = -1458.2819
Iteration 4:   log pseudolikelihood = -1458.2819

Probit regression                                 Number of obs   =       3526
                                                  Wald chi2(22)   =     676.47
                                                  Prob > chi2     =     0.0000
Log pseudolikelihood = -1458.2819                 Pseudo R2       =     0.1701
                           (Std. Err. adjusted for 48 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
     expprob |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     newprod |    .194182   .0765153     2.54   0.011     .0442148    .3441491
      upprod |   .0932013   .0545648     1.71   0.088    -.0137438    .2001464
         uni |   .0038345   .0012599     3.04   0.002      .001365    .0063039
        size |   .0017564   .0002927     6.00   0.000     .0011827    .0023301
      sizesq |  -3.45e-07   8.04e-08    -4.30   0.000    -5.03e-07   -1.88e-07
         age |   .0087683   .0045536     1.93   0.054    -.0001565    .0176931
       agesq |   -.000048   .0000442    -1.09   0.277    -.0001346    .0000386
      forown |   .0088187    .001457     6.05   0.000     .0059631    .0116742
   largecity |  -.0310114   .0679701    -0.46   0.648    -.1642303    .1022075
     gdpcap1 |  -.0003481   .0003874    -0.90   0.369    -.0011073    .0004111
   gdpcap1sq |   5.40e-08   7.24e-08     0.75   0.456    -8.80e-08    1.96e-07
 infrastruct |   .0638569   .1730271     0.37   0.712    -.2752699    .4029838
   accessfin |   .1216502   .0605828     2.01   0.045     .0029101    .2403903
     weaklaw |   .0373785   .0710744     0.53   0.599    -.1019248    .1766818
 sectorspill |   .5972039   .2603061     2.29   0.022     .0870133    1.107394
         y08 |  -.1112272   .2983002    -0.37   0.709    -.6958848    .4734304
         y05 |   .0739867   .1349603     0.55   0.584    -.1905305     .338504
         blr |  -.2041086   .2502734    -0.82   0.415    -.6946355    .2864183
         tjk |  -.9569958   .4578334    -2.09   0.037    -1.854333   -.0596588
         uzb |  -.6811677   .3776871    -1.80   0.071    -1.421421    .0590854
         bih |   .0618818   .2211003     0.28   0.780    -.3714668    .4952304
         aze |  -.7712144   .2728744    -2.83   0.005    -1.306038   -.2363903
       _cons |  -1.151319    .485117    -2.37   0.018    -2.102131   -.2005075
```

A4.8.5 Tobit estimation - POOLED2 Medium transition sample

```
. tobit expint newprod upprod uni size sizesq age agesq forown largecity gdpcap1 gdpcap1sq
infrastruct accessfin weaklaw sectorspill bul alb hrv geo ukr rus rom kaz mda bih mkd arm kgz svn
hun lva y08 y05 if trans >=3 & trans <= 3.7, ll vce(cluster countrysect)

Tobit regression                                  Number of obs   =      11720
                                                  F(33,  11687)   =      22.14
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -18669.833                 Pseudo R2       =     0.0522
                          (Std. Err. adjusted for 141 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     newprod |   11.65671    2.01824     5.78   0.000     7.700619     15.6128
      upprod |   7.965424   2.005956     3.97   0.000     4.033415    11.89743
         uni |   .1704282   .0508981     3.35   0.001     .0706595    .2701969
        size |    .049809   .0043532    11.44   0.000      .041276    .0583421
      sizesq |  -5.51e-06   7.44e-07    -7.41   0.000    -6.97e-06   -4.05e-06
         age |   .5627379   .1300207     4.33   0.000     .3078756    .8176001
       agesq |  -.0026013   .0010643    -2.44   0.015    -.0046875   -.0005151
      forown |    .466798   .0456509    10.23   0.000     .3773146    .5562814
   largecity |  -.0765669   2.226478    -0.03   0.973    -4.440835    4.287701
     gdpcap1 |  -.0004825   .0037642    -0.13   0.898     -.007861     .006896
   gdpcap1sq |  -2.78e-08   1.11e-07    -0.25   0.802    -2.45e-07    1.90e-07
 infrastruct |   .1402533   3.243795     0.04   0.966    -6.218126    6.498633
   accessfin |   1.532063    2.04705     0.75   0.454    -2.480498    5.544623
     weaklaw |  -8.309208   2.185261    -3.80   0.000    -12.59268   -4.025732
 sectorspill |   81.51575   11.65492     6.99   0.000     58.67016    104.3613
         bul |  -14.56451   13.94418    -1.04   0.296    -41.89744    12.76842
         alb |  -.3985803   12.06304    -0.03   0.974    -24.04414    23.24698
         hrv |  -2.350376   19.47323    -0.12   0.904    -40.52117    35.82041
         geo |  -26.04751   13.51687    -1.93   0.054    -52.54283    .4478128
         ukr |  -28.91576   12.41509    -2.33   0.020    -53.25141   -4.580101
         rus |  -40.60034   11.74579    -3.46   0.001    -63.62404   -17.57664
         rom |  -19.84129   11.91842    -1.66   0.096    -43.20338    3.520813
         kaz |  -45.73852   10.52642    -4.35   0.000    -66.37205   -25.10499
         mda |  -17.40006   13.53131    -1.29   0.198    -43.92369    9.123577
         bih |   1.256007   16.51344     0.08   0.939     -31.1131    33.62511
         mkd |   10.27617   13.74038     0.75   0.455    -16.65727    37.20961
         arm |  -25.70568    11.9554    -2.15   0.032    -49.14026   -2.271097
         kgz |  -35.47563   15.43803    -2.30   0.022    -65.73675   -5.214509
         svn |   42.81819   28.79924     1.49   0.137    -13.63312     99.2695
         hun |   83.72873   287.6513     0.29   0.771    -480.1158    647.5732
         lva |  -24.66303   20.60027    -1.20   0.231    -65.04301    15.71694
         y08 |   -14.4458   14.19417    -1.02   0.309    -42.26873    13.37714
         y05 |    -.63693   5.685963    -0.11   0.911    -11.78237    10.50851
       _cons |  -108.2231   17.01631    -6.36   0.000     -141.578   -74.86832
-------------+----------------------------------------------------------------
      /sigma |   61.36468   2.203647                      57.04516     65.6842
------------------------------------------------------------------------------
  Obs. summary:       8907  left-censored observations at expint<=0
                      2813     uncensored observations
                         0 right-censored observations
```

A4.8.5.1 Tobit unconditional marginal effects - POOLED2 Medium transition sample

```
. mfx compute, predict (ystar(0,.))

Marginal effects after tobit
      y  = E(expint*|expint>0) (predict, ystar(0,.))
         =  7.2084354
```

variable	dy/dx	Std. Err.	z	P>|z|	[95%	C.I.]	X
newprod*	2.449177	.43576	5.62	0.000	1.5951	3.30325	.469539
upprod*	1.618298	.38978	4.15	0.000	.854336	2.38226	.637969
uni	.0354656	.01073	3.31	0.001	.014443	.056488	31.1112
size	.0103651	.00099	10.45	0.000	.008422	.012308	116.083
sizesq	-1.15e-06	.00000	-7.06	0.000	-1.5e-06	-8.3e-07	185002
age	.1171041	.0263	4.45	0.000	.065553	.168655	14.7108
agesq	-.0005413	.00022	-2.47	0.014	-.000971	-.000111	509.242
forown	.0971393	.0096	10.12	0.000	.078327	.115952	8.67389
largec~y*	-.0159347	.46358	-0.03	0.973	-.924526	.892656	.548805
gdpcap1	-.0001004	.00078	-0.13	0.898	-.001637	.001436	4366.61
gdpcap~q	-5.78e-09	.00000	-0.25	0.802	-5.1e-08	3.9e-08	9.1e+07
infra~ct*	.0292264	.67676	0.04	0.966	-1.2972	1.35566	.064164
access~n*	.3213438	.433	0.74	0.458	-.527327	1.17001	.27099
weaklaw*	-1.64784	.41629	-3.96	0.000	-2.46375	-.831934	.23959
sector~l	16.96319	2.3494	7.22	0.000	12.3584	21.5679	.714006
bul*	-2.600877	2.09767	-1.24	0.215	-6.71224	1.51048	.03686
alb*	-.0825994	2.48978	-0.03	0.974	-4.96248	4.79728	.035751
hrv*	-.4772334	3.85382	-0.12	0.901	-8.03057	7.07611	.035239
geo*	-4.15009	1.60344	-2.59	0.010	-7.29277	-1.00741	.048464
ukr*	-4.729512	1.56212	-3.03	0.002	-7.79122	-1.66781	.126621
rus*	-6.268818	1.29149	-4.85	0.000	-8.8001	-3.73754	.162628
rom*	-3.436697	1.67823	-2.05	0.041	-6.72596	-.147436	.089846
kaz*	-6.325626	.92813	-6.82	0.000	-8.14473	-4.50653	.09744
mda*	-3.039636	1.96928	-1.54	0.123	-6.89935	.820075	.056058
bih*	.2648717	3.52817	0.08	0.940	-6.65021	7.17995	.02756
mkd*	2.369346	3.48807	0.68	0.497	-4.46714	9.20583	.050939
arm*	-4.159228	1.48216	-2.81	0.005	-7.0642	-1.25426	.067321
kgz*	-5.11674	1.45838	-3.51	0.000	-7.97511	-2.25837	.04471
svn*	13.37909	12.364	1.08	0.279	-10.8541	37.6123	.049659
hun*	36.97377	198.34	0.19	0.852	-351.763	425.711	.020222
lva*	-3.898298	2.3344	-1.67	0.095	-8.47364	.677048	.011945
y08*	-2.962291	2.83752	-1.04	0.296	-8.52372	2.59914	.446758
y05*	-.1321468	1.17497	-0.11	0.910	-2.43504	2.17075	.290273

A4.8.5.2 Tobit conditional marginal effects - POOLED2 Medium transition sample

```
. mfx compute, predict (e(0,.))
Marginal effects after tobit
      y  = E(expint|expint>0) (predict, e(0,.))
         =  34.639779
```

variable	dy/dx	Std. Err.	z	P>|z|	[95%	C.I.]	X
newprod*	2.60292	.45384	5.74	0.000	1.7134	3.49244	.469539
upprod*	1.753166	.43145	4.06	0.000	.907548	2.59878	.637969
uni	.0379026	.01136	3.34	0.001	.015637	.060168	31.1112
size	.0110773	.00099	11.22	0.000	.009142	.013013	116.083
sizesq	-1.23e-06	.00000	-7.31	0.000	-1.6e-06	-9.0e-07	185002
age	.1251507	.02848	4.40	0.000	.06934	.180961	14.7108
agesq	-.0005785	.00024	-2.46	0.014	-.00104	-.000117	509.242
forown	.103814	.01001	10.37	0.000	.084185	.123443	8.67389
largec~y*	-.0170288	.49528	-0.03	0.973	-.987762	.953704	.548805
gdpcap1	-.0001073	.00084	-0.13	0.898	-.001749	.001534	4366.61

```
gdpcap~q |  -6.18e-09      .00000    -0.25   0.802  -5.5e-08  4.2e-08    9.1e+07
infra~ct*|   .0312103      .72221     0.04   0.966   -1.3843  1.44672   .064164
access~n*|   .3418919      .45845     0.75   0.456  -.556662  1.24045     .27099
 weaklaw*|   -1.81009      .46704    -3.88   0.000  -2.72547 -.894708     .23959
sector~l |   18.12878     2.53498     7.15   0.000   13.1603  23.0972   .714006
     bul*|  -3.037266     2.71934    -1.12   0.264  -8.36707  2.29254     .03686
     alb*|  -.0884836     2.67328    -0.03   0.974  -5.32802  5.15105    .035751
     hrv*|  -.5172123     4.23859    -0.12   0.903  -8.82469  7.79027    .035239
     geo*|   -5.18713     2.41457    -2.15   0.032  -9.91959 -.454668   .048464
     ukr*|  -5.815782     2.25898    -2.57   0.010  -10.2433 -1.38826   .126621
     rus*|  -7.970777     2.02343    -3.94   0.000  -11.9366 -4.00492   .162628
     rom*|  -4.085849     2.26586    -1.80   0.071  -8.52686   .35516   .089846
     kaz*|  -8.602367     1.67666    -5.13   0.000  -11.8886 -5.31617     .09744
     mda*|  -3.595972     2.60566    -1.38   0.168  -8.70297  1.51103   .056058
     bih*|   .2809486      3.7149     0.08   0.940  -7.00013  7.56203     .02756
     mkd*|   2.391552     3.34323     0.72   0.474  -4.16106  8.94417    .050939
     arm*|   -5.15007     2.16775    -2.38   0.018  -9.39877 -.901367   .067321
     kgz*|  -6.792167     2.54936    -2.66   0.008  -11.7888 -1.79551     .04471
     svn*|   11.59343     9.41133     1.23   0.218  -6.85244  30.0393    .049659
     hun*|   28.37562      140.09     0.20   0.839  -246.196  302.947    .020222
     lva*|  -4.896987     3.62957    -1.35   0.177  -12.0108  2.21685    .011945
     y08*|  -3.191709      3.0989    -1.03   0.303  -9.26545  2.88203    .446758
     y05*|  -.1414673     1.26071    -0.11   0.911  -2.61241  2.32947    .290273
```

A4.8.5.3 Probit estimation - POOLED2 Medium transition sample

```
. probit expprob newprod upprod uni size sizesq age agesq forown largecity gdpcap1 gdpcap1sq
infrastruct accessfin weaklaw sectorspill bul alb hrv geo ukr rus rom kaz mda bih mkd arm kgz svn
hun lva y08 y05 if trans>=3 & trans<=3.7, vce(cluster countrysect)

Iteration 0:   log pseudolikelihood = -6458.8873
Iteration 1:   log pseudolikelihood = -5344.0002
Iteration 2:   log pseudolikelihood =  -5335.058
Iteration 3:   log pseudolikelihood = -5335.0489
Iteration 4:   log pseudolikelihood = -5335.0489

Probit regression                                 Number of obs   =      11720
                                                  Wald chi2(32)   =          .
                                                  Prob > chi2     =          .
Log pseudolikelihood = -5335.0489                 Pseudo R2       =     0.1740

                          (Std. Err. adjusted for 141 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
     expprob |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     newprod |     .28426   .0370075     7.68   0.000     .2117265    .3567934
      upprod |   .1645995   .0334711     4.92   0.000     .0989974    .2302016
         uni |   .0036675   .0008751     4.19   0.000     .0019523    .0053828
        size |   .0010405    .000103    10.10   0.000     .0008385    .0012424
      sizesq |  -1.11e-07   1.35e-08    -8.24   0.000    -1.37e-07   -8.46e-08
         age |     .01048   .0023694     4.42   0.000     .0058359     .015124
       agesq |  -.0000386   .0000209    -1.85   0.064    -.0000795    2.29e-06
      forown |   .0077126   .0006652    11.59   0.000     .0064088    .0090163
   largecity |   .0463918   .0373357     1.24   0.214    -.0267848    .1195683
     gdpcap1 |  -.0000119   .0000664    -0.18   0.858    -.0001421    .0001183
   gdpcap1sq |  -2.43e-10   2.09e-09    -0.12   0.908    -4.35e-09    3.86e-09
 infrastruct |  -.0139196     .05792    -0.24   0.810    -.1274407    .0996016
   accessfin |  -.0042535   .0344771    -0.12   0.902    -.0718274    .0633204
     weaklaw |  -.0839792   .0396413    -2.12   0.034    -.1616748   -.0062836
 sectorspill |   1.414448   .1928889     7.33   0.000     1.036393    1.792504
         bul |  -.5088327   .2640899    -1.93   0.054     -1.02644     .008774
         alb |  -.2509067   .2371918    -1.06   0.290    -.7157942    .2139808
         hrv |  -.1158955   .3465014    -0.33   0.738    -.7950258    .5632347
         geo |  -.6642675   .2546537    -2.61   0.009     -1.16338   -.1651555
         ukr |  -.7120203   .2427966    -2.93   0.003    -1.187893   -.2361478
         rus |  -.8336512   .2307719    -3.61   0.000    -1.285956   -.3813467
```

rom	-.6111751	.2345579	-2.61	0.009	-1.0709	-.1514501
kaz	-.9246606	.2132153	-4.34	0.000	-1.342555	-.5067663
mda	-.5583001	.2601765	-2.15	0.032	-1.068237	-.0483636
bih	-.1166137	.2931753	-0.40	0.691	-.6912266	.4579993
mkd	-.0291052	.24307	-0.12	0.905	-.5055136	.4473033
arm	-.6910871	.2367327	-2.92	0.004	-1.155075	-.2270995
kgz	-.8451282	.2867498	-2.95	0.003	-1.407147	-.2831089
svn	.7629477	.5006513	1.52	0.128	-.2183108	1.744206
hun	.7116887	5.449849	0.13	0.896	-9.969818	11.3932
lva	-.6253253	.3371702	-1.85	0.064	-1.286167	.0355162
y08	-.3003526	.2397889	-1.25	0.210	-.7703301	.1696249
y05	-.0199385	.0907159	-0.22	0.826	-.1977384	.1578615
_cons	-1.766183	.3099077	-5.70	0.000	-2.373591	-1.158775

A4.8.6 Tobit estimation - POOLED2 Advanced transition sample

```
. tobit expint newprod upprod uni size sizesq age agesq forown largecity gdpcap1 gdpcap1sq
infrastruct accessfin weaklaw sectorspill pol est cze hun lva ltu svk y08 y05 if trans>3.7, ll
vce(cluster countrysect)

Tobit regression                                  Number of obs   =       5268
                                                  F(  24,   5244) =      34.31
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -10898.454                 Pseudo R2       =     0.0367

