The Impact of the Global Financial Crisis on European Transition Countries

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Abstract

In spite of a large number of studies on the international transmission of crises, research is still unable to quantify the determinants of severity of crisis across countries. This thesis contributes to knowledge in this area by investigating the impact of the Global Financial Crisis (GFC) on European transition countries. In analysing the transmission of the GFC to these countries and the nature and severity of the spillovers, both trade and financial channels are examined and particular emphasis is placed on the degree of euroisation, integration with the EU, remittances, bank ownership and foreign credit flows.

This thesis firstly provides a critical review of the existing literature on the transmission of the GFC to European transition countries and identifies gaps in knowledge, which are then addressed through empirical investigations. The first empirical investigation explores how GDP and financial shocks in the European advanced countries (EU15) are transmitted to European transition countries, using the recently-developed global vector auto-regression (GVAR) approach. The results suggest that while trade appears to be the strongest linkage between EU15 and European transition countries, the shocks are propagated by both trade and financial channels. Moreover, although the estimated spillovers from GDP and financial shocks in the EU15 to European transition countries are always negative, there are considerable heterogeneities in the size and statistical significance of these effects across regions. The Baltic countries display the most severe impact from the shocks in the EU15, which appear to be propagated mostly through the financial channel: foreign credit flows; FDI; and remittances. The Balkan countries are affected predominantly through exports, FDI and foreign credit flows. The other Central and Eastern European transition countries are less severely affected by shocks to the EU15 GDP. Furthermore, highly euroised, non-EU members and more open transition countries appear to be more severely affected by the shocks in the EU15.

The initial analysis is extended through a firm-level analysis, which investigates whether initial conditions (from 2007) had an impact on firms' sales during the GFC in 2009. The major finding of this firm-level study is the importance of the financial channel in the transmission of the GFC to European transition countries: a higher share of working capital financed by banks, a higher share of foreign currency loans and a higher share of foreign bank ownership each increased the impact of the GFC on the firms operating in these countries. With regards to the export channel, it is found that both exporting and non-exporting firms operating in the countries covered in this study were significantly affected by the crisis. This finding suggests that, although there is a trade channel, the exporting firms are able to cope with the crisis better than non-exporting firms due to their overall superior performance. This finding may also reflect the cross-sectional nature of the data which can reveal only between-firm differences. So exports, or more precisely, exporting firms constitute a transmission channel of the GFC. Yet, exporting firms are also more able to offset effects of crisis and thus contribute to the resilience of transitional economies.

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Abbreviations

BEEPS –Business Environment and Enterprise Performance Survey

CARDS - Community Assistance for Reconstruction, Development and Stabilisation

CC – Common Creditor

CEE – Central and Eastern Europe

CESEE – Central, Eastern and South-Eastern Europe

CEFTA - Central European Free Trade Agreement

CISS – Composite Indicator of Systemic Stress

CLRM – Classical Linear Regression Model

CPI – Consumer Price Index

ECB – European Central Bank

ECM – Error Correction Model

ETE – European Transition Economy

BIS – Bank for International Settlements

EU 15 – 15 advanced EU member states (before the 2004 enlargement)

FDI – Foreign Direct Investment

GDP – Gross Domestic Product

GFC – Global Financial Crisis

GFEVD - Generalized Forecast Error-variance Decomposition

GIRF – Generalized Impulse Response Function

GNP – Gross National Product

GVAR – Global Vector Auto-regression

IMF – International Monetary Fund

IPA - Instrument for Pre-Accession Assistance

ISPA - Instrument for Structural Policies for Pre-Accession

NFA – Net Foreign Assets

OECD – Organisation for Economic Co-operation and Development

PSP – Public Sector Prices

R&D – Research & Development

SAP - Stabilisation and Association Process

SAPARD - Special Accession Programme for Agricultural and Rural Development

TFP – Total Factor Productivity

VAR – Vector Autoregression

VECM – Vector Error Correction Model

VIF – Variance Inflation Factor

WDI – World Development Indicators

WTO – World Trade Organization

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Note

A paper based on Chapter 4 of this thesis won the 2017 Olga Radzyner Award of the Oesterreichische Nationalbank (OeNB) which is bestowed on young economists for scientific work on European economic integration.

CHAPTER 1

INTRODUCTION

Contents

1.1 Introduction

The aim of this thesis is to investigate the transmission of the global financial crisis (GFC) to European transition economies (ETEs), taking into account the extent of euroisation and integration with the EU, remittance flows, exports, pattern of bank ownership, FDI and foreign credit flows. One particular feature of the GFC has been the speed and synchronicity with which it spread around the world, affecting, both emerging and advanced countries. Although there have been a few studies that have investigated the transmission of the GFC to ETEs (Berglöf et al., 2009; Blanchard et al, 2010; Lane and Milesi-Ferretti, 2011; Rose and Spiegel, 2009a, 2009b, 2011; Berkmen et al., 2012; Popov and Udell, 2012; Feldkircher, 2014; Park and Mercado, 2014; De Haas et al., 2015; Ongena et al., 2015; Ahmed et al., 2017), the literature is still unable to provide conclusive results of the determinants of crisis severity across these countries. This thesis contributes to knowledge in this area by firstly identifying gaps in the literature, then exploring the channels of the international transmission of shocks to ETEs, and finally investigating whether the extent of euroisation and integration with the EU, pattern of bank ownership, exports, remittances, FDI and foreign credit flows significantly modified the propagation of the GFC to ETEs.

The objective of this introductory chapter is to provide the context of the research reported in this thesis. It initially presents an overview of the transition process in the Central and Eastern European countries, focusing on the key areas relevant to the research questions addressed in this thesis. Namely, it starts by describing the process of transition from centrally planned economies towards open, market-oriented economies, examines the output, trade, FDI and remittance fluctuations throughout the period and describes financial developments as well as recording the progress made towards integration with the EU during this period. It then continues with an overview of the GFC and an investigation of its impact on the ETEs. The last section of this chapter lists the key research questions addressed in this research programme and explains the structure of the thesis.

1.2 The transition process in ETEs

Almost three decades ago, Central and Eastern European countries started the transition from centrally planned economies towards open, market-oriented economies. The long-term objective of transition was to build a successful market economy able to deliver sustainable growth (Kolodko, 1999). The transition itself involved a complex process of institutional, structural and behavioural change (De Melo et al., 1996). Considering that the Central and Eastern European countries inherited entrenched and inefficient bureaucratic institutions from the previous decades dominated by the socialist system, they faced many challenges throughout this process (Carmin and Vandeveer, 2004). Three main objectives dominated transition: macroeconomic stabilization; real adjustment at the microeconomic level and creation of a new institutional framework (Piazolo, 2000). Macroeconomic stabilization aimed to resolve the drop in output and monetary and fiscal instability that emerged after the start of transition and was an important accompaniment to liberalization in promoting economic growth during transition (World Bank, 1996). The microeconomic-level reforms sought to stabilize markets through privatization of state entities, price liberalization and openness to international trade. The institutional framework reform was intended to ensure that a decentralization of economic decisions would occur. These three objectives were interrelated; hence, simultaneous progress in all of them was required for the overall economic reform to be successful (Piazolo, 2000). One of the main arguments in favour of moving to a market-oriented economy was the expectation that the move would improve productivity in the former socialist economies (Grün and Klasen, 2001). It was expected that, after a short period of adjustment (the so-called transformational recession), the new market-oriented system would lead to a rapid recovery and sustainable economic growth. However, such anticipations were not fulfilled equally in all transition countries. Some countries recovered rapidly from the initial recession following the beginning of transition, while others went through a deeper transitional recession that lasted for a longer period than was initially expected.

Many economists agree that there were three main economic variables which greatly impacted the recovery period and subsequent economic growth (Falcetti, et al., 2006). Firstly, the initial conditions played an important role in countries' performance and subsequent development (Fischer and Sahay, 2000; De Melo et al., 2001; EBRD, 2004; Coricelli and Maurel, 2011, Roaf et al., 2014). However, there is a general agreement that the impact of initial conditions on performance weakens over time. Secondly, most studies have shown that higher inflation rates and larger budget deficits were negatively associated with recovery and growth. Hence, considering that after the beginning of transition most countries were faced by high inflation and large fiscal deficits, it was essential to introduce a macroeconomic stabilisation programme (Falcetti et al. 2006). Finally, most of these studies concluded that reforms are important for sustainable growth, from early reforms such as price and trade liberalisation and small-scale privatisation to more profound reforms such as corporate restructuring, financial sector development and competition policy (De Melo et al., 2001; Falcetti et al., 2006). Considering that the transition objectives overlapped with the key criteria required for accession to the EU (Piazolo, 2000), progress with EU integration has been positively correlated with progress with transition. Based on different initial conditions and different reform strategies followed by these countries, the transition literature identifies different categorisations of transition countries with regards to their economic performance. In the context of this study, based on the classification of the International Monetary Fund (IMF) in regard to progress with transition (liberalization, macroeconomic stabilization, restructuring and privatization and legal and institutional reforms), together with their economic performance and geographical location, European transition countries are classified into three main groups:

1. South East European (SEE) countries: Albania, Bosnia and Herzegovina (BH), Bulgaria, Croatia, Kosovo, Macedonia, Montenegro, Romania and Serbia;

2. Central East European (CEE) countries: the Czech Republic, Hungary, Poland, the Slovak Republic and Slovenia;

3. Baltic Countries: Estonia, Latvia and Lithuania.

The selection of countries to be studied in this thesis was based on their European perspective and similar transition history. Even though many of these countries are now post-transition, have joined the EU[1] and are today more frequently considered within the group of 10 new EU member states, they have many common features with other ETEs as a result of similar transition experiences and are therefore considered as "transition" countries throughout this thesis. Nevertheless, it has to be pointed out that Russia, for example, was not included in the study since it would have dominated and distorted the sample given its larger size.

In order to provide the necessary background to answer the research questions which will be investigated in this thesis, the rest of this section focuses on output behaviour, trade integration, financial development, FDI, migration and remittances and integration with the EU throughout the period of transition starting from 1989 or from the earliest year for which data is available, usually 1995, up to the latest year available for most of these countries, usually 2015.

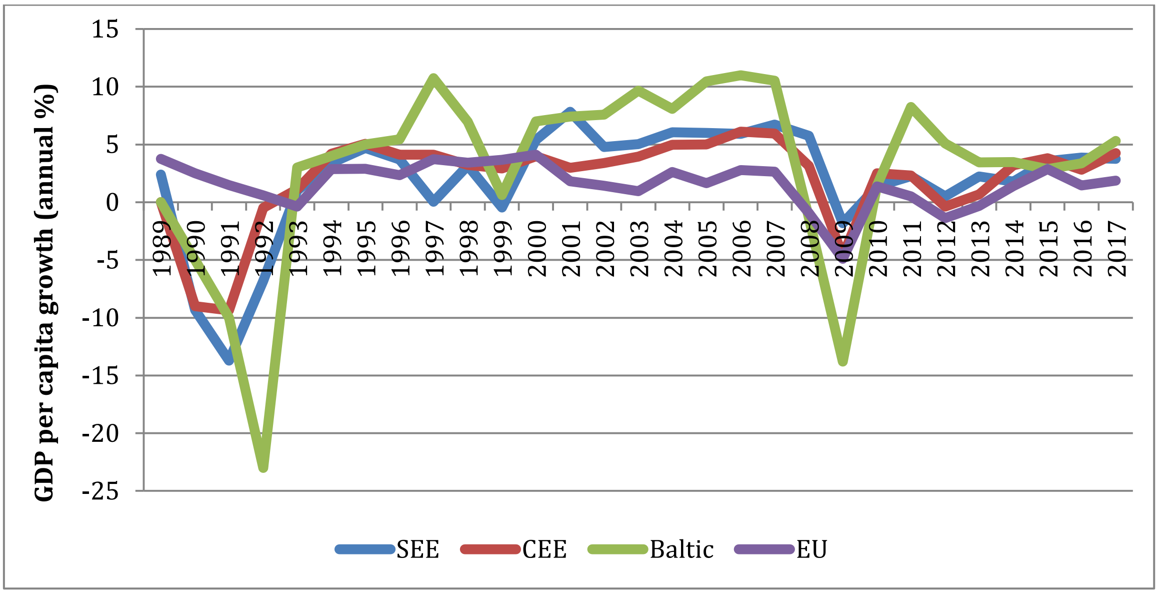
1.2.1 Output during transition

The pattern of output movement since the commencement of transition is illustrated in Figure 1.1 and can be summarized as follows. The beginning of transition was associated with a sharp output decline in all transition countries. However, the three country groups experienced different initial recessions, with the Baltic States being most severely affected where economic activity declined by around 25%. The timing of the recovery period varied among the transition country groups. CEE countries achieved positive economic growth from the beginning of 1992, while SEE countries achieved positive economic growth in 1993 and Baltic States in 1994. Due to bolder reforms undertaken, the CEE countries had a faster return to growth and avoided the second recession that hit the region in 1997 after the initial recession. For the SEE countries, the reversal repeated twice, in 1997 and 1999. All groups of countries appear to have recovered quickly from this second recession, and up to 2007 continued having positive and stable economic growth, which averaged 6% for the region, with no country growing at less than 3 percent annually (World Bank, 2017). The SEE countries' growth continued at around 5 percent up to 2007. However, growth in this period became increasingly imbalanced, driven in many countries by

[1] Czech Republic, Latvia, Lithuania, Estonia, Poland, Slovakia and Slovenia became EU members in 2004, Bulgaria and Romania in 2007 and Croatia in 2013.

large-scale borrowing for consumption and construction, high current account deficits and rising external debt (Roaf et al., 2014). The GFC hit the transition countries with different intensity, with output decline in the region averaging 7% in 2009, a more severe impact than in any other region in the world, including the EU15[2] where the output decline averaged 5%. The Baltic States suffered the largest output decline, which averaged 14% in 2009. The second most affected group of transition countries appears to have been the CEE countries, with an average GDP decline of around 4%. The last group of transition countries, the SEE countries, had an average GDP decline of only around 2%.

Figure 1.1 Annual percentage change of GDP per capita (1989-2017)



Data source: World Bank, World Development Indicators (GDP per capita growth - annual % change) 2017

All three groups of countries returned to positive economic growth in 2010. However, during 2012, economic activity in all country groups declined again due to the intensification of the sovereign debt crisis in the eurozone. Since 2012 growth has remained relatively weak across those transition countries which were particularly integrated with the eurozone due to decline in their exports and capital inflows.

[2] Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and United Kingdom.

1.2.2 Trade during transition

One of the key outcomes of the transition process in the former communist countries has been deeper international integration through increased trade and capital flows (Roaf et al., 2014). Before the transition started, trade in transition countries was mainly focused inwards. In 1990, around 80 percent of exports from the Baltic countries went to Russia (Roaf et al., 2014). After the dissolution of the Soviet Union, these countries experienced a sharp decline in exports. Due to a small manufacturing base and the small size of the economies, the Baltic countries' exports remained relatively low compared to the CEE and SEE countries (see figure 1.2a).

After transition started, considering the failure of the previous system, all countries stood to gain from price and market liberalisation. New open markets increased investment opportunities, which resulted in faster economic growth and improvements in the standards of living. Hence, the transition countries embraced both internal and external liberalisation (EBRD, 2003). By 2000, most of the ETEs became members of the World Trade Organization, which offered new markets and assisted countries in harmonising regulatory and political frameworks and building stable market institutions (Roaf et al., 2014). In addition, most countries joined the Central European Free Trade Agreement (CEFTA) during the period 1992-2007 (EBRD, 2012). Therefore, transition and integration have been closely linked during the past 20 years, with the total value of exports growing significantly during this period, which included an increase of 382% between 1995 and 2015 for the region (see Figure 1.2).

Figure 1.2a Exports patterns across ETEs (1995-2015)

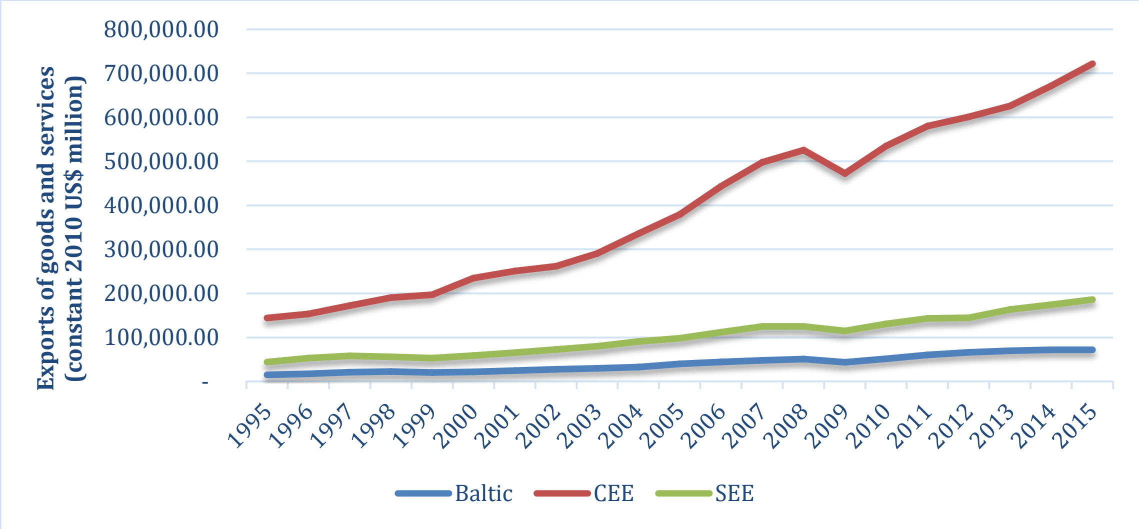


Figure 1.2b Exports as a share of GDP (2000, 2009, 2015)

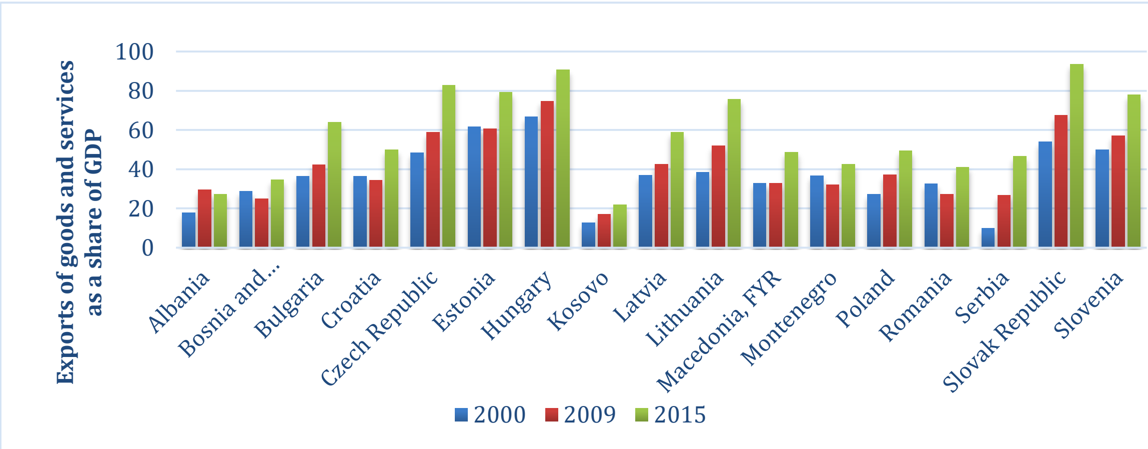
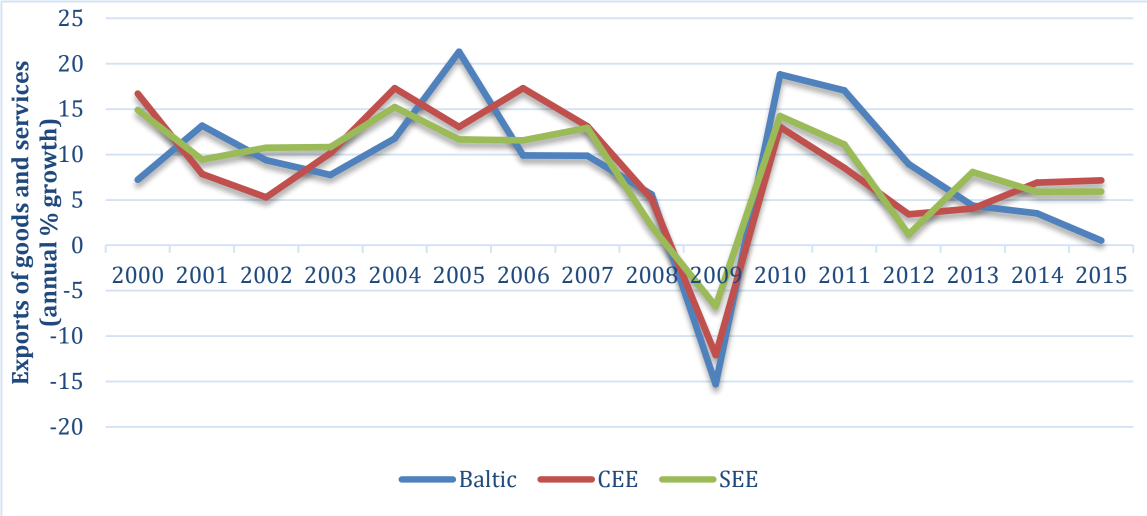


Figure 1.2c Annual percentage growth of exports (2000-2015)



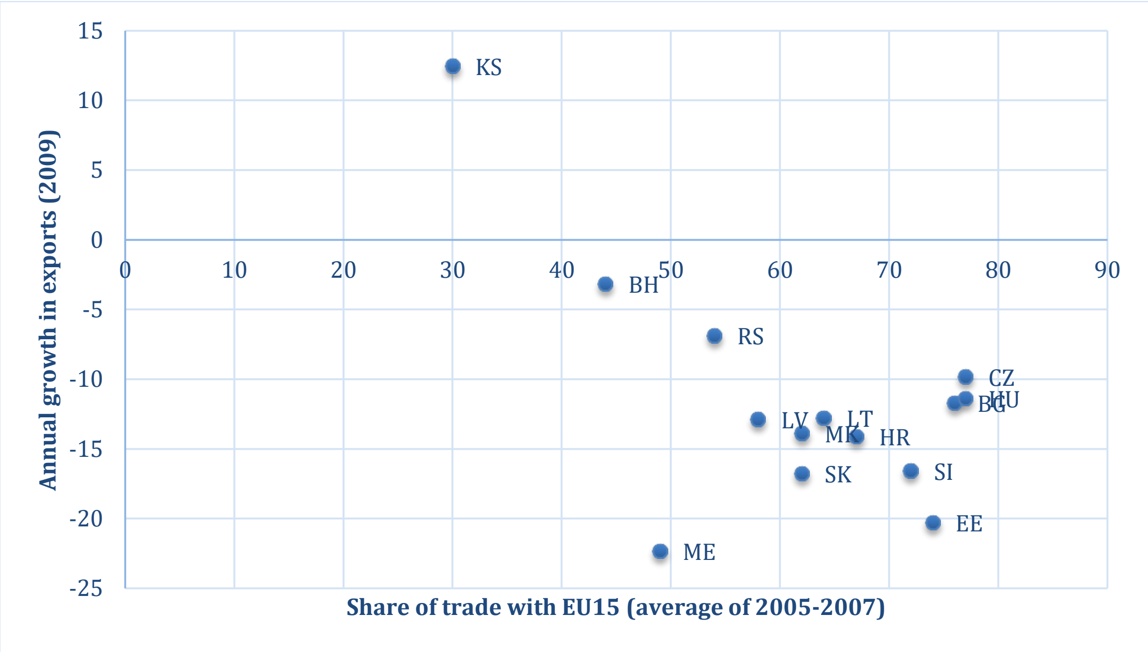
Data source: World Bank – World Development Indicators (Exports of goods and services – constant 2010 US$; Exports of goods and services - % of GDP and Exports of goods and services – annual % growth) 2017.

Figure 1.2a above shows the exports behaviour throughout the period 1995-2015. It is important to note that while the region as a whole, particularly CEE region, experienced a rapid growth of exports, there were considerable heterogeneities across countries. The Czech Republic, Hungary and the Slovak Republic were the largest exporters in 2015, whilst the Western Balkan countries exported the least in 2015. However, it has to be noted that Albania and Serbia achieved the highest growth rate in their exports from 1995 to 2015 (805% and 511%, respectively). The rapid increase of exports led to a significant expansion of exports to GDP ratio. In 2015, exports accounted for around 58% of GDP across transition countries. Figure 1.2b shows that the Slovak Republic, Hungary, the Czech Republic and Slovenia have the highest share of exports in their GDP in 2015 (93%, 91% and 83%, respectively). On the other hand, Kosovo, Albania and Bosnia and Herzegovina have the lowest share of exports in their GDP in 2015 (22%, 27% and 35%, respectively). This heterogeneity can be attributed to location, initial conditions and the policy environment (Roaf et al, 2014).

During 2009 the European transition region experienced a decline of around 10% in exports of goods and services due to the GFC. As can be seen in Figure 1.2c the Baltic countries experienced the largest decline in exports, which averaged 15% in 2009. The CEE countries' exports also declined sharply, averaging 12%, while exports from

SEE countries dropped by an average of 7%. In terms of individual countries, the steepest decline in exports in 2009 was experienced in Estonia, Slovak Republic, and Slovenia (20%, 17% and 16%, respectively), while exports from Kosovo and Albania continued growing throughout 2009, although at a slower rate compared to previous years before the GFC (4% and 12% respectively). The variation in export performance across the region during 2009 can in part be attributed to different levels of exposure to the EU (EBRD, 2012). Figure 1.3 below shows that exports of ETEs with stronger trade linkages with the EU15 appeared to have declined more steeply in 2009 compared to exports of countries with weaker ties. The overall exports recovered rapidly in 2010, with an average rate of increase of 15% in the region. However, the onset of the Eurozone debt crisis resulted in export decline in many ETEs in 2011 and 2012 and export growth has remained slow and/or negative ever since.

Figure 1.3 Export growth in 2009 versus share of trade with EU15



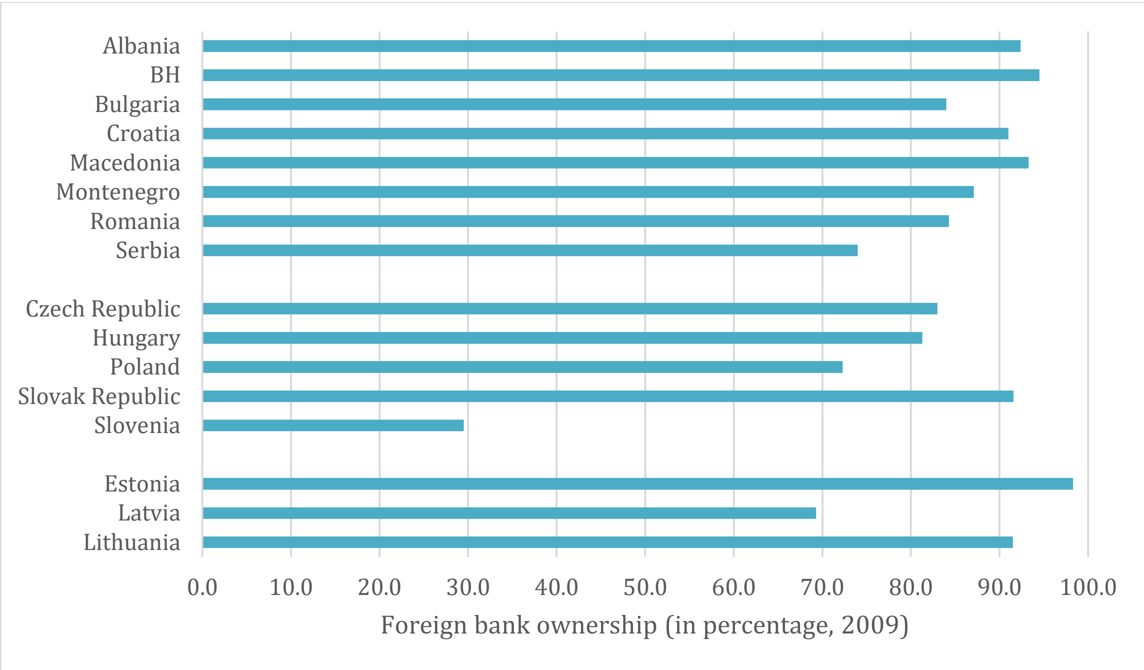
Data source: World Bank – World Development Indicators (Exports of goods and services (annual % growth) 2017; Author's calculations based on IMF – Direction of Trade Statistics 2017.
Note: Share of trade with EU15 is calculated based on average trade flows (sum of exports and imports) among countries for the period 2005-2007.

1.2.3 Financial developments

Since the beginning of transition the banking systems have evolved dramatically from a single institution designed to support the central planning system and responsible for both monetary policy and commercial banking. During the transition from a planned to a market-oriented economy, the financial system was transformed from these single banking institutions into two-tier financial systems. Most countries started this process by dividing the central and commercial banking activities and by breaking up the commercial banking activities into multiple smaller units, which were initially state-owned. However, the banking sector in transition countries faced many difficulties during this stage, due to the fact that these newly established state-owned banks inherited portfolios of unknown quality and balance sheets and staff from the old bureaucratic institutions, which in turn imposed a very heavy supervisory burden on the central banks which were inexperienced in this task (Berglof and Bolton, 2002). Initially, most ETEs went through several waves of restructuring, in an attempt to address these problems in the banking sector. After a number of unsuccessful attempts, the next step of financial reforms was banks' privatisation. Within this period, most countries also allowed the entry of new banks. The ownership structure of the banks has changed dramatically since the beginning of the transition process. Foreign-owned banks became dominant in Central, Eastern and South-eastern European countries, by establishing subsidiaries or branches in this region, mostly stimulated by the high returns in these financial markets due to their underdeveloped financial systems (Bartlett and Prica, 2012). Foreign bank presence in transition countries helped to strengthen national banking systems and improve the low level of financial intermediation (De Haas and Van Lelyveld 2006). The average degree of financial depth in transition countries, measured by domestic credit provided by the banking sector to the private sector as a share of GDP, increased from 25% in 1995 to 49% in 2015 (World Bank, 2017). On the other hand, the increased role of foreign banks increased the exposure of transition countries to foreign shocks (Roaf et al., 2014), as the foreign banks' propensity to experience positive and negative shocks affects credit possibilities in the same direction (Piccotti, 2017).

The average asset share of foreign banks in total banking sector assets in the transition region had, by the time the GFC hit the region, reached more than 82%. Figure 1.4 shows that the degree of foreign bank ownership in 2009 varied from 29% in Slovenia to 98% in the Czech Republic.

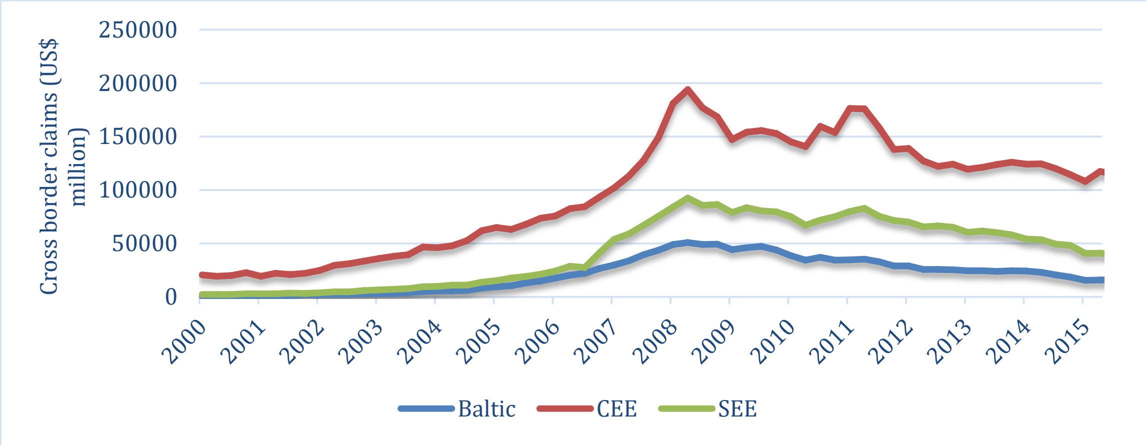
Figure 1.4 Asset share of foreign-owned banks in total banking assets - 2009



Data source: EBRD / Structural Change Indicators 2017 and Claessens and Van Horen, 2015.

Since the early 2000s, an aggressive strategy of expansion of cross-border lending was pursued by many Western European banks with the ETEs being their main focus (Roaf et al., 2014). This resulted in a credit boom in the transition region, which boosted investment and output growth, but also led to large external imbalances financed by cross-border capital flows (EBRD, 2015). During the GFC and the subsequent eurozone debt crisis, cross-border bank flows declined sharply in the region. The average decline of cross-border credit flows reached 13% by the first quarter of 2009. The countries that experienced the sharpest decline in cross-border credit flows during 2009 were Slovakia, Romania and the Czech Republic (60%, 21% and 16%, respectively) (BIS, 2017). Figure 1.5 shows a dramatic decline in cross-border lending by BIS-reporting banks to the transition region during the years following the GFC.

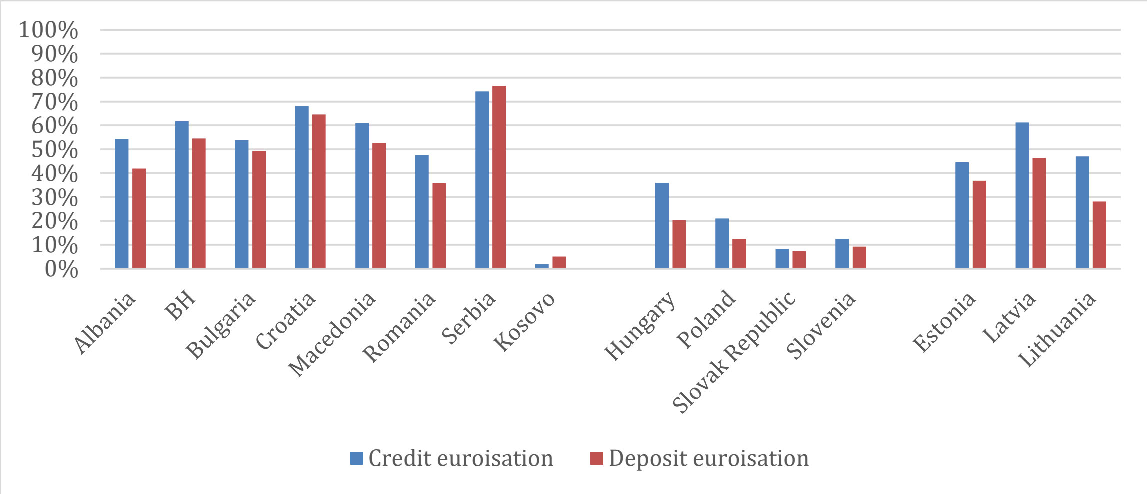
Figure 1.5 Cross-border credit flows to ETEs (2000-2015)



Data source: BIS / Locational data statistics 2017.

The credit boom prior to the GFC was accompanied by a significant expansion in the domestic credit to the private sector to GDP ratio, with the highest share in 2009 being in Latvia (103%) Estonia (101%) and Montenegro (77%) and the lowest share being in Kosovo (34%), Albania (37%) and Romania (38%) (World Bank 2017). In most countries, credit was mainly denominated in foreign currency, which made the borrowers vulnerable to a depreciation in their domestic currency (Berglöf, et al., 2009). Namely, during the GFC, the domestic currencies in ETEs depreciated against the US dollar by an average of 7% in 2008 (World Bank, 2017), which might have boosted competitiveness, but also worsened the debt situation of foreign currency borrowers. The process of substitution of local currency with a foreign currency, known as euroisation, is a common characteristic of ETEs. As can be seen in Figure 1.6 high levels of credit euroisation (the share of foreign currency loans in total loans) and deposit euroisation (the share of foreign currency deposits in total deposits) are prevalent in all transition countries, particularly in SEE countries.

Figure 1.6 Average degree of credit and deposit euroisation (2004-2014)



Data source: EBRD, central banks (various years).

Figure 1.6 shows that throughout the period 2004-2014, SEE countries have had the highest degree of euroisation. An exception is Kosovo which had a very low degree of euroisation, as it adopted Euro as its legal tender, therefore the degree of euroisation is here measured by share of loans and deposits in foreign currencies other than Euro (US dollar, Swiss Franc etc.) in total loans and deposits. As for the other countries, Figure 1.6 shows that credit euroisation varied from 9% in Slovak Republic to 72% in Serbia. The degree of deposit euroisation also varied from 7% in Slovak Republic to 76% in Serbia.

1.2.4 FDI inflows

The large scale privatisation during the transition process was accompanied by continuous FDI inflows in ETEs. FDI brought capital, technology and know-how, contributing to transition countries' productivity growth and development (Derado, 2013). The largest pre-crisis net FDI inflows during the period 2000-2007 were achieved by Hungary, Poland, the Czech Republic, Romania and Bulgaria. However, the GFC considerably reduced international capital flows and almost halved FDI worldwide, with the most pronounced fall throughout developed countries, including the EU (by 40-60%). In ETEs, with the exceptions of Albania and Montenegro, FDI inflows fell sharply in 2009. The average decline of FDI inflows across the ETEs was 57% in 2009. The sharpest falls took place in Slovenia, Hungary, Latvia and Lithuania.

The severe impact of GFC on FDI inflows in ETEs reflects the large percentage of FDI coming from the EU15, as shown in Figure 1.7b. In addition to FDI flows, the GFC also affected remittance flows in ETEs. Considering their importance to these countries, the next sub-section discusses remittances fluctuations throughout the period of transition.

Figure 1.7a Foreign direct investment, net inflows (% of GDP) (1995-2015)

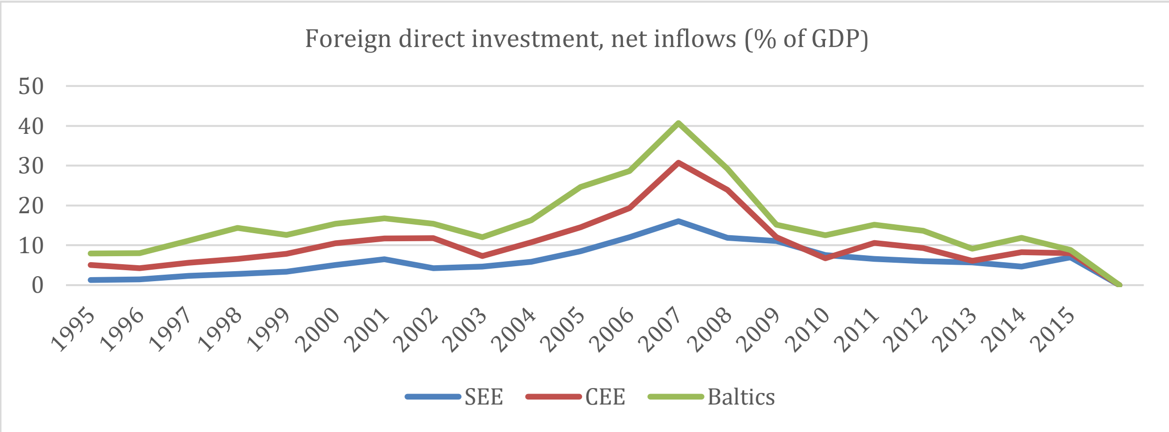
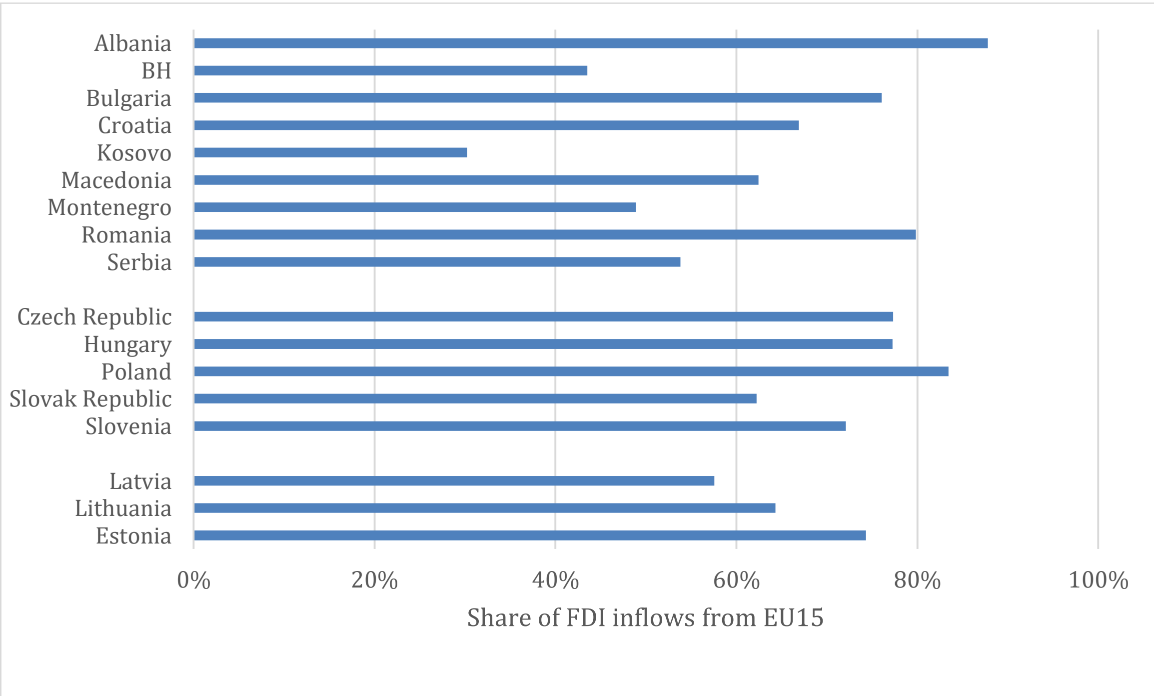


Figure 1.7b Share of FDI inflows from EU15 (2005-2007)

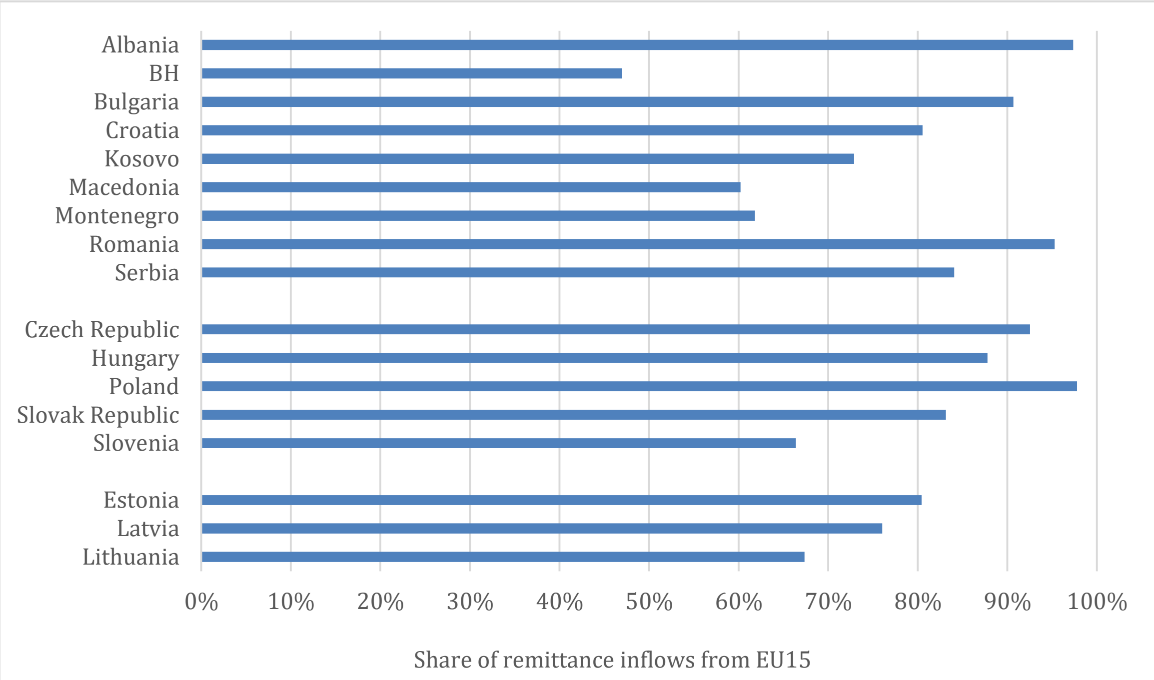


Data source: World Bank / World Development Indicators, 2017; UNCTAD / Bilateral FDI statistics, 2017.
Note: Share of FDI inflows from the EU15 is calculated based on average FDI inflows among countries for the period 2005-2007.