                           (Std. Err. adjusted for 63 clusters in countrysect)
```

expint	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
newprod	12.82735	2.691191	4.77	0.000	7.551497	18.10321
upprod	6.180346	2.165285	2.85	0.004	1.935487	10.42521
uni	.1130379	.0494822	2.28	0.022	.0160322	.2100435
size	.0313905	.0068235	4.60	0.000	.0180136	.0447674
sizesq	-4.36e-06	1.17e-06	-3.71	0.000	-6.66e-06	-2.05e-06
age	.6359983	.1400343	4.54	0.000	.3614727	.9105238
agesq	-.0040798	.001191	-3.43	0.001	-.0064147	-.0017449
forown	.4555354	.0372317	12.24	0.000	.3825459	.528525
largecity	-4.884811	2.76331	-1.77	0.077	-10.30205	.5324283
gdpcap1	.0010014	.0064413	0.16	0.876	-.0116263	.013629
gdpcap1sq	-2.89e-08	2.42e-07	-0.12	0.905	-5.04e-07	4.46e-07
infrastruct	-1.515785	5.664409	-0.27	0.789	-12.62039	9.588816
accessfin	5.050588	2.145372	2.35	0.019	.8447661	9.256411
weaklaw	-11.47705	2.163272	-5.31	0.000	-15.71796	-7.236134
sectorspill	105.4183	19.28493	5.47	0.000	67.61178	143.2248
pol	-10.32866	25.38295	-0.41	0.684	-60.08982	39.4325
est	-.2217787	29.48787	-0.01	0.994	-58.03029	57.58673
cze	8.427892	35.61109	0.24	0.813	-61.38468	78.24046
hun	8.92632	30.45461	0.29	0.769	-50.77739	68.63003
lva	-16.67452	25.17375	-0.66	0.508	-66.02555	32.67652
ltu	-1.218052	26.16621	-0.05	0.963	-52.51472	50.07861
svk	-7.717043	33.63887	-0.23	0.819	-73.66323	58.22915
y08	-14.78297	27.45692	-0.54	0.590	-68.60996	39.04403
y05	3.307394	11.33104	0.29	0.770	-18.90616	25.52095
_cons	-120.7457	28.00253	-4.31	0.000	-175.6423	-65.84905
/sigma	54.91961	1.83114			51.32982	58.50941

A4.8.6.1 Tobit unconditional marginal effects - POOLED2 Advanced transition sample

```
. mfx compute, predict (ystar(0,.))
Marginal effects after tobit
      y  = E(expint*|expint>0) (predict, ystar(0,.))
         =  10.661283
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
 newprod*|   3.978403      .82943    4.80   0.000   2.35274  5.60406   .433941
  upprod*|   1.857241      .66077    2.81   0.005   .562156  3.15233   .599848
     uni |   .0344011      .01496    2.30   0.021   .005085  .063718   19.8424
    size |   .0095531      .00208    4.58   0.000   .005468  .013638   104.151
  sizesq |  -1.33e-06      .00000   -3.69   0.000  -2.0e-06 -6.2e-07    220906
     age |   .1935548      .04149    4.67   0.000   .112238  .274871   14.8852
   agesq |  -.0012416      .00035   -3.50   0.000  -.001936 -.000547   455.299
  forown |   .1386341      .01395    9.94   0.000   .111291  .165977   10.6287
largec~y*|  -1.476235      .85908   -1.72   0.086  -3.15999  .207522   .429765
 gdpcap1 |   .0003047      .00196    0.16   0.877  -.003546  .004155   9386.86
gdpcap~q |  -8.79e-09      .00000   -0.12   0.905  -1.5e-07  1.4e-07   1.0e+08
infra~ct*|  -.4547459     1.67243   -0.27   0.786  -3.73264  2.82315   .050114
access~n*|    1.57733      .67798    2.33   0.020   .248518  2.90614   .255505
 weaklaw*|   -3.29035      .60611   -5.43   0.000   -4.4783  -2.1024   .250569
sector~l |   32.08218     5.60091    5.73   0.000   21.1046  43.0598   .673049
     pol*|  -3.024443     7.20424   -0.42   0.675  -17.1445  11.0956   .319286
     est*|  -.0673671     8.94149   -0.01   0.994  -17.5924  17.4576   .093584
     cze*|   2.734629      12.232    0.22   0.823  -21.2406  26.7098   .133068
     hun*|   2.900087      10.479    0.28   0.782  -17.6383  23.4384   .146735
     lva*|  -4.349099      5.5929   -0.78   0.437   -15.311  6.61277   .067578
     ltu*|  -.3668959     7.80474   -0.05   0.963  -15.6639  14.9301   .097001
     svk*|  -2.199961     8.99856   -0.24   0.807  -19.8368  15.4369   .099279
     y08*|  -4.349658     7.90111   -0.55   0.582  -19.8355  11.1362   .385915
     y05*|   1.013327     3.47303    0.29   0.770  -5.79368  7.82034   .404138
------------------------------------------------------------------------------
```

A4.8.6.2 Tobit conditional marginal effects - POOLED2 Advanced transition sample

```
. mfx compute, predict (e(0,.))

Marginal effects after tobit
      y  = E(expint|expint>0) (predict, e(0,.))
         =  35.031727
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
 newprod*|     3.4541      .71848    4.81   0.000    2.0459   4.8623   .433941
  upprod*|   1.636474      .57686    2.84   0.005   .505853  2.76709   .599848
     uni |   .0301291      .01312    2.30   0.022   .004406  .055852   19.8424
    size |   .0083668      .00181    4.62   0.000   .004815  .011919   104.151
  sizesq |  -1.16e-06      .00000   -3.71   0.000  -1.8e-06 -5.5e-07    220906
     age |   .1695188      .03661    4.63   0.000   .097773  .241264   14.8852
   agesq |  -.0010874      .00031   -3.48   0.001    -.0017 -.000474   455.299
  forown |   .1214183      .01085   11.20   0.000   .100162  .142674   10.6287
largec~y*|  -1.297246      .74446   -1.74   0.081  -2.75635   .16186   .429765
 gdpcap1 |   .0002669      .00172    0.16   0.877  -.003102  .003636   9386.86
gdpcap~q |  -7.70e-09      .00000   -0.12   0.905  -1.3e-07  1.2e-07   1.0e+08
infra~ct*|  -.4009965     1.48608   -0.27   0.787  -3.31366  2.51166   .050114
access~n*|   1.364823       .5827    2.34   0.019   .222761  2.50689   .255505
 weaklaw*|  -2.966226      .54819   -5.41   0.000  -4.04067 -1.89179   .250569
sector~l |   28.09815     4.97713    5.65   0.000   18.3432  37.8531   .673049
     pol*|  -2.698496     6.52738   -0.41   0.679  -15.4919  10.0949   .319286
     est*|  -.0590541     7.84465   -0.01   0.994  -15.4343  15.3162   .093584
     cze*|   2.325197      10.142    0.23   0.819  -17.5531  22.2035   .133068
     hun*|   2.464477     8.68219    0.28   0.777  -14.5523  19.4813   .146735
     lva*|  -4.111779     5.76055   -0.71   0.475  -15.4023   7.1787   .067578
```

```
     ltu*|  -.3229098     6.90133   -0.05   0.963  -13.8493  13.2035   .097001
     svk*|  -1.988656     8.39784   -0.24   0.813  -18.4481  14.4708   .099279
     y08*|  -3.872214     7.11218   -0.54   0.586  -17.8118  10.0674   .385915
     y05*|   .8846899     3.03159    0.29   0.770  -5.05712   6.8265   .404138
------------------------------------------------------------------------------
```

A4.8.6.3 Probit estimation - POOLED2 Advanced transition sample

```
. probit expprob newprod upprod uni size sizesq age agesq forown largecity gdpcap1 gdpcap1sq
infrastruct accessfin weaklaw sectorspill pol est cze hun lva ltu svk y08 y05 if trans>3.7,
vce(cluster countrysect)

Iteration 0:   log pseudolikelihood = -3322.5583
Iteration 1:   log pseudolikelihood = -2930.0795
Iteration 2:   log pseudolikelihood = -2923.0535
Iteration 3:   log pseudolikelihood = -2923.0349
Iteration 4:   log pseudolikelihood = -2923.0349

Probit regression                                 Number of obs   =       5268
                                                  Wald chi2(23)   =          .
                                                  Prob > chi2     =          .
Log pseudolikelihood = -2923.0349                 Pseudo R2       =     0.1202

                           (Std. Err. adjusted for 63 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
     expprob |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     newprod |   .3543037   .0567701     6.24   0.000      .2430363    .4655711
      upprod |   .1281373   .0559516     2.29   0.022      .0184741    .2378004
         uni |   .0040246    .000975     4.13   0.000      .0021137    .0059356
        size |   .0006649   .0001644     4.05   0.000      .0003427     .000987
      sizesq |  -8.96e-08   2.40e-08    -3.73   0.000     -1.37e-07   -4.26e-08
         age |   .0150493   .0029836     5.04   0.000      .0092017     .020897
       agesq |  -.0000793   .0000272    -2.92   0.004     -.0001326    -.000026
      forown |   .0075022   .0008491     8.84   0.000      .0058381    .0091664
   largecity |  -.0239532   .0573094    -0.42   0.676     -.1362775    .0883711
     gdpcap1 |   4.06e-06   .0001158     0.04   0.972      -.000223    .0002311
   gdpcap1sq |  -5.25e-10   4.42e-09    -0.12   0.905     -9.19e-09    8.14e-09
 infrastruct |   -.036649   .1038906    -0.35   0.724     -.2402708    .1669728
   accessfin |    .074875   .0456747     1.64   0.101     -.0146458    .1643957
     weaklaw |  -.1871617   .0398599    -4.70   0.000     -.2652857   -.1090376
 sectorspill |   2.018087   .3850754     5.24   0.000      1.263353    2.772821
         pol |   .0139308   .4699975     0.03   0.976     -.9072473     .935109
         est |   .1944329   .5621602     0.35   0.729     -.9073808    1.296247
         cze |   .5044049   .6611729     0.76   0.446     -.7914702     1.80028
         hun |   .4679312    .562643     0.83   0.406     -.6348288    1.570691
         lva |  -.1432167   .4684944    -0.31   0.760     -1.061449    .7750153
         ltu |   .0720344   .4755714     0.15   0.880     -.8600683    1.004137
         svk |   .1277652   .6232023     0.21   0.838     -1.093689    1.349219
         y08 |    -.25534   .5166365    -0.49   0.621     -1.267929     .757249
         y05 |   .0441457   .2040119     0.22   0.829     -.3557103    .4440017
       _cons |  -2.526197   .5058905    -4.99   0.000     -3.517724    -1.53467
```

A4.9 "Transition reform score" - Sensitivity analysis

A4.9.1 Tobit Estimation – POOLED1 Laggard transition sample alternative specification

```
. tobit expint newprod upprod procinn uni skilled size sizesq age agesq forown busass businf
largecity impint infras truct accessfin weaklaw macobst sectorspill gdpcap1 gdpcap1sq y05 blr tjk
uzb bih aze if trans<3.1, ll vce(cluster  countrysect)

Tobit regression                                  Number of obs   =       3188
                                                  F(  27,   3161) =      21.35
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -4678.2552                 Pseudo R2       =     0.0622

                           (Std. Err. adjusted for 70 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     newprod |   2.490921   4.034167     0.62   0.537     -5.41893    10.40077
      upprod |   7.443484   2.051967     3.63   0.000     3.420162    11.46681
     procinn |   4.094182   3.751523     1.09   0.275    -3.261484    11.44985
         uni |   .1654393   .0626708     2.64   0.008     .0425598    .2883187
     skilled |   .0260081   .0548233     0.47   0.635    -.0814847    .1335009
        size |   .0382872   .0074183     5.16   0.000      .023742    .0528324
      sizesq |  -4.45e-06   1.42e-06    -3.14   0.002    -7.23e-06   -1.67e-06
         age |    .439939    .185955     2.37   0.018     .0753343    .8045437
       agesq |  -.0030438   .0017037    -1.79   0.074    -.0063843    .0002966
      forown |   .3574707   .0823781     4.34   0.000     .1959507    .5189907
      busass |   24.69366   3.956707     6.24   0.000     16.93568    32.45163
      businf |  -.0746278   4.956627    -0.02   0.988    -9.793159    9.643903
   largecity |  -1.431115   3.039438    -0.47   0.638    -7.390586    4.528356
      impint |   .2462236   .0457655     5.38   0.000     .1564906    .3359566
 infrastruct |   1.621405   9.553468     0.17   0.865    -17.11022    20.35303
   accessfin |   1.294204   3.856105     0.34   0.737    -6.266519    8.854927
     weaklaw |  -5.591017   3.977396    -1.41   0.160    -13.38956    2.207522
     macobst |   1.811775   3.156294     0.57   0.566    -4.376817    8.000367
 sectorspill |   65.25337   13.36138     4.88   0.000     39.05551    91.45123
     gdpcap1 |  -.0366482   .0133502    -2.75   0.006    -.0628242   -.0104722
   gdpcap1sq |   7.92e-06   3.74e-06     2.11   0.035     5.75e-07    .0000153
         y05 |   -1.51824   10.00862    -0.15   0.879    -21.14229    18.10581
         blr |   16.71342   10.83257     1.54   0.123    -4.526149    37.95299
         tjk |  -19.15022   13.32817    -1.44   0.151    -45.28296    6.982514
         uzb |  -15.87824   9.393094    -1.69   0.091    -34.29542    2.538939
         bih |   10.40395   7.057106     1.47   0.141    -3.433027    24.24092
         aze |  -16.51048   10.24842    -1.61   0.107     -36.6047     3.58374
       _cons |  -94.29834   15.19386    -6.21   0.000    -124.0892   -64.50752
-------------+----------------------------------------------------------------
      /sigma |   54.11559   3.389572                      47.46961    60.76158
------------------------------------------------------------------------------
  Obs. summary:       2470  left-censored observations at expint<=0
                       718     uncensored observations
                         0 right-censored observations
```

A4.9.2 Tobit Estimation – POOLED1 Medium transition sample alternative specification

```
. tobit expint newprod upprod procinn uni skilled size sizesq age agesq forown busass businf
largecity impint infrastruct accessfin weaklaw macobst sectorspill gdpcap1 gdpcap1sq y05 bul alb
hrv geo ukr rus rom kaz mda mkd arm kgz if trans>=3.0 & trans<=3.5, ll vce(cluster countrysect)

Tobit regression                                  Number of obs   =       5059
                                                  F(  34,   5025) =      38.77
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -7572.1836                 Pseudo R2       =     0.0760

                          (Std. Err. adjusted for 102 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     newprod |   3.211593   2.596684     1.24   0.216     -1.87904    8.302227
      upprod |   6.457886   3.143675     2.05   0.040     .2949121    12.62086
     procinn |   7.949123   3.267578     2.43   0.015     1.543244      14.355
         uni |   .1704967    .052959     3.22   0.001      .066674    .2743193
     skilled |   .0262284    .046605     0.56   0.574    -.0651376    .1175945
        size |    .032984   .0042045     7.84   0.000     .0247413    .0412266
      sizesq |  -3.33e-06   6.20e-07    -5.37   0.000    -4.55e-06   -2.12e-06
         age |   .4643082   .1444335     3.21   0.001     .1811555     .747461
       agesq |  -.0010339    .001007    -1.03   0.305    -.0030081    .0009402
      forown |   .4043582   .0585688     6.90   0.000     .2895379    .5191785
      busass |   20.13444   2.642655     7.62   0.000     14.95368    25.31519
      businf |    14.4109   3.230939     4.46   0.000     8.076847    20.74495
   largecity |   4.765883   3.325341     1.43   0.152    -1.753236      11.285
      impint |   .3557327   .0583175     6.10   0.000      .241405    .4700604
 infrastruct |   1.659171   4.304132     0.39   0.700    -6.778805    10.09715
   accessfin |   4.283965    3.72734     1.15   0.250    -3.023248    11.59118
     weaklaw |  -8.878187   3.296139    -2.69   0.007    -15.34006   -2.416316
     macobst |   2.625155   2.392947     1.10   0.273    -2.066064    7.316374
 sectorspill |   103.7739    12.6322     8.22   0.000     79.00926    128.5385
     gdpcap1 |   .0182954   .0287189     0.64   0.524    -.0380061    .0745969
   gdpcap1sq |  -1.48e-06   4.06e-06    -0.36   0.715    -9.44e-06    6.48e-06
         y05 |  -19.71018   12.09548    -1.63   0.103     -43.4226    4.002243
         bul |  -3930.951   10766.08    -0.37   0.715    -25037.17    17175.26
         alb |   -3912.92   10763.17    -0.36   0.716    -25013.42    17187.58
         hrv |  -3962.265   10766.27    -0.37   0.713    -25068.85    17144.32
         geo |  -3905.889   10747.84    -0.36   0.716    -24976.35    17164.57
         ukr |  -3922.569   10750.13    -0.36   0.715    -24997.52    17152.38
         rus |   -3944.41   10768.16    -0.37   0.714     -25054.7    17165.88
         rom |  -3931.629    10767.7    -0.37   0.715    -25041.01    17177.76
         kaz |  -3936.411   10766.43    -0.37   0.715     -25043.3    17170.48
         mda |  -3892.336   10740.54    -0.36   0.717    -24948.47     17163.8
         mkd |  -3908.691   10765.24    -0.36   0.717    -25013.25    17195.87
         arm |  -3911.047   10747.37    -0.36   0.716    -24980.59    17158.49
         kgz |  -3913.425   10734.42    -0.36   0.715    -24957.57    17130.72
       _cons |   3742.193   10727.66     0.35   0.727    -17288.71    24773.09
-------------+----------------------------------------------------------------
      /sigma |   58.06944   2.579795                      53.01191    63.12696
------------------------------------------------------------------------------
  Obs. summary:       3900  left-censored observations at expint<=0
                      1159     uncensored observations
                         0 right-censored observations
```

A4.9.3 Tobit Estimation – POOLED1 Advanced transition sample alternative specification

```
. tobit expint newprod upprod procinn uni skilled size sizesq age agesq forown busass businf
largecity impint infrastruct accessfin weaklaw macobst sectorspill gdpcap1 gdpcap1sq y05 est cze
hun lva ltu svk if trans>3.7, ll vce(cluster countrysect)

Tobit regression                                  Number of obs   =       2785
                                                  F(  28,   2757) =      76.73
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -5551.7231                 Pseudo R2       =     0.0640

                           (Std. Err. adjusted for 53 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     newprod |   8.358458   3.057748     2.73   0.006     2.362749    14.35417
      upprod |   4.923065   2.331572     2.11   0.035     .3512601     9.49487
     procinn |   2.000492   2.583338     0.77   0.439     -3.06498    7.065964
         uni |   .1443413   .0590463     2.44   0.015     .0285618    .2601208
     skilled |   .1254632   .0480248     2.61   0.009     .0312951    .2196314
        size |   .0190064   .0074242     2.56   0.011     .0044488    .0335639
      sizesq |  -2.59e-06   1.01e-06    -2.57   0.010    -4.57e-06   -6.10e-07
         age |   .4932355   .1886388     2.61   0.009     .1233479    .8631231
       agesq |  -.0031669   .0017833    -1.78   0.076    -.0066636    .0003298
      forown |   .2688176   .0563369     4.77   0.000     .1583509    .3792844
      busass |   8.894127   4.416001     2.01   0.044     .2351228    17.55313
      businf |   15.73946   4.800281     3.28   0.001     6.326953    25.15197
   largecity |  -6.076488    3.15337    -1.93   0.054    -12.25969    .1067184
      impint |   .5105186   .0441735    11.56   0.000      .423902    .5971352
 infrastruct |  -5.194295    5.84518    -0.89   0.374    -16.65567    6.267078
   accessfin |   2.787431   2.749983     1.01   0.311    -2.604804    8.179666
     weaklaw |  -6.306421   1.789551    -3.52   0.000    -9.815417   -2.797425
     macobst |   14.10404   2.825167     4.99   0.000      8.56438    19.64369
 sectorspill |   104.2803   15.12242     6.90   0.000     74.62785    133.9327
     gdpcap1 |   .0186472   .0108308     1.72   0.085    -.0025902    .0398846
   gdpcap1sq |  -1.18e-06   5.66e-07    -2.09   0.037    -2.29e-06   -7.11e-08
         y05 |   4.251745   10.10505     0.42   0.674    -15.56249    24.06598
         est |    25.0239   8.653999     2.89   0.004     8.054927    41.99288
         cze |   29.15976   11.28553     2.58   0.010     7.030806     51.2887
         hun |   26.68342   10.49717     2.54   0.011     6.100305    47.26654
         lva |  -12.00868   7.207959    -1.67   0.096    -26.14223    2.124861
         ltu |   20.04671   17.76248     1.13   0.259    -14.78241    54.87583
         svk |  -6.938999   10.16671    -0.68   0.495    -26.87414    12.99615
       _cons |  -208.8038   35.56019    -5.87   0.000    -278.5311   -139.0765
-------------+----------------------------------------------------------------
      /sigma |   47.33615   1.815016                      43.77723    50.89508
------------------------------------------------------------------------------
  Obs. summary:       1877  left-censored observations at expint<=0
                       908     uncensored observations
                         0 right-censored observations
```

A4.9.4 Tobit Estimation – POOLED2 Laggard transition sample alternative specification

```
. tobit expint newprod upprod uni size sizesq age agesq forown largecity gdpcap1 gdpcap1sq
infrastruct accessfin weaklaw sectorspill y08 y05 blr tjk uzb bih aze if trans<3.1, ll
vce(cluster countrysect)

Tobit regression                                  Number of obs   =       6001
                                                  F(  22,   5979) =      17.12
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -8460.7542                 Pseudo R2       =     0.0448

                           (Std. Err. adjusted for 79 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     newprod |   11.41354   3.179927     3.59   0.000     5.179733    17.64734
      upprod |   4.674259   2.473644     1.89   0.059     -.174975    9.523493
         uni |   .1085828   .0597645     1.82   0.069    -.0085773    .2257428
        size |   .0506833   .0080638     6.29   0.000     .0348755    .0664912
      sizesq |  -6.08e-06   1.76e-06    -3.45   0.001    -9.53e-06   -2.62e-06
         age |   .6893082   .1612141     4.28   0.000     .3732703    1.005346
       agesq |  -.0044054    .001672    -2.63   0.008     -.007683   -.0011278
      forown |   .4766382   .0687736     6.93   0.000     .3418173    .6114592
   largecity |  -2.070716   2.909394    -0.71   0.477    -7.774179    3.632747
     gdpcap1 |   .0038084   .0069071     0.55   0.581     -.009732    .0173488
   gdpcap1sq |  -1.30e-06   8.94e-07    -1.45   0.147    -3.05e-06    4.56e-07
 infrastruct |   .0397688   5.555039     0.01   0.994    -10.85011    10.92965
   accessfin |   4.193688   2.313798     1.81   0.070    -.3421911    8.729568
     weaklaw |  -3.539657   3.435709    -1.03   0.303    -10.27489    3.195572
 sectorspill |   57.25709   14.78332     3.87   0.000     28.27644    86.23773
         y08 |  -1.167134   13.01198    -0.09   0.929    -26.67531    24.34104
         y05 |   -4.13554   6.468618    -0.64   0.523    -16.81637    8.545286
         blr |   .3333769    8.46652     0.04   0.969    -16.26406    16.93081
         tjk |  -23.34872   14.14366    -1.65   0.099    -51.07539    4.377958
         uzb |  -9.688031    12.0263    -0.81   0.421    -33.26391    13.88785
         bih |   11.28662   7.988169     1.41   0.158    -4.373069    26.94632
         aze |  -25.47034   7.497451    -3.40   0.001    -40.16805   -10.77264
       _cons |  -108.6481   15.69716    -6.92   0.000    -139.4202   -77.87602
-------------+----------------------------------------------------------------
      /sigma |   58.35065   2.647209                      53.16117    63.54014
------------------------------------------------------------------------------
  Obs. summary:       4740  left-censored observations at expint<=0
                      1261     uncensored observations
                         0 right-censored observations
```

A4.9.5 Tobit Estimation – POOLED2 Medium transition sample alternative specification

```
. tobit expint newprod upprod uni size sizesq age agesq forown largecity gdpcap1 gdpcap1sq
infrastruct accessfin weaklaw sectorspill bul alb hrv geo ukr rus rom kaz mda bih mkd arm kgz hun
y08 y05 if trans>=3 & trans<=3.5, ll vce(cluster countrysect)

Tobit regression                                  Number of obs   =      10223
                                                  F(  31,  10192) =      23.03
                                                  Prob > F        =     0.0000
Log pseudolikelihood =  -15296.72                 Pseudo R2       =     0.0498

                          (Std. Err. adjusted for 126 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
```

```
     newprod |    12.3524   2.177582     5.67   0.000     8.083915    16.62089
      upprod |   9.459304    2.17819     4.34   0.000     5.189622    13.72899
         uni |   .1539446   .0553455     2.78   0.005     .0454565    .2624328
        size |   .0513728   .0045691    11.24   0.000     .0424164    .0603291
      sizesq |  -5.62e-06   7.44e-07    -7.56   0.000    -7.08e-06   -4.16e-06
         age |   .4927124   .1546478     3.19   0.001     .1895723    .7958524
       agesq |  -.0015682   .0012625    -1.24   0.214     -.004043    .0009067
      forown |   .5153991   .0485502    10.62   0.000     .4202312    .6105671
   largecity |   1.455361   2.371745     0.61   0.539    -3.193726    6.104448
     gdpcap1 |  -.0001344    .012994    -0.01   0.992    -.0256053    .0253365
   gdpcap1sq |  -2.00e-07   9.61e-07    -0.21   0.835    -2.08e-06    1.68e-06
 infrastruct |   .2854465   3.522621     0.08   0.935    -6.619584    7.190477
   accessfin |   1.300565   2.258882     0.58   0.565    -3.127289    5.728419
     weaklaw |  -7.540685   2.418438    -3.12   0.002     -12.2813   -2.800071
 sectorspill |   90.40999   12.48204     7.24   0.000     65.94274    114.8772
         bul |  -20.64809   15.10222    -1.37   0.172    -50.25141    8.955229
         alb |   -2.88055   15.35683    -0.19   0.851    -32.98296    27.22186
         hrv |  -15.14804   22.68334    -0.67   0.504    -59.61184    29.31577
         geo |  -28.68481    21.2554    -1.35   0.177    -70.34958    12.97996
         ukr |  -32.34852   19.33895    -1.67   0.094    -70.25667    5.559626
         rus |  -38.09395   12.70244    -3.00   0.003    -62.99322   -13.19467
         rom |  -23.95816   15.28911    -1.57   0.117    -53.92783     6.01151
         kaz |  -46.62112   11.23209    -4.15   0.000    -68.63823   -24.60401
         mda |  -20.51486   26.12232    -0.79   0.432    -71.71975    30.69003
         bih |  -1.316735   18.17553    -0.07   0.942    -36.94434    34.31087
         mkd |   8.712815   15.14318     0.58   0.565    -20.97079    38.39642
         arm |  -28.68574   20.02463    -1.43   0.152    -67.93796    10.56648
         kgz |  -38.65775   29.79825    -1.30   0.195    -97.06819    19.75269
         hun |   541.8248   2536.229     0.21   0.831    -4429.683    5513.333
         y08 |  -15.42686   20.24274    -0.76   0.446    -55.10662     24.2529
         y05 |  -2.082315   8.539913    -0.24   0.807    -18.82223     14.6576
       _cons |  -114.8288   33.26762    -3.45   0.001    -180.0399    -49.6177
-------------+----------------------------------------------------------------
      /sigma |   63.23391   2.202217                      58.91713    67.55069
------------------------------------------------------------------------------
  Obs. summary:       7953  left-censored observations at expint<=0
                      2270     uncensored observations
                         0 right-censored observations
```

A4.9.6 Tobit Estimation – POOLED2 Advanced transition sample alternative specification

```
. tobit expint newprod upprod uni size sizesq age agesq forown largecity gdpcap1 gdpcap1sq
infrastruct accessfin weaklaw sectorspill pol est cze hun lva ltu svk y08 y05 if trans>3.5, ll
vce(cluster countrysect)

Tobit regression                                  Number of obs   =       6765
                                                  F(  24,    6741) =      35.19
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -14267.426                 Pseudo R2       =     0.0394

                           (Std. Err. adjusted for 87 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     newprod |   11.81166   2.359026     5.01   0.000      7.18722    16.43609
      upprod |   5.390961   2.088357     2.58   0.010     1.297122    9.484799
         uni |   .1502118     .05006     3.00   0.003     .0520784    .2483452
        size |   .0343761    .006081     5.65   0.000     .0224554    .0462967
      sizesq |  -4.81e-06   1.21e-06    -3.98   0.000    -7.18e-06   -2.44e-06
         age |    .674594   .1162494     5.80   0.000     .4467085    .9024795
       agesq |  -.0044563   .0009713    -4.59   0.000    -.0063602   -.0025523
      forown |   .4150655   .0368384    11.27   0.000     .3428506    .4872805
   largecity |  -5.772059   2.372568    -2.43   0.015    -10.42304   -1.121076
     gdpcap1 |     .00567   .0026331     2.15   0.031     .0005083    .0108318
   gdpcap1sq |  -1.43e-07   1.06e-07    -1.35   0.177    -3.50e-07    6.44e-08
```

```
 infrastruct |  -.6745308   4.897032    -0.14   0.890    -10.27426    8.925199
   accessfin |    5.24711   2.096516     2.50   0.012     1.137276    9.356945
     weaklaw |  -12.32091    1.96582    -6.27   0.000    -16.17454   -8.467283
 sectorspill |   86.67675   14.54339     5.96   0.000     58.16712    115.1864
         pol |  -10.60177   6.026415    -1.76   0.079    -22.41545    1.211904
         est |  -5.842564   8.789108    -0.66   0.506    -23.07199    11.38687
         cze |  -1.979031   6.132533    -0.32   0.747    -14.00073    10.04267
         hun |   1.948779   6.888379     0.28   0.777    -11.55462    15.45218
         lva |  -15.22381    7.99629    -1.90   0.057    -30.89906    .4514476
         ltu |    .697272   10.45108     0.07   0.947    -19.79015     21.1847
         svk |  -13.53818   7.320666    -1.85   0.064      -27.889    .8126343
         y08 |  -35.36923   7.933252    -4.46   0.000    -50.92092   -19.81755
         y05 |  -10.56939   4.349479    -2.43   0.015    -19.09574   -2.043037
       _cons |  -122.9703   16.30116    -7.54   0.000    -154.9258   -91.01491
-------------+----------------------------------------------------------------
      /sigma |   54.70056   1.701647                      51.3648    58.03633
------------------------------------------------------------------------------
  Obs. summary:       4509  left-censored observations at expint<=0
                      2256     uncensored observations
                         0 right-censored observations
```

A4.9.7 Table of comparative “transition reform score” sensitivity estimation results

POOLED2

POOLED2 Dataset	Laggard Transition		Medium Transition		Advanced Transition	
	Original	Alternative	Original	Alternative	Original	Alternative
Transition reform score	(3- and below)	(3 and below)	(3 to 3.7)	(3 to 3.5)	(3.8 and higher)	(3.6 and higher)
Observations	3,526	6,001	11,720	10,223	5,268	6,765
VARIABLES						
newprod	9.280**	11.41***	11.66***	12.35***	12.83***	11.81***
upprod	3.798	4.674*	7.965***	9.459***	6.180***	5.391***
infrastruct	2.097	0.0398	0.140	0.285	-1.516	-0.675
accessfin	5.916*	4.194*	1.532	1.301	5.051**	5.247**
weaklaw	0.783	-3.540	-8.309***	-7.541***	-11.48***	-12.32***
uni	0.173**	0.109*	0.170***	0.154***	0.113**	0.150***
forown	0.535***	0.477***	0.467***	0.515***	0.456***	0.415***
largecity	-1.653	-2.071	-0.0766	1.455	-4.885*	-5.772**
sectorspill	29.54**	57.26***	81.52***	90.41***	105.4***	86.68***
gdpcap1	-0.0195	0.00381	-0.000483	-0.000134	0.00100	0.00567**
gdpcap1sq	3.12e-06	-1.30e-06	-2.78e-08	-2.00e-07	-2.89e-08	-1.43e-07
size	0.0855***	0.0507***	0.0498***	0.0514***	0.0314***	0.0344***
sizesq	-1.77e-05***	-6.08e-06***	-5.51e-06***	-5.62e-06***	-4.36e-06***	-4.81e-06***
age	0.371*	0.689***	0.563***	0.493***	0.636***	0.675***
agesq	-0.00293	-0.00441***	-0.00260**	-0.00157	-0.00408***	-0.00446***
y08	-8.821	-1.167	-14.45	-15.43	-14.78	-35.37***
y05	4.825	-4.136	-0.637	-2.082	3.307	-10.57**
Constant	-67.62**	-108.6***	-108.2***	-114.8***	-120.7***	-123.0***
Source: Stata regression outputs Clustered robust standard errors in parentheses						
*** p<0.01, ** p<0.05, * p<0.1						

A4.10 Alternative model specifications (innovation variables) - POOLED1 Laggard transition sample

A4.10.1 Alternative specification 1

```
. tobit expint newprod upprod uni skilled size sizesq age agesq forown busass businf largecity
impint infrastruct accessfin weaklaw macobst sectorspill gdpcap1 gdpcap1sq y05 blr tjk uzb bih
aze if trans<3, ll vce(cluster countrysect)

Tobit regression                                  Number of obs   =       2062
                                                  F(  26,   2036) =      22.84
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -3128.2482                 Pseudo R2       =     0.0583
                           (Std. Err. adjusted for 47 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     newprod |   3.680775   5.424396     0.68   0.497     -6.95717    14.31872
      upprod |   7.309747   2.719709     2.69   0.007     1.976044    12.64345
         uni |   .2541986   .0824283     3.08   0.002     .0925459    .4158513
     skilled |   .0404671   .0571262     0.71   0.479    -.0715648     .152499
        size |   .0608013   .0127552     4.77   0.000     .0357868    .0858158
      sizesq |  -.0000121   3.00e-06    -4.04   0.000     -.000018   -6.23e-06
         age |   .3411556   .2144393     1.59   0.112    -.0793877    .7616988
       agesq |  -.0027186   .0018356    -1.48   0.139    -.0063185    .0008812
      forown |   .4091843   .1105567     3.70   0.000     .1923683    .6260002
      busass |   23.50534   5.008327     4.69   0.000     13.68336    33.32732
      businf |  -.4448013   6.106919    -0.07   0.942    -12.42126    11.53166
   largecity |  -4.184026   4.121307    -1.02   0.310    -12.26644    3.898393
      impint |   .2306793   .0592077     3.90   0.000     .1145653    .3467933
 infrastruct |  -16.79321   14.99728    -1.12   0.263    -46.20483     12.6184
   accessfin |   4.020715   3.958945     1.02   0.310    -3.743291    11.78472
     weaklaw |  -6.020838    4.82997    -1.25   0.213    -15.49304    3.451361
     macobst |   .9507918   3.732062     0.25   0.799    -6.368267    8.269851
 sectorspill |   54.47584   14.45535     3.77   0.000     26.12703    82.82465
     gdpcap1 |  -.1206594   .0492519    -2.45   0.014    -.2172489    -.02407
   gdpcap1sq |   .0000242   9.76e-06     2.48   0.013     5.03e-06    .0000433
         y05 |   14.82337   13.80337     1.07   0.283    -12.24683    41.89358
         blr |   6.357113   12.73302     0.50   0.618    -18.61399    31.32822
         tjk |  -104.3288   49.07346    -2.13   0.034    -200.5682   -8.089367
         uzb |  -86.42735   35.81066    -2.41   0.016    -156.6567   -16.19799
         bih |   8.919428   8.566406     1.04   0.298    -7.880407    25.71926
         aze |  -62.85346   25.17896    -2.50   0.013    -112.2327   -13.47424
       _cons |   5.810022   55.97975     0.10   0.917    -103.9735    115.5936
-------------+----------------------------------------------------------------
      /sigma |   55.42951   4.376772                      46.84609    64.01293
------------------------------------------------------------------------------
  Obs. summary:       1582  left-censored observations at expint<=0
                       480     uncensored observations
                         0 right-censored observations
```

A4.10.2 Alternative specification 2

```
. tobit expint newprod procinn uni skilled size sizesq age agesq forown busass businf largecity
impint infrastruct accessfin weaklaw macobst sectorspill gdpcap1 gdpcap1sq y05 blr tjk uzb bih
aze if trans<3, ll vce(cluster countrysect)

Tobit regression                                  Number of obs   =       2033
                                                  F(  26,   2007) =      22.48
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -3119.4791                 Pseudo R2       =     0.0568