1.2.5 Migration and remittances

The transition process initially resulted in massive increases in unemployment rates in most of the ETEs. Consequently, there was frequently a rapid rise in migration, in particular to EU countries. High emigration rates also resulted in the high level of remittance inflows (Roaf et al., 2014). A large percentage of remittances came from the EU. As can be seen in Figure 1.8 below, the share of remittances coming from EU15 countries varies between 98% in Albania and Poland to 48% in Bosnia and Herzegovina.

Figure 1.8 Share of remittance inflows from EU15 (2010[3])



Data source: World Bank / Bilateral remittance flows (2017) and author's calculations.
Note: Share of remittance inflows from the EU15 is calculated based on bilateral remittance flows among countries during 2010, which is the earliest year the data on bilateral remittance flows are available.

Even though remittances lead to positive economic growth through their impact on consumption, savings and investment (Catrinescu et al,, 2009), they create channels of financial contagion throughout periods of economic and financial instability. As a result, during the GFC and the subsequent Eurozone debt crisis, remittances inflows dropped substantially in most ETEs. As can be seen in the first graph of Figure 1.9 below, the average amount of remittances received as a share of GDP throughout the

[3] 2010 is the earliest year bilateral remittance flows are available.

period 1997-2015 varied from 19% in Bosnia and Herzegovina to 0.6% in Romania. Figure 1.9b shows that during 2009, in most transition countries there was a significant decrease in remittance income. More specifically, remittances fell sharply in Romania, Slovenia, Bosnia and Herzegovina, Poland and Albania. Hence, remittance flows might also have composed an important transmission mechanism for the impact of economic crisis in these countries. In the SEE region remittances have yet to return to pre-crisis shares of GDP, as they continued contracting throughout the Eurozone debt crisis. The negative growth in all ETEs reflects the large percentage of remittances coming from the EU15, as shown in Figure 1.8.

Figure 1.9a Remittances received as a share of GDP, average 1997-2015

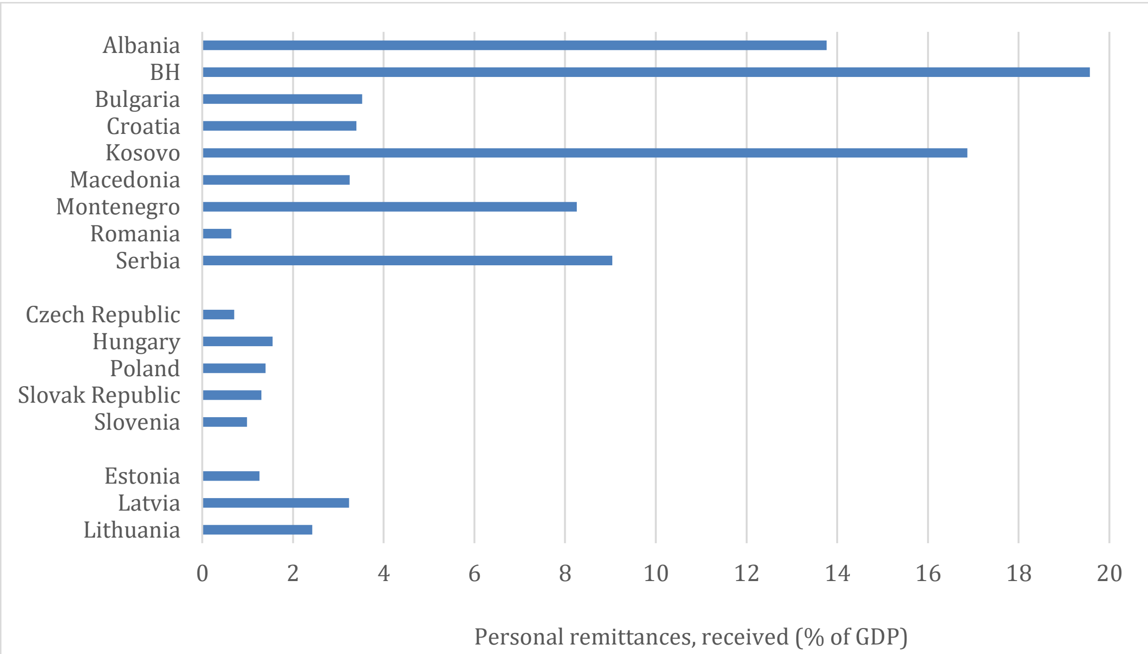
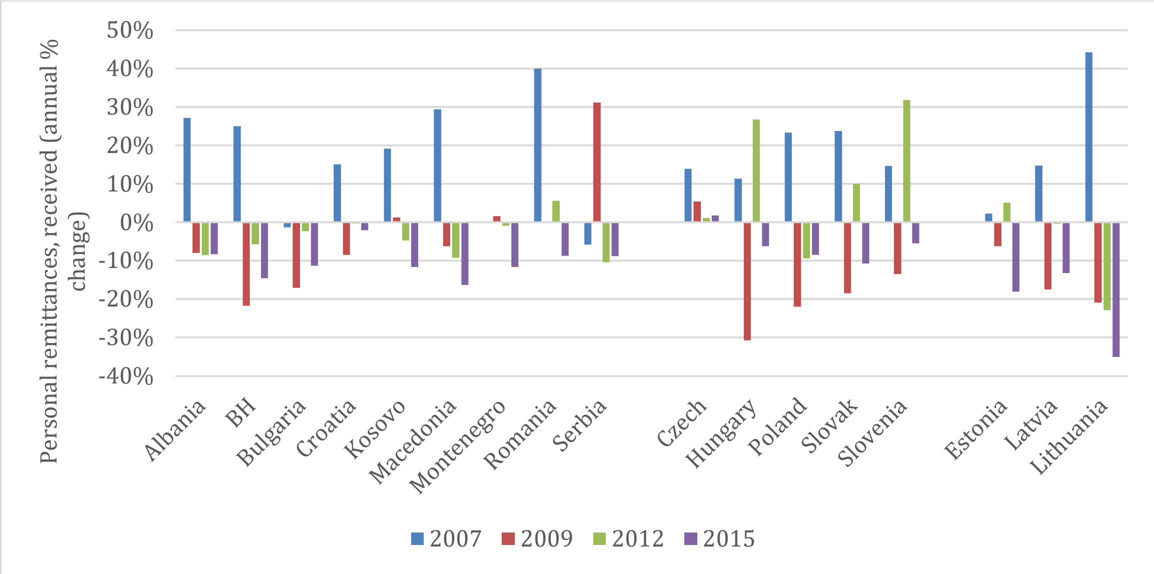


Figure 1.9b Annual percentage change of remittances received



Data source: World Bank / World Development Indicators, 2017.

1.2.6 Integration with the EU and pre-accession support

During the period of transition many countries, in particular West European countries, the United States, Canada and Japan and many intergovernmental organizations offered financial assistance to ETEs (Carmin and Vandeveer, 2004). This assistance was particularly directed towards fulfilling EU accession requirements, by focusing on harmonising ETEs policies and practices with EU directives and regulations (Carius et al., 1999). Since 2007, countries wishing to join the EU have received EU funding and support through the Instrument for Pre-Accession Assistance (IPA), which is designed to build institutional and human capacities in the respective countries. These countries can be divided into candidate countries and potential candidate countries. Candidate countries are those in the process of harmonizing their laws with EU legislation, while potential candidate countries do not yet fulfil the requirements for EU membership. IPA funds amounted to EUR 11.5 billion during the period 2007-2013. The countries currently benefiting from these funds are: Albania, Bosnia and Herzegovina, Kosovo, Macedonia and Serbia

Before 2007, the pre-accession support was provided through the following instruments: Phare; ISPA; SAPARD; the pre-accession instrument for Turkey; and the financial instrument for the Western Balkans, CARDS. The Phare programme supported institution-building, associated investment in candidate countries and economic and social cohesion and cross-border cooperation. The ISPA programme supported the environmental and transport infrastructure in candidate countries, whilst the SAPAPRD programme supported agricultural and rural development. Finally, the CARDS programme was the financial instrument for the Western Balkan countries and its main objective was to support participation of the Western Balkans in the Stabilisation and Association Process (SAP), which seeks to promote stability in the region. Since 2004, 11 ETEs have joined the EU. Hungary, the Czech Republic, Estonia, Slovenia, the Slovak Republic, Poland, Latvia and Lithuania became EU members in 2004, while Bulgaria and Romania joined the EU in 2007 and, most recently, Croatia became an EU member in 2013.

The aim of this section was to present a discussion of the transition process and economic integration of ETEs throughout this period, in order to provide background for the investigation of the research questions in this thesis. Despite the well-known benefits of economic integration, this section showed that it also appears to have made the countries more vulnerable to the effects of the GFC by creating and/or strengthening potential channels for contagion through trade, foreign banks, FDI, remittances and cross-border bank lending. On the other hand, countries that made more progress with EU integration and institutional reforms may have been better able to deal with external shocks, since their higher quality institutions may be expected to contribute to output stability (Balavac and Pugh, 2016). The next section provides an overview of the origins of the GFC and how it spread, while section 1.4 investigates its impact on the ETEs.

1.3 Causes and nature of the GFC and how it spread

Financial crises have occurred repeatedly throughout modern history, affecting both developing and developed countries. The literature identifies four major types of crises: currency crises; sudden stop (or capital account or balance of payments) crises; debt crises; and banking crises (Claessens and Kose, 2013). In recent decades, crises have become more frequent. Laeven and Valencia (2013) identify 147 banking crises, 218 currency crises and 66 debt crises over the period 1970–2011. This rise in frequency has been attributed to an increase in financial market liberalization and floating exchange rates (Claessens and Kose, 2013). A financial crisis can be extremely costly. They are associated with larger declines in output, consumption, investment, employment, exports and imports compared to recessions without financial crises (Cleassens and Kose, 2013). In addition, a large number of studies have shown that recoveries from financial crises are slower than from typical recessions (Reinhart and Rogoff, 2009; Claessens et al., 2012; Papell and Prodan, 2012). Despite its unusual severity, the GFC had many common features with past crises, the most important being a preceding asset price bubble and credit boom (Allen and Gale, 2000; Brunnermeier, 2008; Reinhart and Rogoff, 2008a, 2008b, and 2009; Schularick and Taylor 2009). There is general agreement that financial innovation in the form of asset securitization, global imbalances, expansionary monetary policy, government policies to increase homeownership and weak regulatory oversight played a significant role in causing the pre-crisis boom (Taylor, 2009; Keys et al., 2010; Laeven and Valencia, 2013). Many economists consider the GFC as the worst meltdown since the Great Depression. It resulted in the collapse of large financial institutions, bailouts of banks by governments and declines in stock markets all over the world. The crisis had a major impact on business failures and consumer wealth and economic activity declined, which led to a global recession and the European sovereign-debt crisis.

The origins of the GFC are by now well-known; it can be traced back to a credit and housing boom in the United States. The housing boom started in the late 1990s and reached its peak in mid 2000s (Crotty, 2008). Prices increased at a 7 to 8 percent annual rate in 1998 and 1999, and at 9 to 11 percent from 2000 to 2003, while the most rapid price increases were in 2004 and 2005, with house price appreciation ranging from 15 to 17 percent (Bernanke, 2010). The large inflows of foreign funds following the Russian debt crisis and Asian financial crisis of 1997–1998, increased the availability of credit in the U.S., which led to a housing construction boom and debt-financed consumer spending (Brunnermeier, 2008). Following the housing and credit boom, a number of financial innovations emerged, such as mortgage-backed securities and collateralized debt obligations (Simkovic, 2013). These financial innovations made it easier for investors and institutions around the world to invest in the U.S. A decline in U.S. housing prices caused mortgage-backed financial securities to experience significant losses, which, by 2008, were estimated to be approximately 500 billion dollars (Greenlaw et al., 2008). The associated increase in mortgage delinquencies triggered a liquidity crisis and bank runs. However, this did not initially occur in the traditional-banking system. Instead, as pointed out by Gorton and Metrick (2012), it took place in the "securitized-banking" system. As opposed to traditional banking, which is the business of making and holding loans with insured demand deposits as the main source of funds, securitized banking is the business of packaging and reselling loans, with repo agreements as the main source of funds (Gorton and Metrick, 2012). As such, a traditional-banking run is triggered by the withdrawal of deposits, while a securitized-banking run is triggered by the withdrawal of repurchase (repo) agreements. An important element of the repo agreement is the requirement to post collateral with a higher value than the loan: Gorton and Metrick (2012) refer to this as a "haircut". The authors define the "haircut" as the percentage by which an asset's market value is reduced for the purpose of calculating the amount of overcollateralization of the repo agreement. Since the value of mortgage backed securities fell continuously, the haircuts' levels grew up to 50 percent. Hence, the borrowing that could be supported by the same amount of capital decreased significantly. This led to deleveraging and forced many financial institutions to sell off assets, which had an adverse effect since the lower asset values decreased collateral's value. Uncertainty kept rising, which caused haircuts levels to continue rising and financial institutions to sell more assets.

One particular feature of the GFC was the speed and synchronicity with which it spread around the world (Chudik and Fratzscher, 2011). Even though it originated in the U.S., it spread not only to countries that shared similar vulnerabilities, but also to most emerging and advanced countries. The international spillovers were transmitted through a number of phases. The first phase was through direct exposures and affected a few financial markets which had a heavy exposure to the U.S. market. As a result of direct exposures to subprime assets, the crisis spread quickly to European banks, e.g. in France (BNP Paribas, 2007) and in Germany (IKB, 2007) (Claessens et al., 2010). These events as well as housing market stress caused liquidity and funding problems in some markets. In the UK, Northern Rock, which was disproportionately funded through short-term borrowing in the capital markets suffered a bank-run in 2007.

The second phase of the transmission of the crisis was through asset markets. Namely, liquidity shortages, frozen credit markets, foreign exchange fluctuations and stock price declines accelerated the transmission of the international spillovers. Policy responses aiming to address liquidity problems were not effective in the short term. In addition, countries used different approaches to address the liquidity problems. These ad-hoc interventions worsened the level of confidence among creditors and investors and were unable to resolve the underlying problems that caused an almost complete breakdown in market trust and confidence (Claessens et al., 2010). Following the collapse of Lehman Brothers, the third phase of transmission of crisis started mainly due to insolvency problems. By October 2008, many of the major global financial institutions had massive losses and had written off a large number of illiquid assets. Market confidence continued to deteriorate which resulted in further failures.

As the crisis developed into a global recession, in many countries economic stimulus was used as a main tool to attempt to stabilise output. Rescue plans and bailouts were carried out for banking systems and failing businesses in the U.S, China and EU. Most policy responses to the economic and financial crisis were taken by individual nations. Nevertheless, there was some coordination at the European level as well as global level through the G-20 countries. The first summit dedicated to the crisis took place in November 2008 and a second summit in April 2009. The main decisions taken in these summits were to coordinate actions and to stimulate demand and employment. In addition, G-20 countries committed to maintain the supply of credit by providing more liquidity. Central banks committed to maintain low interest rate policies for as long as it was necessary. Moreover, it was also agreed to help the emerging economies through the International Monetary Fund (IMF).

The crisis in Europe transformed from a banking crisis to a sovereign debt crisis. The European sovereign debt crisis started in 2008, with the collapse of Iceland's banking system, and spread primarily to Greece, Ireland and Portugal during 2009 (Arghyrou and Kontonikas, 2012). The debt crisis led to a crisis of confidence in European businesses and economies. Several countries received bailout packages from the European Commission, European Central Bank, and IMF. By 2012, many European countries had improved their budget deficits relative to their GDP and the eurozone's recovery started to take hold in 2013.

1.4 The impact of the GFC on ETEs

Even though the GFC commenced in the United States, as a result of the current global macroeconomic imbalances and financial globalization, the crisis could not be contained within the United States financial system and quickly spread to the other major financial centres. The GFC was associated with the worst recession since World War II. The world GDP per capita declined by 2% in 2009. As discussed in sub-section 1.2.1, the ETEs were severely affected by the GFC with an average GDP decline of around 7 percent in 2009, a more severe impact than in any other region in the world, including the EU15, where the output decline averaged 5% in 2009. However, as identified in sub-section 1.2.1, the impact of the crisis on economic activity varied extensively across countries in transition, with the Baltic States being most severely affected where economic activity in 2009 declined, on average, by around 14%, while the least affected were the Balkan countries with an average GDP decline of only around 4% in 2009.

ETEs, like other emerging markets, weathered the GFC relatively well up to mid-2008. The region was first hit by the crisis in the third and fourth quarters of 2008. Until then, most of these countries continued experiencing output and credit growth, large capital inflows and stable financial markets, despite the fact that the financial crisis had already hit the advanced economies over a year previously (EBRD, 2009). Based on the experience of previous emerging market crises, a dramatic decrease and subsequent reversal in cross-border lending flows was expected. In particular, ETEs seemed particularly at risk since they generally financed expansion with foreign bank loans, which resulted in the accumulation of large external and internal imbalances in many countries. Although a shock of such a massive proportions at the international financial system's centre was expected to rapidly spread to the transition countries, that did not occur (Berglöf et al., 2009). With a few exceptions, emerging Europe was left unaffected by the crisis during its first four quarters, since capital inflows held up and credit and output growth continued. The exceptions include the three Baltic States, where the credit boom started to reverse even before the beginning of the GFC. However, after the collapse of Lehman Brothers and Washington Mutual, the crisis finally hit emerging Europe. By the end of 2008 capital inflows to the ETEs and global trade declined sharply. More specifically, exports of goods and services dropped by around 10% in 2009. As shown in Figure 1.2c in sub-section 1.2.2, the Baltic countries experienced the largest decline in exports, which averaged 15% in 2009. The CEE countries' exports also declined sharply, averaging 12% in 2009, while exports from SEE countries dropped by an average of 7% during 2009. As for individual countries, the steepest decline in exports in 2009 was experienced in Estonia, Slovak Republic, and Slovenia (20%, 17% and 16%, respectively), while exports from Kosovo and Albania continued growing throughout 2009, although at a slower rate. The variation of the impact of GFC on exports in these countries can in part be attributed to different levels of exposure to the EU (EBRD, 2012). Figure 1.3 in sub-section 1.2.2 showed that exports of ETEs with stronger trade linkages with the EU15 appear to have declined more steeply in 2009 compared to exports of countries with weaker ties. Cross-border bank flows also declined sharply in the region, averaging 13% by the first quarter of 2009. As shown in sub-section 1.2.3, the countries that experienced the sharpest decline in cross-border credit flows during 2009 were Slovakia, Romania and the Czech Republic (60%, 21% and 16%, respectively) (BIS, 2017). The average decline of FDI inflows across the ETEs was 57% in 2009. The sharpest falls took place in Slovenia, Hungary, Latvia and Lithuania. The GFC also affected the remittance inflows in ETEs. More specifically, remittances fell sharply in Albania, Bosnia and Herzegovina, Poland, Romania and Slovenia.

Most of the financial indicators started to point up in 2010, corresponding to the general recovery in international financial markets. Almost all countries in the region saw a return to growth in 2010 and early 2011. However, the nature of the crisis changed fundamentally in 2011-2012. The banking crisis was transformed into a sovereign debt crisis in the Eurozone. The European banks weakened, which led to a decline in inflows of funds to emerging Europe. The average decline of the cross-border bank flows in the region was 7% in 2012 As shown in section 1.2.3, the countries that experienced the sharpest decline in cross-border credit flows during 2012 were Hungary and Slovenia (30% and 29%, respectively) (BIS, 2017). Nevertheless, the impact of this crisis was not as severe as from the 2008 crisis, considering that in most transition countries the governments undertook important adjustment measures. In addition, the Vienna Initiative helped to ensure that an immediate large-scale withdrawal of foreign banks from the region did not occur; thus it stabilised lending temporarily by the 17 banks that signed commitment letters (EBRD, 2015). Even so, transition countries were still vulnerable due to their dependence on the eurozone and their high levels of non-performing loans and foreign-currency denominated debt (EBRD, 2011). Consequently, since 2013, growth has remained relatively weak across many transition countries highly integrated with the eurozone due to decreases in capital flows and export demand.

Given the severity of the GFC and its impact on ETEs, it is important for policy makers in these countries to understand the international channels of transmission of the crisis in order to reduce their vulnerability to future negative shocks.

1.5 Key research questions and structure of the thesis

One of the key outcomes of the transition process in the former communist countries, as shown in section 1.2, has been deeper international integration through trade and financial flows. The rapid increase in exports led to a significant expansion of the exports to GDP ratio, which made these countries vulnerable to a decrease in export demand. In addition, a large proportion of exports was directed towards the EU, exposing these countries to shocks in the EU. Moreover, evidence suggests that countries with stronger trade linkages have more synchronized business cycles (Juvenal and Monteiro, 2017). In addition, cross-border bank acquisitions composed an important component of financial integration. The average asset share of foreign banks in transition region had, by 2009, reached more than 82% (Figure 1.4). Cross-border lending and foreign bank ownership resulted in a pre-GFC credit boom in the transition region, which boosted investment and output growth, but also led to large external imbalances financed by cross-border capital flows. In most of these countries, debt was mainly denominated in foreign currency, as shown in Figure 1.6, which made the borrowers vulnerable to a depreciation of the exchange rate.

Furthermore, even though remittances are an important source of capital flows in many transition countries, particularly SEE countries, as shown in sub-section 1.2.5, they made the countries more vulnerable to external shocks by creating an additional potential channel for contagion. These possibilities, to our knowledge, have not been addressed thoroughly in empirical studies related to transmission of the GFC to ETEs. To sum up, by investigating the transmission of the GFC to ETEs, whilst taking into account the degree of euroisation, integration with the EU, exports, remittance flows, bank ownership, FDI and foreign credit flows, this research intends to explore the extent to which they matter, and consequently make an original contribution to knowledge. Thus, this thesis will address these three key research questions:

1) What are the relevant models and empirical evidence on the international transmission of financial crises? What are the gaps in knowledge?

2) Which were the most significant channels of international transmission of shocks to ETEs?

3) Did the degree of euroisation, integration with the EU, remittance inflows, bank ownership, trade and foreign credit flows significantly modify the propagation of the GFC to ETEs?

The first research question is addressed through a review of the literature on financial contagion presented in Chapters 2 and 3. Chapter 2 identifies the theoretical framework behind the channels of transmission of the GFC and the influences of the degree of euroisation, foreign bank ownership, foreign capital flows and integration with the EU in transmission of the GFC to ETEs. It starts with an overview of the theory of financial contagion, which is followed by a review of the theory on the causes of increased euroisation and its main costs and, lastly, the theory of European integration. Chapter 3 provides a critical review of the empirical studies that have investigated the international transmission of the GFC and the role of euroisation, bank ownership, foreign credit flows and integration with the EU in this process. The aim of both these chapters is to identify the gaps in the literature, which are then addressed empirically in Chapters 4 and 5.

The analysis presented in Chapters 4 and 5 answer questions 2 and 3 using, respectively, macro and micro level data and different estimations techniques.

Chapter 4 investigates how GDP and financial shocks in European advanced countries were transmitted to ETEs, using the recently-developed GVAR (global vector auto-regression) approach. Two samples were employed over the period 1999Q1-2014Q4 and 2003Q1-2014Q4. The first sample encompasses 30 countries (15 ETEs and 15 advanced EU countries) and the second sample encompasses 32 countries (17 ETEs and 15 advanced EU countries). Two types of variables are used to capture the main channels of international financial contagion: trade and financial.

Chapter 5 investigates the transmission of the GFC of 2008/2009 by employing firm-level data. This chapter covers six transition countries and examines whether the initial conditions (from 2007) had an impact on the firms' sales in 2009. The measure of sales growth from 2008 to 2009 is used to proxy the impact of the GFC on firms. The intention of this study is to distinguish between two main channels of transmission as suggested by theory, namely the trade and financial channels, thus a wide range of variables is used to capture these channels.

Finally, Chapter 6 presents the key findings of the thesis, establishes their contribution to knowledge, examines their policy implications, identifies the main limitations of the research and provides recommendations for future research.

CHAPTER 2

TRANSMISSION OF GLOBAL FINANCIAL CRISES: A REVIEW OF THE THEORETICAL LITERATURE

Contents

2.1 Introduction

Having looked at the influences of exports, bank ownership, foreign credit flows, FDI inflows, remittances, the degree of euroisation and extent of progress towards EU integration in the transmission of the GFC to ETEs in Chapter 1, this thesis proceeds with a critical review of the theoretical (Chapter 2) and the empirical literature on the international transmission of crises (Chapter 3). The reviews presented in these chapters will provide the basis for developing the models that will be used to explore the international transmission of GFC to ETEs in the empirical chapters.

The increase in the frequency of crises during recent decades has generated a growing strand of theoretical and empirical literature on their origins and channels of transmission. Considering the severe impact of the GFC on transition countries (see section 1.4), a number of studies have been particularly focused on the transmission of the crisis from developed to transition countries. Factors that have been highlighted as playing an important role in explaining why certain countries were hit by the crisis harder than others include: fast pre-crisis credit growth; large current account deficits; high trade openness; high international openness of the banking sector; a higher level of GDP per capita (Berglöf et al., 2009; Blanchard et al, 2010; Lane and Milesi-Ferretti, 2011; Rose and Spiegel, 2009a, 2009b, 2011; Berkmen et al., 2012; Popov and Udell, 2012; Feldkircher, 2014; Park et al., 2014; De Haas et al., 2015; Ongena et al., 2015; Ahmed et al., 2017). One potentially important factor that previous studies neglected, although it is a common characteristic of ETEs, is the extent to which a country has assets and liabilities denominated in foreign currencies, namely the degree of euroisation. Consequently, when investigating the transmission of the GFC to ETEs, it is important to control for the degree of euroisation. Additionally, the degree of integration with the EU and quality of institutions may have given rise to different exposure to the transmission mechanisms and different transmission channels. As highlighted in Chapter 1, these additional possibilities, to the best of our knowledge, have not been addressed thoroughly in previous empirical studies related to the transmission of GFC to ETEs.

Accordingly, three main strands of literature are relevant to this research. First, there is research on financial contagion and transmission channels, which distinguishes between fundamental causes (common shocks, trade linkages and financial linkages) and investors' behaviour (liquidity problems, asymmetric information, incentive problems etc.) (Masson, 1998; Dornbusch et al., 2000; Forbes and Rigobon, 2001). While these causes shape the transmission of the shock from the advanced economies, the magnitude to which it gets intensified depends, to a large extent, on institutional responses and existing macroeconomic vulnerabilities (Berkmen et al., 2012).

Consequently, the second strand of literature that is relevant to this research is related to the extent to which a country has assets and liabilities denominated in foreign currencies, namely the degree of euroisation. The main costs/risks associated with euroisation are: inability/ineffectiveness to act as a lender of last resort, adverse currency mismatches and reduction in monetary policy autonomy/effectiveness all of which can increase the vulnerability of the banking system, increase interest spreads and reduce the credit supply (Honohan and Shi, 2002; Winkler, et al., 2004; Click, 2007; Honohan, 2007; Chitu, 2013). These three main costs associated with euroisation might become more evident during periods of severe financial crisis. Hence, the recent global financial crisis can be considered as a unique opportunity to investigate the influence of degree of euroisation on the severity of the impact of the GFC in ETEs.

The third strand of the literature relevant to this research relates to integration with the EU, which might have provided different exposures to the transmission mechanisms and different transmission channels. Countries that made more progress with institutional reforms may have been better able to deal with external shocks, given their higher quality institutions and/or more effective governments. On the other hand, countries that made the most progress in integrating with the EU may be more vulnerable to the crisis, as they were more open to the transmission effects through financial flows and falling export demand (Bartlett and Prica, 2012).

This chapter identifies the theoretical framework behind the channels of transmission of the GFC and the influences of the degree of euroisation, trade, foreign bank ownership, foreign capital flows and integration with the EU in transmission of the financial crisis to ETEs. It starts with an overview of the theory on international channels of transmission of shocks, which is followed by the theory on the causes of increased euroisation and its main costs and, lastly, the theory of European integration.

The chapter is organized as follows. Section 2.2 reviews the theoretical framework on channels of transmission of the global financial crises. The theory behind euroisation and its main costs is summarized in section 2.3. Section 2.4 provides some theoretical background on European integration. The last section of this chapter provides conclusions and examines their implications for the design and implementation of this research programme.

2.2 International transmission of the GFC

A rich literature covering both theoretical and empirical research on crises and transmission channels has emerged in recent years. There are different views on defining "financial contagion" and modelling the transmission of shocks. According to Claessens and Forbes (2004), a contagion is defined as the transmission of a crisis between two countries that are located in different regions and have no direct trade or financial ties. However, the authors point out that there seems to be some disagreement on whether this scenario should be defined as contagion, as some economists prefer to use the term shift contagion to describe this kind of situation. Moreover, there is also disagreement on whether "financial contagion" is appropriate to describe a situation where a crisis spreads between two similar and strongly linked countries. As an example, if there are two countries in the same geographical location, linked through trade and financial channels and very similar regarding their market structure, then they tend to be highly inter-connected all the time, during stable as well as crisis periods (Claessens and Forbes, 2004). Nevertheless, there is a general agreement that financial contagion can be defined as co-movement in asset prices or financial flows after a shock to a country or group of countries.

Orthodox theory on the transmission of shocks distinguishes between two groups of theories that explain contagion: fundamental causes (common shocks, trade and financial linkages) and investors' behaviour (liquidity problems, asymmetric information, incentive problems etc.) (Masson 1998; Dornbusch et al., 2000; Forbes and Rigobon, 2001; Karolyi, 2003; Claessens and Forbes, 2004). Given the increasing international integration of ETEs through trade and capital flows discussed in section 1.2, sub-section 2.2.1 focuses on explaining the international transmission of shocks through fundamental causes, in particular trade and financial channels, with a particular focus on the GFC. Further, investors' behaviour as a mechanism for the international transmission of shocks is elaborated in sub-section 2.2.2. However, given the relatively low level of financial market development in most ETEs, investors' behaviour factors are likely to be less important in explaining contagion in these countries. Nevertheless, it has to be pointed out that there might be some overlap between these two categories of theories that explain contagion. Namely, if investors' behaviour is not completely irrational and if it is partially based on some macroeconomic fundamentals, then this behaviour might also fit under the theory that explains contagion based on fundamental causes. Section 2.2.3 provides an overview of the theory of transmission of shocks from the financial to the real economy.

2.2.1 Fundamental causes

The first group of theories that explain contagion, fundamental causes, refer to transmission of shocks due to the usual interdependencies that exists across markets and economies. Typically, fundamental causes are divided into three categories: common or global shocks; financial channel; and the trade channel. The first of these mechanisms of transmission of shocks is the common or global shock, such as a major change in the relative price of oil, which triggers crises in both developed and emerging economies (Dornbusch et al, 2000). Common shocks can lead to co-movements in asset prices or capital flows.

Secondly, trade linkages are considered one of the most important fundamental causes for the international transmission of crises. This group includes linkages through direct trade and competitive devaluations (Eichengreen et al. 1996; Glick and Rose, 1999; Corsetti et al., 2000; Dornbusch et al., 2000; and Forbes, 2002). During the last two decades, there has been a growing consensus that countries with stronger trade linkages have more synchronized business cycles (Juvenal and Monteiro, 2017). Chui et al. (2004) identify a number of potential trade channels. A crisis in one country by causing a reduction in income may reduce the demand for imports, thus affecting exports, the trade balance, and related economic fundamentals in other economies through direct trade links. A competitiveness effect may arise if the initial crisis in one economy causes its currency to be devalued (Chui et al., 2004). Devaluation temporarily improves the country's competitiveness, while reducing the competitiveness (both bilaterally and in common export markets) of tradables produced by other economies, thus worsening their economic performance. This can lead to pressuring other countries' currencies to depreciate. Therefore, a currency crisis that hits one country may be expected to spread over time to other countries. Gerlach and Smets (1995) show how the depreciation of one currency affects the competitiveness of countries with pegged currencies, which might trigger a crisis and force depreciation of their currency. Moreover, they show that the contagion impact is higher, the higher the degree of trade integration between these countries and the lower the degree of integration of these countries with another country. Similarly, Glick and Rose (1999) concluded that currency crises spread mainly because of the trade linkages. Specifically, countries may be attacked because of the actions of their neighbours, who mainly due to geographic proximity tend to be their major trading partners. A crisis is spread from one country to another if these two countries share various economic features, such as a real exchange rate over-valuation, weaknesses in their banking systems and low international reserves (Sachs et al., 1996). Given that bilateral trade flows are, in most of the cases, negatively affected by distance, currency crises are likely to be regional. As shown in section 1.2, during 2009 the European transition region experienced a decline of around 10% in exports of goods and services that was attributed to the GFC. It was argued in section 1.2 that the variation in export performance during the GFC can in part be attributed to different levels of exposure to the Eurozone: exports of ETEs with stronger trade linkages with the EU15 declined more steeply in 2009 compared to exports of countries with weaker ties.

The third mechanism for the transmission of shocks through fundamental causes is the financial channel. Transmission of shocks through this channel has gained increasing attention in recent years. In a highly integrated region, a crisis that starts in one country will affect other countries by reducing capital inflows (Claessens and Forbes, 2004). Therefore, as argued in section 1.2, increased financial integration made the ETEs more vulnerable to international crises by creating and/or strengthening potential financial channels for contagion through foreign banks, cross-border bank flows, FDI and remittances. In particular, the crisis in one country, by reducing the capital supply of that country, will decrease the lending and investing abilities of that country to another country. Therefore, these reductions in capital inflows will increase the borrowing costs and put pressure on currency depreciation for countries that are highly dependent on external funding. According to Chui et al. (2004), the impact of shocks on the costs of domestic or cross-border sources of finance will depend on an emerging economy's sensitivity to each.

Theoretical models of banking crises suggest that an important role in the propagation of a financial crisis is played by large and highly leveraged financial institutions, such as international banks (Tirole, 2011; Greenwood et al., 2015). During the GFC, an important transmission mechanism has been the global restriction of credit, which has especially affected transition economies with a high penetration of foreign banks (Lane and Milesi-Ferretti, 2011). As argued in section 1.2, the presence of foreign banks in transition countries helped to strengthen their national banking systems and improve their low level of financial intermediation. On the other hand, the growing role of foreign banks increased the exposure of transition countries to foreign shocks (Roaf et al., 2014).

Árvai et al. (2009) highlight the importance of cross-border finance in transmitting crises through financial linkages. They illustrate some of the channels of transmission of contagion through financial linkages. One possible channel is the existence of a common lender which lends to a number of countries. If one of the countries that borrows from the banking system of this common lender faces a shock, given that the common lender's banking system is largely exposed to this country, it will affect the liquidity or solvency of the common lender. Therefore, other countries borrowing from the lending country will also be affected, even though they do not have direct linkages with the country that was hit by the shock. Similarly, if a parent bank withdraws its deposit or lending or charges higher interest rates to its subsidiary, and if the subsidiary is highly dependent on the funding of the parent bank, it will face liquidity and solvency problems. As a consequence, in heavily concentrated banking systems with substantial market linkages, liquidity problems can rapidly spread to other domestic or foreign-owned banks and, as a result, their parent banks and the banking systems in which the parent banks operate. This in turn will affect the banking sector of the entire region. Árvai et al. (2009), point out that the size of contagion through financial channel depends on: the size of the exposures of home banks (common lender) to the host country with a problem and the dependence of the host country on funds from the home country. "Bank balance-sheet driven contagion" can also occur through the international banking system when banks decrease loans in one country as a response to losses in another country. This indirect financial contagion mechanism was first suggested by Calvo (1998) to introduce a causal link between the 1998 Russian crisis and the following crisis in Brazil. Bank balance sheet shocks start from deteriorations in the balance sheets of a country's foreign bank creditors. Such shocks can be direct or indirect. Direct bank balance sheet contagion occurs when banks from a creditor country with a deteriorating risk profile decide to withdraw international funding to comply with internal rules or prudential regulations such as capital adequacy requirements. On the other hand, indirect bank balance sheet contagion occurs when banks decrease loans to a debtor country in response to deteriorations in their loan portfolio in another country (Ahrend and Goujard, 2013).

Even though, as argued above, trade and financial linkages serve as international channels of transmission of shocks, the extent to which the shocks get amplified also depend on the responses of policy-makers and existing domestic vulnerabilities. During the years following the GFC there has been a growing consensus on the importance of macroeconomic fundamentals in coping with external shocks. Frankel and Saravelos (2012) analyse the effects of the GFC by selecting variables from an extensive review of the previous literature on early warning indicators. They find that real exchange rate overvaluation and levels of international reserves can explain the variation of the impact of GFC across countries. Fratzscher (2012) demonstrates that the heterogeneity of the impact of the GFC across countries can be explained by differences in country risk, quality of domestic institutions and the strength of domestic macroeconomic fundamentals. More specifically, the author shows that countries with high-quality institutions and strong macroeconomic fundamentals were better able to protect their financial markets from adverse shocks during the GFC. In addition, the author highlights that trade and financial linkages played a minor role in explaining cross-country heterogeneities in the transmission of the GFC. Ahmed et al., (2017) show that the financial markets in emerging economies with better macroeconomic fundamentals (current account balance; foreign exchange reserves; short-term external debt; the gross government debt; inflation etc.) were less severely affected by the GFC and the subsequent Eurozone debt crisis in 2011. They also find that financial conditions worsened more in countries that had previously experienced larger capital inflows and greater exchange rate appreciation. In contrast, Eichengreen and Gupta (2015) and Aizenman et al. (2016) do not find evidence that strong macroeconomic fundamentals (a lower public debt, a lower budget deficit, a higher level of international reserves and higher economic growth) protected emerging economies from the effects of the global shocks.

2.2.2 Investors' behaviour

The second group of theories that explain contagion are based on investors' behaviour. If fundamentals and common shocks are not able to fully explain the relationship between countries, then the spillover effects might be explained by rational or irrational herding behaviour (Dornbusch et al., 2000; Forbes and Rigobon, 2001; Karolyi, 2003; Economou et al., 2011; Galariotis et al., 2016). Claessens and Forbes (2004) define five main categories of theories explaining contagion based on investors' behaviour: liquidity problems; incentive problems; informational asymmetries; market coordination problems and investor reassessment. One common feature of all of these theories is that despite the fact that investors' behaviour is often rational ex-ante, it might still lead to excessive co-movements in market prices in the sense that market prices are not explained by real fundamentals (Claessens and Forbes, 2004). However, given the relatively low level of financial market development in ETEs, investors' behaviour factors are likely to be less important in explaining contagion.

The first category focuses on liquidity problems (Goldfajn and Valdés, 1997; Dornbusch et al., 2000; Kaminsky et al., 2001; Claessens and Forbes, 2004). Investors who due to a crisis are faced with liquidity problems tend to sell their securities in other markets in order to raise cash. This kind of behaviour causes a decrease in asset prices outside of the crisis region. As a result, the initial disturbances will spread and affect different markets and borrowers.

The second category of theories that explain the impact of investors' behaviour on contagion focuses on incentives and risk aversion (Claessens and Forbes, 2004). Broner et al. (2006) present a model that analyses the effect of changes in investors' risk aversion on portfolio decisions and stock prices. Their findings suggest that an investor who cares about his performance relative to that of other investors, would shift his portfolio towards the average portfolio as a response to an increase in risk aversion. More specifically, the investor would shift his assets from countries to which he is overexposed towards those to which he is underexposed. Considering that crises mostly affect those investors who are most exposed to the crisis country and those investors, in turn, adjust their portfolios away from other countries in which they are overexposed, crises are transmitted through overexposed investors. This type of behaviour could result in widespread price declines and currency depreciations.