                           (Std. Err. adjusted for 47 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     newprod |   5.756077   5.838354     0.99   0.324    -5.693792    17.20595
     procinn |   2.477542   4.888507     0.51   0.612    -7.109537    12.06462
         uni |   .2585272   .0831392     3.11   0.002      .095479    .4215753
     skilled |   .0536624   .0578205     0.93   0.353    -.0597321    .1670569
        size |   .0606318   .0128724     4.71   0.000     .0353873    .0858764
      sizesq |  -.0000121   3.06e-06    -3.96   0.000    -.0000181   -6.11e-06
         age |   .3332111    .205873     1.62   0.106    -.0705362    .7369583
       agesq |  -.0026066   .0017435    -1.49   0.135    -.0060259    .0008128
      forown |    .406841   .1067322     3.81   0.000     .1975234    .6161585
      busass |   23.48979   5.194265     4.52   0.000     13.30307     33.6765
      businf |  -.2921673   6.104412    -0.05   0.962    -12.26381    11.67948
   largecity |  -3.897257   4.044065    -0.96   0.335    -11.82826    4.033747
      impint |   .2259073   .0595396     3.79   0.000     .1091414    .3426733
 infrastruct |   -16.3942   14.91651    -1.10   0.272    -45.64767    12.85926
   accessfin |   3.994335   3.968382     1.01   0.314    -3.788245    11.77691
     weaklaw |  -5.735656   4.795498    -1.20   0.232    -15.14033    3.669019
     macobst |   1.672335   3.675643     0.45   0.649     -5.53614    8.880809
 sectorspill |   57.17466   14.81699     3.86   0.000     28.11637    86.23295
     gdpcap1 |  -.1147359   .0484913    -2.37   0.018    -.2098345   -.0196373
   gdpcap1sq |    .000023   9.55e-06     2.41   0.016     4.28e-06    .0000417
         y05 |   13.81808   14.02112     0.99   0.324    -13.67938    41.31555
         blr |   6.785036   12.93876     0.52   0.600    -18.58977    32.15984
         tjk |  -98.91788   48.70426    -2.03   0.042    -194.4341   -3.401686
         uzb |  -82.32778   35.51549    -2.32   0.021    -151.9789   -12.67668
         bih |   7.870516   8.425348     0.93   0.350    -8.652827    24.39386
         aze |  -60.26676    25.1972    -2.39   0.017    -109.6822   -10.85136
       _cons |  -.3166087   55.76748    -0.01   0.995    -109.6848    109.0516
-------------+----------------------------------------------------------------
      /sigma |    55.2419   4.413522                      46.58634    63.89747
------------------------------------------------------------------------------
  Obs. summary:       1554  left-censored observations at expint<=0
                       479     uncensored observations
                         0 right-censored observations
```

A4.10.3 Alternative specification 3

```
. tobit expint upprod procinn uni skilled size sizesq age agesq forown busass businf largecity
impint infrastruct accessfin weaklaw macobst sectorspill gdpcap1 gdpcap1sq y05 blr tjk uzb bih
aze if trans<3, ll vce(cluster countrysect)

Tobit regression                                  Number of obs   =       2034
                                                  F(  26,   2008) =      26.74
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -3118.6209                 Pseudo R2       =     0.0571

                           (Std. Err. adjusted for 47 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      upprod |   7.988404   3.005396     2.66   0.008     2.094382    13.88242
     procinn |   2.176445    4.43765     0.49   0.624    -6.526435    10.87932
         uni |   .2606085   .0834437     3.12   0.002     .0969632    .4242538
     skilled |   .0513866   .0577047     0.89   0.373    -.0617808     .164554
        size |   .0607695   .0126032     4.82   0.000     .0360529    .0854861
      sizesq |  -.0000122   2.99e-06    -4.08   0.000     -.000018   -6.32e-06
         age |   .3228307   .2042369     1.58   0.114    -.0777077    .7233691
       agesq |  -.0025606   .0017455    -1.47   0.143    -.0059838    .0008626
      forown |   .4085895   .1071119     3.81   0.000     .1985275    .6186515
      busass |   23.50171    5.13362     4.58   0.000     13.43393    33.56949
      businf |  -.8310782   6.009126    -0.14   0.890    -12.61585     10.9537
   largecity |  -3.927636   4.129488    -0.95   0.342    -12.02616    4.170893
      impint |   .2282223    .059054     3.86   0.000     .1124088    .3440357
 infrastruct |  -16.77803   15.13007    -1.11   0.268     -46.4503    12.89424
   accessfin |   3.808654   3.947818     0.96   0.335    -3.933595     11.5509
     weaklaw |  -5.587224   4.862581    -1.15   0.251    -15.12346    3.949008
     macobst |    1.47585   3.610195     0.41   0.683     -5.60427     8.55597
 sectorspill |   55.84191   14.69513     3.80   0.000     27.02262     84.6612
     gdpcap1 |   -.117814   .0487887    -2.41   0.016    -.2134957   -.0221322
   gdpcap1sq |   .0000234   9.66e-06     2.42   0.016     4.44e-06    .0000423
         y05 |   15.29068   13.89282     1.10   0.271    -11.95517    42.53653
         blr |   6.086051   12.62458     0.48   0.630    -18.67259     30.8447
         tjk |  -102.7591   48.73634    -2.11   0.035    -198.3382   -7.180009
         uzb |  -85.14837   35.63877    -2.39   0.017    -155.0412   -15.25553
         bih |   7.727219   8.450226     0.91   0.361    -8.844908    24.29935
         aze |  -60.27843     25.259    -2.39   0.017     -109.815   -10.74184
       _cons |   2.247503   55.94094     0.04   0.968    -107.4608    111.9558
-------------+----------------------------------------------------------------
      /sigma |   55.24369   4.394339                      46.62575    63.86163
------------------------------------------------------------------------------
  Obs. summary:       1555  left-censored observations at expint<=0
                       479     uncensored observations
                         0 right-censored observations
```

A4.10.4 Alternative specification 4

```
. tobit expint newprod uni skilled size sizesq age agesq forown busass businf largecity impint
infrastruct accessfin weaklaw macobst sectorspill gdpcap1 gdpcap1sq y05 blr tjk uzb bih aze if
trans<3, ll vce(cluster countrysect)

Tobit regression                                  Number of obs   =       2062
                                                  F(  25,   2037) =      23.05
                                                  Prob > F        =     0.0000
Log pseudolikelihood =  -3129.928                 Pseudo R2       =     0.0577
                           (Std. Err. adjusted for 47 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     newprod |   5.985136   5.341414     1.12   0.263    -4.490068    16.46034
         uni |   .2544652   .0824685     3.09   0.002     .0927338    .4161967
     skilled |    .042208   .0577354     0.73   0.465    -.0710186    .1554346
        size |   .0611634   .0130617     4.68   0.000     .0355477    .0867791
      sizesq |  -.0000121   3.09e-06    -3.94   0.000    -.0000182   -6.10e-06
         age |    .337213   .2110112     1.60   0.110    -.0766073    .7510333
       agesq |  -.0026871   .0018137    -1.48   0.139    -.0062441    .0008699
      forown |   .4062972   .1097962     3.70   0.000     .1909727    .6216217
      busass |   23.94246   5.046806     4.74   0.000     14.04502     33.8399
      businf |  -.1336848   6.188731    -0.02   0.983    -12.27059    12.00322
   largecity |  -4.170344   4.014924    -1.04   0.299    -12.04413     3.70344
      impint |   .2323043   .0592671     3.92   0.000     .1160738    .3485349
 infrastruct |  -16.23487   14.85779    -1.09   0.275    -45.37292    12.90318
   accessfin |    4.18813   3.975132     1.05   0.292    -3.607618    11.98388
     weaklaw |  -6.194234   4.802515    -1.29   0.197    -15.61259    3.224118
     macobst |   1.280004   3.749208     0.34   0.733    -6.072677    8.632685
 sectorspill |   58.03071    14.9784     3.87   0.000     28.65613    87.40529
     gdpcap1 |  -.1179998   .0491487    -2.40   0.016    -.2143868   -.0216128
   gdpcap1sq |   .0000238   9.70e-06     2.46   0.014     4.82e-06    .0000428
         y05 |   13.49977   14.03574     0.96   0.336    -14.02613    41.02567
         blr |   7.313451   12.84549     0.57   0.569    -17.87821    32.50512
         tjk |  -100.7679   49.22061    -2.05   0.041    -197.2959   -4.239964
         uzb |  -83.79941    35.9236    -2.33   0.020    -154.2502   -13.34859
         bih |   9.168621   8.614025     1.06   0.287    -7.724597    26.06184
         aze |  -62.40714   25.37682    -2.46   0.014    -112.1744   -12.63991
       _cons |   2.988008   56.34138     0.05   0.958    -107.5047    113.4807
-------------+----------------------------------------------------------------
      /sigma |   55.44745   4.390722                      46.83668    64.05822
------------------------------------------------------------------------------
  Obs. summary:       1582  left-censored observations at expint<=0
                       480     uncensored observations
                         0 right-censored observations
```

A4.10.5 Alternative specification 5

```
. tobit expint upprod uni skilled size sizesq age agesq forown busass businf largecity impint
infrastruct accessfin weaklaw macobst sectorspill gdpcap1 gdpcap1sq y05 blr tjk uzb bih aze if
trans<3, ll vce(cluster countrysect)

Tobit regression                                  Number of obs   =       2063
                                                  F(  25,   2038) =      25.19
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -3128.8133                 Pseudo R2       =     0.0582
                           (Std. Err. adjusted for 47 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      upprod |   8.516542   3.042211     2.80   0.005     2.550375    14.48271
         uni |     .25691   .0829165     3.10   0.002     .0943001    .4195198
     skilled |   .0403433   .0573261     0.70   0.482    -.0720805    .1527671
        size |   .0612389   .0127466     4.80   0.000     .0362412    .0862366
      sizesq |  -.0000122   3.01e-06    -4.07   0.000    -.0000181   -6.33e-06
         age |   .3258589   .2085918     1.56   0.118    -.0832166    .7349343
       agesq |  -.0026334   .0018087    -1.46   0.146    -.0061805    .0009137
      forown |   .4083861   .1099895     3.71   0.000     .1926826    .6240896
      busass |   23.94013   4.938248     4.85   0.000     14.25559    33.62467
      businf |  -.7420752   6.007312    -0.12   0.902    -12.52319    11.03904
   largecity |  -4.200355   4.112676    -1.02   0.307    -12.26584    3.865132
      impint |   .2338913   .0588619     3.97   0.000     .1184554    .3493271
 infrastruct |   -16.6986   15.12029    -1.10   0.270    -46.35142    12.95423
   accessfin |   3.959094   3.952361     1.00   0.317    -3.791995    11.71018
     weaklaw |  -6.018863   4.871021    -1.24   0.217    -15.57156    3.533835
     macobst |    1.09134   3.684254     0.30   0.767    -6.133957    8.316636
 sectorspill |   56.44591   14.88923     3.79   0.000     27.24622    85.64559
     gdpcap1 |  -.1210829   .0494277    -2.45   0.014     -.218017   -.0241487
   gdpcap1sq |   .0000242   9.82e-06     2.46   0.014     4.94e-06    .0000434
         y05 |   15.09713   13.82994     1.09   0.275    -12.02516    42.21941
         blr |   6.525305   12.61031     0.52   0.605    -18.20514    31.25575
         tjk |  -104.7653   49.18477    -2.13   0.033     -201.223   -8.307671
         uzb |  -86.71968   35.94942    -2.41   0.016    -157.2211   -16.21825
         bih |   8.958075   8.636053     1.04   0.300    -7.978337    25.89449
         aze |  -62.30105   25.44118    -2.45   0.014    -112.1945   -12.40761
       _cons |   5.501272   56.47471     0.10   0.922    -105.2529    116.2554
-------------+----------------------------------------------------------------
      /sigma |   55.44389   4.367783                      46.87811    64.00968
------------------------------------------------------------------------------
  Obs. summary:       1583  left-censored observations at expint<=0
                       480     uncensored observations
                         0 right-censored observations
```

A4.10.6 Alternative specification 6

```
. tobit expint procinn uni skilled size sizesq age agesq forown busass businf largecity impint
infrastruct accessfin weaklaw macobst sectorspill gdpcap1 gdpcap1sq y05 blr tjk uzb bih aze if
trans<3, ll vce(cluster countrysect)

Tobit regression                                  Number of obs   =       2034
                                                  F(  25,   2009) =      24.66
                                                  Prob > F        =     0.0000
Log pseudolikelihood =  -3120.676                 Pseudo R2       =     0.0565
                           (Std. Err. adjusted for 47 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     procinn |   4.405861   4.371304     1.01   0.314    -4.166902    12.97862
         uni |   .2618403   .0832567     3.14   0.002     .0985618    .4251188
     skilled |   .0529915   .0583824     0.91   0.364    -.0615049    .1674879
        size |   .0613976   .0128904     4.76   0.000     .0361177    .0866775
      sizesq |  -.0000123   3.07e-06    -4.00   0.000    -.0000183   -6.27e-06
         age |   .3054555   .2012244     1.52   0.129    -.0891748    .7000858
       agesq |  -.0024474   .0017221    -1.42   0.155    -.0058246    .0009298
      forown |   .4063191   .1055671     3.85   0.000     .1992867    .6133516
      busass |   24.22049   5.241497     4.62   0.000     13.94115    34.49983
      businf |  -.7018858   6.059484    -0.12   0.908    -12.58541    11.18164
   largecity |  -3.913432   4.015634    -0.97   0.330    -11.78868    3.961811
      impint |   .2316194    .059277     3.91   0.000     .1153685    .3478702
 infrastruct |  -16.22253   15.12472    -1.07   0.284     -45.8843    13.43924
   accessfin |   3.943626   3.988392     0.99   0.323    -3.878192    11.76544
     weaklaw |   -5.76332   4.850011    -1.19   0.235     -15.2749    3.748258
     macobst |   1.921934    3.65262     0.53   0.599    -5.241384    9.085253
 sectorspill |   60.58199   15.63391     3.88   0.000     29.92162    91.24237
     gdpcap1 |  -.1145867   .0490504    -2.34   0.020    -.2107816   -.0183918
   gdpcap1sq |    .000023   9.65e-06     2.38   0.017     4.03e-06    .0000419
         y05 |   13.63931   14.22433     0.96   0.338    -14.25666    41.53528
         blr |   7.519312   12.55035     0.60   0.549    -17.09376    32.13238
         tjk |  -98.37606   49.39185    -1.99   0.047    -195.2407    -1.51145
         uzb |  -81.80536   36.08809    -2.27   0.024    -152.5793   -11.03136
         bih |    8.01787   8.565853     0.94   0.349    -8.781013    24.81675
         aze |  -59.37407   25.62306    -2.32   0.021    -109.6246   -9.123519
       _cons |  -1.653897   56.90328    -0.03   0.977    -113.2495    109.9417
-------------+----------------------------------------------------------------
      /sigma |   55.25946   4.405813                      46.61902     63.8999
------------------------------------------------------------------------------
  Obs. summary:       1555  left-censored observations at expint<=0
                       479     uncensored observations
                         0 right-censored observations
```

A4.11. Alternative model estimations with interaction terms - full sample

A4.11.1 POOLED1 Tobit estimation using interaction term *newprod#trans*

newprod - newly introduced products in the 36 months prior to the survey
trans - EBRD transition index taking values 1 to 4.3 (low to high)

```
. tobit expint i.newprod##c.trans upprod procinn uni skilled size sizesq age agesq forown busass
businf largecity impint infrastruct accessfin weaklaw macobst sectorspill gdpcap1 gdpcap1sq y05
blr tjk uzb bih mne aze bul alb hrv geo ukr rus rom kaz mda mkd arm kgz hun lva est cze ltu svk
svn, ll vce(cluster countrysect)
Tobit regression                                  Number of obs   =      10609
                                                  F(49,  10560)   =      32.85
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -17959.365                 Pseudo R2       =     0.0671