A third type of theories explaining contagion caused by investors' behaviour is based on asymmetric and imperfect information. Due to the lack of complete information about the conditions in each country, a financial crisis in one country can make investors think that other countries may face the crisis too. Therefore, they start selling their assets in those countries which they believe will face similar problems. This type of behaviour can also be a result of actions of other investors (Calvo and Mendoza, 2000). Due to the lack of information, investors may find it less costly and easier to follow the example of other informed and uninformed investors.

A fourth group of theories explaining contagion based on investors' behaviour focuses on market coordination problems (Masson, 1998). According to this theory, investors can change their behaviour as a result of self-fulfilling expectations that can cause multiple equilibria (Dornubusch et al., 2000; Claessens and Forbes, 2004). In particular, investors could unexpectedly withdraw from a country based on their beliefs about the future and their fears that unless they act quickly, it will be too late to utilise the limited foreign exchange reserves (Dornbusch et al, 2000). These types of market coordination problems are believed to be one of the most important channels of contagion.

As per Claessens and Forbes (2004), the last category of theories that explain contagion based on investors' behaviour focuses on the reassessment and beliefs of investors regarding the stability of rules governing international finance. A country's and more generally investors' concerns regarding the aggressive policies that other countries might follow during the crisis period with respect to foreign creditors, as well as their concern that financial institutions will not help countries in difficulties due to limited funds, would cause investors to sell their assets outside the crisis country, thus causing contagion.

Having identified the theory behind the international channels of transmission of shocks, the next sub-section summarizes the theory on transmission of shocks from the financial sector to the real economy.

2.2.3 Transmission of shocks from the financial sector to the real economy

The recent global crisis prompted many researchers to revise the analysis of the transmission of shocks from the financial to the real sphere of the economy, both in general and with regards to particular economies (Blot et al., 2009; Boorman, 2009; Cardarelli et al., 2011). The literature on the transmission of shocks identifies channels between real and financial sectors that might work in both directions. Namely, financial conditions are influenced by the conditions in the real economy, specifically households' and firms' balance sheets, whilst those balance sheets eventually influence the real economic sector (Foglia et al., 2011). Literature on the transmission channels between the real and the financial sectors is based on standard macroeconomic theory (Vousinas, 2013). More specifically, households' and businesses' performance decreases as a result of weaker macroeconomic conditions that affect their income and profits (Foglia et al., 2011; Lupu, 2012, Vousinas, 2013). Another potential effect would be a tightening of credit conditions and an increase in borrowers' default probabilities, which would directly weaken banks' net returns and hence their balance sheets. There is considerable academic research that documents the link between financial and real sectors. The most well-known categories of these transmission channels are: the interest rate channel; the wealth effect; and, the financial accelerator (also referred to as the borrower balance sheet channel and the bank balance sheet channel).

The interest rate channel or cost of capital may be a significant mechanism in the transmission of interest rate shocks (due to changes of liquidity on interbank market and/or changes of monetary policy) (Lupu, 2012). A decrease in interest rates, by causing a reduction in the cost of capital and assuming that prices and wages are fixed, typically induces a rise in investment spending, therefore leading to a rise in aggregate demand and in output. A similar rationale applies to investment decisions in housing or purchases of durable goods by households, with a fall in the interest rate accounting for a fall in the cost of borrowing. The interest rate channel of monetary transmission has traditionally been a key component of how monetary policy effects are transmitted to the economy (Mishkin, 1995). More specifically, contractionary monetary policy increases the short-term nominal interest rate, then, due to sticky prices and rational expectations, the long-term interest rate increases as well (Lupu, 2012). The higher interest rates initially decrease residential investment and consumption expenditure, which is followed by a decline in business investment, resulting in an overall decline in aggregate output (Bernanke and Gertler, 1995).

While traditional theory suggests that the interest rate channel may play a key role in transmission of shocks from the financial to the real sector, the lack of empirical evidence in this area has led to consideration of other channels, in particular the wealth effect and the credit channel (Mishkin, 1995; Boschi and Goenka, 2012; Lupu, 2012). The wealth effect is based on Friedman's permanent income hypothesis. According to this theory, the consumption of households is determined by the wealth they own through actualizing their current and expected future incomes. A negative shock on equity price or stock markets, by reducing consumers' permanent income, will reduce their consumption expenditure. However, if the shock is perceived as temporary, consumption will not change, considering that the households actualize their current and future income. On the contrary, higher equity prices will boost consumers' confidence and increase consumption expenditure (Bernanke, 2010).

The borrower balance sheet channel and the bank balance sheet channel highlight the influence of the net worth of agents on the credit conditions they face. In most of the cases, these channels result from the information asymmetries and agency costs as well as regulations on bank capital requirements (Vousinas, 2013). Stiglitz and Weiss (1981) have suggested that information asymmetries between lenders and borrowers generate agency costs because of the need to monitor and obtain information on the quality of projects applying for financing. In addition, Bernanke and Blinder (1988) and Bernanke and Gertler (1995) show that financial imperfections, due to asymmetric information, can contribute to the transmission and amplification of the shocks. In models based on the financial accelerator, borrowers have to pay a premium for external financing that is specific to each debtor depending on agency costs. (Bernanke and Gertler, 1995). The higher the informational asymmetries, the more costly external financing and the higher net wealth, the less costly external financing is. Thus, a shock that decreases the revenues of non-financial agents or reduces the value of their collateral, will lead to a higher premium for external financing. As a consequence, agents will modify investment and consumption projects, which would result in amplification of the initial shock (Goodhart and Hofmann, 2008, Mishkin, 2007). On the other hand, considering that the premium for external financing depends on the net wealth of agents, banks may adjust their balance sheets in favour of larger firms.

The literature related to the bank balance sheet channel is itself divided into two separate parts. The first part is the bank lending channel which emphasizes that credit supply is affected by shocks on banks' balance sheets. The second part is the bank capital channel. Specifically, a decrease in banking capital would result in an increase of the cost of financing faced by banks and, as a result, in the cost of credit faced by borrowers. Regulatory capital requirements also affect lending decisions. During economic downturns, in addition to loan losses, the increased risk-weighted assets also decrease the banks' capital. As a result, banks would be faced with higher capital needs, but due to difficulties in increasing their capital, they would most likely de-lever their assets and decrease assets with higher risk weights, such as lending. As a result of this reduction in credit extended to firms and households, the initial economic downturn worsens. Peek and Rosengren (1995) have shown that contractionary shocks to banking capital reduce banks' credit supply in the case of regulatory capital requirements, which reactivates the credit channel. Following a shock which would lower assets' quality, in order to satisfy their prudential ratios, banks have either to reduce their exposure to risk (by offering fewer loans) or increase their capital. However, in the context of informational asymmetries, raising capital is costly, especially in financially and economically "troubled" times.

This section provided an overview of the theory explaining the international and domestic channels of transmission of shocks, covering the first strand of literature relevant to this research programme. The next section continues with the second strand of relevant literature: the theory explaining the causes of increased euroisation and its main benefits and costs.

2.3 Euroisation

As shown in section 1.2, ETEs are characterized by a high degree of euroisation. There are various causes of this high degree of euroisation: a lack of macroeconomic credibility and high inflation volatility, whilst the expected euro adoption in some countries has also stimulated the use of foreign currency instead of domestic currency (Zettelmeyer et al., 2010). In addition, the high concentration of foreign bank ownership in most transition countries and the availability of foreign financing have further encouraged the use of foreign currency. The presence of euroisation in these countries made them more vulnerable to the crisis. The remaining discussion in this section will provide a brief overview of the theory of euroisation, the main costs and benefits associated with it and relevance to the transmission of international crises to ETEs.

Euroisation is a process where the domestic currency is substituted by a foreign currency for conducting transactions. The literature distinguishes between official or full and unofficial or partial euroisation depending on whether the country has officially adopted a foreign currency. The literature also recognizes two different types of partial euroisation: currency substitution when foreign currency is used as a means of payment and unit of account; and asset substitution when assets are held in a foreign currency.

Previous research identifies four different streams of theories that explain the reasons for euroisation: the conventional view; the portfolio view; the market failure view; and the institutional view (Calvo and Veigh, 1992; Savastano, 1996; Levy Yeyati and Sturzenegger, 2001; Ize and Levy Yeyati, 2003; De Nicolo et al., 2005; Galindo and Leiderman, 2006; Levy Yeyati, 2006; Sanchez, 2006).

The first stream of theory that explains the presence of euroisation, the conventional view, relates partial euroisation to macroeconomic instability and considers it as an obstacle to the conduct of monetary policy. The conventional view mainly derives from the early literature on currency substitution, whose findings showed a positive impact of inflation and exchange rate instability on foreign currency presence (Baliño et al., 1999; Reinhart et al., 2003; Court et al., 2010). More specifically, the early literature on currency substitution argued that in highly euroised economies the demand for money is more unstable and the price response to monetary shocks is more elastic, considering that devaluation expectations influence the currency composition of liquid balances (Levy Yeyati, 2006). In highly euroised economies monetary policy may be less effective in influencing interest rates (Baliño et al., 1999; Levy Yeyati, 2006; Reinhart et al., 2014).

The second stream of theory behind euroisation, the portfolio approach, justifies the presence of euroisation as reflecting optimum portfolio choices made by risk-averse investors based on given distributions of expected returns for each currency (Levy Yeyati, 2006). According to this view, the degree of financial euroisation is a result of the interaction between supply and demand for foreign currency assets in the loanable funds market (Levy Yeyati, 2006). Consequently, financial euroisation is a result of financial equilibrium between borrowers and creditors who seek to optimize their assets based on risk/return across currencies. Thus, the return on domestic currencies depends on changes in the inflation rates, while the return on euroised assets depends on changes affected by the real exchange rates. If the real interest rates do not differ across currencies, then investors would choose the currency composition which would minimize the variance on portfolio returns, which is affected by changes in inflation rates and real exchange rates. Hence, according to the portfolio approach, it would be expected that the degree of financial euroisation will increase if the expected instability of the inflation rate is high in relation to that of the real exchange rate (Levy Yeyati, 2006).

The market failure view relates financial euroisation to the presence of market imperfections and externalities, and an inadequate regulatory framework which fails to address them (Levy Yeyati, 2006). More specifically, the market failure view suggests that financial euroisation increases when economic agents ignore the risks associated with exchange rates while lending and borrowing in foreign currency.

The final stream of theory behind euroisation, the institutional view, argues that euroisation is a direct result of the low institutional credibility. Due to low institutional credibility, borrowers would expect high interest rates and inflation in domestic currency, which would lead to a higher level of euroisation (Savastano, 1996)

2.3.1 Benefits and costs/risks associated with euroisation

Euroisation was endorsed in ETEs due to the potential benefits expected from it. One of the expected benefits of full euroisation is the decrease in inflation rates, taking into account that under full euroisation there is no risk of currency depreciation. Another expected benefit from full euroisation is the lower cost of borrowing, considering that full euroisation eliminates the devaluation risk and should therefore reduce interest rates. In the public sector, the reduction in the cost of borrowing represents a reduction in the costs of servicing debt, while in the private sector, the lack of devaluation risk should attract investors and stablise capital flows (Quispe-Agnoli, 2002). When it comes to benefits from partial euroisation, the research identifies the following. By allowing the opening of deposits in foreign currency accounts, monetary authorities have an opportunity to promote higher financial intermediation, financial sophistication and diversification (Quispe-Agnoli, 2002; Komarek and Melecky, 2003). Moreover, by lowering the cost of international financial transactions, euroisation increases the degree of integration with global financial markets and reduces the possibility of foreign exchange and financial crises (Quispe-Agnoli, 2002; Click, 2007).

On the other hand, research highlights various costs associated with a high degree of euroisation. First, there is inability/ineffectiveness to act as a lender of last resort. A classical explanation of the lender of last resort is that bank runs may occur even if the banking system is solvent (Broda and Levy Yeyati, 2002). However, Diamond and

Dybvig (1983) argue that the lender of last resort can prevent such runs on deposits if, for example, an excessive number of depositors withdraw their deposits, they can trigger a general withdrawal. Due to imperfect information about the solvency of the banks, potential lenders may decline credit to solvent institutions in need. However, the lender of last resort can provide liquidity, and under such conditions, the withdrawal of deposits could be stopped and bankruptcy avoided. Nevertheless, it has been argued that a high degree of euroisation may impair the country's lender of last resort function and central bank's response to emergencies in the financial system (Berg and Borensztein, 2000). More specifically, a devaluation would pose a significant threat to unhedged banks, especially if banks are permitted to keep open currency positions in foreign currencies. Bank runs may be triggered if foreign currency borrowers earn their income in domestic currency. If devaluation expectations continue, depositors could withdraw their money which would increase the demand for foreign currency, hence would further increase the devaluation expectations. Euroisation does not completely limit the ability of central bank to provide short term liquidity to the banking system, considering that it may have foreign currency reserves or may secure credit from international institutions. However, in a situation where there is a general loss of confidence in the banking system, the central bank would not be able to fully back bank deposits. Considering that the central banks do not have the ability to print foreign currencies, then their function as a lender of last resort would be impaired.

The second cost of euroisation relates to adverse currency mismatches, defined as differences in the values of the foreign currency denominated assets and liabilities on the balance sheets of households, firms, the government, and the economy as a whole (Eichengreen et al., 2003). The banking sector is affected by this imbalance if a bank borrows in foreign currency and lends in the domestic currency (Levy Yeyati, 2006). The currency mismatch is the difference between the foreign currency denominated liabilities and assets. Currency mismatches are mainly present at the firm level. Due to increased levels of deposit euroisation, banks tend to lend in foreign currency in order to reduce their currency risk (Abrams and Beato, 1998). Foreign currency loans are usually made available to borrowers whose income is mainly denominated in domestic currency, thus the foreign exchange risk is transferred to them (Levy

Yeyati, 2006). With regards to firms, the currency mismatch derives from the relationship between net foreign currency denominated liabilities and the net present value of domestic currency denominated cash flow. Hence, a firm with a currency mismatch will be subject to an adverse balance sheet effect if a depreciation of the exchange rate increases the value of its foreign currency denominated liabilities in relation to the net present value of its cash flow (Eichengreen et al., 2003).

Similarly, the sovereign debt denominated in a foreign currency can be a subject to adverse currency mismatches due to the increased vulnerability of the country to depreciations of its domestic currency during severe crises. Furthermore, the exposure to real exchange rate variations would amplify the effect of shocks or speculations on the currency, which could lead to bankruptcies and financial collapses (Levy Yeyati, 2006).

The third cost of euroisation is related to a reduction in monetary policy autonomy. A common view among economists is that a high degree of euroisation makes monetary policy less effective since it can increase the volatility of demand for domestic currency due to reduced costs of switching from local to foreign currency in order to avoid the impact of inflation (Alvares-Plata and García-Herrero, 2007). However, currency substitution also increases exchange rate volatility. In an economy with high currency substitution, a policy of devaluation is less effective in changing the real exchange rate because of significant pass-through effects to domestic prices (Berg and Borensztein, 2000).

The three main costs associated with euroisation may become more evident during periods of severe financial crisis. Given the presence of the relatively high degree of euroisation in ETEs (discussed in section 1.2), the GFC can be considered an exceptional opportunity to investigate the impact of the degree of euroisation on the international transmission of crises to these countries. Even though euroisation is associated with several benefits highlighted above, it is not clear whether they might have outweighed the costs during the GFC. On the one hand, given the liquidity problems that many transition countries faced during the GFC, euroisation might have helped with financial intermediation due to its advantage in reducing transaction costs and leading to a greater financial integration. On the other hand, euroisation might have made these countries more vulnerable to cross-border lending, which, as shown in section 1.2, decreased dramatically during the GFC. In addition, the depreciation of the domestic currencies during the crisis, as mentioned in section 1.2, might have prevented unhedged borrowers from servicing their loans in foreign currencies. Hence, it is crucial to investigate the impact of the degree of euroisation on ETEs during the GFC. The next section provides an overview of the third strand of literature relevant to this research programme: the degree of integration with the EU.

2.4 Integration with the EU

In general, economic integration starts with a free trade agreement, which guarantees free trade between countries that enter this agreement, by eliminating customs duties and tariff trade barriers within the free trade zone. The establishment of the customs union in 1968 was the first major achievement of the process of European integration (Vetter, 2013). A customs union is a free trade area that requires all member countries to adopt the same policies with regards to tariffs for trade with non-members, whereas members of the free trade area are entitled to set their own policies regarding trade with non-member countries. The Single European Market is a higher level of integration which allows free movement of all factors of production between member countries. Most countries in the Single Market participated in the Economic and Monetary Union, which was established in 1999. With the formation of the Economic and Monetary Union, European economic integration reached its highest level (Badinger and Breuss, 2011). Many theories which aim to explain the process of integration with the European Union and its possible outcomes have emerged during the years. The most influential theories about the process are the following: neo-functionalism, which places a major emphasis on the role of "spill-over" effects which would trigger economic and political dynamics leading to further cooperation and integration; intergovernmentalism, which rejects the "spill-over" effects proposed by the neo-functionalism theory and emphasizes the importance of the member states in the integration process by arguing that the governments of the member states are the main actors in this process and they get strengthened by the process; liberal intergovernmentalism, which also argues that the national governments are the main actors in the integration process and stresses the model of preferences, where governments state their preferences and bargain with other member states; institutionalism, which gives emphasis to the relevance of institutions during the process of European integration; and multi-level governance, which argues that European integration is a too complicated process to be explained by the static integration theories and considers policy-making in the EU as uneven and frequently changing (Moravscik, 1993; Puchala, 1999; Rosamond, 2000).

2.4.1 Benefits associated with European integration

The impact of European integration on countries and regions is a much debated topic in the theoretical and empirical literature. From a theoretical point of view, both positive and negative effects from increased economic integration are possible (Badinger, 2005). Smith and Wanke (1993) argue that while the EU as a whole may benefit from the implementation of the 1992 program and the Maastricht Treaty, individual countries are expected to be differently affected by the increased economic integration.

- When it comes to economic benefits that result from European integration, although there is a general agreement that most of them are related to trade liberalization, the single market and the common currency, it is widely recognised that the most important effects are related to economic growth and productivity (Baldwin, 1989; Baldwin and Seghezza, 1996; Frankel, 2010). The main recognised economic benefits associated with European integration are the following (Anderson and Reichert, 1995; Vetter, 2013):

- Cost reductions resulting from the elimination of border formalities and national regulations due to harmonisation of production and quality standards (Vetter, 2013). This results in a reduction of import prices, both for companies and consumers.

- Economies of scale: access to a larger market potentially increases the sales of companies. In industries characterized by increasing economies of scale, companies can become more cost-efficient. As such, companies can optimise their production by establishing international manufacturing networks and using comparative cost advantages. This would in turn increase competitiveness with rival companies outside the EU as well as attract foreign direct investment from third countries.

- Increased competition as a result of lower entry barriers and easier market entry for foreign firms. Companies that are inefficient are competed out of the market by more efficient companies, which reduces the mark-ups in heavily protected and inefficient markets (Vetter, 2013). Another benefit for consumers is greater product diversity. In addition, consumers are faced with greater product diversity.

- Increased employment opportunities: EU citizens have equal rights in labours markets of any Single Market country as domestic workers. Professional and academic qualifications are mutually recognised, which enhances opportunities abroad and enables companies to attract skilled employees from abroad (Vetter, 2013).

- Lower financial transaction costs: cross border financial transactions are cheaper due to liberalisation of capital flows and financial integration. Consumers are faced with greater package of financial products and have greater portfolio diversification possibilities.

2.4.2 Integration with EU

The process of accession to the European Union requires countries to fulfil a number of key criteria, by focusing on harmonising their policies and practices with EU directives and regulations (Carius et al., 1999). These key criteria overlap with the objectives that dominated the transition process: macroeconomic stabilization; real adjustment at the microeconomic level; and creation of a liberal institutional framework (Piazolo, 2000). Consequently, progress with EU integration has been positively correlated with progress in transition.

The theory on European integration lacks clear economic arguments to explain the mechanism by which the degree of European integration and progress with transition influence the severity of impact of the external shocks on transition countries. However, there are a few views as to whether progress with transition and integration to EU better equipped countries with the tools necessary to deal with external shocks, or rather made them more vulnerable to them. Belke et al. (2009) have shown that progress with EU integration has a positive effect on institutional quality as measured by the World Bank Governance Indicators. They conclude that even introducing formal relationships of a country with the EU improves its institutional quality beyond merely economic institutions. In general, the institutional characteristics which may shape the impact of external shocks are related to the quality of developed institutions, progress with transition to a market economy and the quality of government policy making. On the one hand, the EU-induced institutional development might have prepared transition countries to better offset the crisis effects. On the other hand, the increased economic and institutional integration may facilitate the transmission of the crisis to these countries by creating and/or strengthening potential channels for contagion through trade, foreign banks, FDI, remittances and cross-border bank flows. Even though political, trade and financial integration have been considered as the fundamentals of the development model for ETEs in the past two decades (Friedrich et al., 2013), the severe impact of the GFC on the transition countries has shaken the foundations of this model. Countries that made more progress with integration to EU, were more exposed to financial and export flows, therefore potentially being more vulnerable to the crisis. Hence, despite the large potential benefits of European integration for most ETEs, during periods of instability increased economic and institutional integration may facilitate the transmission of the crisis to these countries (Bartlett and Prica, 2012). Moreover, during the recent Eurozone crisis, transition countries outside the EU did not receive the bailout support from EU funds and policy instruments intended to help EU member countries to cope with the Eurozone crisis. Namely, while the Eurozone crisis had impacted the weakest members in the EU, it has not been widely recognized that it had even more impact on some countries outside the EU (Bartlett and Uvalic, 2013). These countries' dependency on the EU appears to have made them even more vulnerable to the crisis, considering that EU monetary integration might have amplified the effects of the financial and Eurozone crisis in these countries (Bartlet and Prica, 2012). Therefore, the current research is needed to better understand the impact of the degree of European integration on the transmission of GFC to ETEs.

2.5 Conclusion

This chapter has provided a review of theoretical framework on the international transmission of crises. It initially identified the main strands of literature that are relevant to the objectives of this thesis, namely: financial contagion; euroisation and integration with the EU. Next, the discussion revealed that theory on financial contagion and transmission channels distinguishes between fundamental causes (common shocks, trade linkages and financial linkages) and investors' behaviour (liquidity problems, asymmetric information, incentive problems etc.). Fundamental causes, in particular trade and financial linkages, are considered as the most applicable mechanism of transmission of the GFC to ETEs, given the strong trade and financial ties these countries have with the EU15 recorded in section 1.2. It was argued that, given the relatively low level of financial market development in European Transition economies, investors' behaviour factors are likely to be less important in explaining contagion in these countries. Nevertheless, it was also concluded that there might be some overlap between the two categories of theories that explain contagion. Namely, if investors' behaviour is not completely irrational and if it is partially based on some macroeconomic fundamentals, then this behaviour might also fit under the theory that explains contagion based on fundamental causes. The chapter continued with elaboration of the theory of the transmission of shocks from the financial sector to the real economy, identifying the following transmission channels: the interest rate channel; the wealth effect and the financial accelerator (also referred to as the borrower balance sheet channel and the bank balance sheet channel).

Subsequently, the chapter provided an overview of the theory on the causes of increased euroisation in ETEs and its main benefits and costs. Despite the benefits associated with euroisation, the chapter argued that it is not yet known whether they might have been outweighed by the costs during the GFC. It concluded that the main costs associated with euroisation may become more evident during the periods with severe financial crisis and, therefore, that the GFC can be considered an exceptional opportunity to investigate the impact of the degree of euroisation on transmission of shocks to ETEs.

Lastly, the chapter provides a theoretical overview of the third strand of the literature relevant to this thesis, which is integration with the EU. Initially, it provides a concise outline of the main theories which aim to explain the process of integration with the European Union. Next, it continues with a breakdown of the advantages associated with European integration. The chapter concludes that the theory on European integration lacks clear economic arguments to explain the mechanism by which the degree of European integration influences the severity of impact of external shocks on transition countries. On the one hand, the EU-induced institutional development might have prepared transition countries to offset the crisis effects. On the other hand, the increased economic and institutional integration may facilitate the transmission of the crisis to these countries by creating and/or strengthening potential channels for contagion through trade, foreign banks, FDI, remittances and cross-border bank flows. Therefore, the current research is needed to better understand the impact of European integration on transmission of international crises to ETEs.

The theoretical review presented in this chapter provides the base for developing the models that will be used to explore the international transmission of GFC in the empirical chapters. Specifically, the discussion in this chapter emphasized the potential importance of trade and financial linkages, as well as the degree of euroisation and European integration in transmission of the GFC to ETEs. It is clear that further research is needed to understand these potential transmission channels and amplification mechanisms. The next chapter of the thesis provides a critical review of the empirical studies that have investigated the international transmission of the GFC and the role of euroisation and integration with the EU in this process. The gaps identified in the literature will be addressed empirically in Chapters 4 and 5.

CHAPTER 3

TRANSMISSION OF GLOBAL FINANCIAL CRISES: A REVIEW OF THE EMPIRICAL LITERATURE

Contents

3.1 Introduction

Having established the importance of the GFC's impact on ETEs in Chapter 1 and examined the international channels of transmission, as well as other potential amplification factors, of the crisis in Chapter 2, this chapter reviews previous empirical studies that have investigated the international transmission of the financial crises and the roles of both the extent of euroisation and integration with the EU in this process.

Although there are an extensive number of empirical studies that have investigated the international transmission of the GFC, the literature is still unable to provide conclusive results of determinants of crisis severity across countries. The studies reviewed in the following sections provide a wide range of results, which are sometimes not in line with the expectations suggested by orthodox theory. Rose and Spiegel (2011) argue that there seems to be developing a consensus that it is difficult to understand the determinants of the intensity of the crisis across countries using simple quantitative models. Moreover, within these empirical studies, a wide range of measures of crisis severity are used. With respect to crisis definition, the recent literature has generally focused on the decline of GDP growth (e.g. Berglöf et al., 2009; Rose and Spiegel, 2010; Brezigar-Masten et al., 2011; Lane and Milesi-Ferretti, 2011; Milesi-Ferretti and Tille 2011; Berkmen et al., 2012). However, other measures of crisis severity such as cross-market correlation coefficients, financial stress indexes, changes in capital flows, exchange rate tensions, credit growth and credit rating downgrades have also been considered (e.g. Balakrishnan et al., 2011; Cetorelli and Golberg, 2011; Milesi-Ferretti and Tille, 2011; Frankel and Saravelos, 2012; Ozkan and Unsal, 2012; De Haas and Van Lelyveld, 2014; Ahmed et al., 2017), which makes it difficult to reach conclusions regarding the severity of the crisis. Even though there are a large number of studies that have investigated the transmission of the GFC to developed and developing countries, there is still a lack of studies focusing on ETEs. Moreover, the latter limited number of studies have not considered certain factors such as the extent of integration with the EU and, in particular, the degree of euroisation, although these are common characteristics of ETEs.

The rest of this chapter is organised as follows. Section 3.2 reviews empirical studies that have investigated the channels of transmission of global financial crises, shocks and contagion. Section 3.3 provides a comprehensive review of studies that have taken into account the impact of euroisation on financial fragility and transmission of shocks. Section 3.4 provides a critical review of the empirical studies that have investigated the costs and benefits associated with the integration with the EU, focusing on its impact on crises severity. Empirical studies on transmission of the GFC to ETEs are critically reviewed in section 3.5. Important details such as authors of the study, sample size, period under investigation, estimation technique adopted, definition of the crisis (when available), independent variables employed as well as the main findings of the study are summarized in respective tables (3.1, 3.2, 3.3 and 3.4) in each section. Section 3.6 provides conclusions on the empirical work related to the impact of the GFC on ETEs and summarizes the main identified limitations and gaps in the existing empirical studies.

3.2 Channels of transmission of global financial crises, shocks and contagion

Financial crises in the last three decades have attracted extensive empirical research on financial contagion and international channels of transmission of financial shocks. The empirical literature on financial contagion can be categorized into two main frameworks: a framework focusing on the co-movement of asset prices during periods of crisis; and the other framework focusing on the individual channels of transmission of financial crises (e.g. trade and financial linkages). The rest of this section is organized as follows. Sub-section 3.2.1 provides a comprehensive review of studies that investigate the presence of financial contagion based on cross-market correlation coefficients, while sub-section 3.2.2 reviews empirical studies that investigate individual channels of transmission of financial crises. The key features of the main studies reviewed in these sub-sections are summarized in tables 3.1 and 3.2, respectively.

3.2.1 Cross-market correlation coefficients

The first group of empirical studies that investigate contagion examine changes in the cross-market correlation coefficients of stock prices, interest rates and sovereign spreads across different countries from normal periods and periods after a shock.

Most of these studies find evidence of a co-movement of asset prices, although there is no general agreement that such co-movements increase during and after a crisis. However, the studies that use this framework for testing for contagion find mixed results partly due to econometric problems with heteroscedacity, omitted variables and endogeneity. In addition, there may be country, region and time-specific factors which give rise to differences in results. The results of the main studies investigating financial contagion based on cross-market asset correlation coefficients are summarized in Table 3.1 below.

Table 3.1 Empirical studies investigating financial contagion based on cross market correlation coefficients

Authors (year)	**Sample**	**Period**	**Main conclusions**
King and Wadhwani (1990)	Unites States, United Kingdom and Japan	Daily returns on the US, UK and Japanese stock markets during 1987- 1988.	Increase in price volatility in the United States' stock market causes an increase in the correlation of returns across other markets.
Baig and Goldfajn (1999)	Five Asian countries	Daily returns on stock market, exchange rates and sovereign spreads 1995-1998.	Cross-country correlations between currencies and sovereign spreads increase during the crisis.
Andersen et al. (2001)	Germany and Japan	December 1, 1986, - November 30, 1996.	Volatility movement are highly correlated across two exchange rates. Correlation between exchange rates increases with volatility.
Forbes and Rigobon (2002)	28 stock markets (OECD, East Asia, Latin America and other emerging markets)	Daily returns on 10 stock markets during NYSE crash in 1987, 28 stock markets during the Mexican crisis in 1994 and Asian crisis in 1997.	Results using the adjusting correlations indicate that there was only one case of contagion in 1997 (out of 27); zero cases in 1994 (out of 27); and zero cases in 1987 (out of 9).
Boschi (2005)	Brazil, Mexico, Russia, Turkey, Uruguay, and Venezuela	Daily data ranging from December 1st, 2001 to November 29th, 2002.	There is no evidence of contagion.
Chiang et al. (2007)	Eight Asian markets	Daily stock-return data series from 1990 to 2003.	Two phases of correlation during Asian crisis are identified (contagion and herding behaviour).

Authors (year)	Sample	Period	Main conclusions
Guo et al. (2011)	United States	Weekly data ranging from October 2003 to March 2009.	There is evidence of contagion.
Kenourgios et al. (2011)	Brazil, Russia, India, China, U.S. and United Kingdom	1995–2006	The results confirm a contagion effect from the crisis country to all others, for each of the examined financial crises.
Choe et al. (2012)	27 national stock markets – 11 national markets from Asia, 10 markets from Europe, and 6 markets from North and South America	1997	No evidence of contagion during the 1997 Asian crisis. The correlations during crisis, reported as contagion by the constant correlation tests are caused by the cross-market co-movements as a result of changes in behaviour of risk-averse investors during the crisis.
Bekaert et al. (2014)	415 country-sector equity portfolios across 55 countries worldwide	Weekly data ranging from January 1, 1995 to March 15, 2009	There is little evidence of contagion from the United States and the global financial sector. Contagion was mainly spread from domestic equity markets to individual domestic equity portfolios.

Amongst the first papers that use this framework, King and Wadhwani (1990) investigate the increased cross-market correlations between stock markets of the United States, United Kingdom and Japan in 1987 and show that an increase in price volatility in the United Sates causes an increase in the correlation of returns across other markets. The authors argue that contagion spread can be attributed to investors who infer information about price fluctuations in other economies due to the lack of complete information about the conditions in each economy. In the same vein, Baig and Goldfajn (1999) test for an increase in cross-market correlations during the East Asian crisis in the financial markets of Thailand, Malaysia, Indonesia, Korea and the Philippines. They use daily data for the period 1995-1998 for the five selected countries. The authors employ VAR methodology to estimate impulse responses to shocks in each stock and currency markets. They show that correlations in currency and sovereign spreads increased significantly during the crisis, while their results for equity market correlations are inconclusive. Andersen et al. (2001) use high-frequency data on deutschemark and yen returns against the dollar and estimate a model of daily exchange rate volatility and correlation for a period of 10 years. They find that volatility movement are highly correlated across the two exchange rates. The authors also show that correlation between exchange rates increases with volatility. Chiang et al. (2007) by using a dynamic multivariate GARCH model, analyse financial contagion during the Asian crisis. The authors present evidence of contagion. They identify two phases of correlation during the Asian crisis (contagion and herding behaviour). Guo et al. (2011) study the cross-asset contagion between the stock market, real estate market, credit default market and energy market during the GFC and find evidence of contagion. However, they only investigate the cross-asset contagion within the United States and cannot conclude on the contagion spread to the other economies worldwide.

Kenourgios et al. (2011), using daily data analyse the cross-market correlations during and immediately after the 1987 Black Monday, the 1998 Russian Crisis, the burst of the dot-com bubble of 2001, the shock after September, 11, 2001, and the USA subprime mortgage crisis of 2008. Their results confirm a contagion effect from the crisis country to all others, for each of the examined financial crises. Results show that correlations between the crisis country and other countries' financial markets are higher following shocks than during stable periods, confirming contagion, and during the more volatile periods, conditional correlations are higher than unconditional correlations, supporting the presence of asymmetric responses to shocks. The authors find that the previously conventional policy responses to a crisis are unlikely to prevent the spread among countries, arguing that changes in fundamentals do not help to avoid it since cross-market correlation dynamics are driven by behavioural factors. Bekaert et al. (2014) analyse the transmission of the GFC to 415 country-industry equity portfolios and find evidence of contagion. However, despite the origins of the GFC in the United States, the authors find that contagion was mainly spread from domestic equity markets to individual domestic equity portfolios. Namely, the authors find that while the co-movements of equity portfolios across markets during the GFC were low, there was a significant increase of within-country portfolio co-movements.

Even though most of the studies reviewed above provide evidence of financial contagion, Forbes and Rigobon (2002), who investigate contagion based on stock market correlations during the 1997 Asian crisis, the 1994 Mexican devaluation and the 1987 United States market crash, conclude that tests for contagion based on cross-market correlations are biased and inaccurate due to heteroscedasticity. According to the authors, these correlation coefficients depend on the degree of market volatility. As a result, during the periods of crisis when markets are more volatile, correlation coefficients tend to increase. Hence, if no adjustment is made for this bias, tests based on these coefficients usually find evidence of contagion. The authors argue that it is possible to correct the biasness of the coefficients; however, this can be done only under assumptions of no endogeneity and no omitted variables. After correcting for heteroscedsticity, the authors find no evidence of contagion during these three crises' periods. Similarly, Boschi (2005) using VAR models tests for contagion and after adjusting for heteroscedasticity, finds no evidence of contagion between Argentina and Brazil, Venezuela, Uruguay, Mexico and Russia. Choe et al. (2012) use the Structural Dynamic Conditional Correlation (SDCC) multivariate GARCH model to estimate time-varying cross-market correlations associated with the 1997 Asian crisis and find no evidence of contagion. However, their conclusions are based on a number of assumptions, which do not appear to be in line with the theory of contagion. More specifically, they define contagion as a structural break in correlation dynamics during a crisis and assume that a structural break in time-varying correlation dynamics is a consequence of an excessive cross-market co-movement beyond the level that can be explained by the risk-return relation. They do not view a temporal change in the correlation dynamics as evidence of contagion, as they assume that a temporal variation in the correlation dynamics is a reflection of time-varying cross-market co-movements induced by the intertemporal risk-return adjustments by rational, risk-averse investors in response to changing volatility.

Considering the studies reviewed above, the empirical results concerning the presence of contagion based on cross-market correlation coefficients are inconclusive. The first group of studies define contagion as a significant increase in cross-country asset correlations following a crisis and find evidence of contagion, whereas the second group of studies argue that, when taking into account heteroscedasticity, there is no evidence of contagion. The next section presents an overview of empirical studies that investigate financial contagion based on individual channels of contagion.

3.2.2 Individual channels of contagion

The second method of testing for contagion is based on measuring the different channels through which contagion might occur. This method provides more intuition on how exactly a crisis has been transmitted (Claessens and Forbes, 2004) and given the limitations of the previous method presented in section 3.2.1 has become the most popular method to test for financial contagion. The empirical studies focused on individual channels of transmission of financial crises have provided different results. The first group of studies that used this method found evidence that trade linkages were the major factor that explain how a crisis was transmitted. A second group of studies showed the importance of financial linkages as a channel of transmission of crises, while a third group found evidence of the importance of macroeconomic fundamentals on the amplification and severity of financial crises. Table 3.2 below summarizes the results of the main studies that have investigated the international transmission of financial crises focusing on trade and financial linkages as well as macroeconomic fundamentals.

Table 3.2: Empirical studies investigating financial contagion based on individual channels

Authors (year)	Countries	Period	Estimation technique	Crisis definition	Explanatory variables	Main conclusions
Eichengreen et al. (1996)	20 industrial countries	1959 - 1993	Probit and logit model	Extreme values of exchange market; Pressure index calculated as a weighted average of exchange rate changes, reserve changes, and interest rate changes (values measured relative to those prevailing in Germany).	Total non-gold international reserves; period-average exchange rates; short-term interest rates; discount rates otherwise; exports and imports.	The occurrence of a currency crisis in one country increases the probability of a speculative attack in other countries by 8 percentage points. Trade linkages explain contagion better than macroeconomic similarities.
Masson (1998)	13 Asian and South American countries	The 1994 Mexican crisis and the 1997 Asian crisis	Simple balance of payments model	Jumps between equilibria (multiple equilibria).	Level of reserves; trade balance; external debt; foreign interest rate.	Trade was not important in the international transmission of the 1994 Mexican crisis and the 1997 Asian crisis.

Authors (year)	Countries	Period	Estimation technique	Crisis definition	Explanatory variables	Main conclusions
Glick and Rose (1999)	161 developed and developing countries	1971-1997 (five different currency crises in 1971, 1973, 1992, 1994, and 1997)	Binary probit model	An indicator variable which is initially defined as unity if country i suffered from the crisis in a given episode, and zero if otherwise.	Trade; the annual growth rate of domestic credit; the government budget as a percentage of GDP; the current account as a percentage of GDP; the growth rate of real GDP; the ratio of M2 to international reserves; domestic CPI inflation; and the degree of currency under-valuation.	Macroeconomic and financial influences are not associated with the cross-country incidence of speculative attacks. Trade linkages help explain cross-country correlations in exchange market pressure during crisis episodes, even after controlling for macroeconomic factors.
Van Rijckeghem and Weder (2001)	Cross sectional data for 118 industrial and developing countries	1994, 1996 and 1997	Probit and logit model	Contagion is a binary variable that takes the value 1 if the country had a currency crisis in a particular episode.	Funds competition; trade competition; credit to private sector (% of GDP); M2/reserves; real exchange rate appreciation; current account.	The common lender channel is significant in explaining contagion during the Mexican, Asian and Russian crises. Trade and financial linkages appear to be correlated.

Authors (year)	Countries	Period	Estimation technique	Crisis definition	Explanatory variables	Main conclusions
Forbes (2002)	58 countries	1994 - 1999	Probit and logit model	Extreme values of exchange market pressure index which account for movements in a country's exchange rate, interest rate and reserve levels.	Competiveness-effect linkages; income effect linkages; cheap import effect linkages; private credit growth; government consumption/GDP; current account surplus; bank reserves; private capital inflows/GDP; domestic credit growth/GDP; money supply/reserves; openness-total trade/GDP; growth in GNP per capita; inflation (CPI).	Trade can transmit crises through three different channels: a competitiveness effect; an income effect; and cheap-import effect.
Fratzscher (2003)	24 emerging markets and transition economies	1986-1998 using monthly data	Markov – switching model and panel data models	Exchange market pressure which is a weighted average of the changes in the exchange rate, the interest rate and the foreign exchange reserves.	Capital flows; lending boom; foreign debt; overvaluation; reserves; trade balance; real contagion; equity market contagion; bank contagion.	A high degree of economic integration through trade and financial linkages can explain and predict the transmission of financial crises.

Authors (year)	Countries	Period	Estimation technique	Crisis definition	Explanatory variables	Main conclusions
Caramazza et al. (2004)	41 emerging countries	Monthly data during 1990-1998	Panel probit	Binary values of index of exchange market pressure that accounts for the movements in a country's exchange rate and foreign exchange reserves.	Real exchange rate appreciation; current account balance; fiscal balance; M2 growth; GDP growth; trade contagion; short-term BIS debt; short-term debt to reserves; common creditor (CC); crisis dummies; regional dummies.	External imbalances play a larger role than domestic imbalances in the occurrence of a crisis. Financial linkages are highly important, while trade spillovers are relevant for countries with weak current account balances.
Balakrishnan et al. (2011)	16 emerging economies and three advanced regions	1997-2009	Two-stage estimation approach; panel and case studies	Stress index composed of banking-sector beta, stock market returns, time-varying stock market return volatility, sovereign debt spreads, and an exchange market pressure index.	Industrial production growth; commodity price growth; Libor (3-month); bank linkages; portfolio linkages; direct investment linkages; trade linkages; US and Canada dummy; Western Europe dummy; trade openness; financial openness; current account; fiscal balance; foreign reserves.	Financial links appear to be a key channel of transmission: emerging economies with higher foreign liabilities to advanced economies have been more affected by financial stress in advanced economies than emerging economies that are less linked. In the most recent period, bank lending ties have been a major channel of transmission, with western European banks a main source of stress.