                             (Std. Err. adjusted for 202 clusters in countrysect)
```

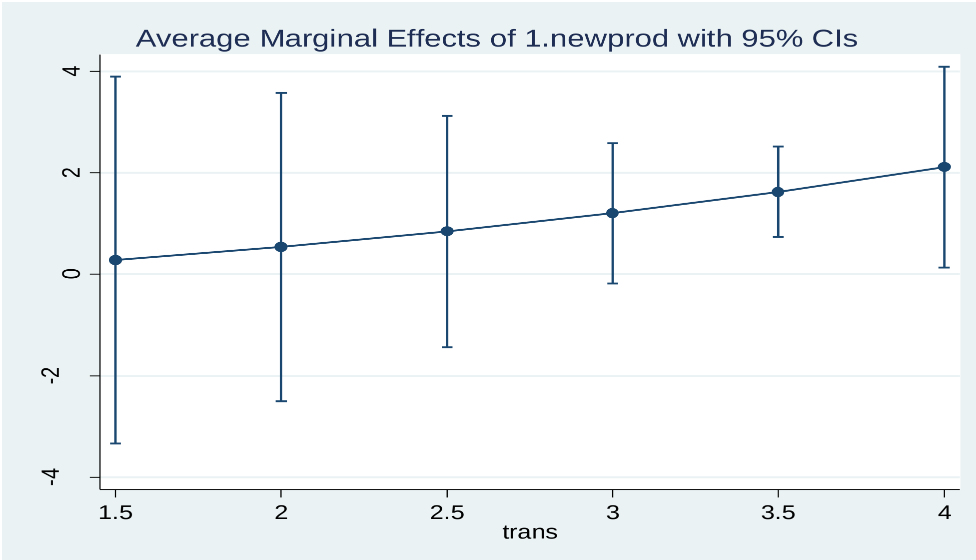
expint	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
1.newprod	**-1.763913**	**18.02169**	**-0.10**	**0.922**	**-37.08982**	**33.56199**
trans	**8.947242**	**7.950559**	**1.13**	**0.260**	**-6.637355**	**24.53184**
newprod#c.trans						
1	**2.223249**	**5.212873**	**0.43**	**0.670**	**-7.994965**	**12.44146**
upprod	5.358704	1.601189	3.35	0.001	2.220071	8.497338
procinn	3.841177	1.965668	1.95	0.051	-.0119035	7.694258
uni	.1853078	.0375559	4.93	0.000	.1116912	.2589244
skilled	.0901965	.0296826	3.04	0.002	.032013	.14838
size	.029284	.0035928	8.15	0.000	.0222415	.0363265
sizesq	-3.33e-06	6.43e-07	-5.18	0.000	-4.59e-06	-2.07e-06
age	.5152151	.0916074	5.62	0.000	.3356473	.6947828
agesq	-.0026353	.0007354	-3.58	0.000	-.0040767	-.0011938
forown	.3453192	.0375707	9.19	0.000	.2716735	.4189649
busass	16.30397	2.624967	6.21	0.000	11.15854	21.4494
businf	12.44453	2.337939	5.32	0.000	7.861727	17.02733
largecity	-.9837858	2.079766	-0.47	0.636	-5.06052	3.092948
impint	.3811768	.0341853	11.15	0.000	.3141671	.4481865
infrastruct	-1.103248	3.56819	-0.31	0.757	-8.097575	5.891078
accessfin	4.625964	1.973061	2.34	0.019	.7583925	8.493536
weaklaw	-7.905474	1.787901	-4.42	0.000	-11.4101	-4.400851
macobst	6.440569	1.808501	3.56	0.000	2.895565	9.985573
sectorspill	86.76144	8.820689	9.84	0.000	69.47122	104.0516
gdpcap1	.0018944	.0012202	1.55	0.121	-.0004975	.0042863
gdpcap1sq	-1.61e-10	2.69e-09	-0.06	0.952	-5.43e-09	5.11e-09
y05	-6.523872	3.740607	-1.74	0.081	-13.85617	.8084228
blr	17.94872	14.83613	1.21	0.226	-11.13289	47.03033
tjk	8.706044	10.78213	0.81	0.419	-12.42896	29.84105
uzb	14.81921	10.61616	1.40	0.163	-5.990462	35.62888
bih	3.536324	8.184958	0.43	0.666	-12.50774	19.58039
mne	-19.65977	15.81328	-1.24	0.214	-50.65679	11.33724
aze	-9.965778	9.010702	-1.11	0.269	-27.62846	7.696898
bul	1.339928	9.107603	0.15	0.883	-16.51269	19.19255
alb	8.109907	11.8587	0.68	0.494	-15.13539	31.35521
hrv	-14.95594	10.66859	-1.40	0.161	-35.8684	5.956517
geo	6.321163	10.47319	0.60	0.546	-14.20826	26.85058
ukr	-6.040299	8.020448	-0.75	0.451	-21.76189	9.681292
rus	-9.056972	7.152527	-1.27	0.205	-23.07727	4.96333
rom	-.7764907	8.297649	-0.09	0.925	-17.04145	15.48847
kaz	-8.47737	5.914488	-1.43	0.152	-20.07088	3.116143
mda	13.00747	7.519809	1.73	0.084	-1.732779	27.74771
mkd	14.94497	11.70881	1.28	0.202	-8.006499	37.89644
arm	.1638691	9.294683	0.02	0.986	-18.05546	18.3832
kgz	-11.34322	10.05634	-1.13	0.259	-31.05553	8.369094
hun	19.80877	9.166106	2.16	0.031	1.841476	37.77607
lva	-8.407019	11.34845	-0.74	0.459	-30.65212	13.83808

```
         est |   8.293528   9.323154     0.89   0.374    -9.981612    26.56867
         cze |   17.55756   9.937423     1.77   0.077    -1.921667    37.03678
         ltu |   10.05997   15.96741     0.63   0.529    -21.23915     41.3591
         svk |  -10.97654   11.06949    -0.99   0.321    -32.67482    10.72174
         svn |   20.28602   13.38429     1.52   0.130    -5.949708    46.52175
       _cons |  -173.7853    25.9939    -6.69   0.000    -224.7382   -122.8323
-------------+----------------------------------------------------------------
      /sigma |   54.11741   1.810804                      50.56789    57.66692
------------------------------------------------------------------------------
  Obs. summary:       7795  left-censored observations at expint<=0
                      2814     uncensored observations
                         0 right-censored observations
```

A4.11.1a POOLED1 Tobit unconditional marginal effects of *newprod* across transition scores

```
. margins, dydx(newprod) at (trans=(1.5,2,2.5,3,3.5,4)) predict (ystar(0,.))

Average marginal effects                          Number of obs   =      10609
Model VCE    : Robust
Expression   : E(expint*|expint>0), predict(ystar(0,.))
dy/dx w.r.t. : 1.newprod

1._at        : trans           =         1.5
2._at        : trans           =           2
3._at        : trans           =         2.5
4._at        : trans           =           3
5._at        : trans           =         3.5
6._at        : trans           =           4
------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
1.newprod    |
         _at |
          1  |   .2816815   1.846532     0.15   0.879    -3.337455    3.900818
          2  |   .5363296   1.550545     0.35   0.729    -2.502682    3.575341
          3  |   .8423197   1.163498     0.72   0.469    -1.438094    3.122733
          4  |   1.204312   .7048754     1.71   0.088    -.1772184    2.585842
          5  |   1.626694   .4539303     3.58   0.000     .7370073    2.516382
          6  |   2.113464   1.008854     2.09   0.036     .1361457    4.090781
------------------------------------------------------------------------------
Note: dy/dx for factor levels is the discrete change from the base level.

. marginsplot
```

Variables that uniquely identify margins: trans



A4.11.2 POOLED1 Tobit estimation using interaction term *newprod#stages*

newprod - Newly introduced products in the 36 months prior to the survey
stages - Index of stages of transition: 1 for Laggard, 2 for Medium and 3 for Advanced stage of transition

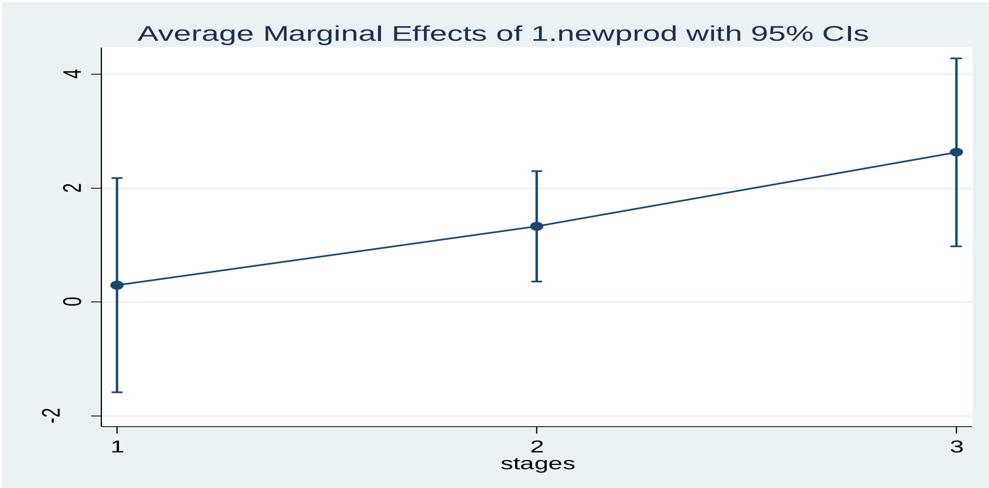
```
. tobit expint i.newprod##c.stages upprod procinn uni skilled size sizesq age agesq forown busass
businf largecity impint infrastruct accessfin weaklaw macobst sectorspill gdpcap1 gdpcap1sq y05
blr tjk uzb bih mne aze bul alb hrv geo ukr rus rom kaz mda mkd arm kgz hun lva est cze ltu svk
svn, ll vce(cluster countrysect)

Tobit regression                                  Number of obs   =      10609
                                                  F(  49,  10560) =      32.27
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -17957.752                 Pseudo R2       =     0.0671

                              (Std. Err. adjusted for 202 clusters in countrysect)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   1.newprod |  -2.547729   7.140272    -0.36   0.721    -16.54401    11.44855
      stages |   4.722744   5.056959     0.93   0.350     -5.18985    14.63534
newprod#c.stages |
          1  |    3.85526   3.079072     1.25   0.211    -2.180301    9.890821
      upprod |   5.306252   1.601469     3.31   0.001     2.167072    8.445433
     procinn |   3.911638   1.964492     1.99   0.046     .0608625    7.762413
         uni |    .184626   .0374789     4.93   0.000     .1111603    .2580917
     skilled |   .0899938    .029543     3.05   0.002      .032084    .1479035
        size |    .029279   .0035968     8.14   0.000     .0222287    .0363294
      sizesq |  -3.33e-06   6.44e-07    -5.17   0.000    -4.59e-06   -2.07e-06
         age |   .5124309   .0911908     5.62   0.000     .3336798     .691182
       agesq |    -.00262   .0007294    -3.59   0.000    -.0040499   -.0011902
      forown |   .3447148     .03758     9.17   0.000     .2710509    .4183787
      busass |   16.34964   2.620918     6.24   0.000     11.21215    21.48714
      businf |   12.40166   2.329989     5.32   0.000     7.834445    16.96888
   largecity |  -.9499613   2.068033    -0.46   0.646    -5.003695    3.103773
```

```
         impint |   .3808695   .0340919    11.17   0.000      .314043     .447696
    infrastruct |  -1.116362   3.572345    -0.31   0.755    -8.118832    5.886108
      accessfin |   4.565641   1.972916     2.31   0.021      .698354    8.432928
        weaklaw |  -7.913119   1.793851    -4.41   0.000     -11.4294   -4.396834
        macobst |   6.486519   1.799412     3.60   0.000     2.959332    10.01371
    sectorspill |   86.99075   8.764131     9.93   0.000      69.8114    104.1701
        gdpcap1 |   .0017057   .0012858     1.33   0.185    -.0008147    .0042262
      gdpcap1sq |  -3.20e-10   2.63e-09    -0.12   0.903    -5.48e-09    4.84e-09
            y05 |  -5.248281   3.881199    -1.35   0.176    -12.85616    2.359602
            blr |   10.21021   11.79601     0.87   0.387    -12.91219    33.33262
            tjk |   9.463911   10.99258     0.86   0.389    -12.08362    31.01145
            uzb |   11.08698   9.540302     1.16   0.245     -7.61381    29.78777
            bih |   3.343915   8.139094     0.41   0.681    -12.61025    19.29807
            mne |  -18.23048   16.16842    -1.13   0.260    -49.92363    13.46266
            aze |  -7.596795   9.426147    -0.81   0.420    -26.07382    10.88023
            bul |   3.611416    8.87528     0.41   0.684    -13.78581    21.00864
            alb |   7.747763   11.88505     0.65   0.514    -15.54918    31.04471
            hrv |  -11.77205   10.70749    -1.10   0.272    -32.76075    9.216656
            geo |   6.917495   10.40589     0.66   0.506    -13.48001      27.315
            ukr |  -7.479165   8.204513    -0.91   0.362    -23.56156    8.603228
            rus |  -9.634191    7.19369    -1.34   0.181    -23.73518    4.466799
            rom |   .0074698   8.240274     0.00   0.999    -16.14502    16.15996
            kaz |  -10.39402   6.020719    -1.73   0.084    -22.19576    1.407728
            mda |   11.43019   7.651987     1.49   0.135    -3.569143    26.42953
            mkd |   15.26178   11.69082     1.31   0.192    -7.654438      38.178
            arm |   1.334148   8.979705     0.15   0.882    -16.26777    18.93606
            kgz |  -10.91642   10.01558    -1.09   0.276    -30.54885    8.716005
            hun |   21.67505   8.715247     2.49   0.013     4.591519    38.75857
            lva |  -7.034129   11.12327    -0.63   0.527    -28.83783    14.76957
            est |   9.419505   8.961298     1.05   0.293     -8.14633    26.98534
            cze |   17.89085   9.926415     1.80   0.072    -1.566792     37.3485
            ltu |   9.669965   16.03812     0.60   0.547    -21.76778    41.10771
            svk |  -9.503604    10.6238    -0.89   0.371    -30.32825    11.32104
            svn |   25.55392    14.2551     1.79   0.073    -2.388754     53.4966
          _cons |  -154.0912    12.7679   -12.07   0.000    -179.1187   -129.0637
----------------+----------------------------------------------------------------
         /sigma |   54.10199    1.80892                      50.55617    57.64782
---------------------------------------------------------------------------------
  Obs. summary:       7795  left-censored observations at expint<=0
                      2814     uncensored observations
                         0 right-censored observations
```

A4.11.2a POOLED1 Tobit unconditional marginal effects of *newprod* across transition stages

```
. margins, dydx(newprod) at (stages=(1,2,3)) predict (ystar(0,.))

Average marginal effects                          Number of obs   =      10609
Model VCE    : Robust
Expression   : E(expint*|expint>0), predict(ystar(0,.))
dy/dx w.r.t. : 1.newprod
1._at        : stages          =           1
2._at        : stages          =           2
3._at        : stages          =           3
------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
1.newprod    |
         _at |
          1  |   .2954679   .9589701     0.31   0.758    -1.584079    2.175015
          2  |   1.330208   .4937994     2.69   0.007     .3623787    2.298037
          3  |   2.630498    .841528     3.13   0.002     .9811339    4.279863
------------------------------------------------------------------------------
```

```
Note: dy/dx for factor levels is the discrete change from the base level.

. marginsplot

  Variables that uniquely identify margins: stages
```



A4.11.3 POOLED2 Tobit estimation using interaction term *newprod#stages*

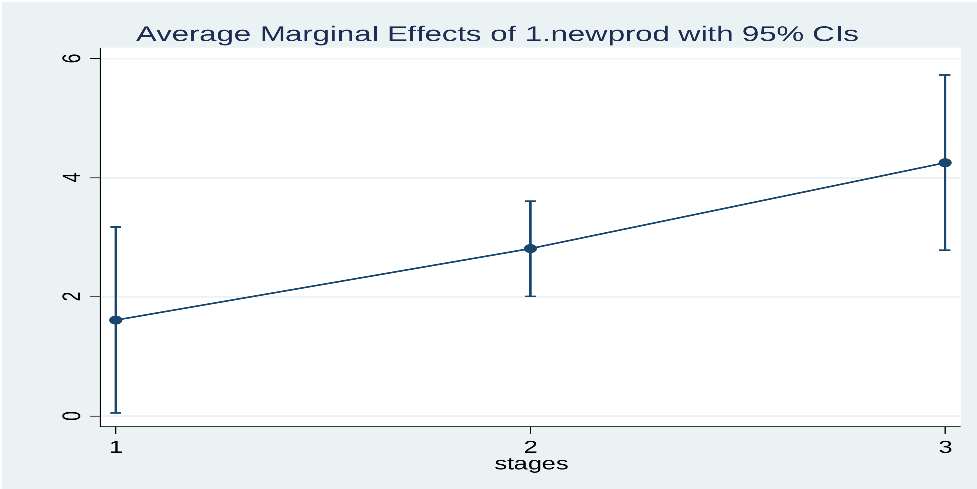
newprod - newly introduced products in the 36 months prior to the survey
stages - Index of stages of transition: 1 for Laggard, 2 for Medium and 3 for Advanced stage of transition

```
. tobit expint i.newprod##c.stages upprod uni size sizesq age agesq forown largecity gdpcap1
gdpcap1sq infrastruct accessfin weaklaw sectorspill y08 y05 blr tjk uzb bih mne aze bul alb hrv
geo ukr rus rom kaz mda mkd arm kgz hun lva est cze ltu svk svn, ll vce(cluster countrysect)

Tobit regression                                  Number of obs   =      20514
                                                  F(  44,  20470) =      32.23
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -34374.881                 Pseudo R2       =     0.0477

                              (Std. Err. adjusted for 214 clusters in countrysect)
----------------------------------------------------------------------------------
                 |               Robust
          expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-----------------+----------------------------------------------------------------
       1.newprod |   3.304485   6.175001     0.54   0.593    -8.799009    15.40798
          stages |   3.883266   4.292536     0.90   0.366    -4.530448    12.29698
newprod#c.stages |
              1  |   4.054812   2.719893     1.49   0.136    -1.276395     9.38602
          upprod |   6.418979   1.415929     4.53   0.000     3.643646    9.194313
             uni |   .1485217   .0357038     4.16   0.000     .0785394    .2185039
            size |   .0455076   .0038537    11.81   0.000     .0379541    .0530612
          sizesq |  -5.45e-06   7.46e-07    -7.30   0.000    -6.91e-06   -3.99e-06
             age |   .5792426   .0927811     6.24   0.000     .3973843     .761101
           agesq |  -.0030963   .0007898    -3.92   0.000    -.0046445   -.0015481
          forown |   .4765325   .0307296    15.51   0.000        .4163    .5367649
       largecity |  -1.946789   1.599295    -1.22   0.224    -5.081536    1.187957
         gdpcap1 |   -.000451   .0010302    -0.44   0.662    -.0024702    .0015683
       gdpcap1sq |  -3.08e-10   2.84e-09    -0.11   0.914    -5.87e-09    5.25e-09
     infrastruct |  -.5824865   2.741577    -0.21   0.832    -5.956197    4.791224
       accessfin |   2.745935   1.560843     1.76   0.079    -.3134412    5.805312
         weaklaw |  -8.680647   1.533134    -5.66   0.000    -11.68571   -5.675581
     sectorspill |   78.05684    9.05106     8.62   0.000     60.31604    95.79764
```

```
            y08 |  -11.21683   7.178387    -1.56   0.118    -25.28705    2.853377
            y05 |   .0844767   3.191749     0.03   0.979    -6.171605    6.340559
            blr |  -5.212817   9.311951    -0.56   0.576    -23.46498    13.03935
            tjk |  -24.39723    10.7515    -2.27   0.023    -45.47102   -3.323438
            uzb |  -4.512597   11.52911    -0.39   0.695    -27.11058    18.08539
            bih |   7.928251   8.498255     0.93   0.351    -8.729008    24.58551
            mne |  -15.01188   16.45658    -0.91   0.362    -47.26809    17.24433
            aze |   -27.4648   8.431688    -3.26   0.001    -43.99159   -10.93802
            bul |  -1.611688   6.306991    -0.26   0.798    -13.97389    10.75052
            alb |   10.40797   7.203215     1.44   0.148    -3.710905    24.52685
            hrv |   6.423231     8.5263     0.75   0.451      -10.289    23.13546
            geo |  -14.18098    8.32478    -1.70   0.088    -30.49821    2.136259
            ukr |  -16.82463   6.451448    -2.61   0.009    -29.46999   -4.179279
            rus |  -29.40416   4.926204    -5.97   0.000    -39.05991    -19.7484
            rom |  -8.809122   6.299175    -1.40   0.162    -21.15601    3.537764
            kaz |  -33.99643   5.070911    -6.70   0.000    -43.93582   -24.05704
            mda |  -5.916705   6.742883    -0.88   0.380    -19.13329    7.299884
            mkd |   19.79657   9.450625     2.09   0.036     1.272587    38.32055
            arm |  -13.99389   5.716606    -2.45   0.014    -25.19889   -2.788886
            kgz |  -23.71228   8.969529    -2.64   0.008    -41.29327   -6.131283
            hun |    20.9105   7.767218     2.69   0.007     5.686128    36.13486
            lva |  -5.438372   7.540488    -0.72   0.471    -20.21833    9.341586
            est |   10.37562   8.590903     1.21   0.227    -6.463241    27.21447
            cze |   18.53111   7.764277     2.39   0.017     3.312508    33.74971
            ltu |   9.070693   9.814062     0.92   0.355    -10.16565    28.30704
            svk |   6.476907   8.050942     0.80   0.421    -9.303583     22.2574
            svn |   41.90614   12.76598     3.28   0.001      16.8838    66.92848
          _cons |   -121.443    12.5255    -9.70   0.000    -145.9939   -96.89198
----------------+----------------------------------------------------------------
         /sigma |   59.43006   1.519265                      56.45218    62.40794
---------------------------------------------------------------------------------
  Obs. summary:      15288  left-censored observations at expint<=0
                      5226     uncensored observations
                         0 right-censored observations
```

A4.11.3a POOLED2 Tobit unconditional marginal effects of *newprod* across transition stages

```
. margins, dydx(newprod) at (stages=(1,2,3)) predict (ystar(0,.))