Authors (year)	Countries	Period	Estimation technique	Crisis definition	Explanatory variables	Main conclusions
Milesi-Ferretti and Tille (2011)	22 countries	1993-2009	Panel	The change in a country's capital flows relative to the pre-crisis situation and the annualized value of capital flows.	GDP per capita; GDP growth 2005-2007; financial openness; gross debt; grow equity; net debt; net equity; Net foreign assets (NFA)/GDP; Net position vis a vis BIS banks; foreign exchange reserves; trade openness; share of manufacturing output; commodity trade balance; private credit credit/ GDP and change in private credit/GDP; change in growth; change in growth in trading partners; change in public debt projections; change in fiscal balance projections; change in growth projections; credit market restriction index.	The degree of financial integration explains the scale of decrease in capital flows during the GFC. Macroeconomic conditions and their connection to world trade flows are also important in explaining the magnitude of decrease in capital flows.

Authors (year)	Countries	Period	Estimation technique	Crisis definition	Explanatory variables	Main conclusions
Rose and Spiegel (2010)	85 countries	2006-2009	Multiple Indicator Multiple Cause (MIMIC)	Real GDP growth over 2008; the percentage change in a broad measure of the national stock market over the 2008; the percentage change in the SDR (measured as the domestic currency price of a Special Drawing Right); change in the country credit rating from Institutional Investor magazine.	Natural logarithm of 2006 real GDP per capita, and the percentage change in the stock market between 2003 and 2006; log of 2006 population; variables covering trade linkages and financial linkages.	International financial linkages were not a transmission channel of the GFC in developed countries and emerging markets.
Cetorelli and Golberg (2011)	49 emerging markets across Europe, Asia, and Latin America	2006Q2 to 2007Q2 and the post-crisis period from 2008Q3 to 2009Q2	Cross-country panel	The domestic and cross-border bank lending growth pre-post crisis for each emerging market country.	Share of cross border interbank funding obtained; ratio of total cross- border interbank funding to total domestic lending; Vienna Initiative participant dummy.	Exposure of domestic and foreign-owned banks to cross-border funding and to the internal capital of the banking group where they operate explains their vulnerability to foreign liquidity shocks.
Chudik and Fratzscher (2011)	26 advanced and emerging economies	Weekly data for the period 2005-2009	GVAR model	n/a	VIX index, for the S&P500, as proxy for financial market risk; and TED spread as proxy for US liquidity pressures; money market rates;	During the GFC, advanced economies were most severely affected by the tightening in financial conditions, whereas the real side of the economy

Authors (year)	Countries	Period	Estimation technique	Crisis definition	Explanatory variables	Main conclusions
					stock markets.	was the main channel for the transmission of crises in emerging economies.
Frankel and Saravelos (2012)	122 emerging and advanced countries	2006-2009	OLS and Probit	Nominal local currency percentage change versus the US dollar; Equity market returns; Percentage change in the level of real GDP; Percentage change in industrial production; Recourse to IMF financing.	Reserves; real effective exchange rate; GDP; credit; current account; money supply; exports and imports; inflation; equity returns; interest rates; debt composition; external debt; peg/financial openness; regional/income dummy variables.	Real exchange rate overvaluation and levels of international reserves explain the heterogeneity of the impact of the GFC across countries.
Fratzscher (2012)	50 emerging and developed countries	Weekly data from 12 October 2005 to 22 November 2010	Pooled OLS	Net capital flows	Macroeconomic fundamentals; institutions; policy interventions; exposure (trade/financial).	The variation of the impact of the GFC across countries can be explained by differences in: country risk; the quality of domestic institutions; and the strength of domestic macroeconomic fundamentals.

Authors (year)	Countries	Period	Estimation technique	Crisis definition	Explanatory variables	Main conclusions
Kalemli-Ozcan et al. (2013)	18/20 developed countries	1978-2009	Panel	Crisis indicator – dummy variable and time-varying bilateral measure reflecting the synchronization of output growth between countries and business cycle synchronization with the negative of divergence in growth rates, defined as the absolute value of GDP growth differences between countries.	Log of the share of the stock of bilateral assets and liabilities between countries i and j in the previous quarter relatively to the sum of the two countries' GDP in the previous period; log of the share of the stock of bilateral assets and liabilities between each country-pair and the U.S. and the Cayman Islands in the previous quarter relatively to the two countries' GDP in the previous period.	Countries with stronger financial links to U.S. had more synchronized business cycles during the GFC.
Kapan and Minoiu (2013)	55 advanced economies and emerging markets	Quarterly data from 2006-2010	OLS	Log-change in lending	Loan amount; syndicate size; dummies for year-quarters; loan currency; lender role; lender and borrower nationality; and borrower industry.	Lending of banks that were more exposed to cross-border funding declined more steeply during the GFC. The adequacy of bank capital also determined the magnitude of credit decline: better-capitalized banks decreased their lending less than other banks.

Authors (year)	Countries	Period	Estimation technique	Crisis definition	Explanatory variables	Main conclusions
De Haas and Van Lelyveld (2014)	48 multinational banks from 19 home countries with 199 subsidiaries across 53 countries.	1992-2009	Cross-country panel	Percentage growth of gross loans; a matrix of host-country macroeconomic variables; a matrix of characteristics of bank *i* itself, including a dummy to distinguish between multinational bank subsidiaries and domestic banks, and/or its parent bank; crisis dummy.	Credit growth of banks.	Multinational bank subsidiaries decreased lending about twice as fast as domestic banks during the GFC. This difference in lending can be attributed to the greater use of deposits as a more stable source of funding by domestic banks.
Ahmed et al. (2017)	20 emerging economies	1994-2013	Cross-country panel	Percent change in the country's bilateral nominal exchange rate against the dollar; the change in the local currency bond yields on ten-year government bonds; the percent change in the stock market index; and the change in EMBI and CDS spreads between the peak and trough of each crisis episode.	Macroeconomic fundamentals and policy choices of a country; variables that might help identify how much capital might have been flowing in prior to the episode; those that might be capturing aspects of a country's financial structure such as openness and financial development.	Macroeconomic fundamentals such as current account balance, foreign exchange reserves, short-term external debt, the gross government debt, inflation etc. explain the severity of the impact of the GFC and Eurozone debt crisis.

A number of empirical studies have investigated the impact of trade on the international transmission of shocks. The results are mixed, some studies argue that trade is a major important mechanism for transmission of the financial crises, while other studies find no evidence for the importance of a trade channel in the international transmission of the recent financial crises. Among the first studies arguing that trade is an important channel for the international transmission of the financial crisis is that of Eichengreen et al. (1996). The authors use panel data from twenty countries during the period 1959-1993 and find that contagion spreads more easily to countries with stronger trade linkages than to countries with similar macroeconomic conditions. They conclude that trade links have been the dominant channel for the international transmission of crises in the selected sample. Glick and Rose (1999) further develop this framework by investigating five different currency crises during the period 1971-1997 for 161 countries, many of which were not directly involved in any of the five episodes and test whether trade linkages had an impact in the probability of a country being affected by the crisis. They conclude that trade linkages help explain cross-country correlations in exchange market pressure during crisis episodes, even after controlling for macroeconomic factors. Similarly, Forbes (2002) measures whether trade linkages are an important determinant of a country's vulnerability to crises that originate in other countries. The author shows that trade can transmit crises through three different channels: a competitiveness effect (when changes in relative prices affect a country's ability to compete abroad); an income effect (when a crisis affects income and imports); and cheap-import effect (when crisis decreases import prices and acts as a positive supply shock). More recently, Ozkan and Unsal (2012) investigate the transmission of the GFC to emerging economies (Argentina, Brazil, Korea, Mexico and the Philippines). The authors develop a two-country dynamic stochastic general equilibrium model with an explicit treatment of both trade and financial linkages between the countries. They find that the greater a country's trade integration with the rest of the world, the greater the response of its macroeconomic aggregates to a sudden stop in capital flows.

While the empirical studies reviewed above present convincing evidence that trade linkages composed an important channel for the international transmission of recent financial crises, several other studies disagree. Among the first of these studies was

Masson (1998), who based on a two-country simple balance of payments model argues that trade was not important in the international transmission of the 1994 Mexican crisis and the 1997 Asian crisis. Baig and Goldfajn (1999) also argue that trade was not an important international transmission channel for the Asian crisis. Harrigan (2000) likewise concludes that trade did not compose a significant channel of transmission of the Asian crisis to the United States. Van Rijckeghem and Weder (2001) show that spillovers through bank lending, as opposed to trade linkages and country characteristics can better explain contagion. They find that if either trade or financial linkages are included in the model, they are highly significant. But if both of them are included in the model, one of them becomes insignificant, reflecting the high correlation between competition for funds and trade.

Trade linkages were the focus of the earlier research and helped explain contagion. However, the researchers of the recent financial crises focused more on financial linkages as an international channel of transmission of crises. Nevertheless, the results of empirical studies focused on financial linkages are also diverse. A number of empirical studies have found evidence that direct financial ties and competition for funds from common bank lenders can forecast the impact of financial contagion and crises, while others argue that financial linkages have played no role in international transmission of recent financial crises.

Among the first studies arguing that financial linkages is an important channel for the international transmission of financial crises was that of Fratzscher (2003), who analyses the role of contagion in the currency crises in emerging markets during the 1990s. By using Markov-switching and panel data models, the author concludes that financial crises can be explained and future transmission of financial crises can be predicted by a high degree of economic integration through trade and financial channels. Balakrishnan et al. (2011), using a new financial stress index for emerging economies, investigate how financial stress is transmitted from advanced to emerging countries. They find that the extent of pass-through of financial stress is related to the depth of financial linkages between advanced and emerging economies. Similarly, Milesi-Ferretti and Tille (2011) show that the magnitude of the decrease in capital flows across countries is linked to the extent of international financial integration, its specific nature (with countries relying on bank flows being the hardest hit) as well as domestic macroeconomic conditions and their connection to world trade flows. The authors argue that this diversity of experiences across countries can be explained by the size of external exposures, reliance on debt instruments and the importance of cross-border banking activity. Countries with high degrees of financial integration through debt and banking were more affected, and countries with large net liabilities in debt instruments suffered sharper declines in capital inflows. Chudik and Fratzscher (2011) study 26 economies using weekly data and find that a tightening of financial conditions was the key transmission channel in advanced economies, whereas the real side of the economy was the main channel in emerging economies. Another conclusion of their paper is that Europe suffered a greater effect than other advanced economies from the shocks in the US, in particular shocks to risk appetite (measured by VIX index for the S&P500 as a proxy of financial market risk). Kalemli-Ozcan et al. (2013) also study the effect of financial integration on the transmission of financial crises. They use a sample of 18/20 developed countries between 1978 and 2009 and find that financial crises induce co-movement among more financially integrated countries. They also show that countries with stronger financial links to the US had more synchronized business cycles during the GFC.

A number of empirical studies that investigate the transmission of financial crises have focused on the common creditor channel which links the probability of experiencing a financial crisis with sharing the same lender with a country hit by a crisis. Van Rijckeghem and Weder (2001) show that spillovers through bank lending contributed to the transmission of currency crises during a number of episodes of financial instability in emerging markets. They indicate that spillovers caused by banks' exposures to a crisis country help predict flows in third world countries after the Mexican and Asian crisis. Moreover, they argue that countries might reduce contagion risk by diversifying the sources of their financing and by carefully monitoring borrowing from creditors exposed to potential crisis countries. Caramazza et al. (2004) using panel probit regressions, examine the role of financial linkages, especially through a common creditor, in the international transmission of crisis to 41 emerging economies during the 1990s. They show that financial linkages were important factors in explaining the spread of the Mexican, Asian, and Russian crises. Similarly, Cetorelli and Goldberg (2011) demonstrate that the impact of foreign liquidity shocks on domestic and foreign-owned banks depends on their exposure to cross-border funding and to the internal capital of the banking group where they operate. Likewise, Kapan and Minoiu (2013) show that banks that were more dependent on cross-border funding reduced their lending more than other banks during the GFC and that the adequacy of bank capital was important in explaining the scale of credit decline: better capitalized banks decreased their lending less than other banks. De Haas and Van Lelyveld (2014) investigate a large group of multinational bank subsidiaries and stand-alone domestic banks and conclude that multinational bank subsidiaries decreased lending about twice as fast as domestic banks during the GFC. They argue that this difference in lending can be attributed to the greater use of deposits, a more stable source of funding by domestic banks.

In contrast to the evidence related to the role of financial linkages in international transmission of crisis provided by the studies reviewed above, a number of other studies find opposing empirical results. In particular Rose and Spiegel (2010) find no role for international financial linkages in transmitting the GFC to developed countries and emerging markets. Similarly, Lane and Milesi-Ferretti (2011) find no evidence that higher financial integration contributed to the intensity of the GFC. After controlling for the pre-crisis level of development, buoyancy of economic activity and credit, external vulnerabilities and openness to trade, the authors find that more financially integrated economies experienced smaller output declines during the GFC. The lack of conclusive evidence of the relationship between financial linkages and output decline during recent years has even led some researchers to claim that financial linkages might not be an important factor in determining crisis severity. The diversity of results might be due to variations across studies in terms of samples, periods covered, methodologies and variables employed to account for crisis severity.

Even though the literature on the international transmission of shocks focuses extensively on trade and financial linkages as channels of contagion, the extent to which the shocks get amplified also depends on the responses of policy-makers and existing domestic vulnerabilities. During the years following the GFC there has been a growing consensus on the importance of macroeconomic fundamentals in determining the severity of the impact of crises across countries. Frankel and Saravelos (2012) analyse the effects of the GFC by selecting variables from an extensive review of the previous literature on early warning indicators. They find that real exchange rate overvaluation and levels of international reserves can explain the variation of the impact of GFC across countries. Fratzscher (2012) demonstrates that the heterogeneity of the impact of the GFC across countries can be explained by differences in country risk, quality of domestic institutions and the strength of domestic macroeconomic fundamentals. More specifically, the author shows that countries with high-quality institutions and strong macroeconomic fundamentals were better able to protect their financial markets from adverse shocks during the GFC. In addition, the author highlights that trade and financial linkages played a minor role in explaining cross-country heterogeneities in the transmission of the GFC. Ahmed et al. (2017) show that the financial markets in those emerging economies with better macroeconomic fundamentals (current account balance; foreign exchange reserves; short-term external debt; the gross government debt; inflation etc.) were less severely affected by the GFC and the subsequent Eurozone debt crisis. They also find that financial conditions worsened more in countries that had previously experienced larger capital inflows and greater exchange rate appreciation.

3.3 Benefits and costs associated with euroisation

The consequences of increasing dollarization/euroisation has been a subject of controversial debates for a long time due to the costs associated with it (refer to section 2.3) and the potentially greater financial instability it creates. One important issue stressed in the literature is the increased vulnerability to exchange rate fluctuations that increased euroisation creates with respect to financial distress and limitations on monetary and exchange rate policies (Chitu, 2013). The role of euroisation in amplifying the impact of financial crises has not been sufficiently investigated by previous research. Nevertheless, a number of empirical studies have investigated the relationship between financial dollarization and financial instability, banking crises and inflation, but overall the evidence is inconclusive. Results of the main studies investigating the impact of dollarization/euroisation on financial stability/crisis severity are summarized in Table 3.3 below.

Table 3.3: Empirical studies investigating dollarization/euroisation and its impact on financial stability/crisis severity/inflation

Authors (year)	Sample	Period	Estimation technique	Dependent variable	Independent variables	Main conclusions
Edwards and Magendzo (2001)	199 countries	1970-1998	Probit	Binary variable (if country is dollarized)	GDP; population; degree of openness of the economy; dummy variable if the country is an island; dummy variable if the country has a common border with a nation whose currency is defined by the IMF as a convertible currency; variable that measures the country's geographical location; dummy if the economy in question is an independent nation.	Inflation has been significantly lower in dollarized nations than in non-dollarized ones. Dollarized nations have had a lower rate of economic growth than non-dollarized ones. Macroeconomic volatility is not significantly different across dollarized and non-dollarized economies.
Honohan and Shi (2002)	58 emerging economies	1980-2000	Seemingly unrelated regression	The log of the consumer price index	Log dollar exchange rate; real exchange rate.	A high level of dollarization increases banking spreads. A greater degree of dollarization is associated with a higher pass-through coefficient from exchange rate change to consumer prices.
Arteta (2003)	92 developing and transition economies	1975 - 1999	Probit, OLS, panel and instrumental-variable regression	Crisis-binary variable; currency crash - binary variable; GDP growth.	Deposit and credit dollarization; FDI/GDP; short term debt/total debt; international reserves; current account balance/GDP; real exchange rate overvaluation; domestic credit growth; GDP growth; M2 reserves; US interest rate; OECD growth rate.	The results show little evidence that dollarization increases the probability of banking crises or currency crashes. There is no evidence that banking crises and currency crashes are more costly in countries with high degree of dollarization.

Authors (year)	Sample	Period	Estimation technique	Dependent variable	Independent variables	Main conclusions
Bahmani - Oskooee and Domac (2003)	Turkey	Monthly data from January 1990 to December 2001	VAR	n/a	CPI; exchange rate; public prices; dollarization ratio.	There is a positive relationship between the degree of dollarization and inflation.
De Nicolo et al. (2003)	100 countries	1990-2001	Cross-country panel	2001 level of deposit dollarization; the average level for available years during 1990-2001; a calculated country specific equilibrium level of dollarization for 2001 based on a simple trend-augmented autoregressive model.	Risk measures based on price movements; proxies for policy credibility effects; adoption of formal inflation targeting regime; institutional variables; dummy regional variables for countries in transition.	Financial instability is likely to be higher in dollarized economies.
Gulde et al (2004)	58 countries	1995-2001	Cross section	Deposit volatility (standard deviation of total deposit growth); Index of the probability of insolvency of a firm.	Average ratio of foreign deposits to total deposits; variance of inflation; variance of real exchange rate depreciation; covariance between inflation and real exchange rate depreciation; financial dollarization (foreign deposits to total deposits); average variance of inflation.	Increased dollarization may increase financial vulnerability. The variance of deposit growth is positively and significantly correlated with dollarization, suggesting that dollarized financial systems may be more exposed to credit cycles and liquidity risk.

Authors (year)	Sample	Period	Estimation technique	Dependent variable	Independent variables	Main conclusions
Bailey (2005)	Jamaica	1996-2004	VAR analysis	n/a	Exchange rate; CPI; base money; an index of public sector prices (PSP) computed as government expenditure per capita and is deflated using 1995 values; the dollarization ratio; dummy variable for crisis years.	Shocks to financial dollarization reduce the monetary base, since investors switch to domestic currency from foreign currency. The high elasticity of substitution between domestic and foreign currency is also confirmed by the positive exchange rate response to an increase in foreign money holdings.
Calvo (2006)	161 countries	1990-2004	Panel OLS	EMBI Index (Emerging Markets Bond Index Spread)	Volatility of EMBI; nominal exchange rate; exports; imports; capital flows proxy; exchange rate regime; sudden stop dummy; GDP; pre-crisis level of RES; Minimum level of RES during SS; maximum loss of Reserves during SS; pre-crisis level of EXR; maximum level of EXR during SS; maximum nominal depreciation; ratio reserves to external short-term debt; ratio reserves to M2.	Emerging market economies with greater degrees of euroisation face financial vulnerabilities that weaken the effectiveness of a domestic lender of last resort. As a result, monetary policy is linked to the state of the credit market. These conditions also impact on optimal monetary policy in normal but high-volatility periods.
Berkmen and Cavallo (2010)	145 countries	1970-2003	GMM	Liability dollarization	Reserve volatility; exchange rate policy; volatility of Inflation; trade openness; capital account openness; country size.	Countries with high liability dollarization tend to stabilize their exchange rate. There is no causal effect going in the opposite

Authors (year)	**Sample**	**Period**	**Estimation technique**	**Dependent variable**	**Independent variables**	**Main conclusions**
						direction. The move towards more flexible exchange rates is not, in-and-of-itself, sufficient to promote de-dollarization.
Bordo et al. (2010)	45 countries	1880-1913 and 1973-2003	Fixed effects panel regression; Probit	Dummy: one if there was a currency crisis and zero otherwise; Sovereign debt obligations	Change in the ratio of the net international investment position to GDP; the ratio of hard currency government debt outstanding to total government debt (1880 - 1913) or the within country average ratio of foreign currency debt to total debt issued on international markets.	Greater ratios of foreign currency debt to total debt is associated with increased risks of currency and debt crises, although the strength of the association depends crucially on the size of a country's reserve base and its policy credibility.
Chitu (2013)	60 emerging countries	2006-2009	Bayesian Averaging with Classical Estimates framework (BACE) OLS	Change in the real GDP growth rate between 2007 and 2009	Loan and deposit dollarization; pre-crisis credit growth; current account deficits; trade an financial openness; market regulation; international openness of the banking sector; GDP per capita.	High degrees of unofficial dollarization/euroisation were an important contributor to the severity of the crisis, once other determinants are taken into account. The adverse impact of dollarization/euroisation has been transmitted through the main traditional channels.

Authors (year)	Sample	Period	Estimation technique	Dependent variable	Independent variables	Main conclusions
Reinhart, Rogoff and Savastano (2014)	1980-2001 and 1996-2001	2 samples: 90 and 48 non-industrial economies	Two-pronged methodology	Inflation rate, average GDP growth and revenues from seigniorage as a measure of monetary policy effectiveness.	The sum of the ratio of foreign currency deposits to broad money, the ratio of domestic government debt to total government debt and the ratio of external debt to GNP.	A high degree of dollarization does not seem to be an obstacle to monetary control or to disinflation. A high level of dollarization increases exchange rate pass-through.

Honohan and Shi (2002) show that that a high level of dollarization increases banking spreads. A greater degree of dollarization is associated with a higher pass-through coefficient from exchange rate change to consumer prices. Similarly, De Nicolo et al. (2003) analyse the advantages and disadvantages of increased dollarization. The authors show that dollarization is associated with higher financial instability. Similar results are presented by Gulde et al. (2004), who investigate the solvency and liquidity risks related to dollarization. The authors find that increased dollarization may increase financial vulnerability. They also show that more dollarized economies are more prone to credit cycles as well as liquidity and solvency risk. Levy Yeyati (2006) shows that dollarized countries have a more unstable demand for money, higher inflation rates, a greater propensity to suffer from banking crises after a depreciation of the local currency and slower and more volatile output growth, without a significant positive impact on financial depth.

On the other hand, very different results are provided by Arteta (2003). Using data on deposit and credit dollarization for a large number of developing and developed countries, the author finds little evidence that greater levels of dollarization increase the probability of banking crises or currency crashes. Also, the author finds no evidence that banking crises and currency crashes are more costly in countries with a high degree of dollarization. Instead, macroeconomic and exchange rate policies are more significant in determining such costs. Similarly, Honig (2006) investigate the potential variables that could predict banking crises, focusing on the role played by unofficial dollarization. Through a multivariate probit model, the author finds only weak evidence that the degree of unofficial dollarization affects the probability of a banking crisis. Calvo (2006) investigates the limitations faced by more dollarized countries to act as a lender of last resort. Calvo argues that highly dollarized emerging market economies face greater financial vulnerabilities that impair the function of the lender of last resort. An empirical investigation of the relationship between dollarization and exchange rate policy choice was conducted by Berkmen and Cavallo (2010). They find that countries with a high share of foreign currency lending are likely to be more actively involved in exchange rate stabilization operations, while they find no evidence that floating encourages de-dollarization. Bordo et al. (2010) investigate the impact of foreign currency debt on currency and debt crises and find a positive relationship between the two. However, the authors show that the severity of the crises depends on the amount of reserves and policy credibility. On the other hand, Reinhart et al. (2014), using a large sample of developing countries, which they group according to their variety of dollarization (degree and type), find that a high degree of dollarization does not impact the effectiveness of monetary policy and that output fluctuations are similar in countries with different levels of dollarization. However, they show that the average inflation rate has been higher in more dollarized countries compared to those where the degree of dollarization has been low. In addition, they show that the exchange rate pass-through to prices has been different across countries with different levels of dollarization. They conclude that the inflationary impact of exchange rate changes in the 1990s was higher in more dollarized economies and lower in less dollarized economies. The relationship between dollarization and inflation is also investigated by Bahmani-Oskooee and Domac (2003). The authors investigate the role of dollarization in the dynamics of inflation in Turkey. They find a positive relationship between the degree of dollarization and inflation. Their results suggest that an increase in dollarization initially leads to a decline in the monetary base as the public switches from domestic to foreign money holdings. However, the monetary base increases later on to generate the required inflation tax for a given budget deficit as fiscal authority tries to compensate for part of the decline in the inflation tax through raising administered prices. As expected, the exchange rate responds positively to increased dollarization owing to the high elasticity of substitution between domestic and foreign currency. Likewise, Bailey (2005) analyses the association between dollarization and inflation volatility in Jamaica. The author uses VAR analysis and finds a positive relationship between dollarization and inflation. The results show that shocks to financial dollarization reduce the monetary base, since investors switch to domestic currency from foreign currency. The high elasticity of substitution between domestic and foreign currency is also confirmed by the positive exchange rate response to the increase in foreign money holdings. Very different results are presented by Edwards and Magendzo (2001), who investigate whether dollarization is associated with lower inflation and faster growth. They use a matching estimator technique and conclude that inflation has been significantly lower in dollarized countries. They also find that the rate of economic growth has been lower in more dollarized economies. The authors show that dollarized and non-dollarized economies experience similar levels of macroeconomic volatility.

None of the previous studies reviewed above consider the impact of dollarization/euroisation on the amplification of financial crises. One study that investigates the role of dollarization in amplification of the recent financial crises is that of Chitu (2013). The author investigates whether the GFC had a more severe impact in unofficially dollarized/euroised economies than in other economies. The author uses OLS and Bayesian analysis for 60 emerging economies and shows that unofficial dollarization/euroisation intensified the crisis, after controlling for other determinants (fast pre-crisis credit growth; market regulation; international openness of the banking sector; trade and financial openness; current account deficits; and GDP per capita). Moreover, the author shows that the impact of dollarization was transmitted through the three main traditional channels (currency mismatches, reduced monetary policy autonomy and limited lender of last resort ability). However, as the author also acknowledges, the data are not fully harmonised across countries.[4] Furthermore, the study employed a commonly used measure of currency mismatches: the difference

[4]The data on loan and deposit dollarization pertain to both advanced and emerging economies worldwide, from Europe, CIS, America, Africa, Middle East to Asia and Pacific. Data on the share of foreign currency loans to total loans are available for 76 economies worldwide, of which 60 are emerging economies, and those on the share of foreign currency deposits to total deposits for 75 economies worldwide, of which 55 are emerging economies. For the purpose of the empirical exercise, end-2006 was taken for data on foreign currency loans and deposit ratios. However, the data have been collected for an extended time horizon, which varies according to the countries considered. For example, data for loan dollarization for the period 1999 to 2008 for Albania, as opposed to Serbia where the ratio of foreign currency- denominated loans is available only since 2008. In addition, the change in the ratio of the private sector credit growth to GDP refers to the period between 2004 and 2007; the current account balance to GDP ratio is averaged out over 2005-2007; both (log) GDP per capita and trade openness are set at their 2007 values. As regards the transmission channels, the monetary policy channel is captured by the change in the key policy rate between July 2007 and April 2009, while the lender of last resort channel is captured by the changes in the central bank's total assets (scaled by GDP in 2007) between July 2007 and April 2009.

between foreign currency loans and foreign currency deposits as a share of total loans, which is an aggregate measure and cannot fully account for the potential currency mismatches at the firm level

3.4 Integration with EU

Given the lack of empirical studies investigating the relationship between the degree of integration with the EU and the international transmission of the GFC, this section focuses on the empirical studies that have investigated the costs and benefits associated with EU integration. The impact of European integration on countries and regions has been a subject of controversial debates for a long time. From a theoretical point of view, both positive and negative effects from increased economic integration are possible (Badinger, 2005). When it comes to economic benefits that result from European integration, although there is a general agreement that most of them are related to trade liberalization, the single market and the common currency, it is widely recognised that the most important effects are related to economic growth and productivity (Baldwin and Seghezza, 1996; Badinger, 2005; Campos et al., 2014). Table 3.4 below summarizes the results of the main studies related to the costs and benefits associated with a higher degree of integration with the EU.

Table 3.4 Empirical studies investigating the degree of integration with EU and progress with transition

Authors (year)	**Sample**	**Period**	**Estimation technique**	**Dependent variable**	**Explanatory variables**	**Main conclusions**
Baldwin and Seghezza (1996)	20 countries and 39 countries	1965 and 1989	Three stage least square, cross-country data	Real per capita income	Average population growth; 1960 secondary school enrolment rate; secondary school attainment rate; average investment to GDP ratio; domestic and foreign trade barriers.	Domestic protection reduces investment and slows economic growth.
Badinger (2001)	14 EU countries	1950-2000	Time series and panel	Per capita growth	Real capita stock; gross fixed capital formation; depreciation rate; employment of persons; degree of integration; tariff country; real trade with country j; country indexes.	GDP per capita of the EU would be approximately one fifth lower today, if no integration had taken place since 1950.
Dion (2004)	14 EU countries	1975-2000	Cross-section time series and	GDP growth	Imports of goods and services; inflows of foreign direct investment; distance between capitals; gross domestic product; population; border (dummy); language (dummy); membership to regional trade area (dummy); area; domestic R&D; foreign R&D; patents.	Regional economic integration has, through the liberalization of trade and its consequent international transmission of knowledge, a positive impact on growth.

Authors (year)	Sample	Period	Estimation technique	Dependent variable	Explanatory variables	Main conclusions
Belke et al. (2009)	25 transition countries	1996-2008	Cross-country panel	Institutional quality measured by an index based on the World Bank Governance Indicators.	Dummy variable about Stabilization and Association Agreement; Dummy variable which equals 1 starting in the year a membership action plan was established; Dummy variable which equals 1 for all years following WTO or GATT accession; Official Development Assistance and Official Aid (Share of GDP), average over current and past two years; FDI net Inflows (share of GDP), average over current and past two years.	Pre-accession incentives provided by EU and NATO are important for the development of institutions.
Bartlett and Prica (2012)	12 SEE countries	2008-2009	Descriptive statistics and graphical analysis	Change in GDP growth	Exports; credit growth; FDI; remittances; integration with EU; quality of institutions; progress with transition.	Countries that were more integrated with the EU were more affected by the crisis, especially through credit and foreign investment channels. Countries that made more progress with transition were also more affected.

Authors (year)	Sample	Period	Estimation technique	Dependent variable	Explanatory variables	Main conclusions
Campos et al. (2014)	17 EU countries	Country and regional level data from the 1973, 1980s, 1995 and 2004	Synthetic control methods for causal inference in comparative case studies	Percentage difference between the actual and estimated GDP per capita.	Real GDP per capita; labour productivity; trade openness; financial integration; EURO; political constraints; year of membership; country dummies, year dummies.	Growth and productivity effects from European Union accession vary across countries and over time, but without the EU, European incomes would be around 10 percent lower in 2013.

Baldwin and Seghezza (1996) investigate the relationship between trade liberalization and investment-led growth. They find that domestic protection reduces investment and slows economic growth. Badinger (2005) using a time series and panel approach, study the permanent and temporary growth effects of integration with EU. Even though the hypothesis of a permanent growth effect is rejected, the author finds that GDP per capita of the EU would be approximately one fifth lower today, if no integration had taken place since 1950. Dion (2004) contributes to the empirical literature by providing a quantitative measurement of the influence of regional trade integration on productivity. They address the link between trade and productivity of EU countries through knowledge spillovers in a multi-country model. They show that regional economic integration has, through the liberalization of trade and its consequent international transmission of knowledge, a positive impact on growth. Campos et al. (2014) also analyse the growth and productivity effects from European Integration. The authors use country and regional level data from the 1973, 1980s, 1995 and 2004 enlargements for various measures of growth and productivity and find significant and substantial positive growth and productivity effects from European Union accession. They find that these effects vary across countries and over time, but they conclude that without the EU, European incomes would be around 10 percent lower in 2013. Additional benefits from integration with the EU are the increased employment opportunities, cost reductions resulting from the elimination of border formalities and national regulations, economies of scale (Egger and Pfaffermayr, 2004; De Sousa et al., 2012).

Despite the overall positive effects associated with European integration, when it comes to periods of crisis and shocks, it is still a debatable topic whether progress with integration to EU equipped countries with the necessary tools to better deal with them or whether it made them more vulnerable. A number of empirical studies suggest that progress with EU integration has a positive effect on the quality of institutions (Beck and Laeven, 2006; Di Tommaso et al., 2007; Belke et al. 2009). In general, the institutional characteristics that may shape the impact of external shocks are related to the quality of developed institutions, progress with transition to a market economy and the quality of government policy-making (Bartlett and Prica, 2012). From the perspective of adjusting to external shocks, the institutional development with respect to governance, including capacity for monetary and fiscal policy/stabilization and well-functioning markets are unambiguously positive. Likewise, during the periods of financial crises investors tend to withdraw from those markets with weak macroeconomic fundamentals and poor institutions, thus contributing to the transmission of crises (Bekaert et al., 2014).

Beck and Laeven (2006) show that EU membership has positive effects on institutional change in ETEs. They measure institutional change using the World Bank Governance Indicators. Di Tommaso et al. (2007) find similar results of the positive impact of basic agreements between the EU and transition countries. They measure institutional change by using EBRD indicators; however, they focus only on economic institutions, ignoring political and legal institutions. Belke et al. (2009) using a panel of 25 transition countries for the period 1996-2008 show that pre-accession incentives provided by EU and NATO are important for the development of institutions. They provide similar results for a positive relationship between progress with EU integration and institutional quality measured by the World Bank Governance Indicators.

The empirical studies reviewed above suggest that there is a positive relationship between increased integration with the EU and the quality of institutions. However, there is a lack of empirical studies that investigate the impact of integration with the EU on the sensitivity of economies to exposure to external shocks. One paper that considers integration with the EU and progress with transition in assessing the impact of the GFC on economic activities of transition countries is that of Bartlett and Prica (2012). The authors conclude that countries that were more integrated with the EU were more affected by the crisis, mainly through credit and FDI channels. Countries that made more progress with transition were also more affected, possibly because this has led to deeper structural and institutional integration with the EU. The authors argue that progress in adopting market-friendly institutions has made these countries more vulnerable to external shocks by creating new channels of contagion. However, this conclusion relies excessively on descriptive statistics and graphical analysis and the authors consider only the South East European countries. Nevertheless, as shown in section 1.2, despite the well-known benefits of economic integration, it also appears to have made the countries more vulnerable to the effects of the GFC by creating and/or strengthening potential channels for contagion through trade, foreign banks, FDI, remittances and cross-border bank flows. On the other hand, countries that made more progress with EU integration and institutional reforms may have been better able to deal with external shocks, since their higher quality institutions may be expected to contribute to output stability (Balavac and Pugh, 2016).

3.5 Empirical work for European transition economies

Even though previous research contains numerous empirical studies on the transmission of the GFC to developed and developing countries, there is still a lack of empirical studies regarding transmission to the Central and Eastern European countries. Given the relatively low level of financial market development in ETEs, the empirical studies investigating the transmission of the GFC to these countries have generally employed the second method of testing for contagion, which focuses on individual channels of transmission of shocks. The following part of this section reviews the main studies that have included ETEs in investigating the impact of the GFC. It starts with studies that have focused on financial linkages and then continues with those that focused on trade linkages as an international channel of transmission of crises. The empirical studies which include ETEs in the investigation of the determinants of the GFC are summarized in Table 3.5 below.

Table 3.5 Empirical studies investigating ETEs

Authors (year)	Countries	Period	Estimation technique	Crisis definition	Main explanatory variables	Main conclusions
Árvai et al. (2009)	CEE and Western European countries	2002-2008	N/A	Contagion index	Cross-border exposures	Most of Central, Eastern and Southern European countries are highly dependent on cross-border credit flows from Western European banks. Even in the cases where exposures of CESE countries are diversified, interdependencies between each other could trigger a regional contagion if one of the countries were to face a shock.
Milesi-Ferretti and Tille (2011)	75 countries from Emerging Europe, CIS, Emerging Asia, Western Hem. Carib. Africa, Industrial countries, Middle East	2008-2009	Panel, OLS estimation	Change in output growth between 2008-2009 and 2005-2007	GDP per capita, CA/GDP is the ratio of the 2007 current account balance to GDP, Private credit growth, Financial openness and Growth gap.	Trade openness and the manufacturing share in GDP are positively correlated with the output and demand declines; also, fast private credit growth and current account deficits are correlated with the decline in the growth rate of output and especially domestic demand during the crisis. The nature of the crisis in advanced economies is highlighted by the negative

Authors (year)	Countries	Period	Estimation technique	Crisis definition	Main explanatory variables	Main conclusions
						correlation between GDP per capita and the decline in output growth.
Berglof et al. (2009)	European emerging economies	2008-2009	Cross–country OLS	Sum of quarterly real GDP growth Q4 2008 + Q1 2009	The loan-to-deposit ratio; openness to trade; reserves as a share of short-term debt; the asset share of foreign banks in the banking system; the stock of foreign direct investment liabilities; the current account deficit in 2007; the share of foreign currency debt in total liabilities of the banking system.	Countries with higher shares of foreign-owned banks in the financial system tended to suffer smaller bank lending outflows in the fourth quarter of 2008 and first quarter of 2009. Higher foreign-bank ownership is also associated with milder output declines in the transition region.

Authors (year)	Countries	Period	Estimation technique	Crisis definition	Main explanatory variables	Main conclusions
Balakrishnan et al. (2011)	26 advanced and emerging countries	1998-2003 2003-2009	Two stage econometric analysis; cross-section panel	Financial stress	Industrial production growth; commodity price growth; libor (3-month); bank linkages; portfolio linkages; direct investment linkages; trade linkages; US and Canada dummy; Western Europe dummy; trade dummy; trade openness; financial openness; current account; fiscal balance; foreign reserves.	Financial stress passes through rapidly to emerging economies. Financial links are the main channel of transmission of crisis. Emerging economies with higher levels of foreign liabilities to advanced economies have been more affected by the crisis that originated in advanced economies than emerging economies with lower foreign liabilities.
Jovičić (2010)	Western Balkan countries	2009	VAR	N/A	Domestic production; exports	Countries with stronger trade ties with the EU experienced the crisis sooner. However, the countries with weaker trade ties with the EU had a larger decrease in production.

Authors (year)	Countries	Period	Estimation technique	Crisis definition	Main explanatory variables	Main conclusions
Brezigar-Masten et al. (2011)	31 European countries	1996-2004	Cross-country panel	Real GDP per capita growth	Lagged GDP per capita growth; depth of national financial markets; inflation.	A high degree of financial integration did not increase the degree of financial fragility of transition countries and did not intensify the effects of the financial crises. They conclude that countries with a higher degree of financial openness had less of a credit decline during the GFC.
Berkmen et al. (2012)	40 emerging market economies	2009	Cross-country OLS	Changes in the consensus forecast for 2009 between the averages of January–June 2009 and January–June 2008	Trade openness; Leverage; exchange rate peg dummy; EU accession dummy; cumulative credit growth.	Degree of leverage and cumulative credit growth and exchange rate policy explain a large share of the variation in the growth forecast revisions across these countries. Also the effect of leverage appears to have been stronger in the EU accession countries and there is weak evidence suggesting that a strong fiscal position helped shield countries from the effect of the GFC.

Authors (year)	Countries	Period	Estimation technique	Crisis definition	Main explanatory variables	Main conclusions
De Hass et al. (2012)	1,294 banks in emerging Europe	1999-2009	Cross-section panel	Annual gross nominal credit growth	Vienna participation dummy variables; dummy for crisis; dummy variables for private domestic, state or foreign banks.	Both domestic and foreign banks sharply reduced credit during the crisis, but foreign banks that participated in the Vienna Initiative were relatively more stable lenders.
Popov and Udell (2012)	16 emerging European countries	Survey data from 2005 and 2008 on 10,701 firms	Cross-section	A dummy variable equal to 1 if firm i in city j in country k in industry l is credit constrained in fiscal year 2007	A matrix of firm characteristics; index of average bank balance sheet conditions; a matrix of country dummies; a matrix of industry dummies.	Firms' access to credit was affected by changes in the financial conditions of their parent banks.

Authors (year)	Countries	Period	Estimation technique	Crisis definition	Main explanatory variables	Main conclusions
Ongena et al. (2015)	14 transition countries in Eastern Europe and Central Asia	2009	Cross-country	Loan Growth	Internationally-borrowing domestic bank that equals one if the domestic bank borrowed at least once from the international wholesale market between 2004 and 2007 and equals zero otherwise; dummy foreign bank that equals one if the bank was foreign-owned in 2007 and equals zero otherwise.	Internationally borrowing domestic and foreign-owned banks contracted their credit more during the crisis than domestic banks that are funded only locally. Firms that are dependent on credit and at the same time have a relationship with an internationally borrowing domestic or a foreign bank suffer more in their financing and real performance.
Bonin and Louie (2015)	256 European bank subsidies in 8 ETEs	2004-2010	Cross-country panel	Real loan growth	GDP growth; assets, equity rationing; loans. deposits; ROAA; Inflation; Depreciation.	The 6 biggest European banks did not change their behavior in 8 ETEs under investigation during the GFC and the Eurozone debt crisis, whereas other foreign banks, in addition to contributing to credit boom prior to the GFC, also reduced their lending during the crises.

Authors (year)	Countries	Period	Estimation technique	Crisis definition	Main explanatory variables	Main conclusions
Fadejeva et al. (2017)	41 emerging countries from Asia, the CESEE region including the Baltics, the CIS region, Latin America and EU.	Quarterly data from 1995Q1 to 2013Q4	GVAR	N/A	Real GDP; change in prices; the real exchange rate; short term interest rates; and government bond yield; total credit to the private sector.	All shocks originating in the US and EU affect output and credit internationally, but with a different intensity. The study also finds that European emerging countries are more severely affected by these shocks than other emerging countries included in the sample.
Allen et al. (2017)	400 banks in CEE countries	1994-2010	Cross-section panel	Real growth in total loans	Deposit growth; liquidity (liquid assets to total assets); profitability (return on average assets); solvency (equity to asset); total bank assets to a country's GDP as a measure of Size; parent bank-specific measures.	Lending behavior of foreign banks depended on the type of crisis; it remained constant during the domestic crises, while foreign crises were associated with decreased lending by foreign bank subsidies.

An important international transmission mechanism of the GFC highlighted in the literature has been the restriction of credit, which, as discussed in section 1.2, has particularly affected transition countries with a high degree of foreign bank ownership. The EBRD (2009) claims that prior to the crisis, foreign financing, often disproportionately funded by foreign banks, contributed to credit booms in these countries. Moreover, most of this debt was denominated in foreign currency, which increased the vulnerability of the region to external shocks. Milesi-Ferretti and Tille, (2011) analyse capital flows in 75 countries (including ETEs) at a quarterly frequency. They show that the global restriction of credit during the GFC in particular affected those transition economies with a deeper international financial integration. Similarly, Árvai et al. (2009) explore financial contagion focusing on financial linkages. This study also draws attention to the important role of external financing as a source of funding domestic credit growth. The authors explore the cross-border exposures between emerging and advanced European countries. They present indicators of contagion exposure which help identify the key points and spillover effects and propagation channels of a shock that starts in a certain country. The findings of this research highlight the relevance of financial interlinkages within Europe and the high dependence of most of the Central, Eastern and Southern European countries on Western European banks. The authors point out that even in cases where exposures of CESE countries are diversified, interdependencies between each other could trigger a regional contagion if one of the countries faces a shock. However, their conclusions are mostly based on an interpretation of stylized facts, without employing econometric techniques. Balakrishnan et al. (2011) develop a new financial stress index for emerging economies to investigate how financial stress is transmitted during crises, including the GFC. Based on a two-stage estimation, the authors assess the factors and intensity of transmission of stress between advanced and emerging economies. In the first stage the degree of the transmission of stress is estimated, while in the second stage differences and the factors of co-movement are assessed. An annual panel data model employing structural variables and policy variables is also used. The main results suggest that financial stress passes rapidly to emerging economies. They suggest that financial links are the main channel of transmission of crisis. They show that emerging economies with a higher level of foreign liabilities to advanced economies have been more affected by a crisis that originated in advanced economies than emerging economies with lower foreign liabilities.

The determinants of credit growth during the GFC are analysed by De Hass et al. (2012). By using data on 1,294 banks, the authors find that foreign banks reduced lending earlier and deeper than did domestic banks in the 30 transition economies they investigate. However, they show that countries that were part of the Vienna Initiative were more stable sources of credit than those that did not participate in this scheme. Similarly, Popov and Udell (2012), using survey data on 10,701 firms in 16 ETEs, find that firms' credit access during the GFC was affected by the balance sheet conditions of parent banks. Ongena et al. (2015) also find that banks that had international funding sources as well as foreign-owned banks contracted lending more during the GFC than did banks that had mainly domestic funding sources. Their investigation employs bank-firm level data from Eastern Europe and Central Asia. They also show that firms that relied on external funding were more severely affected by the GFC. Another similar investigation assessing the lending behavior of foreign banks during the GFC and the Eurozone debt crisis conducted by Bonin and Louie (2015) provides additional insights. They show that the 6 biggest European banks did not change their behavior in 8 ETEs under investigation during the GFC and the Eurozone debt crisis, whereas other foreign banks, in addition to contributing to credit boom prior to the GFC, also reduced their lending during the crisis. Allen et al. (2017), using a panel data for 400 banks, also investigate the impact of foreign bank ownership on lending behavior in Central and Eastern European countries during the period 1994-2010. They find that the lending behavior of foreign banks depended on the type of crisis; it remained constant during the crises originating domestically, while crises that originated in foreign countries were associated with decreased lending by foreign bank subsidies. A study that employs the global vector auto-regression (GVAR) approach to investigate the international transmission of aggregate demand, loan supply and loan demand shocks originating in the USA and EU was conducted by Fadejeva et al. (2017). The findings of this research revealed that all shocks originating in the US and EU affect output and credit internationally, but with a different intensity. While aggregate demand and loan demand shocks significantly affect output internationally, there is no evidence of spillovers from loan supply shocks. The study also finds that European emerging countries were more severely affected by these shocks due to their deep economic integration with the EU, which exposed these countries to both EU and US shocks.

Consequently, the studies reviewed above provide evidence of the international transmission of the crisis to the transition countries through financial linkages. These studies point out the importance of foreign banks in international transmission of shocks to these countries. However, this finding is not completely confirmed by Berglöf et al. (2009); Lane and Milesi-Ferretti, (2011); Brezigar-Masten et al. (2011) and Berkmen et al. (2012). These authors find no evidence that the presence of foreign banks in transition countries have amplified the effects of the GFC.

Berkmen et al. (2012) employs cross-country regressions to try to explain the differences in the severity of the GFC across developing and emerging economies. As a proxy for the financial crisis impact on output, the authors focus on revisions of projections for GDP growth, comparing the forecasts prior to and after the crisis in September 2008. The authors use several explanatory variables in order to capture the transmission of crisis through financial and trade channels. Another group of variables such as current account deficit, level of reserves, level of debt, credit growth etc, are used to capture the principal vulnerabilities and financial structure and pre-existing conditions. For the basic regression, the authors use the changes in the forecast between the averages of January–June 2009 and January–June 2008 for 40 emerging economies. They find that the degree of leverage and cumulative credit growth, as well as exchange rate policy, can explain a high share of projected output decline in emerging countries. Moreover, their results suggest that countries with a larger number of foreign banks experienced less banking outflows in the fourth quarter of 2008 and the first quarter of 2009. Similarly, they find that those emerging economies with a higher share of foreign-owned banking assets suffered a softer output decline. The authors conclude that, in general, the increasing level of financial integration has had a mixed effect in emerging economies, since the foreign banks contributed to credit booms and external debts but helped to stabilise the economies during the crisis. Similar results are reported by Berglöf et al. (2009) who analyse the effects of the GFC on growth in emerging Europe. They show that countries with higher shares of foreign-owned banking assets experienced smaller bank lending outflows and milder output declines during the GFC; whereas countries with larger pre-crisis credit booms, higher external debt and hard pegs experienced larger output declines. The authors also argue that, considering that foreign-owned banks have contributed to credit booms and external debt accumulation, the effect of financial integration on the crisis in ETEs has been mixed.

Lane and Milesi-Ferretti (2011) analyse whether the severity of the GFC depended on pre-crisis macroeconomic and financial conditions, especially focusing on financial linkages for a global sample of countries, including ETEs. They include macroeconomic variables for 2008 and 2009 (though the 2009 data are based on October 2009 projections) and they also include total domestic demand and consumption. Their results suggest that pre-crisis factors such as a higher development level, increasing economic activity and higher credit and trade openness significantly increased the intensity of the crisis. On the other hand, they do not find any evidence supporting the view that a higher level of financial integration intensified the crisis. Brezigar-Masten et al. (2011) also investigate the role of financial integration in transition countries' growth, differentiating periods of financial crisis from normal times. The authors conclude that a high degree of financial integration did not increase the degree of financial fragility of transition countries and did not intensify the effects of the financial crises. They conclude that countries with a higher degree of financial openness had less of a credit decline during the GFC. The final group of studies reviewed above find no evidence of the importance of financial linkages in the international transmission of the GFC to transition countries.

Trade appears to have been another important transmission channel of the crisis for ETEs, considering that increasing trade deepening and rising trade integration with the EU has made these countries more vulnerable to a reduction in export demand (EBRD, 2009; Bartlett and Prica, 2012). A few studies have empirically investigated this relationship and found a positive relationship between the impact of greater trade linkages and the severity of the impact of the GFCC in transition countries (IMF, 2010; Jovicic, 2010; Blanchard, 2010; Lane and Milesi-Ferreti, 2011). Jovcic (2010) using VAR modelling investigated the relationship between the strength of trade linkages with the EU and the speed of contagion and the intensity of the crisis in Western Balkan countries. The author shows that those countries with stronger trade ties with the EU experienced the crisis sooner. However, the countries with weaker trade ties with the EU had a larger decrease in production. On the other hand, the IMF (2010) finds that, amongst other factors (higher pre-crisis vulnerabilities, including pre-crisis credit booms), countries with a higher degree of trade integration with the global economy were more severely affected by the crisis. Blanchard et al. (2010) also show that trade and financial linkages as well as different growth performances of partners in trade explain a large portion of the variability of growth performance across transition countries during the GFC. Similarly, Lane and Milesi-Ferretti (2011) show that international trade variables mattered during the crisis. They find that countries more open to international trade and countries whose main trading partners' growth declined further during the crisis suffered larger declines in capital inflows.

The review of the empirical studies presented above has shown that the majority of the investigations have concentrated on financial linkages/financial integration as an international channel of transmission of shocks, while less attention has been given to trade linkages. More specifically, most of the studies reviewed above focus on the degree of foreign-bank ownership and credit restriction during the GFC. However, there is no consensus as to whether increased financial integration and foreign bank ownership intensified the impact of the GFC on ETEs. While a number of the studies reviewed above report a positive relationship between foreign-bank ownership and the restriction of credit during the GFC, other studies claim that a higher degree of foreign bank-ownership contributed to the resilience of the transition region. Nevertheless, the latter group of studies acknowledge the contribution of foreign-bank ownership in fuelling credit booms prior to the GFC. A potential explanation for this difference in the results of the relationship between financial integration/foreign bank ownership and crisis severity is the difference in sample/period coverage, estimation technique adopted and measurement of the crisis severity.

A common weakness of most of the studies reviewed above, but also of other empirical studies addressing the determinants of the severity of the GFC which can lead to biased estimates, is the employment of inappropriate variables to measure the impact of the GFC and define the crisis. The most commonly used measures have been based on GDP growth/change in GDP growth or difference between forecast and actual GDP growth and binary definition of the crisis presence during a certain year/country. These might not be the most appropriate measures, given that using a binary definition of the presence of a crisis does not provide a measure of the intensity of the crisis nor does it take into account situations that do not completely fit into a full-scale crisis, even though they might have a certain level of macroeconomic impact. Likewise, using the difference between forecast and actual GDP growth might lead to distorted results, given that forecasts for GDP growth for 2009 were made during 2008 when the initial effects of the crisis were already present in most of these countries. Hence, the forecast GDP growth for 2009 already took into consideration some of the effects of the crisis. Also, employing simply GDP growth as a measure of the impact of the crisis might not provide accurate estimates, considering that factors other than the crisis affect GDP growth and that these studies have generally not controlled for such factors. Other measures of crisis severity such as credit growth and financial stress indexes have also been considered, which makes it difficult to reach conclusions regarding the severity of the crisis.

An additional weakness of many of the studies reviewed above is that they have not reported diagnostic tests regarding model specification, therefore the conclusions reached regarding the determinants of the crisis severity should be interpreted with some caution. With regards to estimation techniques, the majority of the studies reviewed above adopted cross-country panel methods. However, other estimation techniques such as VAR and GVAR have been adopted by some studies. It should be pointed out that even though panel analysis is a well-established method, nonetheless it is, normally, a single equations method with one endogenous variable and other exogenous variables. Given the ambiguity of defining and measuring crisis severity, other modelling approaches such as VAR and GVAR might be more appropriate to model the transmission of financial crises as they treat all variables as endogenous and provide full-system estimation where everything is allowed to depend on everything else. In addition, the GVAR modelling approach allows for interdependencies at international level and for long-run and short-run relationships consistent with the theory and data. Overall GVAR provides a coherent and theory-consistent solution to the issue of dimensionality in global modelling (Smith and Galessi, 2014).

The limited number of studies that have investigated the transmission of the GFC to ETEs have not considered certain factors such as the degree of integration with the EU, and, in particular, the high but differing degrees of euroisation, although both are key characteristics of ETEs. Furthermore, the majority of the studies reviewed above have been carried out at country level, while there is a lack of studies that investigate the transmission of the GFC to ETEs based on firm-level analysis. As Claessens and Forbes (2004) point out, trade and financial linkages between countries are often highly correlated; therefore, a firm-level investigation could provide additional insights into the specific channels for the international transmission of crisis.

3.6 Conclusion

This chapter has provided an overview of the main empirical studies that have investigated the international transmission of shocks through different channels (cross-market asset correlations and individual channels of transmission of shocks) before focusing on the determinants of the severity of GFC on ETEs. Although there are a large number of empirical studies that have investigated the international transmission of financial crises, the literature is still unable to provide conclusive results on the determinants of crisis severity across countries. The studies reviewed in this chapter provide a wide range of results, which are sometimes not in line with the expectations suggested by orthodox theory. The analysis presented in this chapter showed that the empirical results on the transmission of financial crises based on cross-market correlation coefficients are inconclusive. More specifically, when contagion was defined as a significant increase in cross-country asset correlations following a crisis, without taking into account heteroscedasticity, the authors found evidence of contagion, whereas when heteroscedasticity was accounted for, no evidence of contagion was found. It was argued that the second approach of testing for contagion, which is based on individual channels of transmission of shocks, might provide more intuition on how exactly crisis has been transmitted, as it distinguishes between different channels and propagation mechanisms (e.g. trade and financial linkages, macroeconomic fundamentals). However, in spite of the large number of empirical studies that have investigated the transmission of financial crises based on individual channels of contagion, the results remain inconclusive. To a large extent, the lack of conclusive results has been attributed to measurement and misspecification errors of crisis severity. With respect to crisis definition, the recent literature has most commonly focused on the decline of GDP growth, cross-market correlation coefficients, financial stress indexes, changes in capital flows and exchange rate tensions, which makes it difficult to reach overall conclusions regarding the severity of the crisis.

The empirical studies investigating the transmission of the GFC to ETEs have generally employed the second method of testing for contagion. The lack of studies employing the first method of testing for contagion (based on cross-market correlation confidents) has been attributed to the relatively low level of financial market development in ETEs. The majority of the investigations have concentrated on financial linkages/financial integration as an international channel of transmission of shocks, while less attention has been given to trade linkages. As yet there is no consensus as to whether the strengthening of financial linkages intensified the impact of the GFC on ETEs. As for the estimation techniques, the majority of the studies reviewed in this chapter have adopted cross-country panel methods, while some studies also considered other methods such as GVAR and VAR. Given the measurement and misspecification errors of crisis severity, it was argued that panel analysis might not be the most appropriate method to test for transmission of the GFC, since it is a single equation approach, with one endogenous variable and other exogenous variables, which requires researchers to define and measure crisis severity as a dependent variable. On the other hand, an approach such as GVAR treats all variables as endogenous and is a full system approach to estimation in which everything is allowed to depend on everything else. Therefore, GVAR is considered a more appropriate approach to model interdependencies between countries and international transmission of shocks.

The empirical review also disclosed that the limited number of studies that have investigated the transmission of the GFC to ETEs have ignored factors such as differing levels of integration with the EU, and, in particular, variations in the degree of euroisation. In addition, it was shown that there is a complete lack of studies that investigate the transmission of the GFC to ETEs based on firm-level analysis, which is an important gap given (i) the argued correlations between trade and financial linkages and (ii) the possibility that a firm-level investigation would provide more insights into the specific channels of international transmission of crisis to ETEs. The gaps identified in this chapter will be addressed empirically in Chapters 4 and 5. The following chapter will investigate the international transmission of GDP and financial shocks from 15 European advanced countries to 17 ETEs using the recently developed GVAR approach, while Chapter 5 will investigate the transmission of the GFC to 6 ETEs by employing firm-level data.

CHAPTER 4

EXPLAINING THE IMPACT OF THE GLOBAL FINANCIAL CRISIS ON EUROPEAN TRANSITION COUNTRIES: A GVAR APPROACH

Contents

4.1 Introduction

Chapter 2 of this thesis provided an overview of the theoretical framework within which the international channels of transmission of the GFC are investigated. The review presented in Chapter 3 showed that although there are a large number of empirical studies that have investigated the international transmission of crises, the literature is still unable to provide conclusive results of the determinants of crisis severity across transition countries. To a large extent, the lack of conclusive results has been attributed to measurement and misspecification errors of crisis severity. With respect to crisis definition, the recent literature has most commonly focused on the decline of GDP growth, cross-market correlation coefficients, financial stress indexes, changes in capital flows and exchange rate tensions, which makes it difficult to reach overall conclusions regarding the severity of the crisis. In addition, previous studies have generally not reported diagnostic tests regarding model specification. Furthermore, these studies have generally neglected to address the degree of integration with the EU, and, in particular, the level of euroisation, even though these are common characteristics of ETEs.

Understanding how external shocks transmit into domestic economies in ETEs is important for policy makers. In order to investigate the interdependencies among countries and to understand how shocks are transmitted internationally, a model that accounts for these interdependencies and looks at them from a global perspective is needed. Given the measurement and misspecification errors of crisis severity presented in Chapter 3, it was argued that panel analysis might not be the most appropriate method to test for transmission of the GFC, since it is a single equation approach, with one endogenous variable and other exogenous variables, which requires researchers to define and measure crisis severity as a dependent variable. On the other hand, an approach such as GVAR treats all variables as endogenous and, as such, is a full system approach to estimation in which everything is allowed to depend on everything else. The main thing about the GVAR methodology is time series depth. Single equation methods, whether they are cross sectional or panel, are rooted in microeconomics, whereas in macroeconomic analysis it is very difficult to distinguish between dependent and independent variables and, potentially, everything is endogenous. That is why time series analysis has developed a range of tools, most of which are in the platform of VAR and GVAR, precisely to analyse interdependences. GVAR provides an effective way of modelling interactions in a complex high-dimensional system such as the global economy. Consequently, this chapter presents analyses of the international transmission of the GFC in a global context. More specifically, by employing the global vector auto-regression (GVAR) approach developed by Pesaran et al. (2004) and Dees et al. (2007), this chapter investigates the international transmission of financial shocks to ETEs.

The rest of this chapter is organized as follows. Section 4.2 provides an overview of the GVAR modelling framework, its structure and applications. Section 4.3 specifies the variables and data to be used in this investigation. Section 4.4 provides details of the estimation technique adopted, specifying each step and presents the empirical findings and diagnostic tests. The last section provides conclusions.

4.2 The GVAR approach

As reviewed in Chapter 2, there are many channels through which the international transmission of shocks takes place. Transmission could be a result of the common observed global shocks or other unobserved factors, but even when all common factors are taken into account, there is likely to be important residual interdependence that remains to be explained (Di Mauro and Pesaran, 2013). Therefore, a global framework is needed to investigate the importance of sources of international transmission of crises. In order to investigate the international transmission of the global financial shocks to ETEs, in this chapter we use the Global Vector Auto-Regression (GVAR) modelling framework. The GVAR approach, developed by Pesaran et al. (2004) and further extended by Dées et al. (2007) and Dées et al. (2009), can be used to investigate the international interdependencies among countries and international channels of transmission of shocks (Dovern and Roye, 2013). The main advantages of the GVAR modelling approach are that it allows: (i) for interdependence at different levels (national or international) in a transparent way that can be empirically evaluated; and (ii) for long-run relationships consistent with theory together with short-run relationships consistent with the data and provides a coherent, theory-consistent solution to the "curse of dimensionality" in global modelling (Smith and Galesi, 2014). For a detailed description of the methodology, this chapter refers to Di Mauro and Pesaran (2013).

GVAR combines separately estimated country-specific VARs into a global model. In this model, domestic variables are linked to country-specific foreign variables, such as foreign GDP or foreign exports. The latter are constructed from the domestic variables based on certain weights in order to account for the international trade, international finance or other interdependencies between countries. The country-specific foreign variables serve as a proxy for common unobserved factors, such as the diffusion of technological progress, or investors' behaviour during times of financial crisis or other determinants that we may not be able to measure, but it is known that they are present and affect all the countries. However, even when all these commonalities are accounted for, there might still be some residual interdependencies due to policy or trade spillover effects. Therefore, in the GVAR model the weighted combinations of observable factors are assumed to take into account the unobservable factors. All country-specific variables are treated as endogenous variables. Country-specific foreign variables are calculated and allowed to directly influence domestic variables in the model. The foreign variables and global variables are assumed to be weakly exogenous, assuming that every individual country is a small economy compared to the rest of the world. More specifically, the weak exogeneity of foreign variables means that domestic variables do not affect foreign variables in the long run, while they are affected by them. This is the key assumption of the GVAR modelling strategy since it allows country models to be estimated individually and only at a later stage to be combined together (Di Mauro and Pesaran, 2013). For every country, the standard VAR augmented with foreign variables is estimated. The augmentation takes place at the country level, but once the system as a whole is solved, we end up with a simple VAR. The general specification of a country specific VARX* model is described below:

Suppose there are $N+1$ countries in the global economy, indexed by $i=0,1,2,\dots,N$, where $N=18$ and country 0 is treated as the reference country (EU15 in our case) . For each country i an augmented $VARX^*(q_i, q_i^*)$ model, where q_i and q_i^* are the lag orders of the domestic and foreign variables respectively, can be written as follows:

$$x_{it} = \mathrm{a}_{i,0} + \mathrm{a}_{i,1}t + \sum_{j=1}^{qi} \alpha_{i,j} x_{i,t-j} \ + \ \sum_{j=0}^{q_i^*} \beta_{i,j} x^*{}_{i,t-j} \ + \ \sum_{j=0}^{qi} \gamma_{i,j} d_{t-j} \ + u_{i,t,} \tag{4.1}$$

for $t = 0,1,2, \dots, T$, and $N = 0,1,2, \dots, N$, where $x_{it}$is the k_iX 1 vector of country-specific domestic or endogenous variables, x_{it}^* is the $k_i^* X$ 1 vector of country-specific foreign variables (weakly exogenous), d_ta vector of global exogenous variable (here, oil prices) that exist in every country VARX*, a_{i0} is a constant, t is a linear trend, and $u_{i,t}$ is the k_iX 1 vector of idiosyncratic, serially uncorrelated, country-specific shocks.

Foreign-specific variables are constructed as weighted averages across the domestic variables of all countries, with the weights also being country-specific:

$$x_{it}^* = \sum_{j=0}^{N} w_{ij}\, x_{jt} \tag{4.2}$$

where $w_{ij}$are a set of weights such that $w_{ii} = 0$ and the sum of all weights equals to 1. The weights are determined to capture the importance of country *j* in the economy of country *i*. The country specific VAR models can be transformed into error correction forms (VECMX*) which allows a distinction between short-run and long-run relationships and treatment of the long-run relationships as co-integrating. Even though the VECMX* models are separately estimated on a country-by-country basis taking potential cointegration between x_{it} and x_{it}^*x into account (Smith and Galesi, 2014), the GVAR model is solved for the whole system in which all variables are endogenous. The GVAR model can allow interactions between countries through three different channels: dependence of the domestic variables on foreign specific variables and their lags; dependence of the domestic variables on global exogenous variables such as oil prices; and dependence of shocks in country *i* on shocks in country *j* (Di Mauro and Pesaran, 2013).

The GVAR model is a suitable tool for policy analysis, but it can be used more broadly. For example, previously it has been used for analysing the transmission of shocks (Galesi and Sgherri, 2009; Chudik and Fratszcher, 2011); credit risk (Pesaran et. al., 2006); for forecasting purposes (Pesaran et. al. 2009); dynamics of global trade flows (Bussière et al., 2009); and the role of oil prices in a global context (Rebucci and Spatafora, 2006).

Galesi and Sgherri (2009) use a GVAR model to investigate the international spillovers following slowdowns in U.S. equity prices. Their model contains 27 countries, including the United States, 17 European advanced economies, and 9 European emerging economies. They find that asset prices are the main channel through which shocks are transmitted across countries in the short run, while the cost and quantity of credit are important channels of transmission of shocks in the long run. Chudik and Fratzscher (2011) through a GVAR model investigate the importance of a tightening in liquidity conditions and collapse in risk appetite in the international transmission of the GFC. They find that the tightening of financial conditions was the most important transmission channel in advanced economies, while the emerging market economies were more affected by the decline in risk appetite. Bussière et al. (2009) use a GVAR model for a panel of 21 emerging market and advanced economies to investigate the factors that influence the dynamics of global trade flows. They model exports-imports response to three possible shocks: a shock to U.S. output; a shock to the US real exchange rate; and a shock to German output. They find that global exports are more affected by a shock to US output than by a real effective depreciation of the dollar. Rebucci and Spatafora (2006) use a GVAR model to investigate the role of oil prices in a global context. They find that positive oil price shocks have a negative effect on the current account balance of non-oil exporter countries including the US.

GVAR has not previously been used to model the transmission of financial shocks to ETEs. Hence, in using the GVAR model to investigate the transmission of the GFC to ETEs, this chapter will fill this gap in the literature.

4.3 Specification of data and variables

The first GVAR model will be estimated for 32 countries, including 17 ETEs[5] and 15 European advanced economies (EU15)[6], and using quarterly data for the period 2003Q1–2014Q4. Two types of variables are used to capture the main channels of international financial contagion: trade and financial. The variable used to capture the trade channel is exports. Since a major part of the theoretical and empirical

[5] Albania, Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Kosovo, Latvia, Lithuania, Macedonia, Montenegro, Poland, Romania, Serbia, Slovak Republic and Slovenia.
[6] Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Netherlands, Portugal, Spain, Sweden and the United Kingdom.

review in previous chapters implies that exports are one of the main channels of international transmission of shocks (Eichengreen et al., 1996; Glick and Rose, 1999; Forbes, 2002; Ozgan and Unsal, 2012) the shocks in European advanced countries are expected to affect more severely the ETEs with stronger trade links with them. Quarterly data on exports are obtained from EUROSTAT, the World Bank and central banks. The second group of variables will capture the international transmission of the global financial shocks through financial linkages. A financial crisis in one country can lead to direct financial effects, including reductions in foreign direct investment and other capital flows abroad (Dornbusch et al, 2000; Cetorelli and Goldberg, 2011; Milesi-Ferretti and Tille, 2011; Fratzscher, 2012). Since the GFC affected the EU15 financial sectors, transition countries with strong financial links with these advanced economies are expected to have been more severely affected by the crisis. Therefore, based on the overview of the impact of the GFC presented in Chapter 1 and literature on the transmission of GFC presented in Chapters 2 and 3, the following variables are used to capture the effect of transmission of crisis through the financial channel: foreign credit flows; credit flows in foreign currencies; inward foreign direct investment flows; and remittances. All these variables are expected to influence the international transmission of the global financial shocks. Data on foreign direct investment is obtained from the OECD, EUROSTAT and the European Commission; and on foreign credit flows and credit flows in foreign currencies from the Bank of International Settlements' International Banking Statistics (BIS IBS). This analysis is based on locational data, since these data are residence-based, therefore they are expected to reflect whether conditions in specific 'financial centre' countries affect flows to other countries, including flows to local subsidiaries. Data on remittances are obtained from the World Bank database.

The third group of variables will capture the factors that might have amplified the effects of the crisis on ETEs. They include: the degree of euroisation, namely, the extent to which a country has assets and liabilities denominated in foreign currencies; and the degree of integration with the EU. The degree of euroisation is measured by the average of the share of foreign currency loans in total loans and of foreign currency deposits in total deposits. Data on foreign currency loans and foreign currency deposits are obtained from the EBRD, the ECB, the Bank for International

Settlements and national central banks. The degree of integration with the EU, is captured by EU membership[7] and partially by the trade and financial linkages described in the previous paragraphs. Data from most of the sources are reported in real terms. In cases when data were available only in nominal terms, they were transformed into real terms by dividing the nominal time series with CPI.

4.4 Empirical Approach

The methodology proceeds through the following stages. First, the variables that enter each country model are selected and the VAR model is extended with the addition of a set of country-specific foreign variables. Second, the weights for constructing the country-specific foreign variables are computed. In the third stage, each variable in the model is tested for stationarity. Next, the VECM is specified for each country, which means determining the lag order of the underlying VAR models and testing for cointegration and the cointegrating ranks. Subsequently, different diagnostic tests are checked and the global GVAR is solved. Accordingly, after estimating the individual country VECMX* models as described, the corresponding VARX* models are recovered as the platform for impulse-response analysis and forecast error variance decomposition.

4.4.1 Specification and estimation of the country-specific models

The foreign country-specific variables are constructed as weighted averages of the corresponding variables of other countries based on certain schemes of weights. In theory, we could employ different weighting schemes for each country and variable, but considering the relatively large number of countries, variables and schemes of weights, this would result in an uncontrollable number of possible schemes. In addition, the choice of weighting scheme depends on data availability. However, it is important to know that using a bilateral weight based on a certain type of exposure, i.e. trade or financial exposure, does not imply that the transmission channel associated with the chosen type of exposure will be the only one captured by the

[7] In section 4.4.2 the transmission of shocks from advanced EU countries to ETEs is analysed in sub-samples, which are defined by various country features, one of which is EU membership. Consequently, we address one of the main aims of the thesis, i.e. to analyse whether the degree of integration with the EU influenced the transmission of the global financial crisis to ETEs.

weight since an appropriate bilateral weight will capture a combination of different channels between two countries, as it is assumed to capture the interdependencies that exist between those countries (Di Mauro and Pesaran, 2013). Previous GVAR studies have mainly employed trade weights for constructing the foreign-country specific variables (Pesaran et al., 2004; Dées et al., 2007; Nickel and Vansteenkiste, 2013). In contrast, Eickemier and Ng (2011) use a combination of trade and financial weights, namely, inward and outward FDI positions, cross-country bilateral trade flows and bilateral financial claim positions. Galesi and Sgherri (2009) employ weights based on bank lending data. Nevertheless, considering the importance of both trade and financial linkages between ETEs and European advanced countries (EU15), we believe that it is necessary to consider both trade and financial weights and investigate which capture more accurately the transmission channels between ETEs and European advanced countries. Hence, the number of weighting schemes is limited to trade and financial weights for all the variables in the model, and those weights for which data on bilateral flows are available for all the countries included in the model are chosen. The trade weights are computed using the cross-country exports and imports data for the years before the beginning of the GFC, 2005-2007. The country level trade shares are constructed by dividing the total trade of each country *i* (exports plus imports) by the amount of trade with country *j*, such that the *i*th row sums to one, for all *i*s. The first type of the financial weights is based on foreign direct investment. Foreign Direct Investment weights are computed based on the average FDI inward and outward positions during the period 2003-2007.[8]

In addition, considering the large share of remittance income in ETEs, in particular SEE countries, it was decided to employ a second type of financial weight based on bilateral remittance flows among countries in our model[9]. Weights based on bilateral remittance flows, to our knowledge, represent an original contribution to the GVAR

[8]These specific periods for computing trade and FDI weights were chosen for two reasons: data availability and to cover the period immediately before the GFC.

[9] Bilateral remittance estimates are obtained from the World Bank database. They are constructed based on a methodology developed by Ratha and Shaw (2007). The remittance data used in this study is for 2010, disaggregated using host country and origin country incomes and estimated migrant stocks. The earliest year for which bilateral remittance flow data are available is 2010, hence we use this year for constructing remittance weights in this study.

modelling framework. Trade, FDI and remittance weights are presented in tables 4.1a, 4.1b and 4.1c below.

Table 4.1a Trade weights used for computing foreign country-specific variables

Countries	Alb	bosn	Bulg	croat	czeck	esto	Hung	koso	Latv	Lithu	maced	monte	pola	roma	Serbi	slovak	sloven	EU15
alb	0	0.0013	0.0036	0.0013	0.0001	0.0000	0.0004	0.0361	0.0000	0.0000	0.0135	0.0064	0.0001	0.0006	0.0036	0.0001	0.0009	0.0142
bosn	0.0038	0	0.0041	0.0865	0.0011	0.0001	0.0039	0.0250	0.0001	0.0001	0.0215	0.0390	0.0008	0.0030	0.0744	0.0009	0.0297	0.0083
bulg	0.0278	0.0123	0	0.0110	0.0031	0.0006	0.0061	0.0507	0.0013	0.0020	0.0897	0.0035	0.0032	0.0257	0.0387	0.0030	0.0072	0.0718
croat	0.0134	0.2548	0.0113	0	0.0037	0.0003	0.0112	0.0299	0.0008	0.0008	0.0473	0.0405	0.0024	0.0043	0.0406	0.0035	0.0760	0.0368
czeck	0.0104	0.0228	0.0215	0.0255	0	0.0097	0.0435	0.0100	0.0172	0.0186	0.0111	0.0156	0.0589	0.0280	0.0206	0.1963	0.0281	0.2253
esto	0.0000	0.0002	0.0005	0.0004	0.0013	0	0.0018	0.0000	0.1269	0.0685	0.0001	0.0001	0.0039	0.0003	0.0004	0.0008	0.0006	0.0702
hung	0.0097	0.0588	0.0264	0.0361	0.0343	0.0151	0	0.0193	0.0111	0.0108	0.0108	0.0384	0.0325	0.0715	0.0545	0.0761	0.0387	0.1830
koso	0.0000	0.0000	0.0007	0.0000	0.0000	0.0000	0.0001	0	0.0000	0.0000	0.0000	0.0013	0.0000	0.0001	0.0000	0.0000	0.0023	0.0012
latv	0.0000	0.0001	0.0009	0.0003	0.0016	0.1053	0.0013	0.0000	0	0.1193	0.0001	0.0000	0.0060	0.0004	0.0006	0.0018	0.0007	0.0322
lithu	0.0000	0.0002	0.0018	0.0009	0.0027	0.0815	0.0021	0.0000	0.1806	0	0.0003	0.0000	0.0137	0.0010	0.0010	0.0021	0.0017	0.0372
maced	0.0236	0.0120	0.0220	0.0117	0.0003	0.0000	0.0010	0.2343	0.0000	0.0001	0	0.0104	0.0006	0.0015	0.0350	0.0003	0.0056	0.0185
monte	0.0009	0.0000	0.0001	0.0024	0.0001	0.0000	0.0006	0.0141	0.0000	0.0000	0.0022	0	0.0001	0.0001	0.0519	0.0000	0.0035	0.0035
pola	0.0070	0.0176	0.0284	0.0215	0.0705	0.0391	0.0515	0.0133	0.0759	0.1261	0.0295	0.0123	0	0.0377	0.0223	0.0679	0.0268	0.0200
roma	0.0107	0.0227	0.0689	0.0122	0.0098	0.0009	0.0424	0.0135	0.0010	0.0024	0.0216	0.0097	0.0109	0	0.0366	0.0128	0.0127	0.1134
serbi	0.0040	0.0000	0.0250	0.0147	0.0019	0.0003	0.0079	0.1914	0.0006	0.0002	0.0818	0.2718	0.0013	0.0042	0	0.0032	0.0266	0.0196
slovak	0.0020	0.0086	0.0112	0.0117	0.0893	0.0026	0.0420	0.0028	0.0069	0.0053	0.0049	0.0024	0.0257	0.0146	0.0200	0	0.0181	0.0858
sloven	0.0086	0.1534	0.0131	0.0949	0.0069	0.0015	0.0118	0.0572	0.0019	0.0029	0.0413	0.0595	0.0058	0.0086	0.0619	0.0088	0	0.0590
EU15	0.8779	0.4353	0.7605	0.6690	0.7734	0.7430	0.7724	0.3024	0.5756	0.6430	0.6244	0.4891	0.8342	0.7984	0.5380	0.6224	0.7208	0

Note: Bilateral weights are shown in columns and sum up to one. There is one column for each country in the sample; across the columns row totals have no meaning. Weights are calculated based on average trade flows (sum of exports and imports) among countries for the period 2005-2007. Rows represent the origin country and columns the partner countries; i.e. if we look at Albania, we can see that Bosnia and Herzegovina accounted for 0.4% of the total trade (exports + imports) of Albania during the period 2005-2007, Bulgaria 2.8%, and Croatia 1.3% (the same interpretation applies to all other countries).

Table 4.1b FDI weights

Countries	alb	bosn	bulg	croat	Czeck	esto	hung	koso	latv	lithu	maced	monte	pola	roma	serbi	slovak	sloven	EU15
alb	0	0.0000	0.0000	0.0000	0.0041	0.0000	0.0000	0.0000	0.0000	0.0000	0.0197	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0659
bosn	0.0000	0	0.0000	0.0167	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000
bulg	0.0000	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
croat	0.0000	0.4184	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0394	0.0000	0.0000	0.0000	0.0000	0.0000	0.2567	0.0363
czeck	0.0001	0.0012	0.0100	0.0030	0	0.0010	0.0243	0.0000	0.0014	0.0006	0.0018	0.0000	0.0127	0.0052	0.0000	0.6296	0.0026	0.0929
esto	0.0000	0.0000	0.0000	0.0000	0.0000	0	0.0000	0.0000	0.0321	0.0056	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0017
hung	0.0001	0.0001	0.0034	0.0015	0.0021	0.0011	0	0.0000	0.0006	0.0002	0.0001	0.0246	0.0018	0.0797	0.0000	0.0063	0.0010	0.1488
koso	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
latv	0.0000	0.0000	0.0000	0.0000	0.0000	0.0563	0.0000	0.0000	0	0.0391	0.0000	0.0000	0.0004	0.0000	0.0000	0.0000	0.0000	0.0087
lithu	0.0000	0.0000	0.0000	0.0000	0.0001	0.0111	0.0003	0.0000	0.0538	0	0.0000	0.0000	0.0012	0.0000	0.0000	0.0000	0.0000	0.0043
maced	0.0602	0.0022	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0	0.0000	0.0000	0.0000	0.0338	0.0000	0.0000	0.0000
monte	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
pola	0.0000	0.0028	0.0043	0.0016	0.0255	0.0049	0.0055	0.0000	0.0250	0.3116	0.0008	0.0000	0	0.0015	0.0000	0.0037	0.0015	0.5729
roma	0.0000	0.0000	0.0392	0.0026	0.0000	0.0000	0.0217	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0	0.0000	0.0000	0.0000	0.0127
serbi	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0	0.0000	0.0000	0.0000
slovak	0.0000	0.0003	0.0023	0.0009	0.2567	0.0002	0.0545	0.0000	0.0005	0.0001	0.0097	0.0000	0.0023	0.0012	0.0000	0	0.0015	0.0436
sloven	0.0001	0.0687	0.0004	0.0469	0.0011	0.0000	0.0009	0.0629	0.0000	0.0000	0.0538	0.0000	0.0001	0.0002	0.0000	0.0000	0	0.0122
EU15	0.9393	0.5063	0.9404	0.9268	0.7105	0.9254	0.8928	0.9370	0.8867	0.6428	0.8747	0.9754	0.9816	0.9123	0.9662	0.3603	0.7363	0

Note: Bilateral weights are shown in columns and sum up to one. FDI weights are computed based on the average FDI inflows from each country in the sample during the period 2003-2007.

Table 4.1c Remittance weights

Countries	Alb	bosn	bulg	croat	czeck	esto	hung	koso	latv	lithu	maced	monte	pola	roma	Serbi	slovak	sloven	EU15
alb	0	0.0000	0.0008	0.0003	0.0003	0.0000	0.0000	0.0624	0.0000	0.0000	0.0095	0.0002	0.0000	0.0000	0.0000	0.0000	0.0003	0.0049
bosn	0.0000	0	0.0000	0.0224	0.0000	0.0000	0.0000	0.0017	0.0000	0.0028	0.0015	0.0117	0.0000	0.0004	0.0070	0.0005	0.0448	0.0042
bulg	0.0179	0.0001	0	0.0001	0.0056	0.0014	0.0118	0.0252	0.0006	0.0049	0.0342	-0.0002	0.0003	0.0041	0.0077	0.0001	0.0018	0.0292
croat	0.0045	0.2124	0.0003	0	0.0000	0.0009	0.0290	0.0090	0.0002	0.0001	0.0233	0.0298	0.0003	0.0001	0.0308	0.0001	0.1405	0.0320
czeck	0.0032	0.0012	0.0207	0.0017	0	0.0003	0.0037	0.0017	0.0013	0.0019	0.0006	0.0038	0.0022	0.0145	0.0013	0.1012	0.0106	0.1980
esto	0.0000	0.0000	0.0026	0.0000	0.0000	0	0.0000	0.0000	0.1709	0.0926	0.0009	0.0061	0.0005	0.0000	0.0004	0.0001	0.0000	0.0219
hung	0.0010	0.0064	0.0373	0.0871	0.0038	0.0002	0	0.0000	0.0001	0.0010	0.1799	0.1064	0.0051	0.0204	0.0167	0.0624	0.0056	0.2108
koso	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006
latv	0.0000	0.0000	0.0049	0.0000	0.0000	0.0902	0.0000	0.0000	0	0.0726	0.0000	0.0113	0.0003	0.0000	0.0011	0.0002	0.0002	0.0099
lithu	0.0000	0.0020	0.0063	0.0001	0.0000	0.0955	0.0001	0.0000	0.0595	0	0.0000	0.0065	0.0081	0.0002	0.0016	0.0002	0.0000	0.0151
maced	0.0000	0.0000	0.0020	0.0013	0.0000	0.0000	0.0073	0.0093	0.0000	0.0000	0	0.0033	0.0000	0.0000	0.0032	0.0000	0.0193	0.0025
monte	0.0000	0.0017	0.0003	0.0018	0.0000	0.0000	0.0022	0.0000	0.0007	0.0000	0.0007	0	0.0000	0.0000	0.0113	0.0000	0.0088	0.0014
pola	0.0000	0.0044	0.0033	0.0040	0.0170	0.0045	0.0061	0.0000	0.0050	0.1444	0.0009	0.0056	0	0.0037	0.0018	0.0035	0.0095	0.2792
roma	0.0001	0.0001	0.0091	0.0006	0.0050	0.0022	0.0193	0.0000	0.0001	0.0022	0.0003	0.0003	0.0022	0	0.0057	0.0000	0.0030	0.0841
serbi	0.0000	0.1814	0.0031	0.0145	0.0000	0.0000	0.0047	0.0065	0.0000	0.0024	0.0340	0.1363	0.0002	0.0031	0	-0.0003	0.0887	0.0168
slovak	0.0000	0.0068	0.0006	0.0004	0.0415	0.0006	0.0369	0.0003	0.0013	0.0016	0.0000	0.0006	0.0020	0.0004	-0.0009	0	0.0032	0.0658
sloven	0.0001	0.1136	0.0019	0.0603	0.0015	0.0000	0.0011	0.1552	0.0001	0.0000	0.1120	0.0603	0.0011	0.0005	0.0719	0.0007	0	0.0232
EU15	0.9732	0.4698	0.9067	0.8054	0.9251	0.8042	0.8778	0.7287	0.7603	0.6735	0.6022	0.6181	0.9777	0.9526	0.8404	0.8313	0.6636	0

Note: Bilateral weights are shown in columns and sum up to one. The remittance weights are constructed based on the sum of incoming remittances from each country in the sample in 2010.