Average marginal effects                         Number of obs   =      20514
Model VCE    : Robust

Expression   : E(expint*|expint>0), predict(ystar(0,.))
dy/dx w.r.t. : 1.newprod
1._at        : stages          =           1
2._at        : stages          =           2
3._at        : stages          =           3
------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
1.newprod    |
         _at |
          1  |   1.613051   .7960512     2.03   0.043     .0528197    3.173283
          2  |   2.810363     .40761     6.89   0.000     2.011462    3.609264
          3  |   4.254674   .7506256     5.67   0.000     2.783475    5.725873
------------------------------------------------------------------------------
Note: dy/dx for factor levels is the discrete change from the base level.

. marginsplot

  Variables that uniquely identify margins: stages
```



A4.11.4 POOLED1 Tobit estimation using interaction term *upprod#trans*

upprod - significantly improved or upgraded products in the 36 months prior to the survey
trans - EBRD transition index taking values 1 to 4.3 (low to high)

```
. tobit expint newprod i.upprod##c.trans procinn uni skilled size sizesq age agesq forown busass
businf largecity impint infrastruct accessfin weaklaw macobst sectorspill gdpcap1 gdpcap1sq y05
blr tjk uzb bih mne aze bul alb hrv geo ukr rus rom kaz mda mkd arm kgz hun lva est cze ltu svk
svn, ll vce(cluster countrysect)

Tobit regression                                  Number of obs   =      10609
                                                  F(  49,  10560) =      34.37
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -17959.271                 Pseudo R2       =     0.0671

                            (Std. Err. adjusted for 202 clusters in countrysect)
--------------------------------------------------------------------------------
               |               Robust
        expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
---------------+----------------------------------------------------------------
       newprod |   5.600191   1.789206     3.13   0.002     2.093009    9.107373
      1.upprod |  -3.399595   12.37422    -0.27   0.784    -27.65541    20.85622
         trans |   8.221404    7.54535     1.09   0.276    -6.568905    23.01171
upprod#c.trans |
            1  |   2.631551   3.610534     0.73   0.466    -4.445777     9.70888
       procinn |   3.850037   1.964804     1.96   0.050    -.0013493    7.701424
           uni |   .1853735   .0375553     4.94   0.000      .111758     .258989
       skilled |   .0901448   .0296316     3.04   0.002     .0320613    .1482282
          size |   .0293214   .0035892     8.17   0.000      .022286    .0363569
        sizesq |  -3.33e-06   6.43e-07    -5.19   0.000    -4.59e-06   -2.07e-06
           age |   .5151103    .091422     5.63   0.000      .335906    .6943146
         agesq |  -.0026308   .0007344    -3.58   0.000    -.0040703   -.0011914
        forown |   .3447837   .0375036     9.19   0.000     .2712696    .4182978
        busass |   16.29219   2.624069     6.21   0.000     11.14852    21.43586
        businf |   12.43306    2.33863     5.32   0.000     7.848908    17.01722
     largecity |  -1.003181   2.087912    -0.48   0.631    -5.095882     3.08952
        impint |   .3813569   .0342275    11.14   0.000     .3142646    .4484492
   infrastruct |  -1.098106   3.571946    -0.31   0.759    -8.099794    5.903582
```

accessfin	4.640136	1.969236	2.36	0.018	.7800628	8.50021
weaklaw	-7.898933	1.790944	-4.41	0.000	-11.40952	-4.388344
macobst	6.456588	1.808596	3.57	0.000	2.911398	10.00178
sectorspill	86.77918	8.810151	9.85	0.000	69.50962	104.0487
gdpcap1	.001902	.0012147	1.57	0.117	-.0004791	.0042831
gdpcap1sq	-2.07e-10	2.67e-09	-0.08	0.938	-5.45e-09	5.03e-09
y05	-6.516818	3.73302	-1.75	0.081	-13.83424	.8006059
blr	18.00124	14.7296	1.22	0.222	-10.87155	46.87404
tjk	8.659592	10.81098	0.80	0.423	-12.53197	29.85115
uzb	14.60226	10.509	1.39	0.165	-5.997363	35.20188
bih	3.500192	8.193626	0.43	0.669	-12.56086	19.56124
mne	-19.89734	15.83932	-1.26	0.209	-50.94541	11.15072
aze	-10.39141	9.022823	-1.15	0.249	-28.07784	7.295026
bul	1.348945	9.099282	0.15	0.882	-16.48736	19.18525
alb	8.025254	11.86107	0.68	0.499	-15.22468	31.27519
hrv	-15.09673	10.62997	-1.42	0.156	-35.93347	5.740012
geo	6.2706	10.46364	0.60	0.549	-14.2401	26.7813
ukr	-6.109035	8.022593	-0.76	0.446	-21.83483	9.616761
rus	-9.142171	7.149015	-1.28	0.201	-23.15559	4.871247
rom	-.8443077	8.289424	-0.10	0.919	-17.09314	15.40453
kaz	-8.564345	5.928917	-1.44	0.149	-20.18614	3.057451
mda	12.92352	7.52115	1.72	0.086	-1.819349	27.6664
mkd	14.89827	11.70906	1.27	0.203	-8.053693	37.85023
arm	.1209158	9.282021	0.01	0.990	-18.0736	18.31543
kgz	-11.39069	10.0453	-1.13	0.257	-31.08137	8.299987
hun	19.85459	9.124374	2.18	0.030	1.969093	37.74008
lva	-8.423911	11.33093	-0.74	0.457	-30.63468	13.78686
est	8.213642	9.288756	0.88	0.377	-9.994071	26.42136
cze	17.49907	9.891433	1.77	0.077	-1.890004	36.88815
ltu	10.28806	15.89695	0.65	0.518	-20.87296	41.44909
svk	-11.33925	11.0437	-1.03	0.305	-32.98698	10.30848
svn	20.2273	13.34553	1.52	0.130	-5.932453	46.38705
_cons	-171.3296	25.12529	-6.82	0.000	-220.5799	-122.0793
/sigma	54.11337	1.811414			50.56266	57.66408

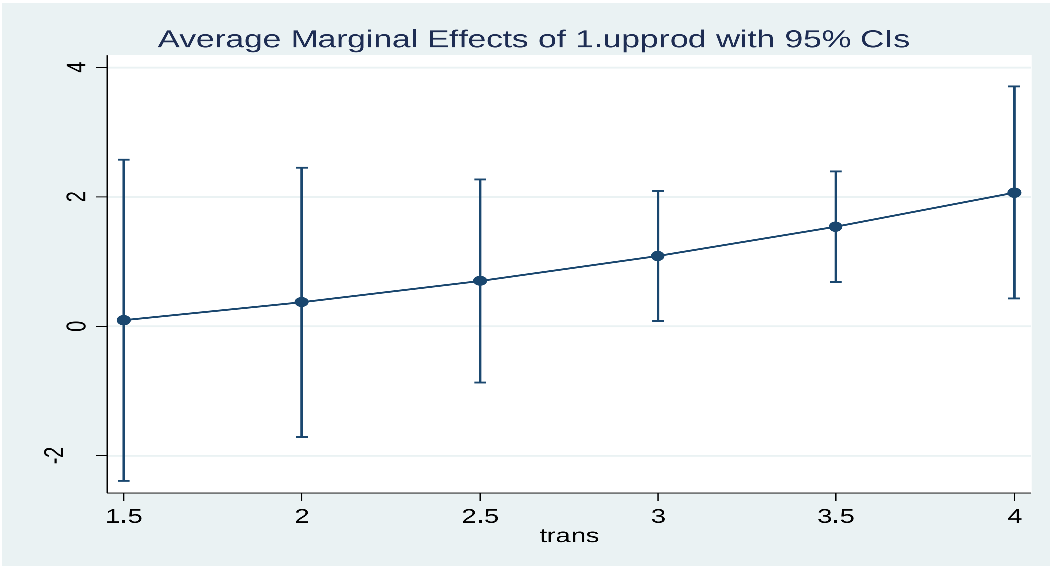
```
  Obs. summary:       7795  left-censored observations at expint<=0
                      2814     uncensored observations
                         0 right-censored observations
```

A4.11.4a POOLED1 Tobit unconditional marginal effects of *upprod* across transition scores

```
. margins, dydx(upprod) at (trans=(1.5,2,2.5,3,3.5,4)) predict (ystar(0,.))

Average marginal effects                          Number of obs   =      10609
Model VCE    : Robust
Expression   : E(expint*|expint>0), predict(ystar(0,.))
dy/dx w.r.t. : 1.upprod
1._at        : trans           =         1.5
2._at        : trans           =           2
3._at        : trans           =         2.5
4._at        : trans           =           3
5._at        : trans           =         3.5
6._at        : trans           =           4
```

	dy/dx	Delta-method Std. Err.	z	P>|z|	[95% Conf.	Interval]
1.upprod						
_at						
1	.0984506	1.266962	0.08	0.938	-2.38475	2.581651
2	.3713622	1.061277	0.35	0.726	-1.708703	2.451427
3	.6998387	.8001076	0.87	0.382	-.8683434	2.268021
4	**1.088906**	**.5141503**	**2.12**	**0.034**	**.0811905**	**2.096622**
5	**1.54335**	**.4355655**	**3.54**	**0.000**	**.6896571**	**2.397043**
6	**2.067597**	**.8361958**	**2.47**	**0.013**	**.4286834**	**3.706511**

```
------------------------------------------------------------------------------
Note: dy/dx for factor levels is the discrete change from the base level.

. marginsplot
  Variables that uniquely identify margins: trans
```



A4.11.5 POOLED1 Tobit estimation using interaction term *upprod#stages*

upprod - significantly improved or upgraded products in the 36 months prior to the survey
stages - Index of stages of transition: 1 for Laggard, 2 for Medium and 3 for Advanced stage of transition

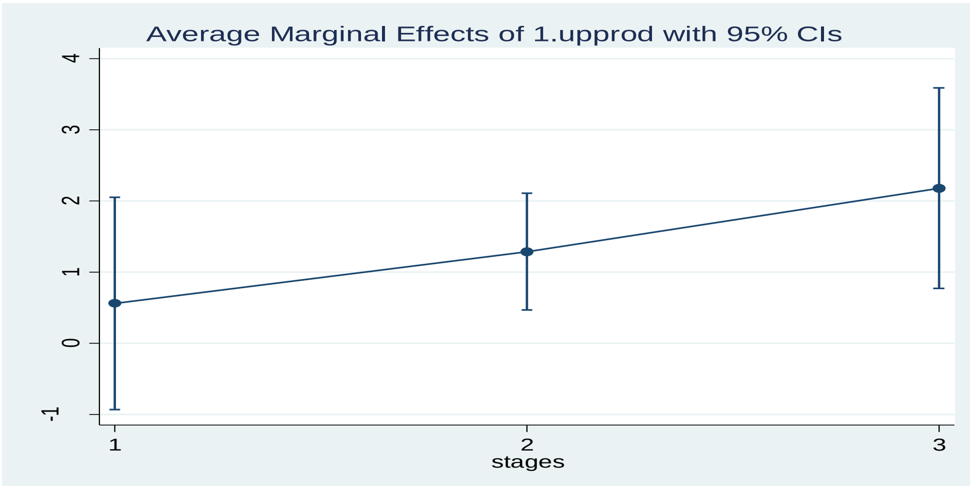
```
. tobit expint newprod i.upprod##c.stages procinn uni skilled size sizesq age agesq forown busass
businf largecity impint infrastruct accessfin weaklaw macobst sectorspill gdpcap1 gdpcap1sq y05
blr tjk uzb bih mne aze bul alb hrv geo ukr rus rom kaz mda mkd arm kgz hun lva est cze ltu svk
svn, ll vce(cluster countrysect)
Tobit regression                                  Number of obs   =      10609
                                                  F(  49,  10560) =      34.13
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -17958.672                 Pseudo R2       =     0.0671
                             (Std. Err. adjusted for 202 clusters in countrysect)
---------------------------------------------------------------------------------
                |               Robust
         expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
----------------+----------------------------------------------------------------
        newprod |   5.533927   1.792775     3.09   0.002     2.019749    9.048105
       1.upprod |  -.1195185   5.545024    -0.02   0.983    -10.98881    10.74977
         stages |   4.709418   4.697828     1.00   0.316    -4.499212    13.91805
upprod#c.stages |
             1  |   2.595892   2.360132     1.10   0.271    -2.030413    7.222196
        procinn |   3.888557   1.961664     1.98   0.047     .0433253    7.733788
            uni |   .1852721   .0375088     4.94   0.000     .1117479    .2587964
        skilled |   .0895997   .0295137     3.04   0.002     .0317473    .1474521
           size |   .0293205     .00359     8.17   0.000     .0222834    .0363577
         sizesq |  -3.33e-06   6.44e-07    -5.18   0.000    -4.60e-06   -2.07e-06
            age |   .5136387   .0909068     5.65   0.000     .3354442    .6918333
          agesq |  -.0026205   .0007293    -3.59   0.000      -.00405   -.0011909
         forown |   .3446046     .03755     9.18   0.000     .2709995    .4182097
         busass |   16.31637   2.620847     6.23   0.000     11.17902    21.45372
         businf |   12.45974   2.329926     5.35   0.000     7.892645    17.02683
      largecity |  -.9937368   2.084448    -0.48   0.634    -5.079648    3.092174
         impint |   .3813233   .0341703    11.16   0.000     .3143431    .4483035
```

```
    infrastruct |  -1.137955   3.577457    -0.32   0.750    -8.150447    5.874536
      accessfin |   4.612941   1.972563     2.34   0.019     .7463455    8.479536
        weaklaw |  -7.877777   1.793556    -4.39   0.000    -11.39348    -4.36207
        macobst |   6.486869   1.804651     3.59   0.000     2.949413    10.02433
    sectorspill |   87.00921   8.760851     9.93   0.000     69.83629    104.1821
        gdpcap1 |   .0017135   .0012775     1.34   0.180    -.0007906    .0042176
      gdpcap1sq |  -3.47e-10   2.62e-09    -0.13   0.895    -5.48e-09    4.78e-09
            y05 |  -5.264601   3.866124    -1.36   0.173    -12.84293    2.313732
            blr |     9.9742   11.71202     0.85   0.394    -12.98358    32.93198
            tjk |   9.318178   10.99392     0.85   0.397    -12.23199    30.86834
            uzb |   10.98173   9.399287     1.17   0.243    -7.442649     29.4061
            bih |   3.149864   8.103738     0.39   0.698    -12.73499    19.03472
            mne |  -18.63972     16.119    -1.16   0.248    -50.23599    12.95655
            aze |  -8.961226    9.32269    -0.96   0.336    -27.23546    9.313005
            bul |    3.36823   8.865432     0.38   0.704    -14.00969    20.74615
            alb |   7.550338   11.88659     0.64   0.525    -15.74963    30.85031
            hrv |  -11.98534   10.66476    -1.12   0.261    -32.89028    8.919607
            geo |   6.686745   10.39332     0.64   0.520    -13.68613    27.05962
            ukr |  -7.684064   8.186435    -0.94   0.348    -23.73102    8.362892
            rus |  -9.835669   7.178764    -1.37   0.171     -23.9074    4.236063
            rom |  -.1415374   8.231551    -0.02   0.986    -16.27693    15.99386
            kaz |    -10.562   6.010313    -1.76   0.079    -22.34335    1.219345
            mda |   11.22127    7.63831     1.47   0.142    -3.751256     26.1938
            mkd |   15.06001   11.69156     1.29   0.198    -7.857647    37.97768
            arm |   1.164147   8.976961     0.13   0.897    -16.43239    18.76068
            kgz |   -11.1158   9.996492    -1.11   0.266    -30.71082    8.479206
            hun |    21.5412    8.67416     2.48   0.013     4.538214     38.5442
            lva |  -7.040905   11.10611    -0.63   0.526    -28.81098    14.72917
            est |   9.100565   8.902979     1.02   0.307    -8.350954    26.55208
            cze |   17.62256   9.869989     1.79   0.074    -1.724485     36.9696
            ltu |   10.15918   15.88921     0.64   0.523    -20.98666    41.30502
            svk |  -10.15683   10.64195    -0.95   0.340    -31.01706     10.7034
            svn |   25.31267   14.14861     1.79   0.074    -2.421272    53.04661
          _cons |  -153.9396   12.64216   -12.18   0.000    -178.7206   -129.1586
----------------+----------------------------------------------------------------
         /sigma |   54.10841     1.8115                      50.55753     57.6593
---------------------------------------------------------------------------------
  Obs. summary:       7795  left-censored observations at expint<=0
                      2814     uncensored observations
                         0 right-censored observations
```

A4.11.5a POOLED1 Tobit unconditional marginal effects of *upprod* across stages of transition

```
. margins, dydx(upprod) at (stages=(1,2,3)) predict (ystar(0,.))

Average marginal effects                          Number of obs   =      10609
Model VCE    : Robust
Expression   : E(expint*|expint>0), predict(ystar(0,.))
dy/dx w.r.t. : 1.upprod
1._at        : stages          =           1
2._at        : stages          =           2
3._at        : stages          =           3
------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
1.upprod     |
         _at |
          1  |   .5579438   .7612664     0.73   0.464    -.9341109    2.049999
          2  |   1.287081   .4190602     3.07   0.002      .465738    2.108424
          3  |   2.178635   .7188123     3.03   0.002     .7697887    3.587481
```

```
------------------------------------------------------------------------------
Note: dy/dx for factor levels is the discrete change from the base level.

. marginsplot

  Variables that uniquely identify margins: stages
```



A4.11.6 POOLED1 Tobit estimation for Advanced Stage of Transition using interaction term *newprod#upprod*

newprod - newly introduced products in the 36 months prior to the survey
upprod - significantly improved or upgraded products in the 36 months prior to the survey

```
tobit expint i.newprod##i.upprod procinn uni skilled size sizesq age agesq forown busass businf
largecity impint infrastruct accessfin weaklaw macobst sectorspill gdpcap1 gdpcap1sq y05 est cze
hun lva ltu svk if trans>3.7, ll vce(cluster countrysect)

Tobit regression                                  Number of obs   =       2785
                                                  F(  29,   2756) =      95.73
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -5551.6838                 Pseudo R2       =     0.0640

                             (Std. Err. adjusted for 53 clusters in countrysect)
--------------------------------------------------------------------------------
               |               Robust
        expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
---------------+----------------------------------------------------------------
     1.newprod |   9.495233    4.76898     1.99   0.047     .1440964    18.84637
      1.upprod |   5.398405   2.822103     1.91   0.056    -.1352445    10.93205
newprod#upprod |
          1 1  |  -1.597172   5.067924    -0.32   0.753    -11.53448    8.340141
               |
       procinn |   2.016625   2.577293     0.78   0.434    -3.036996    7.070246
           uni |   .1443131   .0591718     2.44   0.015     .0282876    .2603387
       skilled |   .1254567   .0480637     2.61   0.009     .0312122    .2197012
          size |   .0190448   .0073748     2.58   0.010     .0045841    .0335054
```

```
     sizesq |  -2.59e-06   1.00e-06    -2.58   0.010    -4.56e-06   -6.23e-07
        age |   .4937247   .1875787     2.63   0.009     .1259156    .8615339
      agesq |  -.0031637   .0017842    -1.77   0.076    -.0066621    .0003348
     forown |   .2687402   .0564846     4.76   0.000     .1579837    .3794967
     busass |   8.888969   4.405685     2.02   0.044     .2501913    17.52775
     businf |   15.75267   4.811041     3.27   0.001     6.319065    25.18628
  largecity |  -6.078583    3.15357    -1.93   0.054    -12.26218    .1050156
     impint |   .5098731   .0434744    11.73   0.000     .4246275    .5951187
infrastruct |  -5.135878   5.883097    -0.87   0.383     -16.6716    6.399846
  accessfin |   2.792251   2.742336     1.02   0.309     -2.58499    8.169492
    weaklaw |  -6.304658   1.789634    -3.52   0.000    -9.813816   -2.795499
    macobst |   14.09284   2.805179     5.02   0.000      8.59237     19.5933
sectorspill |   104.1272   15.31592     6.80   0.000      74.0954    134.1591
    gdpcap1 |   .0187741   .0109599     1.71   0.087    -.0027164    .0402645
  gdpcap1sq |  -1.19e-06   5.73e-07    -2.07   0.038    -2.31e-06   -6.31e-08
        y05 |   4.136489   10.16165     0.41   0.684    -15.78873     24.0617
        est |   25.07737   8.663329     2.89   0.004     8.090092    42.06464
        cze |     29.126   11.29903     2.58   0.010     6.970592    51.28142
        hun |   26.65659   10.52162     2.53   0.011     6.025534    47.28764
        lva |  -11.93892   7.218334    -1.65   0.098    -26.09281    2.214974
        ltu |   20.04622   17.76594     1.13   0.259    -14.78969    54.88212
        svk |  -6.974297   10.18466    -0.68   0.494    -26.94464    12.99605
      _cons |  -209.3999    36.0763    -5.80   0.000    -280.1392   -138.6606
------------+----------------------------------------------------------------
     /sigma |   47.33586   1.814187                      43.77856    50.89317
-----------------------------------------------------------------------------
  Obs. summary:       1877  left-censored observations at expint<=0
                       908     uncensored observations
                         0 right-censored observations
```

A4.11.6a POOLED1 Advanced Stage of Transition - Tobit unconditional marginal effects of *newprod* and *upprod*

```
. margins, dydx(_all) predict (ystar(0,.))

Average marginal effects                          Number of obs   =       2785
Model VCE    : Robust

Expression   : E(expint*|expint>0), predict(ystar(0,.))
dy/dx w.r.t. : 1.newprod 1.upprod procinn uni skilled size sizesq age agesq forown busass businf
largecity impint infrastruct accessfin weaklaw macobst sectorspill gdpcap1 gdpcap1sq y05 est cze
hun lva ltu svk

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   1.newprod |   2.753859   .9877922     2.79   0.005      .817822    4.689896
    1.upprod |   1.467987   .7841513     1.87   0.061    -.0689208    3.004896
------------------------------------------------------------------------------
Note: dy/dx for factor levels is the discrete change from the base level.
```

A4.11.7 POOLED2 Tobit estimation for Advanced Stage of Transition using interaction term *newprod#upprod*

newprod - newly introduced products in the 36 months prior to the survey
upprod - significantly improved or upgraded products in the 36 months prior to the survey

```
. tobit expint i.newprod##i.upprod uni size sizesq age agesq forown largecity gdpcap1 gdpcap1sq
infrastruct accessfin weaklaw sectorspill pol est cze hun lva ltu svk y08 y05 if trans>3.7, ll
vce(cluster countrysect)

Tobit regression                                  Number of obs   =       5268
                                                  F(  25,   5243) =      32.57
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -10898.083                 Pseudo R2       =     0.0367

                             (Std. Err. adjusted for 63 clusters in countrysect)
--------------------------------------------------------------------------------
               |               Robust
        expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
---------------+----------------------------------------------------------------
     1.newprod |   15.95813   4.536782     3.52   0.000     7.064144    24.85211
      1.upprod |    7.47679   2.706388     2.76   0.006     2.171142    12.78244
newprod#upprod |
          1 1  |  -4.200451   4.335194    -0.97   0.333    -12.69924    4.298335
           uni |   .1122731   .0496866     2.26   0.024     .0148667    .2096795
          size |   .0314225   .0068065     4.62   0.000     .0180789    .0447661
        sizesq |  -4.36e-06   1.17e-06    -3.71   0.000    -6.66e-06   -2.06e-06
           age |   .6368914   .1396993     4.56   0.000     .3630227    .9107602
         agesq |  -.0040704   .0011938    -3.41   0.001    -.0064108   -.0017301
        forown |   .4556221   .0372544    12.23   0.000     .3825881    .5286562
     largecity |  -4.896178    2.76462    -1.77   0.077    -10.31598    .5236287
       gdpcap1 |   .0011074   .0064387     0.17   0.863    -.0115152      .01373
     gdpcap1sq |  -3.21e-08   2.42e-07    -0.13   0.895    -5.07e-07    4.43e-07
   infrastruct |  -1.506153   5.652088    -0.27   0.790     -12.5866    9.574294
     accessfin |   5.078112   2.133968     2.38   0.017     .8946459    9.261579
       weaklaw |  -11.49064   2.173667    -5.29   0.000    -15.75194   -7.229351
   sectorspill |   105.0226   19.33914     5.43   0.000     67.10979    142.9353
           pol |  -10.68179   25.34412    -0.42   0.673    -60.36681    39.00324
           est |  -.4593179   29.47008    -0.02   0.988    -58.23296    57.31432
           cze |   8.082547   35.59454     0.23   0.820    -61.69758    77.86268
           hun |   8.560208   30.43825     0.28   0.779    -51.11144    68.23186
           lva |  -16.93369   25.15744    -0.67   0.501    -66.25275    32.38537
           ltu |  -1.505848   26.14775    -0.06   0.954    -52.76634    49.75464
           svk |  -8.122818   33.61606    -0.24   0.809    -74.02429    57.77866
           y08 |  -15.03657   27.45524    -0.55   0.584    -68.86028    38.78713
           y05 |   3.157579   11.34847     0.28   0.781    -19.09015     25.4053
         _cons |  -121.2508   27.98143    -4.33   0.000    -176.1061   -66.39554
---------------+----------------------------------------------------------------
        /sigma |   54.91435   1.833612                      51.31971    58.50899
--------------------------------------------------------------------------------
  Obs. summary:       3555  left-censored observations at expint<=0
                      1713     uncensored observations
                         0 right-censored observations
```

A4.11.7a POOLED2 Tobit unconditional marginal effects of *newprod* and *upprod*

```
. margins, dydx(_all) predict (ystar(0,.))

Average marginal effects                          Number of obs   =       5268
Model VCE    : Robust

Expression   : E(expint*|expint>0), predict(ystar(0,.))
dy/dx w.r.t. : 1.newprod 1.upprod uni size sizesq age agesq forown largecity gdpcap1 gdpcap1sq
infrastruct accessfin weaklaw sectorspill pol est cze hun lva ltu svk y08 y05

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   1.newprod |   4.277302   .9168743     4.67   0.000     2.480261    6.074342
    1.upprod |    1.65873   .7420001     2.24   0.025     .2044365    3.113023
------------------------------------------------------------------------------
Note: dy/dx for factor levels is the discrete change from the base level.
```

CHAPTER V APPENDICES

The impact of innovation and business environment factors on firm's export performance in Kosovo

Chapter V Appendices

A5.1 Kosovo data 2013 - Correlation matrix

```
. corr expint uni prodinn procinn size sizesq busass foreign weaklaw costfin macobst sectorspill capital
(obs=450)
```

	expint	uni	prodinn	procinn	size	sizesq	busass	foreign	weaklaw	costfin	macobst	sectorpil	capital
expint	1.000												
uni	0.119	1.000											
prodinn	0.034	-0.037	1.000										
procinn	-0.033	0.050	0.474	1.000									
size	-0.024	-0.045	0.066	0.050	1.000								
sizesq	-0.022	-0.017	-0.029	-0.020	0.936	1.000							
busass	-0.032	0.016	0.105	0.066	0.226	0.137	1.000						
foreign	0.127	-0.024	0.040	0.034	0.035	-0.002	0.048	1.000					
weaklaw	0.028	-0.067	0.026	-0.060	-0.013	-0.038	0.107	0.050	1.000				
costfin	0.181	0.033	-0.011	-0.084	-0.020	-0.046	0.073	0.002	0.180	1.000			
macobst	0.181	-0.017	0.018	-0.076	-0.020	-0.044	0.078	0.002	0.336	0.311	1.000		
sectorspill	0.112	-0.005	0.222	0.139	0.039	-0.028	0.110	-0.008	0.115	0.169	0.120	1.000	
capital	0.155	0.157	0.120	0.155	0.104	0.075	-0.047	0.024	0.019	0.129	-0.052	0.125	1.000

A5.2 Model estimations

A5.2.1 Tobit estimation - Specification 1

```
. tobit expint uni novelty procinn size sizesq busass foreign weaklaw costfin macobst sectorspill
capital, ll vce(cluster sectorregion)

Tobit regression                                  Number of obs   =        448
                                                  F(  12,    436) =       4.89
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -716.91281                 Pseudo R2       =     0.0305

                          (Std. Err. adjusted for 18 clusters in sectorregion)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         uni |   .3383373   .1175085     2.88   0.004     .1073839    .5692908
     novelty |   20.58471   9.808527     2.10   0.036     1.306837    39.86259
     procinn |  -18.80971   15.50043    -1.21   0.226    -49.27456    11.65514
        size |   1.910112    .929302     2.06   0.040     .0836434    3.736581
      sizesq |  -.0235265   .0119085    -1.98   0.049    -.0469317   -.0001214
      busass |  -6.222604   15.90968    -0.39   0.696     -37.4918    25.04659
     foreign |   .4743236   .3456345     1.37   0.171    -.2049932    1.153641
     weaklaw |  -6.125834   10.36651    -0.59   0.555    -26.50037     14.2487
     costfin |   20.09501   14.69207     1.37   0.172    -8.781069    48.97109
     macobst |   30.34058   14.39098     2.11   0.036     2.056266     58.6249
 sectorspill |    .548902   .4394144     1.25   0.212    -.3147318    1.412536
     capital |   17.72846   8.786429     2.02   0.044     .4594409    34.99748
       _cons |  -120.2303   34.43294    -3.49   0.001    -187.9055   -52.55513
-------------+----------------------------------------------------------------
      /sigma |   72.09248   4.975359                      62.31381    81.87115
------------------------------------------------------------------------------
  Obs. summary:        345  left-censored observations at expint<=0
                       103     uncensored observations
                         0 right-censored observations
```

A5.2.1.a Tobit unconditional marginal effects – Specification 1

```
. mfx compute, predict (ystar(0,.))

Marginal effects after tobit
      y  = E(expint*|expint>0) (predict, ystar(0,.))
         =  6.4700172
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
     uni |   .0569627      .01528    3.73   0.000   .027022  .086904   5.79793
 novelty*|   3.913993     2.09856    1.87   0.062  -.199101  8.02709    .21875
 procinn*|  -2.893754     2.31615   -1.25   0.212  -7.43333  1.64582   .261161
    size |   .3215878      .08717    3.69   0.000   .150745   .49243   8.37946
  sizesq |  -.0039609      .00115   -3.44   0.001  -.006219 -.001703    830.33
  busass*|  -.9994143     2.42479   -0.41   0.680  -5.75192   3.7531   .133929
 foreign |   .0798575      .05297    1.51   0.132  -.023968  .183683   3.29464
 weaklaw*|   -1.01899     1.80513   -0.56   0.572  -4.55699  2.51901   .401786
 costfin*|   3.389473     2.92321    1.16   0.246  -2.33992  9.11887   .506696
```

```
 macobst*|   5.154849     2.09828    2.46   0.014    1.0423   9.2674   .502232
sector~l |   .0924135      .06905    1.34   0.181  -.042919  .227746   42.9293
 capital*|   3.195397     1.21477    2.63   0.009     .8145  5.57629   .321429
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

A5.2.1.b Probit estimation – Specification 1

```
Probit regression                                 Number of obs   =        448
                                                  Wald chi2(12)   =      47.60
                                                  Prob > chi2     =     0.0000
Log pseudolikelihood = -221.09988                 Pseudo R2       =     0.0847

                          (Std. Err. adjusted for 18 clusters in sectorregion)
------------------------------------------------------------------------------
             |               Robust
    exporter |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         uni |   .0038479   .0013219     2.91   0.004      .001257    .0064389
     novelty |   .3458007   .1587138     2.18   0.029     .0347273    .6568741
     procinn |  -.2285534   .2207991    -1.04   0.301    -.6613117    .2042048
        size |   .0409138   .0117306     3.49   0.000     .0179223    .0639053
      sizesq |  -.0004317    .000151    -2.86   0.004    -.0007276   -.0001358
      busass |  -.1020566   .2463633    -0.41   0.679    -.5849197    .3808066
     foreign |   .0042849   .0048736     0.88   0.379    -.0052672     .013837
     weaklaw |  -.0557726   .1485276    -0.38   0.707    -.3468813    .2353362
     costfin |   .2499256    .187349     1.33   0.182    -.1172717    .6171229
     macobst |   .3944261   .1930765     2.04   0.041     .0160031    .7728491
 sectorspill |   .0064126   .0061848     1.04   0.300    -.0057093    .0185345
     capital |   .1289237   .1387242     0.93   0.353    -.1429706    .4008181
       _cons |  -1.674811   .4309747    -3.89   0.000    -2.519506   -.8301159
```

A5.2.2 Tobit estimation - Specification 2

```
. tobit expint uni prodno procinn size sizesq busass foreign weaklaw costfin macobst sectorspill
capital, ll vce(cluster sectorregion)

Tobit regression                                  Number of obs   =        442
                                                  F(  12,    430) =       7.10
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -691.84968                 Pseudo R2       =     0.0334

                          (Std. Err. adjusted for 18 clusters in sectorregion)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         uni |   .3647739   .1146841     3.18   0.002     .1393627    .5901851
      prodno |   2.466897    .550211     4.48   0.000      1.38546    3.548335
     procinn |  -14.12561   13.79621    -1.02   0.306    -41.24201    12.99078
        size |   2.012141     1.1482     1.75   0.080    -.2446409    4.268923
      sizesq |  -.0294069   .0136582    -2.15   0.032    -.0562521   -.0025617
      busass |  -6.732997   16.66986    -0.40   0.686    -39.49754    26.03154
     foreign |   .5418432   .3756327     1.44   0.150    -.1964616    1.280148
     weaklaw |  -4.383599   9.677826    -0.45   0.651    -23.40533    14.63813
     costfin |   21.25473    14.8691     1.43   0.154    -7.970419    50.47989
     macobst |   30.68469   15.16124     2.02   0.044     .8853283    60.48404
 sectorspill |   .4949143   .4375276     1.13   0.259    -.3650446    1.354873
```

```
     capital |   15.37233    8.38064     1.83   0.067    -1.099785    31.84445
       _cons |  -122.8828   34.20274    -3.59   0.000    -190.1082   -55.65744
-------------+----------------------------------------------------------------
      /sigma |   73.17521   5.124264                      63.10349    83.24693
------------------------------------------------------------------------------
  Obs. summary:        343  left-censored observations at expint<=0
                        99     uncensored observations
                         0 right-censored observations
```