4.4.2 GVAR model specification

We use the GVAR Toolbox 2.0 developed by Smith and Galesi (2014) to estimate the model. At the onset of the analysis, following the literature review in previous chapters, the EU15 countries are aggregated into a region in order to be able to treat it as the base 'country' and so capture its impact on the ETEs.

With the exception of the EU15 model, all country models include the same set of variables, when data are available. The following domestic variables enter each country model: GDP, *gdp;* exports, *exp;* foreign direct investment inward flows, *FDI*; foreign credit flows, *fcf*; remittances, *rem*; and the foreign credit flows in foreign currency, *eur*. The global variable price of oil, *poil*, enters as a weakly exogenous variable in all country models. Considering the importance of the EU15 variables for the other countries and the EU15's size compared to the transition countries and its dominance in the region, it is not expected that other transition countries' variables will significantly affect the EU variables, therefore, following the practice adopted in the GVAR literature, the foreign country-specific variables are not included in the EU model. Other country models include all the foreign country-specific variables. GDP, exports, FDI, foreign credit flows, credit flows in foreign currencies and remittances are measured in real terms and transformed to logs. In addition, the cubic spline interpolation was used to convert annual data into quarterly data for several variables and countries for earlier years where data were not available on a quarterly basis. It has to be noted that this technique can only provide estimates of data between known data points; it cannot create new "unknown" data. The variable specifications are presented in Table 4.2 below.

Table 4.2 Variable specification of country VARX*[10] models

Variable	Description	Expected impact	Source	Units of measurement	Frequency	EU model	Non-EU Model	Foreign Variables	EU model	Non-EU Model
gdp	Gross Domestic Product	n/a	EUROSTAT, World Bank	log	**quarterly**	✓	✓	**gdp***	×	✓
exp	Exports	Negative	EUROSTAT, World Bank, central banks	log	**quarterly**	✓	✓	**exp***	×	✓
fdi	Foreign Direct Investment	Negative	OECD, EUROSTAT, European Commission	log	**quarterly**	✓	✓	**fdi***	×	✓
fcf	Foreign Credit Flows	Negative	Bank of International Settlements	log	**quarterly**	✓	✓	**fcf***	×	✓
rem	Remittances	Negative	World Bank	log	**quarterly**	✓	✓	**rem***	×	✓
eur	Euroisation - foreign credit flows in foreign currencies	Negative	OECD, EUROSTAT, European Commission	log	**quarterly**	✓	✓	**eur***	×	✓
poil	Price of oil	n/a	World Bank	log	**quarterly**	✓	✓		✓	✓

[10] * represents the foreign country-specific variables included in the model.

Before proceeding with the next stage of GVAR estimation, different information criteria are checked and, based on their results, the benchmark model with respect to weighting schemes is selected. More specifically, the performance of the GVAR model in terms of stability (related to its eigenvalues) persistence profiles and impulse response functions is compared under different weighting schemes. These three indicators are crucial with regards to overall stability and performance of the GVAR model (Pesaran et al., 2004; Eickemeier and Ng, 2011; Smith and Galesi, 2014). In the case of I(1) cointegrated variables, the eigenvalues should lie on or inside the unit circle, i.e. no eigenvalue should be above 1. The persistence profiles refer to the time profiles of the effects of system or variable-specific shocks on the cointegrating relations in the GVAR model (Pesaran and Shin, 1996, 1998) and they have a value of unity on impact, while they should tend to zero as $n \rightarrow \infty$. It was observed that the GVAR model that uses only trade weights provides the best performance in terms of these indicators (no eigenvalues that lie above the unit circle, persistence profiles converge to zero, while the impulse responses, which will be discussed latter, are statistically and economically more significant, hence, it was selected as the benchmark model. The next section presents the diagnostic tests for the benchmark model.

- **Unit root tests**

The standard Dickey-Fuller unit-root tests and weighted symmetric (WS) ADF tests (Park and Fuller, 1995) are estimated[11]. Leybourne et al. (2005) provide evidence of the superior performance of the weighted symmetric test statistic compared to the standard ADF test or the GLS-ADF test proposed by Elliot et al. (1996). The lag length employed in the ADF and WS unit root tests is selected to be 1 for all countries (see the next section for further details). Results of the ADF and WS statistics are provided for the level, first differences and second differences of all the country and region-specific domestic and foreign, as well as for the global variables. The results at the 5% significance level suggest that for the majority of the variables the null of non-stationarity cannot be rejected (refer to Table 4.3 below for the number of rejections of the null hypothesis of non-stationarity, while for the complete set of results, refer

[11] The current version of the GVAR toolbox used for estimation of the model does not allow control for structural breaks.

to tables A4.6 and A4.7 in appendix A4). The test results show that GDP is mostly I(1) or borderline I(1) - I(2) (e.g. for Bosnia and Herzegovina, Kosovo, Montenegro and the Slovak Republic). Exports are I(1) variables for all countries, except for Poland where they appear to be I(2). FDI is mostly I(1), except for Bulgaria and Croatia, where it appears to be I(2). Remittances appear to be I(0) variables in Estonia, Latvia, Lithuania and the Slovak Republic, while in all other countries they are I(1). Foreign credit flows is I(0) in Albania and I(2) in Bulgaria, Croatia, Latvia, Lithuania and Romania. Euroisation is mostly I(1), except for Albania, where it is I(0) and Bulgaria and Latvia, where it is I(2).

Since GDP, exports, FDI and remittances are usually considered as I(1) variables in the literature, and taking into account that Dickey-Fuller unit-root tests and weighted symmetric ADF tests do not perform well when the number of observations is relatively small, after looking at the data plots, we assume these variables to be I(1) for all the countries, which allows for long-run cointegration among them. It is important to note that GVAR can be estimated in the presence of I(0) variables. However, cointegration exists only between I(1) variables. The estimation of the model continues under the assumptions of the weak exogeneity of the country-specific foreign variables and stability of the parameters, which are both needed for the GVAR estimation and will be tested at a later stage.

Table 4.3 Number of rejection of the null hypothesis of non-stationarity[12]

Variables	Number of countries with I(0) variables	Number of countries with I(2) variables	Number of countries with I(1) variables (from 18)
Gdp	0	4	14
exp	0	1	17
FDI	0	2	16
fcf	1	5	12
rem	4	0	14
eur	1	2	15

- **Selecting lag length and cointegration rank**

In the next stage, the specifications for individual country models are selected. Initially, the order of the individual country VARX models, *pi* and *qi* is determined, corresponding to the lag orders of domestic and foreign variables, respectively. The lag orders are selected according to the Akaike information criterion under the constraints imposed by data limitations, where the maximum lag order of domestic variables was selected to be 2, while the maximum lag order of foreign variables was selected to be 1. However, considering the small number of observations, whilst taking into account the results of the serial correlation diagnostics, eigenvalues of the model and persistence profiles, and following the practice adopted in the GVAR literature, the number of lags is reduced to 1 for both domestic and foreign variables in all countries.

The choice of cointegration rank is a crucial step in the empirical analysis, considering that a misspecification of the long-run relationships can destabilise the GVAR model and distort the results and impulse response functions (Bussière et al., 2009). The VARX* can manage within and between country cointegration, and as a result country-specific foreign variables also need to be considered for the long-run relationships (Pesaran and Smith, 2006), as there are many international long-run relationships, e.g. the relationship between remittances and remittance-sending

[12] Again, we note that the current version of the GVAR toolbox used for estimation of the model does not allow control for structural breaks.

countries' economic performance / GDP. It should be noted that when the sample is small, the asymptotic distributions are generally poor approximations to the true distributions and can result in substantial size and power distortions (Juselius, 2006). However, the definition of a "small" or "big" sample is not straightforward, being based on the number of observations and also on the amount of information in the data. When the data are very informative about a hypothetical long-run relation, we might have good test properties even if the sample period is relatively short (Juselius, 2006). It is also important to note that the cointegration rank is not in general equivalent to the number of theoretical equilibrium relations derived from an economic model. Namely, cointegration between variables is a statistical property of the data that only exceptionally can be given a direct interpretation as an economic equilibrium relation. The reason for this is that a theoretically meaningful relation can be a linear combination of several 'irreducible' cointegration relations (Davidson, 2002). The rank orders of the VARX models are estimated based on Johansen's trace statistic, as set out in Pesaran et al. (2000) for models with weakly exogenous I(1) regressors. The critical values for models including weakly exogenous variables are obtained from Mackinnon et al. (1999). However, considering that the GVAR model with the reported integrating relations (table 4.4) was not stable, i.e. there were a number of eigenvalues lying above the unit circle and the persistent profiles did not converge to zero even after 40 periods, then following Smith and Galesi (2014), the number of cointegrating relations was decreased in the countries where the persistence profiles did not converge to zero after 40 periods, or where they did converge to zero in a manner that clearly indicated a problem in the underlying vector. Table 4.4 below reports the final order of the VARX* models and the number of cointegration relations. The persistence profiles under the final number of cointegrating vectors are presented in Figure A4.8 in appendix A4.

Table 4.4 Chosen lag length and cointegration rank

Country	**p**	**q**	**Number of cointegrating relations based on Johansen trace statistics**	**Final number of cointegrating relations**
ALBANIA	1	1	5	2
BOSNIA	1	1	3	2
BULGARIA	1	1	4	4
CROATIA	1	1	3	3
CZECK REPUBLIC	1	1	4	4
ESTONIA	1	1	3	3
EURO	1	1	0	0
HUNGARY	1	1	2	2
KOSOVO	1	1	2	2
LATVIA	1	1	4	4
LITHUANIA	1	1	3	3
MACEDONIA	1	1	3	3
MONTENEGRO	1	1	4	1
POLAND	1	1	3	3
ROMANIA	1	1	3	3
SERBIA	1	1	2	2
SLOVAK REPUBLIC	1	1	3	3
SLOVENIA	1	1	4	4

- **Testing for weak exogeneity**

The main assumption of the GVAR methodology is the weak exogeneity of foreign variables. After estimating each country model, the weak exogeneity hypothesis of country-specific foreign variables and global variables (oil prices) has to be tested. The weak exogeneity assumption is verified by employing a test developed by Johansen (1992) and Harbo et al. (1998) which checks the joint significance of the estimated error correction terms in auxiliary equations for the country-specific foreign variables. In particular, for each l^{th}element of X_{it}^{*} the following regression is carried out:

$$\Delta x_{it,l} = \mathrm{a}_{i,l} + \sum_{j=1}^{ri} \delta_{ij,l}\, ECM_{ij,t-1} + \sum_{k=1}^{qi} \Phi_{ik,l}\, \Delta x_{i,t-k} + \sum_{m=1}^{qi*} ¥_{im,l} \Delta \tilde{x}_{i,t-m}^{*} + \eta_{it,l} \qquad (4.3)$$

where $ECM_{ij,t-1}$, j = 1, 2,..., r_i, are the estimated error-correction terms corresponding to the r_i cointegrating relations found for the *i*th country model, x^*_{it} is the $k^*_i X$ 1 vector of country-specific foreign variables that have to be weakly exogenous, q_i and q^*_i are the lag orders of the domestic and foreign variables respectively, $a_{i,l}$ is a constant, t is a linear trend, and $\eta_{it,l}$ is the k_iX 1 vector of idiosyncratic, serially uncorrelated, country-specific shocks. For the weak exogeneity assumption to hold, the ECM of the above equation must not be statistically significant. The test for weak exogeneity is a F-test of the joint hypothesis that

$\delta_{ij,l}$ = 0, j= 1,2,..., r_i in the above regression.

A weakly exogenous variable can be defined as a variable whose value does not depend on the contemporaneous values of the endogenous variables, but may depend on lagged values of these variables. Formally, the weak exogeneity of foreign variables means that domestic variables do not affect foreign variables in the long-run, while they are affected by them. This assumption allows proper identification of the co-integration relation as noted in Johansen (1992). The results of the test are reported in Table 4.5 below. These suggest that the weak exogeneity assumption is not rejected for most of the variables. Nevertheless, the weak exogeneity assumption is rejected at the 5% significance level for the following two variables: exports from Macedonia and foreign credit flows to Montenegro. Even though, based on the results of the test, weak exogeneity holds for all variables of the EU15 region, we decided to exclude all the foreign variables in the EU15 model, since EU15 is considered as the dominant 'country' in our model and we would not expect other smaller countries to significantly affect its variables.

Table 4.5 Test for weak exogeneity at the 5% significance level

Country	F test	Fcrit_0.05	gdps	exps	FDIs	fcls	rems	eurs	poil
ALBANIA	F(2,16)	3.63	0.21	0.59	0.29	0.02	3.56	0.12	1.66
BOSNIA	F(2,18)	3.55	0.41	3.51	0.19	0.37	0.00	1.17	0.69
BULGARIA	F(4,14)	3.11	1.24	1.04	1.67	1.20	1.32	0.83	2.58
CROATIA	F(3,30)	2.92	0.64	0.23	0.84	0.13	0.56	0.14	1.15
CZECK REPUBLIC	F(4,14)	3.11	0.76	2.07	0.06	0.31	0.43	0.95	1.45
ESTONIA	F(3,15)	3.29	1.50	0.19	2.04	0.23	0.32	0.21	1.37
HUNGARY	F(2,16)	3.63	0.37	0.01	3.68	0.75	0.08	0.78	0.05
KOSOVO	F(2,33)	3.28	0.38	0.33	0.14	1.23	0.76	2.00	0.49
LATVIA	F(4,14)	3.11	0.35	0.31	0.90	0.16	2.03	0.27	0.34
LITHUANIA	F(3,15)	3.29	0.21	0.45	1.03	0.28	0.75	0.19	1.25
MACEDONIA	F(3,15)	3.29	1.43	**5.99**	0.24	1.48	0.18	0.14	1.16
MONTENEGRO	F(1,21)	4.32	0.01	0.54	3.96	**5.17**	2.39	2.79	0.14
POLAND	F(3,15)	3.29	1.60	0.49	1.30	1.68	0.51	2.58	1.37
ROMANIA	F(3,15)	3.29	2.00	1.84	0.13	0.74	0.77	0.98	0.53
SERBIA	F(2,22)	3.44	2.59	2.53	1.57	1.76	2.14	2.62	0.11
SLOVAK REPUBLIC	F(3,15)	3.29	0.74	0.66	1.20	0.23	0.64	0.61	0.19
SLOVENIA	F(4,14)	3.11	2.66	1.77	0.38	0.70	0.90	0.18	2.33

Note: The numbers in bold indicate rejection of null hypothesis of weak exogeneity at 5% significance level.

- **Testing for structural breaks**

The following tests for structural stability are performed: Ploberger and Krämer's (1992) maximal OLS cumulative sum (CUSUM) statistic, denoted by *PK*sup, and its mean square variant *PK*msq; tests for parameter constancy against non-stationary alternatives proposed by Nyblom (1989), denoted by X. These tests also include several sequential Wald-type tests of a one-time structural change at an unknown change point: the Wald form of Quandt's (1960) likelihood ratio statistic (QLR), the mean Wald statistic (MW) of Hansen (1992) and Andrews and Ploberger (1994) Wald statistic based on the exponential average (APW). The heteroskedasticity-robust versions of the above tests are also presented. Table 4.6 below reports the number of rejections of the null hypothesis of structural stability based on countries and variables at the 90% confidence level. The results vary across the variables and tests. Using PK tests, the null hypothesis of structural stability is rejected in at most 4 out of the total number of 192 cases. Looking at the other four tests (Nyblom, QLR, MW, APW), the results depend on whether the heteroscedasticity-robust versions of these tests were used. The results of the robust versions of these tests are in line with the PK tests. However, the non-robust versions of these four tests show a larger number of rejections of structural stability hypothesis, 41(QLR) and 40(APW) out of the 192 cases. The results of all the tests indicate that the main reason for rejection of the structural stability hypothesis is the breaks in the error variances and not in the parameter coefficients.

In conclusion, the results suggest that there is structural instability, but it seems to be present mainly in the error variances. Therefore, a conservative approach to inference is adopted in GVAR by using bootstrap medians and confidence intervals when interpreting the impulse responses.

Table 4.6 Number of rejection of structural stability hypothesis per variables and different test statistics

Number of rejections (%) at 90% significance level

Test statistics	***gdp***	***exp***	***fdi***	***fcf***	***rem***	***eur***	***total***
PK sup	2(0.06)	0(0.00)	3(0.10)	1(0.03)	1(0.03)	0(0.00)	7(0.04)
PK msq	1(0.03)	0(0.00)	3(0.10)	1(0.03)	1(0.03)	0(0.00)	6(0.03)
Nyblom	2(0.06)	0(0.00)	4(0.13)	1(0.03)	3(0.10)	1(0.03)	11(0.06)
Robust Nyblom	1(0.03)	0(0.00)	4(0.13)	2(0.07)	2(0.07)	1(0.03)	10(0.05)
QLR	8(0.31)	4(0.13)	9(0.29)	7(0.07)	7(0.24)	6(0.21)	41(0.21)
Robust QLR	1(0.03)	0(0.00)	1(0.03)	0(0.00)	0(0.00)	0(0.00)	2(0.01)
MW	5(0.16)	5(0.16)	7(0.22)	6(0.21)	5(0.17)	4(0.13)	29(0.15)
Robust MW	0(0.00)	0(0.00)	0(0.00)	1(0.03)	0(0.00)	0(0.00)	1(0.01)
APW	8(0.31)	4(0.13)	8(0.26)	7(0.04)	7(0.24)	6(0.21)	40(0.21)
Robust APW	1(0.03)	0(0.00)	0(0.00)	1(0.03)	0(0.00)	0(0.00)	2(0.01)

- **Contemporaneous effects of foreign variables on their domestic counterparts**

The contemporaneous effects of foreign variables on their domestic counterparts can be interpreted as impact elasticities between the domestic and foreign variables and they reveal the international linkages between the domestic and foreign variables (Dées et al., 2007). They are estimated together with t-ratios computed based on standard, as well as White and Newey-West adjusted variance matrices. High elasticities between domestic and foreign variables imply strong co-movements between these variables (Smith and Galesi, 2014). Table A4.9 in appendix A4 reports these coefficients as well as their Newey-West t-ratios.

We observe a significant elasticity between the foreign and the domestic exports, indicating that trade linkages are likely to be strong among countries in our model. For example, for Kosovo, the results suggest that a 1% increase in foreign exports in a given quarter leads to a 0.75% increase in domestic exports in the same quarter. We also observe a significant elasticity between domestic and foreign variables of GDP, indicating close co-movements of this variable in the countries included in the model. In contrast, we find fewer statistically significant elasticities for FDI, suggesting that in the short run the domestic FDI in most countries is not affected significantly by changes in foreign FDI.

- **Pair-wise cross-country correlations: variables and residuals**

  One of the basic assumptions of the GVAR modelling approach is that the country-specific shocks are cross-sectionally 'weakly correlated' so that the weak exogeneity of the foreign variables is ensured (Dées et al., 2007; Smith and Galesi, 2014).[13] We follow Dées et al. (2007) in checking this assumption by calculating pairwise cross-section correlations for the levels and first differences of the endogenous variables of the model, as well as those of the associated residuals over the selected estimation period. These are computed as follows: for every country for each given variable, the pairwise correlation of that country with each of the remaining countries is computed, and averaged across countries. In Table A4.10 in appendix A4 we report the average cross section correlations. The results differ across variables and countries. However, they are generally higher for the level and fall in the first differences. Trade levels show the highest degree of cross section correlations of around 43%-90%. The FDI levels also show a high degree of cross section correlation with an average across countries of 71%, which is followed by the levels of remittances, with an average of 45%, and EU integration variable, with an average cross section correlation of 30%. In contrast, very small correlation coefficients are

[13] Ideally, we would specify our model with period dummies to attenuate cross-country error correlation. Unfortunately, the current version of the GVAR toolbox does not allow for this.

found for the residuals from the VECM models, which is an indication that the model has been successful in capturing the unobserved global common effects.[14]

4.4.3 Dynamic analysis using generalized impulse response functions and generalized forecast error variance decomposition

This section investigates the dynamic properties of the GVAR model based on generalized impulse response functions (GIRFs) and generalized forecast error variance decomposition. Impulse responses, proposed by Koop et al. (1996) for non-linear models and developed further in Pesaran and Shin (1998) and Pesaran and Smith (1998) for vector error correcting models, refer to the time profile of the effects of variable-specific shocks or identified shocks on the future states of a dynamic system and thus on all the variables in the model (Smith and Galesi, 2014). Identification of shocks in a GVAR is difficult, as in standard VARs, but is further complicated due to the cross-country interactions and the high dimensionality of the model (Chudik and Pesaran, 2016). Hence, in the absence of strong a priori beliefs on the ordering of the variables and countries in the GVAR model, although the GIRFs cannot identify the origins of shocks they do provide useful information about the dynamics of the transmission of shocks. In this study, the EU region is considered as the possible source of shocks. The GIRFs are provided for a period of 40 quarters. However, only the impulse responses of the first 8-10 quarters are considered for interpretation. Due to the relatively large number of countries included in the model, in order to simplify discussion of the impulse responses and focus the interpretation on the common patterns of responses based on specific regions, the ETEs are aggregated into these sub-regions:[15] Baltic countries, which include Estonia, Latvia and Lithuania; Balkan countries, which include Albania, Bosnia and Herzegovina, Macedonia, Montenegro, Kosovo and Serbia; the rest of the ETEs, which include the Czech Republic, Bulgaria, Hungary, Poland, Romania, the Slovak Republic, Slovenia and Croatia; and the previously aggregated EU countries.

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[14] By conditioning the country-specific models on weakly exogenous foreign variables, viewed as proxies for the "common" global factors, it is reasonable to expect that the degree of correlation of the remaining shocks across countries/regions will be modest.

[15] This procedure yields similar results to individual country estimation. However, it is easier to interpret our findings in groups compared to individual countries.

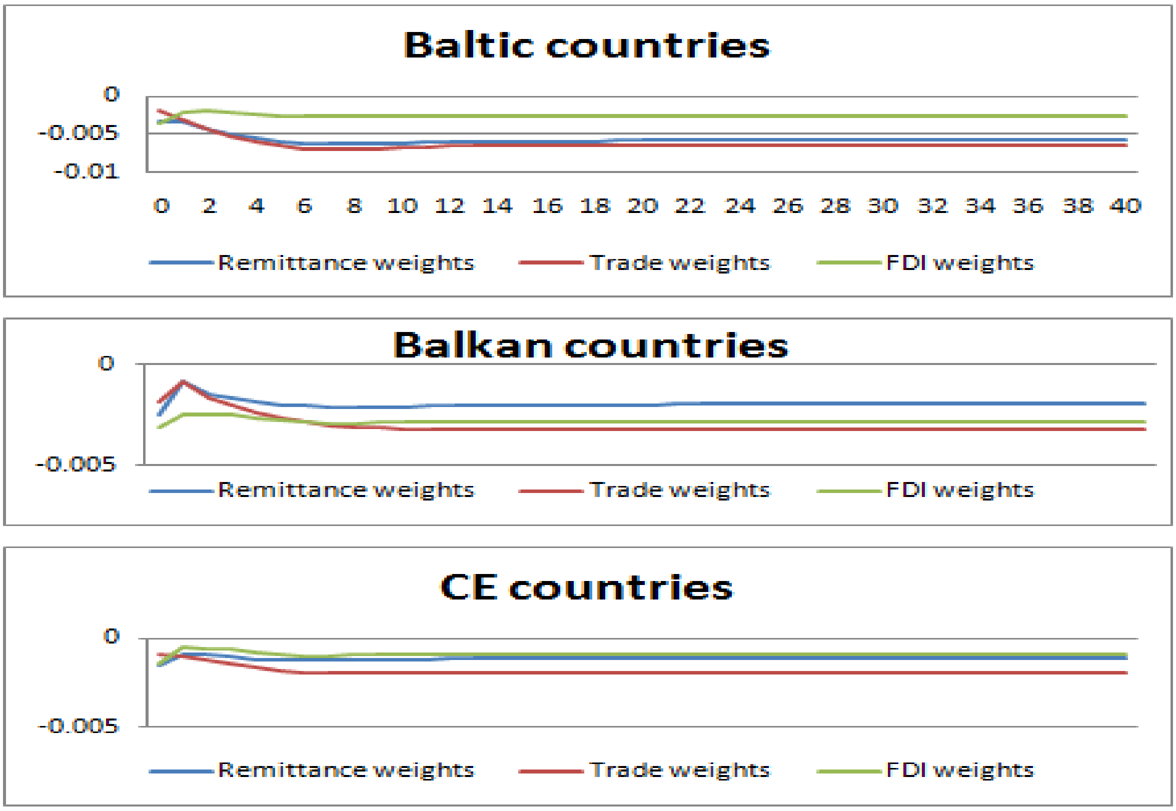
The generalized forecast error-variance decomposition (GFEVD) is also employed to investigate the international linkages between EU and ETEs. GFEVD provides useful information about the international transmission channels through which shocks are propagated (Galesi and Sgherri, 2009). GFEVD allocates the forecast error variance of the shock to its respective variables and regions, where the relative contributions measure the importance of the innovation to a given region's variable to the rest of the regions' variables (Di Mauro and Pesaran, 2013). In the results presented in figures 4.1 and 4.2, the impulse responses stabilise relatively quickly, suggesting that the estimated GVAR model is stable. This is confirmed by the eigenvalues of the GVAR model, which are all within the unit circle and by the persistence profiles, which converge to zero relatively quickly. However, the bootstrap simulation provides rapidly widening confidence bands around the impulse responses, which is most likely a result of the short time series included in the model.

Impulse response functions of one standard error shock to GDP in EU

This subsection reports the effects of a one standard error negative shock in the EU15 GDP, (which corresponds to a 0.3% decline) on five variables of interest: GDP; exports; FDI; foreign credit flows and remittances.

Figure 4.1 reports the regional impulse response functions (in order to simplify the comparison, only point estimates are presented without the standard error bands) of GDP to a shock in EU's GDP using trade weights, FDI weights and remittance weights. These show the effect in each quarter, not the cumulative effect. The graphs indicate that the effect of the shock to GDP is stronger in all regions when using trade weights to construct the foreign country-specific variables, indicating that trade represents the strongest linkage between ETEs and European advanced countries. In addition, as discussed in sub-section 4.2.2, it is observed that the GVAR model using only trade weights provides the best performance in terms of persistence profiles and eigenvalues, hence we selected it as the benchmark model.

Figure 4.1 Regional impulse response functions (point estimates) of GDP to a one standard error shock to GDP in EU15 - remittance weights vs. trade weights vs. FDI weights



Note: Figures are impulse responses (point estimates) to a one standard error fall in the EU's GDP. The impact is in percentages and the horizon is quarterly.

Next, the impulse response functions of the variables of interest are discussed, keeping in mind that trade weights were used to construct the foreign country-specific variables. Figure 4.2 presents the regional impulse response functions of GDP, exports, FDI, foreign credit flows and remittances to a one standard error shock to aggregate EU GDP. The lower and upper bands represent the 90% confidence intervals and the middle band represents the actual impact of the shock in the respective variable. The impact is considered to be statistically significant when all three bands are below or above the X axis (zero line). Although the 90% confidence intervals figures suggest statistical insignificance or borderline significance of the impulse response functions in some cases, there is an economic interest in analysing whether the dynamic behaviour of the variables used in the model are moving in a synchronised way across countries. The Baltic countries display the most severe and statistically significant impact from the shock in EU15 on their GDP, possibly due to their stronger trade links with the EU15 countries.[16] They experience a decline of 0.3% on impact, which then rises by the seventh quarter to 0.7% and dissipates in the following periods. The Balkan transition countries also display a severe impact from the shock to the EU15's GDP, with a decline of their GDP by 0.3% on impact, which increases to 0.5% and stabilises by the eighth quarter. In the other CE countries, the GDP falls by 0.15% on impact and stabilises in the eighth quarter at about 0.3% (see Figure 4.2).

As expected, exports are also negatively affected by a GDP shock in EU15. From the regional perspective, exports from the Balkan countries appear to be most severely affected by the shock in the EU15, even though the impact is at the borderline of the 10% level of statistical significance. The CE transition countries also display a severe and statistically significant impact from a shock to EU15 GDP on their exports which stabilises at a 0.6% decline by the eighth quarter. Contrary to the strong and synchronized regional GDP and exports responses to the EU15 GDP shock, the generalized impulse responses of FDI to the GDP shock are statistically insignificant or close to borderline significance at the 10% level, indicating that economic shocks in the EU15 may not have a severe impact on FDI flows. The Balkan transition countries display the most severe and statistically significant impact from the shock in the EU15's GDP with a decline of their FDI by 0.5% on impact, which then rises by the fifth quarter to 1% and stabilises in the following periods.

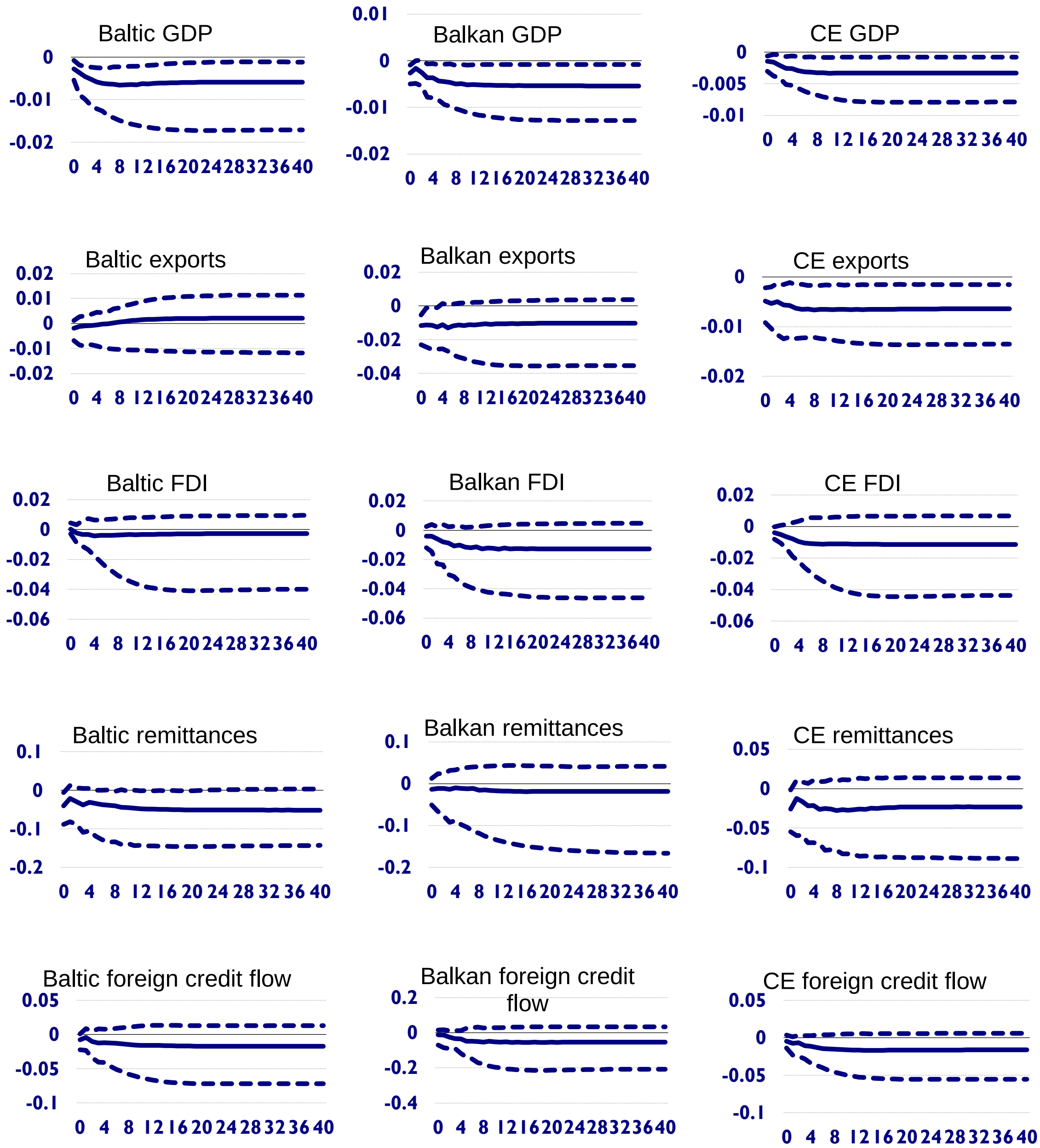
On average, all regions experience a fall in foreign credit flows of 1%-5% following a negative shock to GDP in EU15. The impulse response functions stabilise after about 8 quarters. The effect is strongest in the Balkan countries; however, it appears to be statistically insignificant, though close to the 10% borderline of statistical significance across all regions.

All regions experience a fall in remittances of 1%-5% following a negative shock to GDP in EU15. The impulse response functions stabilise after about 8 quarters. However, the affect appears to be statistically insignificant across all regions except

[16] The average share of exports of the Baltic countries to the EU15 during the period 2005-2007 was 65% of their total exports.

for the Baltic countries, where it appears to be at the 10% borderline of statistical significance.

Figure 4.2 Regional impulse response functions of GDP, exports, FDI, foreign credit flows and remittances to a one standard error shock to GDP in EU with their 90% confidence bands



Note: Figures are median generalized impulse responses to a one standard error fall in the EU's GDP, together with the 10 percent confidence bands. The impact is in percentages and the horizon is quarterly.

Generalized forecast error variance decomposition

- **Shock to GDP in the Balkan Countries**

Following a historical shock to GDP in the Balkan countries, we analyse which of the variables and regions explain most of the forecast error variance decomposition in the short run. More specifically, the forecast error variance of the simulated shock is allocated into respective variables and regions and the importance of innovations in all the variables is checked. Results are presented in Table A4.11 in appendix A4. We observe that among Balkan countries' variables, in the short run, on impact the GDP explains most of the forecast error variance decomposition, it contributes 12% of the variance of the historical shock. On the other hand, exports contribute to the variance in the GDP shock with 10%, remittances with 3%, foreign credit flows with 4%, FDI with 3% and foreign currency credit flows with 2%. The average relative importance of all the variables that explain the shock increases over time. In addition, we also look at the contribution of each region to the explanation of the forecast error variance, since this illustrates how important are the international linkages in the international transmission of shocks. As expected, the foreign regions that contribute mostly to the variance in the shock to the GDP in the Balkan countries are: the EU which, on impact, contributes to the shock with 38%; other ETEs contribute to the shock with 19%; while the Baltic countries contribute 8% to the shock. The average relative importance of all the variables of other regions that explain the shock decreases over time.

- **Shock to GDP in the Baltic countries**

Following a historical shock to GDP in the Baltic countries, we now assess which of the following Baltic countries' variables explain most of the forecast error variance decomposition in the short run. The results are presented in Table A4.12 in appendix A4. Similar to the EU and the Balkan region, GDP explains most of the variance of the shock in the GDP (7%); foreign credit flows explain 5% of the variance of the shock; credit flows in foreign currency explains 5% of the variation; FDI explains 1%; remittances 0.3% and exports 0.1%. The average relative importance of the variables in the Baltic region that explain the shock decreases over time. In addition, we also look at the contribution of each region to the explanation of the forecast error variance. As expected, the foreign regions that contribute most to the variance in the shock to GDP in the Baltic countries are: the EU, which, on impact, contributes to the shock with 57%; other ETEs contribute 10%; while the Balkan countries contribute 14%.

- **Shock to GDP in CE transition countries**

  After a historical shock to GDP in CE transition countries, we observe that, among other EU variables, in the short run, remittances explain most of the forecast error variance decomposition. It contributes 10% to the variance of the historical shock, while foreign credit flows contribute to the shock with 3%, credit flows in foreign currency 3%, FDI 2% and exports 1%. As expected, the foreign regions that contribute mostly to the variance in the shock to GDP in CE countries are: the EU, which, on impact, contributes to the shock with 50%; the Balkan countries contribute 19%; while the Baltic countries contribute to the shock with 9%. The complete set of results is presented in Table A4.13 in appendix A4.

4.4.4 Robustness analysis

In this section we modify the baseline model in two ways. Firstly, given the relatively small number of observations and large number of variables included in the baseline model, which reduces the degrees of freedom available to estimate the parameters' variability, we investigate whether the statistical significance of the impulse responses of the main variables changes when reducing the number of variables in the model. Namely, we estimate the GVAR model with these core variables representing the main transmission channels: exports, FDI, foreign credit flows and GDP. Secondly, we analyse the transmission of shocks from advanced EU countries to ETEs in sub-samples, which are defined by various country features. Consequently, we address one of the main aims of the thesis, i.e. to analyse whether country structural characteristics influence the transmission of the GFC. In addition, splitting the sample in various ways also enables us to deal with country heterogeneity in a more careful manner, since sub-samples analysed here consist of more homogenous groups than the entire sample of 15 transition countries.

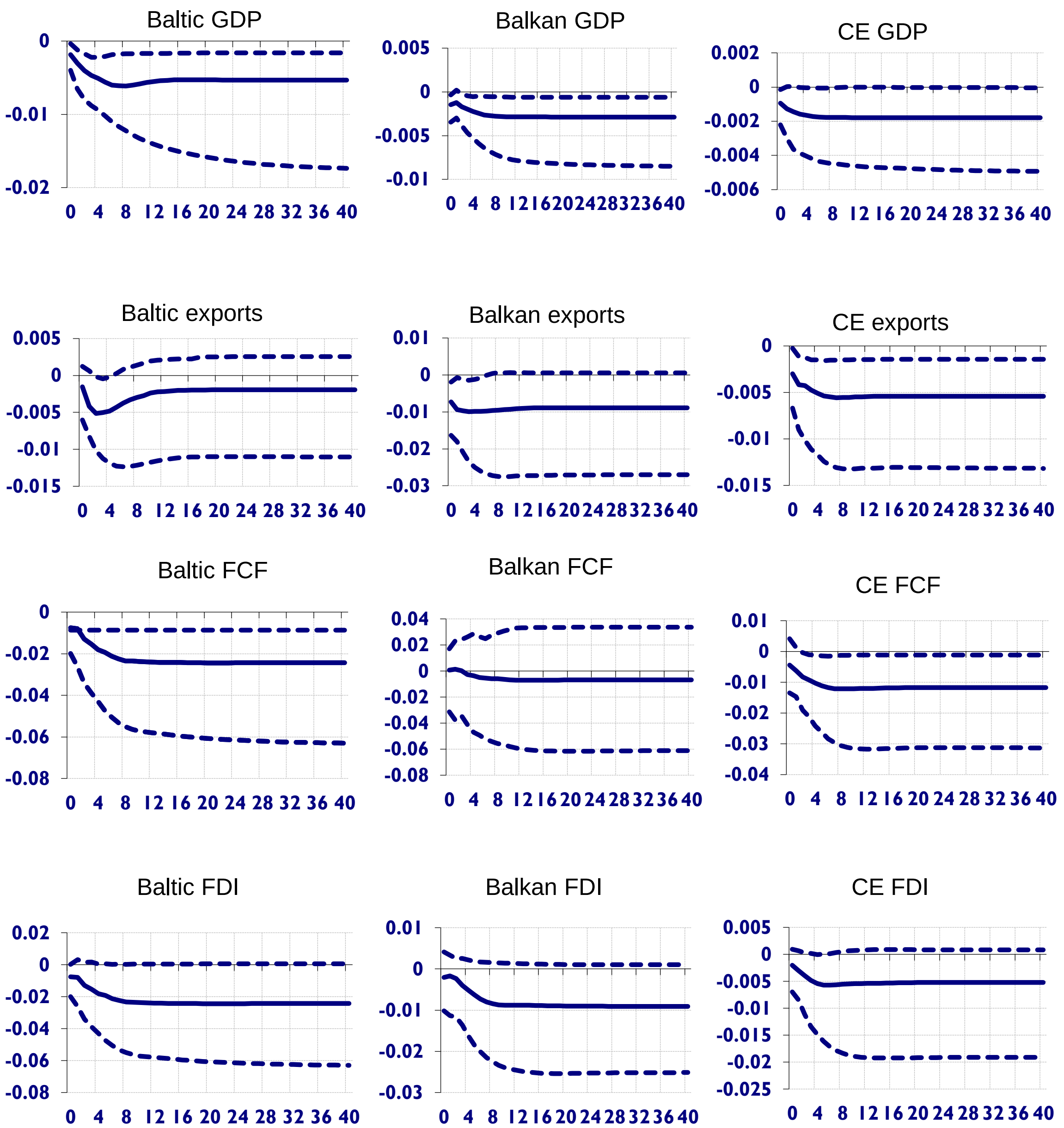
In the results presented in the figures, we can see that the impulse responses stabilise relatively quickly, suggesting that the estimated GVAR model is stable. This is confirmed by the eigenvalues of the GVAR model, which are all within the unit circle and by the persistence profiles, which converge to zero relatively quickly. We observe that the impulse response results are similar in terms of shape, signs and magnitudes, suggesting that the estimated impulse responses do not differ significantly; however, the confidence bands are generally below zero, which indicates more statistical significance. Persistence profiles and other diagnostic tests are presented in appendix A4.

Impulse response functions of a one standard error shock to GDP in the EU

This subsection reports the effects of a one standard error negative shock to the GDP of the EU region (around a 0.3% GDP decline) on four variables of interest: GDP; exports; FDI; and foreign credit flows. Although the 90% confidence intervals suggest only borderline statistical significance of the impulse response functions in some cases, there is nonetheless economic interest in analysing whether the dynamic behaviour of the variables used in our model are moving in a synchronised way across countries. Figure 4.3 presents the regional impulse response functions together with their 10% confidence bands. As can be seen in this Figure, the negative shock to the GDP in the EU15 region results in decreases in the GDP of all regions in the model. The impulse responses in general follow the same pattern: in the first quarters there is an immediate decline in GDP, but the impact stabilizes after 6-10 quarters. The Baltic countries display the most severe and statistically significant impact from the shock in their GDP with a decline of 0.01% on impact, which then rises by the seventh quarter to 0.6% and dissipates in the following periods. Across other regions, the GDP falls by similar amounts (around 0.2%-0.3%). The Balkan transition countries also display a severe impact from the shock to the EU's GDP, with a decline of their GDP by 0.15% on impact increasing to 0.3% by the eighth quarter and then stabilising. In CE countries, the GDP falls by 0.1% on impact and stabilises in the sixth quarter at a decline of about 0.2% compared to the pre-shock level. As expected, exports are also negatively affected by the GDP shock in EU, varying between 0.5% and 1%. The exports impulse response pattern is similar across all regions, showing an initial decline of 0.5% during the first two quarters following the shock, and then oscillating and dissipating in about 5-8 quarters. From the regional perspective, the exports from Balkan countries appear to be the most severely affected by a shock to EU GDP, even though the impact is at the borderline of the 10%

statistical significance level. The CE transition countries also display a severe and statistically significant impact from a shock to EU GDP on their exports, which stabilises at a 0.59% decline by the eighth quarter. Similar behaviour is observed also across the Baltic countries, even though the effect is statistically significant only in the third quarter. The effect of the shock to EU GDP on foreign credit flows is the strongest in the Baltic countries; the foreign credit flows decline by 2% by the eighth quarter. The generalized impulse responses of foreign credit flows are weaker and clearly statistically insignificant for Balkan countries. CE transition countries also show a negative decline in foreign credit flows following a shock to the EU GDP. The generalized impulse responses of FDI to the GDP shock are both small and borderline at the 10% significance level. The Baltic countries display the most severe and statistically significant impact from the shock in the EU GDP with a decline of 1% on impact, which then rises by the eighth quarter to 2.2% and dissipates in the following periods.

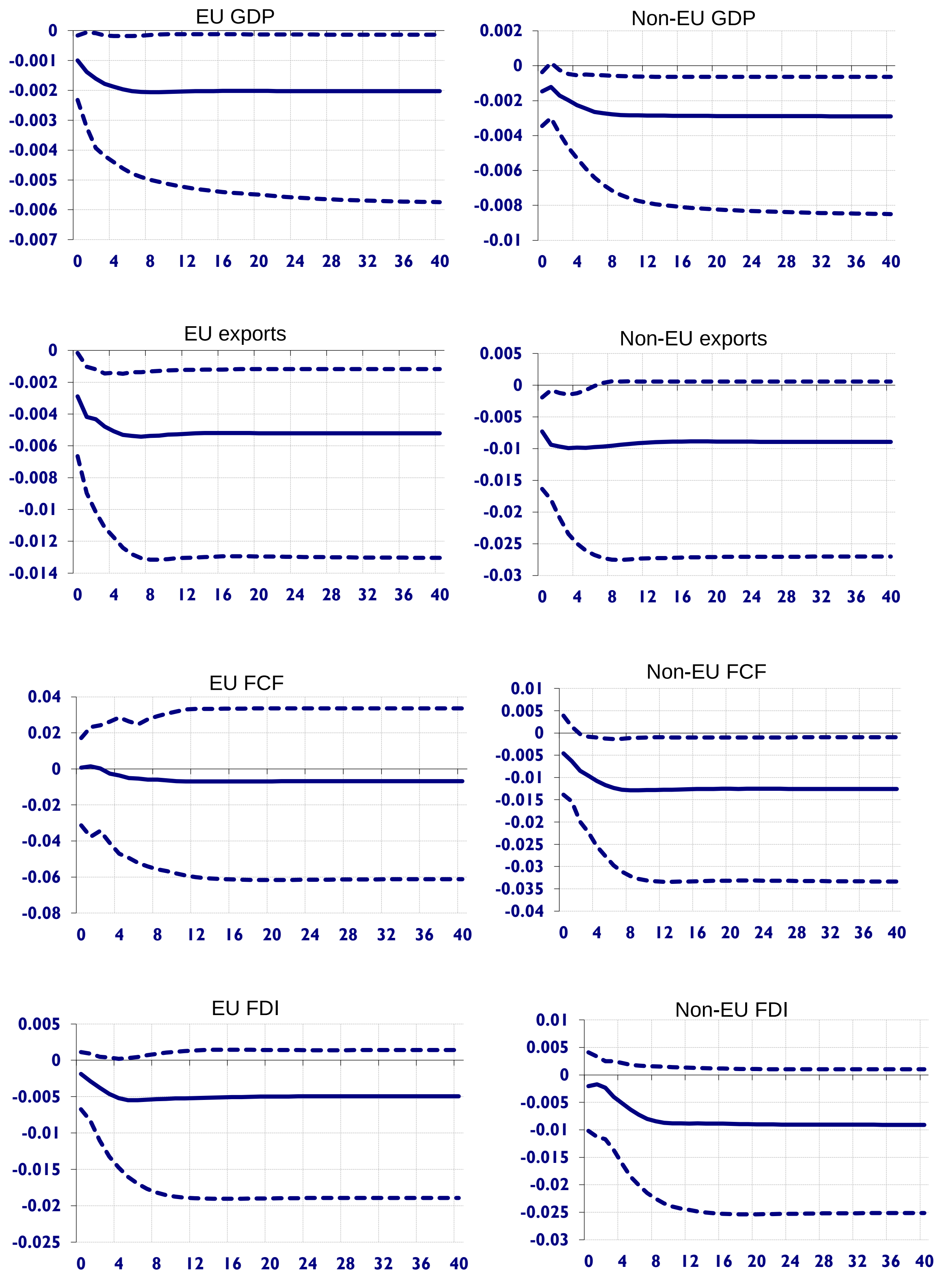
Figure 4.3 Regional impulse response functions of GDP, exports, foreign credit flows and FDI to a one standard error shock to GDP in the EU15, with 90% confidence bands (trade weights)



Note: Figures are median generalized impulse responses to a one standard error fall in EU's GDP, together with the 10 percent confidence bands. The impact is in percentages and the horizon is quarterly.

Figure 4.4 shows the generalized impulse response of GDP, exports, FDI and foreign credit flows in EU transition countries versus non-EU transition countries to the negative one standard error shock to the EU's GDP. As expected, almost all variables in both sub-samples are negatively affected by the GDP shock in the EU, varying between 0.2% and 1%. However, the impact of the shock is larger in all the variables of the non-EU transition countries. The GDPs impulse response pattern is similar in both sub-samples, showing an initial decline of 0.2% during the first four quarters following the shock and stabilising by the fourth quarter at 0.2% decline in the EU transition countries and 0.3% decline in the non-EU transition countries. The impulse response function of exports in non-EU transition countries show a decline which stabilises at 1% by the second quarter, while in the EU transition countries the impulse response stabilises at a 0.55% decline by the eighth quarter. Nevertheless, it should be pointed out that the impact has a higher statistical significance in non-EU transition countries, while it is at the borderline of the 10% significance level in EU transition countries. Similarly, the effects of the shock to EU GDP on foreign credit flows and FDI are the strongest in the non-EU transition countries; the foreign credit flows decline by 1.2% by the eighth quarter and FDI declines by 0.9% by the eighth quarter. For EU transition countries, the generalized impulse responses of foreign credit flows and FDI are weaker and statistically insignificant, or at the borderline of the 10% statistical significance in the case of FDI.

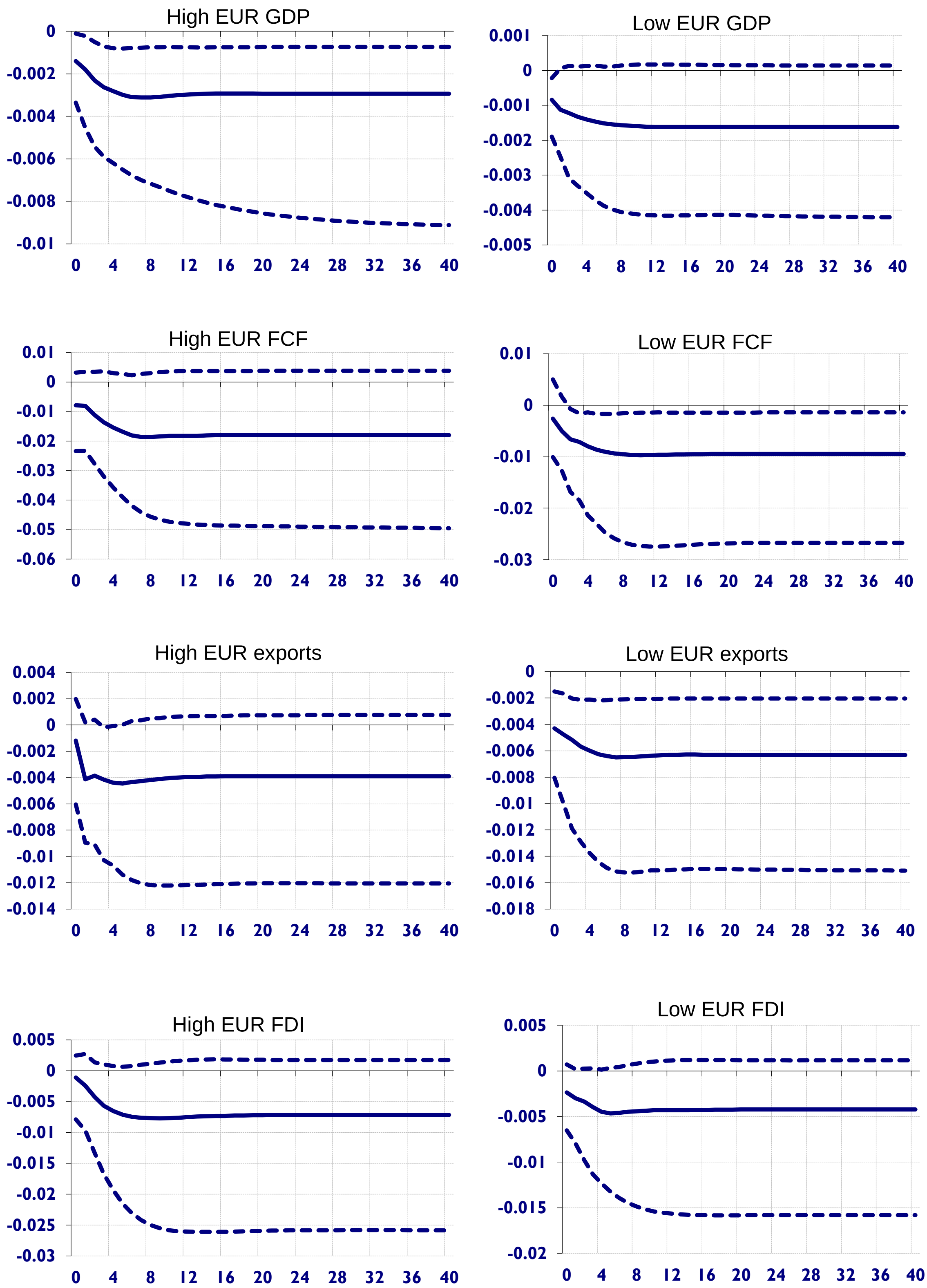
Figure 4.4 Impulse response functions to a one standard error shock to GDP in EU15 with their 90% confidence bands (EU transition countries vs. NON-EU transition countries)



Note: Figures are median generalized impulse responses to a one standard error fall in EU's GDP, together with the 10 percent confidence bands. The impact is in percentages and the horizon is quarterly.

Figure 4.5 shows the generalized impulse response of GDP, exports, FDI and foreign credit flows in countries with a high degree of euroisation versus countries with a low degree of euroisation to a negative one standard error shock to the EU's GDP. All variables are negatively affected by the EU GDP shock in both sub-samples, varying between 0.1% and 2%. The impact of the shock is larger and statistically more significant in highly euroised countries' GDPs. The impulse response functions of GDP show a decline which stabilises by the fifth quarter at -0.3% for highly euroised countries and -0.1% for countries with a lower degree of euroisation. Other variables impulse response patterns are similar between both sub-samples, showing an initial decline of 0.2%-2% during the first four quarters following the shock and stabilising by the eighth quarter.

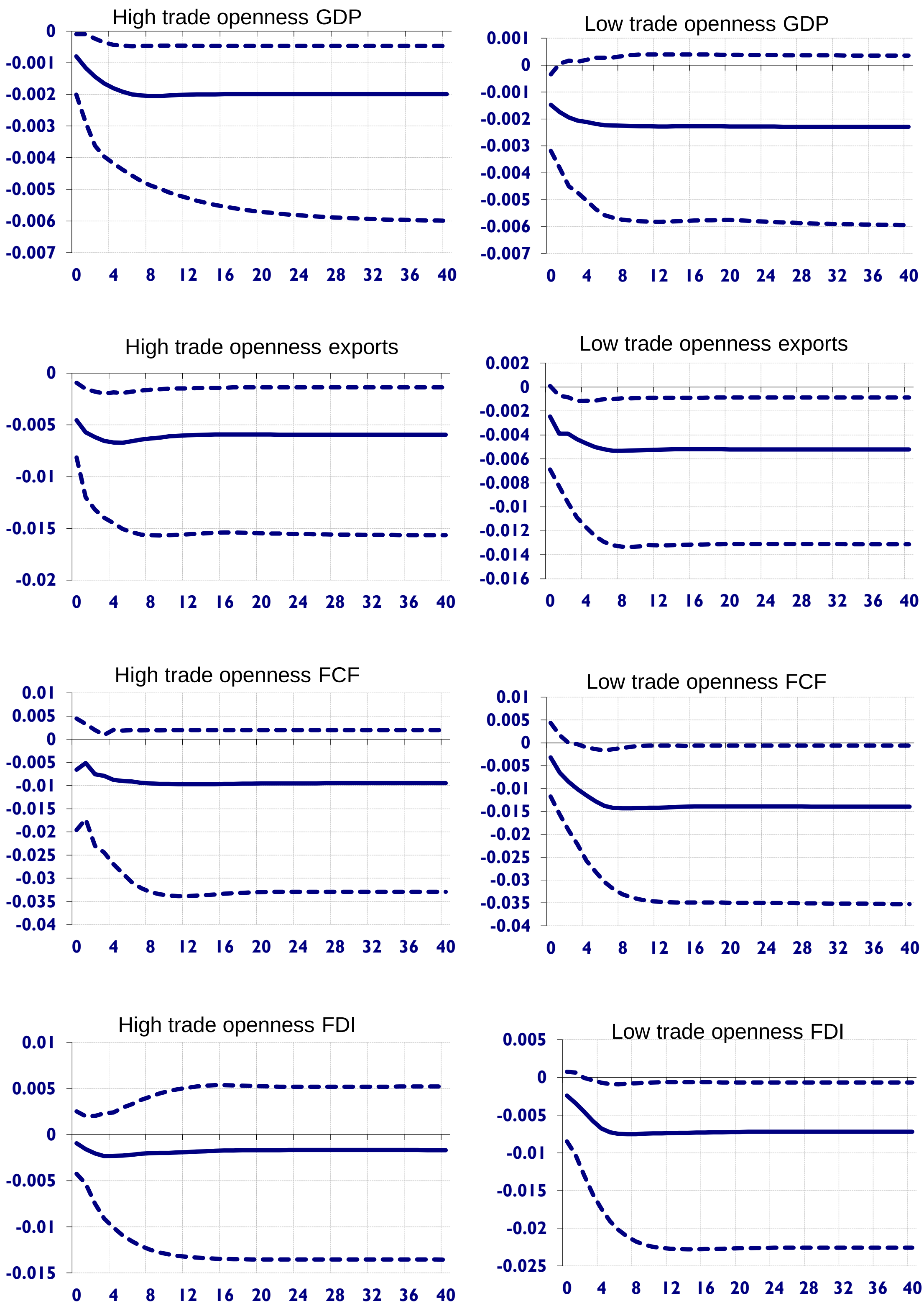
Figure 4.5 Regional impulse response functions to one standard error shock to GDP in EU15 with their 90% confidence bands (Highly euroised countries vs. lowly euroised countries)



Note: Figures are median generalized impulse responses to a one standard error fall in EU's GDP, together with the 10 percent confidence bands. The impact is in percentages and the horizon is quarterly.

Figure 4.6 shows the generalized impulse response of GDP, exports, FDI and foreign credit flows in more open transition countries versus less open transition countries to a negative one standard error shock to the EU's GDP. As expected, almost all variables are negatively affected by the EU GDP shock in both sub-samples, varying between 0.2% and 1%. The impact of the shock is larger on the GDP and the exports of the more open economies compared to the less open economies and it is slightly smaller for foreign credit flows and FDI in more open economies. The GDP impulse response functions show a decline which stabilises at 0.2% by the eighth quarter in both sub-samples; however, the effect is statistically more significant in more open economies. The impulse response function of exports in more open economies shows an initial decline of 0.7%, which stabilises at 0.6% by the eighth quarter, while in the less open transition countries the impulse response stabilises at a 0.5% decline by the eighth quarter. The effect of the shock to EU GDP on foreign credit flows and FDI is stronger and more statistically significant in less open transition countries.

Figure 4.6 Regional impulse response functions to one standard error shock to GDP in EU15 with their 90% confidence bands (highly open countries vs. lowly open countries)



Note: Figures are median generalized impulse responses to a one standard error fall in EU's GDP, together with the 10 percent confidence bands. The impact is in percentages and the horizon is quarterly.

4.4.5 The effects of increased financial stress in the EU15

In this section the baseline model is modified in two ways. Firstly, given the relatively small number of observations included in the baseline model, the dataset is extended by using observations from the first quarter of 1999 to the fourth quarter of 2014 to estimate the 16 country/region-specific VARX* models. However, due to data availability, two countries were dropped from estimation (Kosovo and Montenegro). Secondly, given this study's objective to analyse the macroeconomic effects of increased global financial market volatility, we include an indicator to measure the systemic stress in advanced economies in our framework. This indicator for advanced economies is the composite indicator of systemic stress (CISS), constructed by Holló et al. (2012), which measures the contemporaneous state of instability in the financial system. The CISS can be interpreted as a measure of the systemic risk that has materialised already (Holló et al., 2012). The CISS is composed of 15 mostly market-based financial stress measures[17] equally split into five categories, namely the financial intermediaries' sector, money markets, equity markets, bond markets and foreign exchange markets, which represent the most important segments of an economy's financial system. In the results presented in the figures, we can see that the impulse responses stabilise relatively quickly, suggesting that the estimated GVAR model is stable. This is confirmed by the eigenvalues of the GVAR model, which are all within the unit circle and by the persistence profiles, which converge to zero relatively quickly. Persistence profiles and other diagnostic tests are presented in appendix A4. However, here as well it should be pointed out that the bootstrap simulation provides rapidly widening confidence bands around the impulse

[17] Realised volatility of the 3-month Euribor rate; interest rate spread between 3-month Euribor and 3-month French T-bills; Monetary Financial Institution's (MFI) emergency lending at Eurosystem central banks; realised volatility of the German 10-year benchmark government bond index; yield spread between A-rated non-financial corporations and government bonds; 10-year interest rate swap spread; realised volatility of the DataStream non-financial sector stock market index: CMAX for the DataStream non-financial sector stock market index; stock-bond correlation; realised volatility of the idiosyncratic equity return of the DataStream bank sector stock market index over the total market index; yield spread between A-rated financial and non-financial corporations (7-year maturity); CMAX as defined above interacted with the inverse price-book ratio (book-price ratio) for the financial sector equity market index; and realised volatility of the euro exchange rate vis-à-vis the US dollar, the Japanese Yen and the British Pound, respectively.

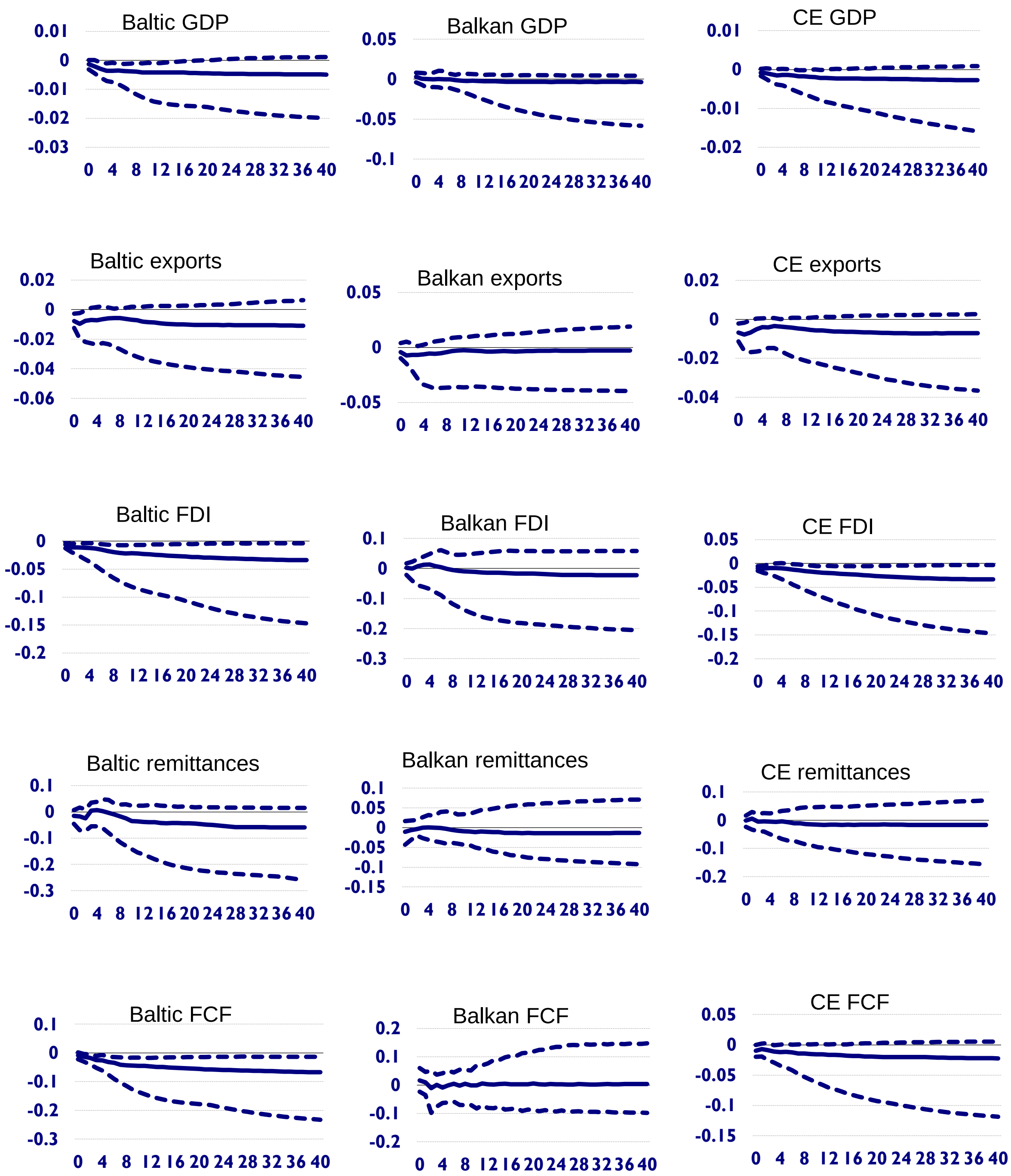
responses, which is again most likely a result of the short time series available for estimation.

Impulse response functions of a one standard error shock to CISS in EU

This subsection reports the effects of a one standard error positive shock to the EU15 CISS on five variables of interest: GDP, exports, FDI, foreign credit flows and remittances. The generalized impulse responses of GDP to the shock in the EU's CISS are presented in Figure 4.7 below. As can be seen in this Figure, the positive shock to the CISS in EU15 region results in decreases in the GDP of all regions in our model. The Baltic countries display the most severe and statistically significant impact from the shock in their GDP with a decline of 0.1% on impact, which then rises by the eighth quarter to 0.5% and stabilises in the following periods. The Central and Eastern ETEs also display a severe impact from the shock to the EU's CISS, with a decline of their GDP by 0.1% on impact, which increases to 0.2% by the eighth quarter. The effect is not statistically significant in the Balkan countries. As expected, exports are also negatively affected by the EU15 CISS shock, varying between 0.5% and 1%. The exports impulse response pattern is similar across all regions, showing an initial decline of 0.5% during the first two quarters following the shock, and then oscillating and dissipating in about 5-8 quarters. From the regional perspective, the exports from Baltic countries appear to be the most severely affected by a shock to the EU15's CISS, even though the impact is at the borderline of the 10% statistical significance level. The CE transition countries also display a severe and statistically significant impact from a shock to the EU15's CISS on their exports.

The effect is less significant statistically in the Balkan region. When it comes to FDI, the Baltic countries display the most severe and statistically significant impact from the shock in the EU15's CISS with a decline of 1% on impact, which then rises by the eighth quarter to 3%. Similar behaviour of the impulse response is observed across CE transition countries. The generalized impulse responses of FDI are weaker and clearly statistically insignificant for Balkan countries. The generalized impulse responses of remittances are clearly statistically insignificant for all regions. The generalized impulse responses of foreign credit flows are the strongest in the Baltic countries; the foreign credit flows decline by 5% by the eighth quarter, while they are weaker and clearly statistically insignificant for Balkan countries. Other CE transition countries also show a negative decline in foreign credit flows following a shock in the CISS of the EU15.

Figure 4.7 Regional impulse response functions of GDP, exports, FDI, foreign credit flows and remittances to a one standard error shock to the EU15 CISS with their 90% confidence bands



Note: Figures are median generalized impulse responses to a one standard error fall in EU15 CISS together with the 10 percent confidence bands. The impact is in percentages and the horizon is quarterly.

4.5 Conclusion

Although there are a number of empirical studies that have investigated the international transmission of crisis, the literature is still unable to provide conclusive results on the determinants of crisis severity across transition countries. This study contributes to knowledge in this area by providing analyses of the international transmission of the global financial crises in a global context, employing the global vector auto-regression (GVAR) approach.

The study begins with a discussion of the modelling framework, its structure and applications. The discussion also relates the choice of the methodology to the objective of the thesis. The methodology proceeds through four stages. Firstly, the weights for constructing the country-specific foreign variables are computed. Considering the importance of both trade and financial linkages between ETEs and European advanced countries (EU15), trade, FDI and remittance weights are computed and considered for the model. Second, for each country the VAR model is extended with the addition of a set of country-specific foreign variables. These foreign variables are computed as weighted averages of the respective domestic variables, using the weights constructed during the first stage. In the third stage, each variable in the model is tested for stationarity. Next, the VECM is specified for each country. Particular attention has been paid to diagnostic tests and stability to ensure the model is statistically well specified and thus produces valid estimates. In the final stage, the global GVAR is solved and results from the estimated model are interpreted by means of impulse responses and forecast error variance decomposition.

By using GVAR, we extend the limited and quite recent body of literature that uses this modelling framework in several key aspects. First, this is the first study that uses the GVAR to model the transmission of shocks to ETEs. Second, weights based on bilateral remittance flows, to our knowledge, represent an original contribution to the GVAR modelling framework. Thirdly, unlike several other GVAR studies on the transmission of crises, this method is applied in an extensive manner to deal with country heterogeneity, by dividing the countries in sub-samples based on several country characteristics (the level of country openness, the degree of euroisation, and

EU membership). Last but not least, our model specifications and variable definitions to a considerable extent rely on the arguments put forward in the extensive literature on the transmission of the GFC (discussed in chapters two and three), which is not always the case in the relatively small body of GVAR studies.

The results indicate that the transmission of the shock from EU's GDP to ETEs' GDP is stronger in all regions when using trade weights to construct the foreign country-specific variables, indicating that trade linkages represent a significant channel of transmission of shocks from advanced EU countries to ETEs. While the estimated spillovers from shocks to GDP and financial stress index in the EU to ETEs are negative, there are considerable heterogeneities across regions. The main results are reported in Table 4.7 below and discussed more thoroughly in the following part of the section.

Table 4.7 Summary of main results

	Impact on variables of different regions / sub-samples					
Variables	**Baltic**	**Balkan**	**CE**	**Baltic**	**Balkan**	**CE**
	Shock to EU15 GDP			**Shock to EU15 CISS**		
GDP	Negative / significant	Negative / 10% borderline significance	Negative / 10% borderline significance	Negative / significant	Negative / insignifcant	Negative / 10% borderline significance
Exports	Insignificant	Negative / 10% borderline significance	Negative/significant	Negative / 10% borderline significance	Negative / insignifcant	Negative / 10% borderline significance
FDI	Negative / insignifcant	Negative / 10% borderline significance	Negative / insignifcant	Negative / 10% borderline significance	Negative / insignifcant	Negative / 10% borderline significance
Remittances	Negative / 10% borderline significance	Insignificant	Insignificant	Negative / 10% borderline significance	Negative / i+G18Insignifcant	Negative / insignifcant

Foreign credit flows	Negative / close to 10% of borderline statistical significance	Negative / close to 10% of borderline statistical significance	Negative / significant	Negative / 10% borderline significance	Negative / insignifcant	Negative / 10% borderline significance

Shocks to EU15 GDP

	EU	Non-EU	High EUR	Low EUR	High trade openness	Low trade openness
GDP	Negative / borderline statistical significance	Negative / significant	Negative / significant	Negative / borderline statistical significance	Negative / significant	Negative / borderline statistical significance
Exports	Negative / significant	Negative / borderline statistical significance	Negative / borderline statistical significance	Negative / significant	Negative / significant	Negative / significant
FDI	Negative / borderline statistical significance	Negative / borderline statistical significance	Negative / borderline statistical significance	Negative / borderline statistical significance	Insignificant	Negative / significant
Foreign credit flows	Insignificant	Negative / significant	Negative / borderline statistical significance	Negative / significant	Negative / borderline statistical significance	Negative / significant

The Baltic countries display the most severe and statistically significant impact to both GDP and the financial stress index in the EU15 on their GDP. The shocks appear to be propagated to this region mainly through foreign credit flows, FDI and remittances, suggesting that the financial channel, particularly foreign credit flows, played a major role in the transmission of the shocks to these countries. An important transmission mechanism of the recent GFC previously identified in the literature has been the global restriction of credit. Moreover, it is well known that a higher level of foreign bank presence[18], may expose a country to foreign shocks and can tighten liquidity conditions during a crisis, as parent banks reallocate capital across borders and therefore capital may be withdrawn from the transition country

[18]The average share of foreign bank assets in Baltic region during the period 2000-2014 was 83%.

when it is needed in the bank's home country (in line with the findings of Cetorelli and Goldberg, 2011). In addition, recent empirical studies (Popov and Udell, 2012; Ongena et al., 2015; by Bonin and Louie, 2015; Allen et al., 2017) have shown that foreign bank subsidiaries in emerging Europe reduced lending earlier and faster than domestic banks.

The Balkan transition countries also display a severe impact from the shock to the EU15 GDP, with a decline of their GDP by 0.3% on impact, which increases to 0.6% and stabilises by the eighth quarter. The shock in this region is propagated mainly through exports, FDI and foreign credit flows. However, the region does not appear to be affected by a shock to the EU15's CISS; the impulse response functions are clearly statistically insignificant for all the variables, possibly due to their relative lack of development of the financial sector, which has not been affected by risky and unsafe financial instruments.

The other CE transition countries are less severely affected by the shock to the EU's GDP, possibly because they represent more advanced transition countries. Belke et al. (2009) have shown that the level of development has a positive effect on institutional quality as measured by the World Bank Governance Indicators, hence making these countries more able to deal with external shocks. In general, the institutional characteristics that may shape the impact of external shocks are related to the quality of developed institutions, progress with transition to a market economy and the quality of government policy making. Therefore, it seems that these countries are more able to offset crisis effects and thus contribute to the resilience of the region. The shock in this region is mainly propagated through the export channel, probably due to their stronger trade linkages with the EU15.

In addition, through general forecast error variance decomposition, it was observed that the variables of the EU region can explain most of the shock on other regions' GDP, confirming the importance of linkages between the EU15 and ETEs in the transmission of shocks. The baseline analysis is followed by robustness checks, which in general confirm the results of the baseline model for the core variables representing the main transmission channels: exports; FDI; foreign credit flows; and GDP.

The chapter proceeds to analyse the transmission of shocks in various subsamples, which are defined by various country characteristics: the degree of euroisation; EU membership; and level of openness. The results suggest that the impact of the shock is larger and statistically more significant on the GDPs of highly euroised countries. Chapter 2 highlights various costs associated with euoisation, which may become more visible during periods of severe financial crisis. First, there is the inability/ineffectiveness to act as a lender of last resort. In a situation where there is a general loss of confidence in the banking system, the central banks in these countries are unable to fully back bank deposits. Considering that the central banks do not have the ability to print foreign currencies, their function as a lender of last resort is impaired. The second cost of euroisation relates to adverse currency mismatches. During the recent GFC, the depreciation of the domestic currencies in these countries prevented some unhedged borrowers from servicing their loans in foreign currencies. The third cost of euroisation is related to a reduction in monetary policy autonomy. A common view among economists is that euroisation makes monetary policy less effective, since it can increase the volatility of demand for domestic currency due to reduced costs of switching from local to foreign currency in order to avoid the impact of inflation (Alvares-Plata and García-Herrero, 2007). However, currency substitution also increases exchange rate volatility. In an economy with high currency substitution, a policy of devaluation is less effective in changing the real exchange rate because of significant pass-through effects to domestic prices (Berg and Borensztein, 2000).

With regards to country openness, as expected, the impact of the shock is larger on the GDPs of the more open economies compared to the less open economies. This finding is in line with our expectations, as the literature on financial contagion identifies exports as one of the main channels of the transmission of shocks. In addition, impulse responses show that the shock is amplified in these countries mainly through exports. Moreover, dividing the sample into more/less open economies delivers a general gain in the statistical significance of the results, suggesting an important heterogeneity that should be controlled for any modelling of transmission effects.

When it comes to EU membership, it was observed that the impact of the shock in EU GDP is larger on all the variables of the non-EU transition countries compared to the EU transition countries. Although in the Balkan context, as argued above, there may have been some advantages to lack of financial development, our findings for the EU transition countries and the other CE transition countries suggest the advantages of greater institutional development. This contrast may suggest that while institutional development with respect to governance, including capacity for monetary and fiscal policy/stabilization, and well-functioning markets are unambiguously positive from the perspective of adjusting to external shocks, financial development may bring both benefits and costs (i.e. a “mixed blessing”).

CHAPTER 5

EXPLAINING THE IMPACT OF THE GLOBAL FINANCIAL CRISIS ON EUROPEAN TRANSITION COUNTRIES: IMPACT ON FIRMS' SALES

Contents

5.1 Introduction

Chapter 4 of this thesis presented an analysis of the international transmission of shocks to ETEs. The results from the GVAR approach suggested the importance of financial and trade interdependencies across countries in the international transmission of shocks. Even though the GVAR model is very effective in dealing with interdependencies and international co-movements of business cycles (Di Mauro and Pesaran, 2013), the analysis faces difficulties when attempting to identify real shocks. In addition, the use of macro data has been argued to be a weakness of GVAR models when investigating the transmission of crisis, since, as Claessens and Forbes (2004) point out, the aggregate proxies for trade and financial links are often correlated and it is difficult to quantify the specific channels. For instance, firms' performance can be worsened by both a decline in exports and a reversal of capital flows. Furthermore, macro data often do not account for all the underlying channels of transmission of crises, such as consumption and investment behaviour. On the other hand, using firm-level data allows the different exposures of firms to the GFC to be distinguished (e.g. firms that were more exposed to exports and those firms that were more dependent on external financing). Therefore, a firm-level investigation could provide more insights into the specific channels for the international transmission of crisis and complement the study at macro level. Consequently, this chapter investigates the transmission of the GFC by employing firm-level data. This is the first study that comprehensively investigates the transmission of the GFC to ETEs using firm-level data.

The rest of this chapter is organized as follows. Section 5.2 examines the research design and specifies the variables and data to be used in the model. Section 5.3 provides the details of the estimation technique adopted. Section 5.4 provides diagnostic tests. Section 5.5 reports and discusses the results, and section 5.6 provides conclusions.

5.2 Research design and data description

Firm-level analysis of the 2007-2009 GFC is relatively scarce, partly because firm-level data for many countries are released only with a long lag. The closest study to the one presented in this chapter is Claessens et al. (2012), who investigate how the

2007-2009 crisis affected firm performance and how various linkages propagated shocks across borders by using accounting data for 7,722 non-financial firms in 42 countries. They find that the crisis had a bigger negative impact on firms with a greater sensitivity to demand and trade (constructed as the elasticity of firm-specific sales and exports to the country's GDP in the six years before the crisis, i.e. 2000-2006), particularly in those countries more open to trade. Other studies that used firm or sector-level data to investigate the 2007-2009 GFC can be classified into two main groups: the first group focus on the financial channel and credit constraints as the main source of transmission and amplification of shocks (Ongena et al., 2015; Iyer et al., 2014 and Laeven and Valencia, 2013); while the second group focus on the drivers of the decline in trade (Levchenko et al., 2010; Alessandria et al., 2010 and Duchin et al., 2010).

In this chapter firm-level data is used from the World Bank's *Financial Crisis Survey* conducted in 2010 and the World Bank/EBRD's *Business Environment and Enterprise Performance Survey* (BEEPS) conducted in 2009. BEEPS is a firm-level survey of a representative sample of an economy's private sector whose objective is to gain an understanding of firms' perception of the environment in which they operate. BEEPS covers a broad range of business environment topics including access to finance, corruption, infrastructure, crime, competition, and performance measures. There are five rounds of surveys: 1999-2000; 2002; 2005; 2009; and 2012-2013. This study uses data from the fourth round of BEEPS carried out in 2008-2009 but referring to fiscal year 2007. The survey covered almost 12,000 enterprises in 29 countries.

The World Bank conducted three rounds of the *Enterprise Financial Crisis Survey* in six countries of the Europe and Central Asia region (Bulgaria, Hungary, Latvia, Lithuania, Romania and Kazakhstan). The range and variety of the countries included makes them informative about transition countries as a whole, given that Hungary is included as one of the Visegrad Group of the more advanced transition countries, Bulgaria and Romania as representatives of less advanced ETEs, Latvia and Lithuania as representative of the Baltic states, and Kazakhstan as a representative of Central Asian transition countries. The surveys aimed to assess the effect of the GFC on each country's private sector. The first round took place in June/July 2009, covering 1,686 firms, the second one in February/March 2010 covered 1,892 firms, and the last one in June 2010, covered 1,393 firms in both the manufacturing and service sectors. For these surveys, the World Bank contacted the same companies interviewed in BEEPS 2009. The main idea was to use the previous round of surveys of the BEEPS as a baseline to quantify the effect of the recent financial crisis on the private sector. Efforts were made to contact all respondents of the baseline survey (BEEPS 2009) to determine which of the companies were still operating and which were not. The original data also served as a baseline for comparisons, because it referred mostly to fiscal year 2007, thus measuring the pre-crisis scenario. The data from the BEEPS survey of 2009 mostly refers to the fiscal year 2007, which suits this investigation as these data are used to account for the pre-crisis conditions. Regarding the *Financial Crisis Survey*, given the profound impact of the crisis in the countries of interest in 2009 (refer to Chapter 1), it was decided to use the second survey, as it refers also to the fiscal year 2009 (hereafter *Financial Crisis Survey 2009*). Accordingly, the variables that are employed to measure the severity of the crisis across these six countries are obtained from the *Financial Crisis Survey 2009*, while the variables that account for the pre-crisis conditions as well as general information about the firms are obtained from the BEEPS 2009. Data from the two surveys is linked together through the common firm ID appearing in both surveys. Most of the companies surveyed for BEEPS 2009 appear also in the Financial Crisis Survey 2009.

This empirical analysis investigates whether the initial conditions from 2007 had an impact on the firms' sales during the GFC in 2009. In order to do so, the relationship between firms' sales growth and different initial conditions is examined. More specifically, the determinants of sales growth are estimated using a basic Cobb-Douglas production function augmented with some additional variables of interest. The dependent variable, which also proxies the severity of the crisis, is the *percentage change in sales* from 2008 to 2009. Sales data are often used as proxies for output in production functions. Moreover, the sales growth enables the investigation of both price and output responses to the GFC and it reflects changes in demand generally better than output growth, which includes inventory changes. In addition, as a robustness check, the variable capacity utilization rate in 2009 is employed as a dependent variable, which proxies for firms' performance during the GFC, where firms that were able to cope better with the crisis are expected to have a higher capacity utilization rate. This approach allows examining the underlying economic factors, which have driven any observed changes in the potential output. The *percentage change in employment* and *capital purchased* are also included as basic variables of the Cobb-Douglas production function. Further, other variables are employed that might have affected the firms' sales during the GFC. This study's intention is to distinguish between two main channels of transmission as suggested by theory and confirmed by the previous investigation in this thesis, namely the trade and financial channels. In order to do that, the following approach is pursued. If the trade channel was important for the impact of the severity of the crisis on firms, it would be expected that exporting firms would have been more affected by the GFC. Consequently, the dummy variable *exports* is employed to capture the trade channel. In terms of the financial channel, several indicators are employed to capture its importance. Namely, if the financial channel was important, this would have been reflected in firms that relied more on external finances for working capital being more affected by the GFC; hence, the variable *share of working capital financed by banks* is employed to account for this channel. In addition, following the literature review presented in section 2.3 and based on the results from the previous empirical chapter, it would be expected that firms with a larger share of foreign currency loans would have been more severely affected by the GFC. The firms with larger amounts of foreign currency loans in their balance sheets are expected to face stronger financial difficulties if their domestic currencies depreciate. Therefore, the variable *share of firm's foreign currency loans in total loans* is employed. Finally, given the potential importance of the FDI channel in the transmission of the GFC discussed in Chapters 1 and 2, this study also investigates whether the share of *foreign ownership* affected firms' performance during the crisis. Previous empirical studies suggest that the nationality of a firm’s owner has an important influence on its financial vulnerability, and foreign-owned firms generally have broader access to financial support, especially during periods of crisis and in countries with weak financial institutions (Desai et al., 2004; Desai et al., 2008). Since foreign ownership potentially represents a financial advantage, it is expected that foreign-owned firms will suffer less from the financial crisis, in particular from the tightening of liquidity conditions.