A5.2.2.a Tobit unconditional marginal effects – Specification 2

```
. mfx compute, predict (ystar(0,.))

Marginal effects after tobit
      y  = E(expint*|expint>0) (predict, ystar(0,.))
         =  5.7064122
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
     uni |   .0548799      .01501    3.66   0.000   .025458  .084301   5.87663
  prodno |   .3711426      .11455    3.24   0.001   .146624  .595661   2.19683
 procinn*|  -1.979961     1.92315   -1.03   0.303  -5.74927  1.78934   .257919
    size |   .3027249      .09309    3.25   0.001   .120273  .485177   8.15837
  sizesq |  -.0044242      .00095   -4.66   0.000  -.006284 -.002565   829.982
  busass*|  -.9614229     2.20632   -0.44   0.663  -5.28573  3.36289   .133484
 foreign |   .0815198      .05664    1.44   0.150  -.029491   .19253   3.11312
 weaklaw*|  -.6535786     1.49776   -0.44   0.663  -3.58913  2.28197   .400452
 costfin*|    3.20274     2.76072    1.16   0.246  -2.20817  8.61365    .50905
 macobst*|   4.677397     2.08055    2.25   0.025   .599593   8.7552   .497738
sector~l |   .0744594      .06166    1.21   0.227  -.046387  .195306   42.8158
 capital*|   2.457053     1.01714    2.42   0.016   .463487  4.45062   .321267
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

A5.2.2.b Probit estimation – Specification 2

```
Probit regression                                 Number of obs   =        442
                                                  Wald chi2(12)   =      72.67
                                                  Prob > chi2     =     0.0000
Log pseudolikelihood = -213.32528                 Pseudo R2       =     0.0926

                          (Std. Err. adjusted for 18 clusters in sectorregion)
------------------------------------------------------------------------------
             |               Robust
    exporter |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         uni |   .0043109   .0013836     3.12   0.002     .0015992    .0070227
      prodno |    .041997   .0101845     4.12   0.000     .0220357    .0619582
     procinn |  -.1575203   .1945223    -0.81   0.418     -.538777    .2237364
        size |   .0410552   .0157281     2.61   0.009     .0102287    .0718817
      sizesq |  -.0004855   .0001897    -2.56   0.010    -.0008574   -.0001137
      busass |  -.0992589   .2509733    -0.40   0.692    -.5911575    .3926396
     foreign |   .0053301   .0052079     1.02   0.306    -.0048773    .0155375
     weaklaw |  -.0170817   .1325701    -0.13   0.897    -.2769144    .2427509
     costfin |   .2682246    .190808     1.41   0.160    -.1057522    .6422014
     macobst |   .3931641    .199458     1.97   0.049     .0022337    .7840946
 sectorspill |   .0052529   .0058994     0.89   0.373    -.0063096    .0168155
     capital |   .0754098   .1351232     0.56   0.577    -.1894269    .3402465
       _cons |  -1.681251   .4249777    -3.96   0.000    -2.514192   -.8483098
------------------------------------------------------------------------------
```

A5.2.3 Tobit estimation - Specification 3

```
. tobit expint uni prodinn procinn size sizesq busass foreign weaklaw costfin macobst sectorspill
capital, ll vce(cluster sectorregion)

Tobit regression                                  Number of obs   =        450
                                                  F(  12,    438) =       4.25
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -717.46367                 Pseudo R2       =     0.0305

                          (Std. Err. adjusted for 18 clusters in sectorregion)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         uni |   .3689314   .1160306     3.18   0.002     .1408854    .5969774
     prodinn |   17.36466   9.956673     1.74   0.082    -2.204133    36.93346
     procinn |  -20.23508   13.94539    -1.45   0.147    -47.64329     7.17312
        size |   2.022257   .8570511     2.36   0.019     .3378129    3.706701
      sizesq |  -.0234581   .0109871    -2.14   0.033     -.045052   -.0018642
      busass |  -8.313215   16.23643    -0.51   0.609    -40.22421    23.59778
     foreign |   .4926518   .3504781     1.41   0.161     -.196176     1.18148
     weaklaw |  -6.039488   10.69295    -0.56   0.572    -27.05537    14.97639
     costfin |    21.3176   15.49156     1.38   0.170    -9.129424    51.76463
     macobst |   31.45493   14.15659     2.22   0.027     3.631641    59.27822
 sectorspill |   .5239678   .4531147     1.16   0.248    -.3665816    1.414517
     capital |   16.95283   8.724996     1.94   0.053     -.195233    34.10089
       _cons |  -123.9067   35.93415    -3.45   0.001    -194.5315   -53.28189
-------------+----------------------------------------------------------------
      /sigma |    72.4827   5.069108                      62.5199     82.4455
------------------------------------------------------------------------------
  Obs. summary:        347  left-censored observations at expint<=0
                       103     uncensored observations
                         0 right-censored observations
```

A5.2.3.a Tobit unconditional marginal effects – Specification 3

```
. mfx compute, predict (ystar(0,.))

Marginal effects after tobit
      y  = E(expint*|expint>0) (predict, ystar(0,.))
         =  6.4904892
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
     uni |   .0620029      .01358    4.56   0.000   .035379  .088627   5.77216
 prodinn*|   3.015052      1.2637    2.39   0.017   .538249  5.49185   .417778
 procinn*|  -3.087001     1.93379   -1.60   0.110  -6.87716  .703159       .26
    size |    .339862      .07165    4.74   0.000    .19944  .480284   8.35778
  sizesq |  -.0039424        .001   -3.95   0.000  -.005898 -.001986   826.704
  busass*|  -1.312186     2.38078   -0.55   0.582  -5.97844  3.35407   .133333
 foreign |   .0827954      .05357    1.55   0.122  -.022207  .187798      3.28
 weaklaw*|  -1.002833     1.84188   -0.54   0.586  -4.61284  2.60718        .4
 costfin*|   3.590688     3.07212    1.17   0.242  -2.43055  9.61192   .506667
 macobst*|   5.345686     2.02025    2.65   0.008   1.38608   9.3053        .5
sector~l |   .0880584      .07291    1.21   0.227   -.05484  .230957   42.8928
 capital*|   3.038985     1.24578    2.44   0.015   .597307  5.48066   .322222
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

A5.2.3.b Probit estimation – Specification 3

```
Probit regression                                 Number of obs   =        450
                                                  Wald chi2(12)   =      69.97
                                                  Prob > chi2     =     0.0000
Log pseudolikelihood =  -220.7602                 Pseudo R2       =     0.0880

                          (Std. Err. adjusted for 18 clusters in sectorregion)
```

exporter	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
uni	.0044315	.0012784	3.47	0.001	.0019259	.0069371
prodinn	.3595854	.1517442	2.37	0.018	.0621722	.6569987
procinn	-.290384	.1967003	-1.48	0.140	-.6759095	.0951415
size	.04116	.0110109	3.74	0.000	.019579	.062741
sizesq	-.0004156	.0001397	-2.98	0.003	-.0006893	-.0001419
busass	-.130719	.2529523	-0.52	0.605	-.6264964	.3650584
foreign	.0045252	.0047987	0.94	0.346	-.0048801	.0139305
weaklaw	-.0557406	.15178	-0.37	0.713	-.3532239	.2417427
costfin	.2726058	.1979402	1.38	0.168	-.1153498	.6605614
macobst	.4078572	.1884234	2.16	0.030	.0385541	.7771603
sectorspill	.0055049	.0060612	0.91	0.364	-.0063749	.0173847
capital	.1131708	.1395279	0.81	0.417	-.1602988	.3866405
_cons	-1.718389	.4432567	-3.88	0.000	-2.587156	-.8496214

A5.3 Tobit estimation – alternative specifications for innovation variables

A5.3.1 Tobit estimation Specification (1a)

```
. tobit expint uni procinn size sizesq busass foreign weaklaw costfin macobst sectorspill capital,
ll vce(cluster sectorregion)

Tobit regression                                  Number of obs   =        450
                                                  F(  11,    439) =       4.64
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -718.80267                 Pseudo R2       =     0.0286

                          (Std. Err. adjusted for 18 clusters in sectorregion)
```

expint	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
uni	.3525697	.1129844	3.12	0.002	.1305121	.5746273
procinn	-13.21597	13.41375	-0.99	0.325	-39.57911	13.14718
size	2.279197	.964229	2.36	0.019	.3841181	4.174275
sizesq	-.0258976	.012093	-2.14	0.033	-.049665	-.0021301
busass	-7.698926	15.67733	-0.49	0.624	-38.51088	23.11303
foreign	.499036	.3523566	1.42	0.157	-.1934795	1.191551
weaklaw	-5.47421	10.9138	-0.50	0.616	-26.92401	15.97559
costfin	20.7841	15.57088	1.33	0.183	-9.818638	51.38684
macobst	32.11907	14.01312	2.29	0.022	4.577928	59.66021
sectorspill	.6245688	.4569219	1.37	0.172	-.2734574	1.522595
capital	17.66966	8.59268	2.06	0.040	.7817577	34.55756
_cons	-124.3594	35.57747	-3.50	0.001	-194.2827	-54.43606
/sigma	72.51728	5.120888			62.45278	82.58179

```
------------------------------------------------------------------------------
  Obs. summary:        347  left-censored observations at expint<=0
                       103     uncensored observations
                         0 right-censored observations
```

A5.3.2 Tobit estimation Specification (1b)

```
. tobit expint uni novelty size sizesq busass foreign weaklaw costfin macobst sectorspill capital,
ll vce(cluster sectorregion)

Tobit regression                                  Number of obs   =        448
                                                  F(  11,    437) =       5.30
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -718.21848                 Pseudo R2       =     0.0287

                          (Std. Err. adjusted for 18 clusters in sectorregion)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         uni |   .3175108   .1173626     2.71   0.007     .0868455    .5481761
     novelty |   15.56049   8.163512     1.91   0.057     -.484131    31.60512
        size |   1.765946   1.013383     1.74   0.082    -.2257655    3.757657
      sizesq |  -.0227503   .0128653    -1.77   0.078    -.0480358    .0025351
      busass |  -7.068651   15.98544    -0.44   0.659    -38.48655    24.34925
     foreign |   .4680393   .3342769     1.40   0.162    -.1889509    1.125029
     weaklaw |  -5.126313   10.55182    -0.49   0.627    -25.86494    15.61231
     costfin |   21.43294   15.66693     1.37   0.172    -9.358956    52.22483
     macobst |   30.67538   13.95734     2.20   0.028     3.243525    58.10723
 sectorspill |    .499206   .4100929     1.22   0.224    -.3067936    1.305206
     capital |    15.5285   8.572184     1.81   0.071     -1.31933    32.37634
       _cons |  -121.3167   34.60213    -3.51   0.001     -189.324   -53.30938
-------------+----------------------------------------------------------------
      /sigma |   72.54885   5.322787                      62.08741     83.0103
------------------------------------------------------------------------------
  Obs. summary:        345  left-censored observations at expint<=0
                       103     uncensored observations
                         0 right-censored observations
```

A5.4 Tobit estimation Specification 2 – Sectoral sample

A5.4.1 Tobit estimation Specification 2 – Whole sample estimation

```
. tobit expint uni prodno procinn size sizesq busass foreign weaklaw costfin macobst capital, ll
vce(cluster sectorregion)

Tobit regression                                  Number of obs   =        445
                                                  F(  11,    434) =       7.76
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -705.15213                 Pseudo R2       =     0.0307

                          (Std. Err. adjusted for 18 clusters in sectorregion)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         uni |   .3704635   .1251407     2.96   0.003     .1245063    .6164206
      prodno |   1.479215   .3294425     4.49   0.000     .8317137    2.126716
     procinn |  -13.55802   14.00501    -0.97   0.334     -41.0841    13.96805
        size |   2.122555    1.12353     1.89   0.060    -.0856816    4.330792
      sizesq |  -.0273973   .0133323    -2.05   0.040    -.0536012   -.0011934
      busass |  -4.123136   16.06393    -0.26   0.798     -35.6959    27.44963
     foreign |   .4463887   .3396238     1.31   0.189    -.2211232    1.113901
     weaklaw |  -2.644013   9.606776    -0.28   0.783     -21.5256    16.23758
     costfin |   24.08589   17.05545     1.41   0.159    -9.435648    57.60744
     macobst |   31.08913   14.90559     2.09   0.038     1.793014    60.38525
     capital |   15.62548   8.287789     1.89   0.060    -.6637183    31.91467
       _cons |  -103.3088    22.7598    -4.54   0.000    -148.0419   -58.57564
-------------+----------------------------------------------------------------
      /sigma |   73.34627   5.232969                      63.06115    83.63138
------------------------------------------------------------------------------
  Obs. summary:        344  left-censored observations at expint<=0
                       101     uncensored observations
                         0 right-censored observations
```

A5.4.2 Tobit estimation Specification 2 – Production and services sector sample estimation

```
. tobit expint uni prodno procinn size sizesq busass foreign weaklaw costfin macobst capital if
trade!=1, ll vce(cluster sectorregion)

Tobit regression                                  Number of obs   =        277
                                                  F(  11,    266) =    1407.38
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -387.30755                 Pseudo R2       =     0.0519

                          (Std. Err. adjusted for 12 clusters in sectorregion)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         uni |   .3583881   .1212038     2.96   0.003     .1197473    .5970289
      prodno |   2.031967   .5368786     3.78   0.000     .9748946    3.089039
     procinn |  -3.208378   11.40659    -0.28   0.779    -25.66706    19.25031
        size |   3.998865   .8985688     4.45   0.000     2.229653    5.768077
      sizesq |   -.049279   .0101733    -4.84   0.000    -.0693095   -.0292485
      busass |  -24.97331   21.31382    -1.17   0.242    -66.93857    16.99194
     foreign |   .7311828   .3578167     2.04   0.042     .0266694    1.435696
     weaklaw |   7.168868   7.353151     0.97   0.330    -7.308914    21.64665
     costfin |   13.10263   7.354708     1.78   0.076    -1.378219    27.58348
     macobst |   40.10748   20.63758     1.94   0.053    -.5263122    80.74126
     capital |     18.081   10.33929     1.75   0.081    -2.276267    38.43826
       _cons |  -118.8528   26.87601    -4.42   0.000    -171.7696   -65.93606
-------------+----------------------------------------------------------------
      /sigma |   62.78692   5.365706                      52.22226    73.35158
------------------------------------------------------------------------------
  Obs. summary:        220  left-censored observations at expint<=0
                        57     uncensored observations
                         0 right-censored observations
```

A5.5 Tobit estimation Specification 1 – micro and small firms

```
. tobit expint uni novelty procinn size sizesq busass foreign weaklaw costfin macobst sectorspill
capital if size<50 & size>0, ll vce(cluster sectorregion)

Tobit regression                                  Number of obs   =        440
                                                  F(  12,    428) =       6.57
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -699.09351                 Pseudo R2       =     0.0300

                          (Std. Err. adjusted for 18 clusters in sectorregion)
------------------------------------------------------------------------------
             |               Robust
      expint |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         uni |   .3252048   .1189225     2.73   0.007       .09146    .5589496
     novelty |   22.76794   11.37471     2.00   0.046     .4106977    45.12518
     procinn |  -19.48757   16.10454    -1.21   0.227     -51.1414    12.16627
        size |    1.18379   2.529085     0.47   0.640    -3.787183    6.154763
      sizesq |   -.008662   .0663811    -0.13   0.896    -.1391355    .1218116
      busass |  -6.900529   16.23581    -0.43   0.671    -38.81237    25.01131
     foreign |   .5071804   .3594605     1.41   0.159    -.1993472    1.213708
     weaklaw |  -4.586702   10.18078    -0.45   0.653    -24.59726    15.42386
     costfin |    19.1522   14.78706     1.30   0.196    -9.912087    48.21649
     macobst |   30.45122   14.78256     2.06   0.040     1.395777    59.50666
 sectorspill |   .5184414   .4124543     1.26   0.209    -.2922465    1.329129
     capital |   20.75895   8.855126     2.34   0.020     3.354001    38.16389
       _cons |  -118.3853    33.4328    -3.54   0.000    -184.0983   -52.67243
```

```
-------------+----------------------------------------------------------------
      /sigma |   73.13819   4.688516                      63.92281    82.35357
------------------------------------------------------------------------------
  Obs. summary:        340  left-censored observations at expint<=0
                       100     uncensored observations
                         0 right-censored observations
```

A5.5.1 Tobit unconditional marginal effects Specification 1 – micro and small firms

```
. mfx compute, predict (ystar(0,.))

Marginal effects after tobit
      y  = E(expint*|expint>0) (predict, ystar(0,.))
         =  9.0048251
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
     uni |    .070187      .01856    3.78   0.000   .033815  .106558   5.89583
 novelty*|   5.558781     2.86198    1.94   0.052  -.050593  11.1682   .209091
 procinn*|  -3.855949     2.84488   -1.36   0.175  -9.43181  1.71992   .254545
    size |   .2554901      .53591    0.48   0.634  -.794872  1.30585   6.07273
  sizesq |  -.0018695      .01429   -0.13   0.896  -.029881  .026142   77.3545
  busass*|   -1.41898     3.15458   -0.45   0.653  -7.60185  4.76389   .122727
 foreign |   .1094616      .07406    1.48   0.139  -.035702  .254626   3.12727
 weaklaw*|  -.9818811     2.17012   -0.45   0.651  -5.23523  3.27147   .402273
 costfin*|   4.136081     3.33489    1.24   0.215  -2.40019  10.6724   .506818
 macobst*|   6.614076     2.87298    2.30   0.021   .983145   12.245   .502273
sector~l |    .111892      .08267    1.35   0.176  -.050146  .273931    42.785
 capital*|   4.819926     1.61123    2.99   0.003   1.66196  7.97789   .315909
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

A5.5.2 Table of comparative unconditional marginal effects – micro and small firms sample and whole sample – Specification 1

Dataset	Whole sample	Micro and small firms sample
Innovation		
procinn	-2.89	-3.855
	(2.316)	(2.844)
novelty	3.91*	5.558*
	(2.098)	(2.861)
Business environment factors		
macobst	5.15**	6.61**
	(2.098)	(2.87)
weaklaw	-1.01	-0.98
	(1.805)	(2.17)
costfin	3.38	4.13
	(2.923)	(3.33)
Other factors		
uni	0.06***	0.07***
	(0.015)	(0.018)
busass	-0.99	-1.41
	(2.424)	(3.15)
foreign	0.08	0.10
	(0.052)	(0.074)
sectorspill	0.09	0.11
	(0.069)	(0.082)
capital	3.19***	4.81**
	(1.214)	(1.61)
Control variable		
size	0.32***	0.25***
	(0.087)	(0.535)
sizesq	-0.004***	-0.001***
	(0.001)	(0.014)
Observations	448	440