Next, a number of control variables are employed to account for various aspects of sales change during the GFC. Considering that the managers' decisions before and during the crisis will have affected firms' sales during the crisis, the number of years of *top managers' experiences* are used as a proxy for the otherwise unobserved top manager's ability. We would expect managerial ability to influence a firm's response to change in demand conditions, since the firm cannot be considered as just a passive recipient but also should be considered as an active agent. In addition, in production function models managerial ability is typically acknowledged as an input, in particular in cross-section analysis, otherwise the unobserved managerial ability would go into the error term. Given that the managerial ability affects directly the use of labour and capital to generate output, then we would have an error term correlated with the independent variables. Further, the variable *firm age* is employed to account for the years of experience of the firms and to investigate whether older or newer firms performed better during the crisis. On the one hand, due to their experience, it can be argued that older firms might be more able to adjust to difficult circumstances than younger firms and are less likely to fail because they have acquired a reputation in the market and therefore face a smaller liquidation risk (Görg and Strobl, 2002). On the other hand, younger firms may be more likely to use advanced technologies, which boost productivity and product quality, hence, they may cope better with the crisis (Van Dijk, 2002). In terms of access to finance and the liquidity of the firms, it is also investigated whether the firms that received *subsidies in the last three years* had a better performance during the GFC. Given the common difficulties in accessing finance during the GFC due to tightened financial conditions, the firms that received subsidies before the crisis are expected to have performed better during the crisis. The level of innovativeness of the firms is also included as a control variable, which is proxied by a dummy variable for whether the firm had introduced any *new products during the last three years*. To account for the firm's perceptions of the environment in which it operates, *political instability* is also controlled for by a dummy that shows whether or not a firm considered *political instability* as a main obstacle to its operations. In addition, the categorical variables *industry* and *firm size* are employed to investigate whether particular industries and firm sizes were more severely affected by the crisis. Finally, country dummies are employed to account for heterogeneity of the crisis impact across countries.

Table 5.1 presents the list of variables together with their description, expected impact on sales growth (derived from the literature review), data sources and descriptive statistics of the variables. The summary of descriptive statistics reveals that, on average, firms' sales decreased by 19% from 2008 to 2009. The maximum increase in sales was 106% and the maximum decrease was 100%, while 69% of the firms reported a decrease, 18% reported an increase and 13% no change in their sales, suggesting that the majority of the firms were severely affected by the crisis. The standard deviation for the change in firms' sales is relatively low, implying that data are spread relatively tightly around the mean. Similarly, the standard deviations of explanatory variables are generally relatively low. The number of employees, on average decreased by 17% from 2008 to 2009. The average proportion of working capital financed by banks was 36%. On average the proportion of foreign currency loans in the total loans of these firms was 13%, while the average level of foreign ownership of the firms was 12%. The average experience of the top managers was 15 years and the average age of the firms was 14 years. When it comes to dummy variables, it is worth mentioning that the percentage of exporting firms is relatively low in the sample; only 18 percent of the firms exported more 10% of their sales in 2007. In addition, only 12 percent of the firms reported having received subsidies in the three years before 2007. The data for industries, firm size and country dummies are more or less proportionally distributed within each category of the respective variable. The statistics from the table below also show that some data are missing for a number of variables. However, the absence of these data seems to be random, therefore this is not expected to affect the accuracy of the results.

Table 5.1 Summary of variables

CONTINUES VARIABLES

Variable (as it appears in equa. 1)	Description	Expected sign	Source	Units of measurement	Obs.	Mean	Std. dev.	Min	Max
salesgrowth	Percentage change in sales from 2008 to 2009	n/a	Financial Crisis Survey, 2009	% change (in decimal form)	1186	-0.19	0.31	-1.00	1.06
emplgrowth	Percentage change in employment from 2008 to 2009	Positive	Financial Crisis Survey, 2009	% change (in decimal form)	1186	-0.17	0.48	-1.00	2.75
capitalpurch	Capital purchased during 2007 (i.e. investment)	Positive	BEEPS, 2009	Additions to the capital stock	1186	2.93	2.42	0.00	9.13
wcbanks	Proportion of working capital financed by banks in 2007	Negative	Financial Crisis Survey, 2009	Proportion	1155	0.36	0.41	0.00	1.00
foreigncurr	Proportion of foreign currency loans in total loans on the firm in 2009	Negative	Financial Crisis Survey, 2009	Proportion	1049	0.13	0.27	0.00	1.00
foreignown	Proportion of the firm's equity owned by foreign individuals, companies or organizations in 2007	Positive	BEEPS, 2009	Proportion	1186	0.12	0.31	0.00	1.00
topmanagerexp	Years of experience of the top manager	Positive	BEEPS, 2009	Years	1186	15.57	10.11	2.00	53.00

firmage	Number of years since the firm started operating	Ambiguous	BEEPS, 2009	Years	1166	14.20	11.60	1.00	144.00

DUMMY VARIABLES

Variable (as it appears in equ. 1)	**Description**	**Expected sign**	**Source**	**Obs.**	**Yes**	**No**	**% (Yes)**	**% (No)**
directexp	A dummy variable equal to one if the firms' direct exports as a percentage of total sales is greater than 10% and zero otherwise	Negative	BEEPS, 2009	1186	208	978	18%	82%
subsidies	A dummy variable with the value of one if the firm has received subsidies in the last three years (before 2007); otherwise zero	Positive	BEEPS, 2009	1173	140	1033	12%	88%
newproduct3years	A dummy variable with the value of one if the firm has introduced any new products during the last three years (before the crisis) and zero otherwise	Positive	BEEPS, 2009	1178	544	634	46%	54%
politicalinstability	A dummy variable equal to one if firm considered political instability as a major obstacle to its operations in 2007 and zero otherwise	Negative	BEEPS, 2009	1140	724	416	64%	36%

currdep	A dummy variable equal to one if there was currency depreciation in 2009 and zero otherwise	Ambiguous	EUROSTAT, World Bank	1186	638	548	54%	46%		
Variable (as it appears in equ. 1)	**Description**	**Expected sign**	**Source**	**Obs.**	**1**	**2**	**3**	**4**	**5**	**6**
industry	1 - manufacturing; 2 - retail; 3 - wholesale; 4 - services	Ambiguous	BEEPS, 2009	1186	432	366	93	295		
firmsize	1 - very small; 2 - small; 3 - medium; 4 - large[19]	Ambiguous	BEEPS, 2009	1186	38	382	404	362		
country	1-Bulgaria; 2-Hungary; 3-Kazakhstan; 4-Latvia; 5-Lithuania, 6-Romania	Ambiguous	BEEPS, 2009	1186	133	147	218	208	207	273

[19] Firm size as defined in BEEPS based on the number of employees: very small - less than 5; small >=5<=19; medium >=20<=99; large >=100.

5.3 Estimation technique

This study employs a Cobb-Douglas production function augmented with additional variables of interest and controls. The augmentation enables the estimation of the determinants of changes in sales other than changes in inputs of capital and labour. Due to data limitations, only labour and capital are employed as inputs in the production function. The one-step production function has been widely used to determine the impact of a various number of variables. An alternative approach would be to use a two-step procedure, in which case during the first step the total factor productivity (TFP) would be obtained from the error term of the basic Cobb-Douglas production function which, during the second step, would be regressed on the other variables which might have impacted on sales during the GFC (Levinsohn and Petrin, 2003). However, considering that the data for changes in other inputs from 2008 to 2009 (materials, electricity, fuel etc.) are not available, the one-step production function is used in this study. The basic function is specified as follows:

$$\%\Delta sales_i = \beta_0 + \beta_1 \%\Delta employment_i + \beta_2 \Delta capitalpurch_i + \beta_3 wcbanks_i + \beta_4 foreigncurr_i + \beta_5 foreignown_i + \beta_6 topmanagerexp_i + \beta_7 firmage_i + \beta_8 directexpdumm_i + \beta_9 subsidies_i + \beta_{10} newproduct3years_i + \beta_{11} politicalinstability_i + \beta_{12} C_i + \varepsilon \quad (5.1)$$

where ε is the usual white noise error term. Assuming that the model (5.1) satisfies the assumptions of the classical linear regression model, the OLS methodology is used to estimate it. Given the assumptions of the classical linear regression model, the least-squares estimates possess some ideal or optimum properties. These properties are contained in the well-known Gauss–Markov theorem: "Given the assumptions of the classical linear regression model, the least-squares estimators, in the class of unbiased linear estimators, have minimum variance, that is, they are BLUE" (Gujarati, 2003, p.79).

Before proceeding with the model estimation, two potential problems related to the empirical strategy employed are acknowledged. Firstly, the potential simultaneity between input choices is mentioned in most production function models. Marschak and Andrews (1944) were among the first who raised the problem of the potential correlation between input levels and the unobserved firm-specific productivity shocks in the estimation of a production function. The simultaneity can arise with firm-level data when input choices respond to shocks, such as the GFC, which would cause some reductions in firms' prices, output and profitability below the levels anticipated and, if this shock is perceived as a permanent one, then input choices are likely to be lowered. However, it has been previously argued that capital and employment adjust only slowly with respect to shocks. Consequently, in the face of shocks, sales fluctuate more than labour and capital input changes (Smolny, 1998). In addition, the capital variable is lagged, so any contemporaneous feedback from changes in sales is broken. Therefore, the change in sales from 2008 to 2009 are not expected to alter the capital input in 2007; whereas it might reasonably be expected that contemporaneous changes in labour will affect sales, the feedback effect takes time. As an additional robustness check, we investigate whether the same variables that affected the firms' sales during the GFC also affected the employment change and we find no significant results (see Table 5.11), which is reassuring and implies that the model does not suffer from simultaneity.

Secondly, a common concern when using survey data is the potential perception bias, since it is common that responses of firms based on surveys are likely to be biased by the general perceptions of firms (Kaufman and Wei, 1999). Depending on their general perception of the environment where they operate, some firms may consistently provide positive or negative answers. In cross-country surveys, such as the BEEPS, the group within which the bias is typically correlated is the particular country in which respondents operate (Godart and Görg, 2013). Fries et al. (2003) check for such perception bias in the BEEPS 2002 and find no significant perception biases across the countries in the sample. Therefore, since the BEEPS 2009 follows a similar methodology, it is not suspected that perception bias will affect the results of this analysis. However, as a further control, the empirical model in equation (5.1) includes industry and country level fixed effects.

5.4 Diagnostic tests

This section investigates how well the data meet the key assumptions underlying OLS estimation assumptions based on the Gaussian, standard, or classical linear regression model (CLRM), which is the cornerstone of most econometric theory (Gujarati, 2003). Table 5.2 reports the results of the main diagnostic tests performed.

Table 5.2. Diagnostic tests

Ramsey RESET test using powers of the fitted values of salesgrowth

Ho: model has no omitted variables

F(3,95) = 1.67
Prob > F = 0.1725

Cameron and Trivedi's decomposition of IM-test			
Source	chi2	df	p
Heteroskedasticity	291.82	244	0.0193
Skewness	25.27	22	0.2844
Kurtosis	14.24	1	0.0002
Total	331.34	267	0.0045

Breusch - Pagan / Cook - Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of salesgrowth
chi2(1) = 1.46
Prob > CHI2 = 0.2267

The results of the Ramsey RESET test reported above suggest that the assumption of linearity holds. On the other hand, tests for heteroskedasticity give ambiguous results. The results of the Breusch-Pagan test provide strong evidence in favour of homoscedastic variance, while the results of Cameron & Trivedi's test reject the assumption of homoscedasticity. Although the null hypothesis of no excessive skewness is clearly rejected, evidence of kurtosis suggests some departure from a normal distribution of the residuals. However, this evidence of non-normality does not invalidate statistical inference (F- and t-tests) in a sample of the size used in the present study (Spanos, 1986). Therefore, a conservative approach to inference is adopted by reporting robust standard errors, as these can address concerns about failure to meet assumptions, such as minor problems about normality (Spanos, 1986), heteroscedasticity, or some observations that exhibit large residuals, leverage or influence (Wooldridge, 2015).

In each case we have investigated the statistical characteristics of the data with further graphic checks, which are reported in appendix A5 (figures A5.1 – A5.4). In terms of the linearity assumption, in line with the results of the Ramsey RESET test, the plots of residuals versus predictor variables and augmented plus residual plots presented in figures A5.1 and A5.2 in appendix A5 do not indicate that the assumption is violated. These plots are evenly distributed vertically, and they do not have outliers, or a clear shape to them. Further, the plot of kernel density (kdensity) and the plots of quantiles of a variable against the quantiles of a normal distribution (qnorm) are presented in figures A5.3 and A5.4 in appendix A5 to check whether the residuals are normally distributed. The plots' appearance is in line with the results of the Cameron and Trivedi's test. Pnorm (representing skewness) shows no indications of non-normality, while the qnorm plot (kurtosis) shows a slight deviation from normality at the upper tail, as can be seen in the kdensity plot as well. Nevertheless, this seems to be a minor deviation from normality and, as argued above, robust standard errors are used for inference.

In the next step we check for multicollinearity by using the variance inflation factor (VIF). As a rule of thumb, if a VIF of a variable is greater than 10, it might require further investigation, as the variable could be considered as a linear combination of other independent variables. Both the individual VIFs and the mean VIF reported in Table 5.3 below satisfy the most conservative thresholds typically used by researchers.

Table 5.3 The variance inflation factor (VIF)

Variable	VIF	1/VIF
capitalpurch	1.29	0.77
foreignown	1.16	0.86
1.directexdumm	1.34	0.74
emplgrowth	1.06	0.95
wcbanks	1.30	0.77
foreigncurr	1.14	0.88
2.subsidies	1.05	0.95
industry		
2	1.47	0.68
3	1.17	0.85
4	1.41	0.71
1.country1	1.47	0.68
1.country2	1.88	0.53
1.country3	2.01	0.50
1.country4	1.67	0.60
1.country5	1.76	0.57
Topmanager	1.13	0.88
Firmsize		
1	7.69	0.13
2	7.80	0.13
3	7.78	0.13
firmage	1.13	0.88
2.newprodu~s	1.12	0.89
1.politicallinstability	1.09	0.92
Mean VIF	**2.22**	

Since none of the key OLS assumptions appears to have been violated, in the next section we discuss the results.

5.5 Empirical results

Table 5.4 presents the baseline regression results from estimating equation (5.1). Most of the estimated coefficients are in accordance with theoretical expectations and previous research. The estimates suggest that the financial variables are the most economically influential and statistically significant. The relationship between foreign currency loans and sales growth rate is negative and significant at the 1% level. An increase of the share of foreign currency loans in total loans of the firm by one percentage point, leads to a decrease in the growth rate of sales by 0.13 percentage points in 2009. This is a large effect relative to the mean growth of sales of -0.19 (i.e. a mean decline of 19 percentage points). The relationship between the variable working capital financed by banks (*wcbanks*) and the growth rate of sales from 2008 to 2009 (*salesgrowth)* is also negative and significant at the 5% significance level. An increase in the proportion of the working capital of firms financed by banks by 1 percentage point decreased the growth rate of sales by 0.06 percentage points. In addition, the dummy variable *subsidies* is also statistically significant at the 5% significance level. The firms that received subsidies during the previous 3 years (before 2007), compared to those firms which did not receive subsidies, had an increase in the growth rate of sales of 7 percentage points. The relationship between *foreignown* and *salesgrowth* is positive and significant at the 5% level. An increase in the foreign ownership of the firm by one percentage points results in an increase of the growth rate of sales of 0.06 percentage points.

Results for most of the control variables appear to be statistically significant and their signs are in accordance with theoretical predictions and previous empirical findings. The relationship between the top manager's experience and the growth rate of sales is positive and significant at the 5% level. An increase in the experience of the top manager by one year leads to an increase in the growth rate of sales by 0.3 percentage points. The variable *newproduct3years* is also significant at the 5% level. Firms that introduced new products in the last 3 years (prior to 2007) experienced a growth rate of sales by 5 percentage points more than those that did not introduce new products. The dummy variable *politicalinstability* is also significant at the 5% level and has a negative relationship with the growth rate of sales. Firms that perceived political instability to be a main obstacle to their operations in 2007 had a decline in the growth rate of sales in 2009 of 5 percentage points more than firms that did not. The remaining dummy variable, *directexp*, does not appear as statistically significant; moreover, it has very small coefficients across all of our estimated models.

Table 5.4 OLS estimates of baseline regression (5.1) and extended models (5.2) and (5.3)

Variables **Dependent Variable: %ΔSales**	**Model (5.1)**	**Model (5.2)**	**Model (5.3)**
Constant	-0.0383	0.3325	0.3312
	[0.0617]	[0.1007]	[0.1060]
%ΔEmployment	0.1251***	0.1264***	0.1282***
	[0.0253]	[0.0252]	[0.0253]
ΔCapital	-0.0043	-0.005	-0.005
	[0.0045]	[0.0045]	[0.0045]
Working Capital financed by Banks	-0.0660**	-0.0622**	-0.0522
	[0.0259]	[0.0253]	[0.1276]
Foreign Currency Loans	-0.1384***	-0.1403***	-0.1395***
	[0.0355]	[0.0354]	[0.0356]
Foreign Ownership	0.0576**	0.0602**	0.0582**
	[0.0274]	[0.0274]	[0.0275]
Top Manager Experience	0.0028**	0.0028***	0.0028**
	[0.0011]	[0.0011]	[0.0011]
Firm Age	-0.0013	-0.0013	-0.0013
	[0.0009]	[0.0009]	[0.0009]
Direct Exports Dummy	0.008	0.0057	-0.0912
	[0.0290]	[0.0288]	[0.0863]
Subsidies	0.0690**	0.0728**	0.0715**
	[0.0290]	[0.0292]	[0.0294]
New Product 3 years	0.0494**	0.0481**	0.0462**
	[0.0207]	[0.0203]	[0.0203]
Political Instability	-0.0528**	-0.0477**	-0.0470**
	[0.0213]	[0.0206]	[0.0206]
Firm Size Dummy1	-0.0516	-0.0496	-0.0501
	[0.0412]	[0.0417]	[0.0424]
Firm Size Dummy2	-0.0326	-0.0281	-0.0276
	[0.0423]	[0.0429]	[0.0435]
Firm Size Dummy3	0.0226	0.0297	0.0296
	[0.0456]	[0.0448]	[0.0456]
Foreign Bank Ownership		-0.3311***	-0.2996***
		[0.0576]	[0.0729]
Aggregate Foreign Currency Loans		-0.1889***	-0.2025**
		[0.0686]	[0.0792]

Exports / GDP		0.0039	-0.0259
		[0.0759]	[0.0788]
Working Capital Banks * Aggregate Foreign Currency Loans			0.0947
			[0.1632]
Direct Exports * Exports / GDP			0.2009
			[0.1533]
Working Capital Banks* Foreign Bank Ownership			-0.0962
			[0.1262]
Country Fixed Effects	✓	✓	✓
Industry Fixed Effects	✓	✓	✓
Robust standard errors in parentheses			
***** p<0.01; **p<0.05; *p<0.1**			

Additional robustness checks

As argued in chapter 1 and based on the results of the previous chapter, the transmission of the GFC is likely to depend not only on the firms' features, but also country characteristics. Therefore, in the second results column of Table 5.4 (model 5.2) we introduce country-specific variables that were found to be important in the theoretical and literature review chapters, such as trade openness, foreign bank ownership and share of foreign currency loans. These variables are described in Table 5.5, while the full model is given in equation 5.2 below.

$$\%\Delta sales_i = \beta_0 + \beta_1 \%\Delta employment_i \beta_2 + \%\Delta capitalpurch_i + \beta_3 wcbanks_i + \beta_4 foreigncurr_i + \beta_5 foreignown_i + \beta_6 topmanagerexp_i + \beta_7 firmage_i + \beta_8 directexpdumm_i + \beta_9 subsidies_i + \beta_{10} newproduct3years_i + \beta_{11} politicalinstability_i + \beta_{12} C_i + \beta_{13}\, tradeopenness_i + \beta_{14}\, foreigbanknown_i + \beta_{15}\, foreigbncurrloans_i + \varepsilon$$

(5.2)

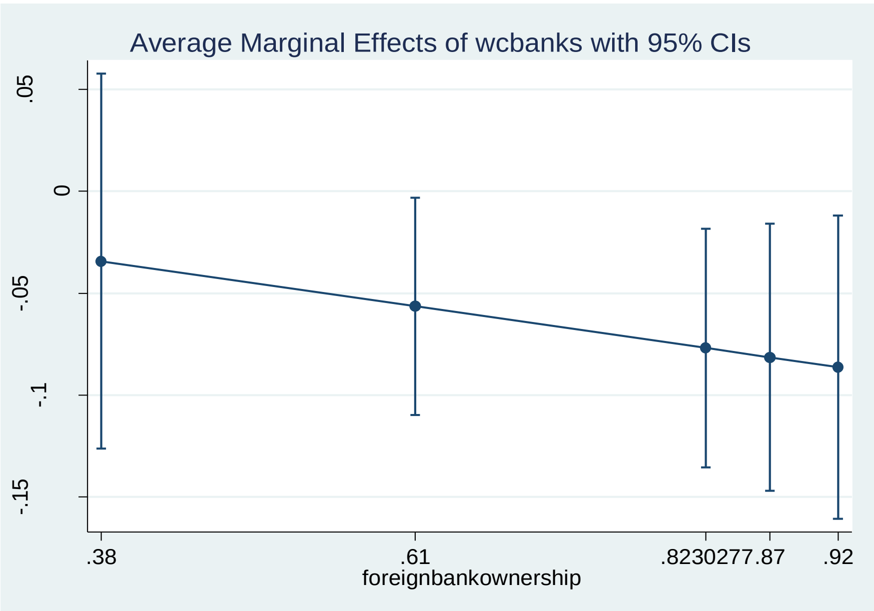
Table 5.5 Description of country-level variables and interaction terms

VARIABLES									
Variable (as it appears in equ. 5.2)	**Description**	**Expected sign**	**Source**	**Units of measurement**	**Obs.**	**Mean**	**Std. dev.**	**Min**	**Max**
tradeopenness	Exports as a share of GDP	Negative	World Bank	Proportion	1186	0.47	0.15	0.29	0.78
foreignbankown	Foreign bank assets as a share of total assets	Negative	EBRD	Proportion	1186	0.71	0.19	0.38	0.92
foreigncurrloans	Foreign currency loans as a share of total loans	Negative	EBRD	Proportion	1186	0.57	0.14	0.43	0.86
Working Capital Banks * Aggregate Foreign Currency Loans	Interaction term between working capital financed by banks in 2007 and a country' share of foreign currency loans in total loans in 2007	Negative	BEEPS 2009, EBRD	Proportion	1155	0.20	0.23	0	0.86
Direct Exports * Exports / GDP	Interaction term between share of exports in firms' sales in 2007 and share of countries' exports in GDP in 2007	Negative	BEEPS 2009, World Bank	Proportion	1186	0.45	0.11	0	0.70
Working Capital Banks* Foreign Bank Ownership	Interaction term between working capital financed by banks in 2007 and countries' share of foreign bank ownership in 2007	Negative	BEEPS 2009, EBRD	Proportion	1155	0.24	0.28	0	0.92

Adding these country-specific variables does not significantly change the results of the previously discussed variables from the baseline regression; indeed, it strengthens them in some cases. The results of the aggregate variables are in line with the results of their corresponding firm-level variables (where applicable) presented in the second column of results in Table 5.4 (model 5.2). The relationship between the aggregate share of foreign currency loans and sales growth is negative and highly significant. An increase in the share of foreign currency loans in total loans of a country by 1 percentage point leads to a decrease in the growth rate of sales of the firms by 0.2 percentage points. The relationship between foreign bank ownership and sales growth is also negative and highly significant. A one percentage point increase in foreign bank ownership leads to a decrease in growth rate of sales by around one third of a percentage point. A similar relationship to the firm-level between exports as a share of total sales of the firm and growth rate of sales is observed between the country-level exports as a share of GDP and sales growth; the exports/GDP variable does not appear to be statistically significant and has a very small coefficient.

Next, the country-level variables are interacted with the firm-level features and the results are reported in the last column of Table 5.4 (model 5.3). For example, in order to investigate whether foreign bank ownership in a country affected firms' sales by affecting access to finance during the GFC, the variable working capital financed by banks is interacted with the level of the country's foreign bank ownership. Further, in order to examine whether the firms that financed their working capital by banks in countries with higher shares of foreign currency loans were more severely affected by the crisis, the variable working capital financed by banks is interacted with the country's level of foreign bank ownership. Finally, to test whether exporting firms in countries more open to trade were affected differently during the GFC, the direct exports dummy is interacted with the country's exports as a share of GDP variable. Again, adding these interaction terms to the baseline regression does not change significantly the results, indicating that the results of the main variables are robust to different model specifications. We cannot infer whether there is any significant effect of the interaction terms based solely on the results reported in the last column of Table 5.3, given that the interaction coefficients show only the average effect of the interaction based on the mean value of the variables composing the interaction. Therefore, in order to provide a more informative interpretation, the marginal effects of these interactions are presented in tables A5.8 and A5.9 in appendix. A5 However, only the final interaction term between working capital financed by banks and foreign bank ownership appears to have statistically significant marginal effects. Stata's marginsplot is used to graphically illustrate these effects in Figure 5.1 below. The coefficients of the marginal effects and the plot suggest that the effect of the proportion of working capital financed by banks in 2007 on the firms' growth rate of sales in 2009 is moderated by the degree of foreign bank ownership in the economy in which it is located. However, the effect of the interaction term is statistically significant only for countries with a degree of foreign bank ownership higher than 61%, since, as can be seen in Figure 5.1 below, all bands are below zero when the level of foreign bank ownership is above 61%. More specifically, the results suggest that the working capital financed by banks has a more severe effect on firms' growth rate of sales in the countries with a higher degree of foreign bank ownership.

Figure 5.1 Average marginal effects of the proportion of firms' working capital financed by banks at different levels of foreign bank ownership in the economy



Tables 5.6 and 5.7 present the results of two further robustness checks. The first one reported in Table 5.6 uses another measure of the impact of the GFC. Namely, the capacity utilization rate in 2009 is employed in this model as the dependant variable,

which proxies for firms' performance during the GFC, where firms that were able to cope better with the crisis are expected to have a higher capacity utilization. The statistical significance and the signs of the independent variables capturing financial channels transmitting GFC effects do not change, which is again reassuring and confirms the significance of these variables on the firm's performance during the GFC. The variable direct exports, however, appears as highly significant, which suggests that exporting firms had a higher capacity utilization than non-exporting firms during the GFC. Nevertheless, the results of this model should be considered with caution as, due to data limitations (the capacity utilization data for 2007 are available only for a very small number of firms), it is not possible to calculate the growth rate of the capacity utilization from 2007 to 2009, therefore only the 2009 value is used.

Table 5.6 Results of the model (5.4)

Variables **Dependent Variable: Capacity Utilization**	**Model (5.4)**
Constant	59.54108
	[7.1659]***
%ΔEmployment	9.5611***
	[2.5201]
ΔCapital	-0.3875
	[0.4928]
Working Capital Banks	-5.2328*
	[3.0505]
Foreign Currency Loans	-4.9794*
	[3.6399]
Foreign Ownership	6.3722**
	[2.8987]
Top Manager Experience	-0.0562
	[0.1107]
Firm Age	-0.0131
	[0.0724]
Direct Exports	8.1697***
	[2.5849]
Subsidies	0.8287
	[2.6147]
New Product 3 years	1.6288
	[2.1689]
Political Instability	-1.3581

	[2.2097]
Firm Size Dummy1	4.6828
	[5.9677]
Firm Size Dummy2	7.576
	[5.9874]
Firm Size Dummy3	13.8414**
	[6.2026]
Country Fixed Effects	✓
Industry Fixed Effects	✓

Robust standard errors in parentheses

***** p<0.01; **p<0.05; *p<0.1**

As an additional robustness check, we investigate whether the same variables that affected firms' sales during the GFC also affected their employment change. As explained above, employment growth is potentially endogenous. However, as argued in section 5.3, the independent variables of the baseline regression are not expected to affect employment change; employment and output change do not change simultaneously, because employment and output have very different adjustment speeds. Therefore, we do not expect to find significant results from the latest regression. The results are reported in Table 5.7 below and, as expected, none of the independent variables appear to be significant influences on employment change within the sample period. This is reassuring as it reduces concerns regarding both simultaneity and common determinants, which could cause output and employment to be correlated even if they stood in no causal relationship to one another. However, we cannot demonstrate that output change and employment change have no *unobserved* influences in common.

Table 5.7 Robustness check (dependent variable %ΔEmployment, model (5.5))

Variables **Dependent Variable: %ΔEmployment**	**Model (5.5)**
Constant	-0.0046
	[0.1360]
Working Capital Banks	-0.0623
	[0.0437]
Foreign Currency Loans	0.098
	[0.0634]
Foreign Ownership	0.0266

	[0.0405]
Top Manager Experience	-0.0004
	[0.0014]
Firm Age	0.0014
	[0.0010]
Direct Exports	0.0337
	[0.0403]
Subsidies	0.0529
	[0.0437]
New Product 3 years	0.0286
	[0.0304]
Political Instability	-0.0225
	[0.0317]
Firm Size Dummy1	-0.1355
	[0.1242]
Firm Size Dummy2	-0.196
	[0.1240]
Firm Size Dummy3	-0.2064
	[0.1245]
Country Fixed Effects	✓
Industry Fixed Effects	✓
Robust standard errors in parentheses	***** p<0.01; **p<0.05; *p<0.1**

Finally, a few more robustness checks are conducted to further investigate the statistical insignificance of the dummy variable *directexp* in model 5.1. Firstly, it should be noted that the lack of significance of this variable does not suggest that exporting firms have not been affected by the crisis, nor that the crisis was not transmitted through the exports channel; it simply suggests that exporting firms have not been affected by the crisis significantly differently from non-exporting firms. Table 5.8 reports the average predicted percentage change in sales when the export dummy is set to zero and the average predicted percentage change in sales when the export dummy is set to one in model 5.1 and shows that both types of firms have been significantly affected by the crisis. However, the relative sizes of the estimated effects suggest that the effect was slightly higher for non-exporting firms, even though the difference in not statistically significant.

Table 5.8 Predictive margins of *directexdumm*

directexp	Margin	Std. Err.	t-value	P>t	[95% Conf.	Interval]
Non-exporters - 0	- 0.203	0.011	- 19.170	0.000	- 0.224	- 0.183
Exporters - 1	- 0.196	0.026	- 7.480	0.000	- 0.247	- 0.144

A growing body of literature has found that exporting firms are substantially and significantly different from non-exporting firms. Numerous authors have documented the superior performance of exporting firms compared to non-exporting firms even in the same industry and region (Chen and Tang, 1987; Clerides et al., 1998; Bernard and Jansen, 1999. Bernard and Jensen (1999) find that exporters are larger, more productive, more technology and capital intensive, use more skilled workers and pay higher wages than non-exporting firms. Other authors, Melitz (2003), Melitz and Ottaviano (2003), and Bernard et al. (2003) claim that high-productivity firms self-select themselves into export markets. Consequently, due to their superior performance, it can be argued that the exporting-firms might be more able to adjust to difficult circumstances; hence, they are more flexible when it comes to reallocating to a different market (foreign or domestic market) due to a decline in exports as a result of the crisis. In order to test whether this applies to the firms included in this study, the variable *directexp* is interacted with the variable *changenatsales* - a new variable computed as the percentage change in proportion of sales to the domestic market from 2007 to 2009. Based on the arguments provided above, it is expected that directly exporting firms able to reallocate a higher percentage of their sales to domestic market have been less severely affected by the crisis.[20] It has to be noted that when using the actual percentage of sales that are exports instead of the dummy variable *directexp,* we obtain similar results. However,

[20] Due to lack of data, it cannot be identified whether the firms that reallocated their sales to other foreign markets / new countries, were less severely affected by the crisis. Therefore, it is only tested if those exporting firms that switched to domestic markets were less severely affected by the crisis.

we decided to use the dummy variable as it illustrates better the differences between exporting and non-exporting firms through the marginsplot. The results of the regression are presented in the first results column in Table 5.9 (model 5.6). Even though the interaction term is statistically insignificant, it cannot be inferred whether it has any relevant and significant effect on crisis severity given that the interaction coefficient shows only the average effect of the interaction based on the mean value of the variable *changenatsales*. Therefore, in order to provide a more informative interpretation, the marginal effect of direct exports across different values of changes in proportion of sales to domestic market is presented in Figure 5.2 below and the marginsplot is used to graphically illustrate the effect. The marginal effect appears as statistically significant under different values of *changenatsales* (appendix A5, Table A5.17). However, the contrasts between exporting firms and non-exporting firms[21] presented in Table 5.10 below do not appear to be statistically significant. Nevertheless, the overall statistical significance of the contrasts increases with the increase of the variable *changenatsales*. Even though these contrasts are not significant at conventional levels, when combined with marginsplot presented in Figure 5.2, they are suggestive that exporting firms which have been able to reallocate higher proportions of their sales to domestic markets have been slightly less affected by the crisis. It should be noted that 52% of the exporting firms in the sample increased their proportion of sales to domestic markets in 2009, 50% of which had an increase of 50% or higher. As for the rest of the exporting firms, 35% decreased their proportion of sales to domestic markets, which suggest that their sales to foreign markets increased and for the remaining 13% of the exporting firms the proportion of sales to domestic markets did not change from 2007 to 2009.

Model 5.7 in Table 5.9 includes the interaction between *directexp* and *foreigncurr*, which fits a separate slope for the relationship between *foreigncurr* and *salesgrowth* for exporting firms versus non-exporting firms. Model 5.8 includes the interaction term between *directexdumm* and *foreignown*, which fits a separate slope for the relationship between the share of firms' foreign ownership and the rate of sales growth for exporting

[21] As explained in Table 5.1, exporting firms refer to firms that export more than 10% of their sales, implying that the category of non-exporting firms includes low-intensity exporters, i.e. the firms that export less than 10% of their sales.

firms versus non-exporting firms. Model 5.9 includes the interaction term between *directexdumm* and *wcbanks*.

Table 5.9 OLS estimates of extended models (5.6) to (5.9)

Variables **Dependent Variable: %ΔSales**	**Model (5.6)**	**Model (5.7)**	**Model (5.8)**	**Model (5.9)**
Constant	-0.0389	-0.0334	-0.0378	-0.0367
	[0.0619]	[0.0622]	[0.0621]	[0.0620]
%ΔEmployment	0.1534***	0.1516***	0.1523***	0.1522***
	[0.0260]	[0.0260]	[0.2595]	[0.2596]
ΔCapital	-0.004	-0.004	-0.004	-0.0039
	[-0.0045]	[0.0046]	[-0.0046]	[0.0046]
Working Capital Banks	-0.0673**	-0.0653**	-0.0654**	-0.0678**
	[0.0263]	[0.0261]	[0.0262]	[0.0280]
Foreign Currency Loans	-0.1328***	-0.1626***	-0.1364***	-0.1361***
	[0.0357]	[0.0406]	[0.0356]	[0.0356]
Foreign Ownership	0.0475*	0.0538*	0.0603*	0.0513*
	[0.0280]	[0.0276]	[0.0339]	[0.0277]
Top Manager Experience	0.0027**	0.0027**	0.0027**	0.0027**
	[0.0010]	[0.0010]	[0.0010]	[0.0010]
Firm Age	-0.0014	-0.0014	-0.0013	-0.0013
	[0.0009]	[0.0009]	[0.0009]	[0.0009]
Direct Exports Dummy	0.0227	-0.0051	0.0225	0.012
	[0.0298]	[0.0338]	[0.0340]	[0.0376]
Subsidies	0.0676**	0.0673**	0.0672**	0.0669**
	[0.0295]	[0.0293]	[0.0294]	[0.0296]
New Product 3 years	0.0504**	0.0479**	0.0482**	0.0482**
	[0.0208]	[0.0208]	[0.0208]	[0.0208]
Political Instability	-0.055***	-0.0546***	-0.0553**	-0.0555***
	[0.0213]	[0.0214]	[0.0213]	[0.0213]
Firm Size Dummy1	-0.0369	-0.0359	-0.0359	-0.03567
	[0.0409]	[0.0414]	[0.0414]	[0.0415]
Firm Size Dummy2	-0.027	-0.025	-0.0262	-0.02589
	[0.0422]	[0.0427]	[0.0427]	[0.0428]
Firm Size Dummy3	0.0198	0.0233	0.023	0.02317
	[0.0447]	[0.0450]	[0.0450]	[0.0451]
Changnetsales	-0.0687			
	0.0521			
Directexp#changnatsales	0.0761			
	[0.0557]			
Directexp#foreigncurr		0.1103		
		[0.0741]		
Directexp#foreignown			-0.0249	
			[0.0574]	

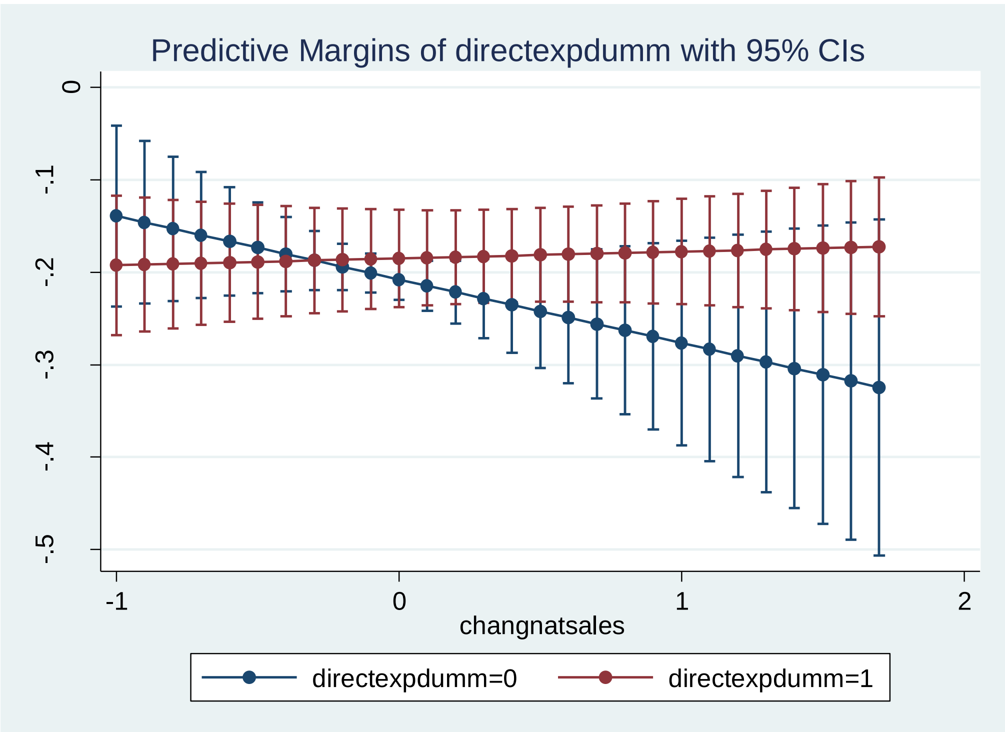
Directexp#wcbanks				0.0199 [0.0564]
Country Fixed Effects	✓	✓	✓	✓
Industry Fixed Effects	✓	✓	✓	✓

Robust standard errors in parentheses
***** p<0.01; **p<0.05; *p<0.1**

Table 5.10 Contrasts of marginal effects of *changenatsales* for exporting vs non-exporting firms

Exporting vs non-exporting	**Contrast**	**Std. Err.**	**p-value**
Exp. vs. non-exp. at changenatsales = 0	0.015	0.029	0.609
Exp. vs. non-exp. at changenatsales = 0.25	0.032	0.034	0.343
Exp. vs. non-exp. at changenatsales = 0.33	0.038	0.036	0.299
Exp. vs. non-exp. at changenatsales = 0.5	0.049	0.043	0.242
Exp. vs. non-exp. at changenatsales = 1	0.085	0.064	0.187
Exp. vs. non-exp. at changenatsales = 1.7	0.134	0.098	0.174

Figure 5.2 Fitted values for *channgnatsales* and *directexp* interaction



Further, as reported in Table 5.9, a number of other factors that might have influenced the impact of exports on crisis severity are investigated. Given the overall significance of the variables comprising the financial channel, it is explored whether they might have affected differently exporting and non-exporting firms. Model 5.7 includes the interaction between *directexp* and *foreigncurr,* which fits a separate slope for the relationship between *foreigncurr* and *salesgrowth* for exporting firms versus non-exporting firms. The results of the regression are reported in the second column of results in Table 5.9. The margins command is used to compute the adjusted means for *foreigncurr* separately for exporting firms and non-exporting firms. Then the marginsplot command is used to graph these adjusted means, which are presented in Figure 5.3. This shows the adjusted mean for *salesgrowth* as a function of *foreigncurr* (on the x axis) and with separate lines for exporting and non-exporting firms. Although the marginal effects presented in Figure 5.3 for both exporters and non-exports are all significantly different from zero, the contrasts between each pair of marginal effects are uniformly non-significant at conventional levels, although their significance increases as the share of *foreigncurr* increases (table 5.11 below). Therefore, the results are suggestive that as the share of foreign currency loans increases, the sales of non-exporting firms are more severely affected. Again, we have some (albeit slight) evidence consistent with the interpretation that exporting firms are more resistant to the pressures of the GFC. It should be pointed out that 46% of the exporting firms and 26% of the non-exporting firms have loans in foreign currencies. In addition, for around 25% of exporting firms and 15% of non-exporting firms the proportion of loans in foreign currency is higher than 50%.

Figure 5.3 Fitted values for *foreigncurr* and *directexp* interaction

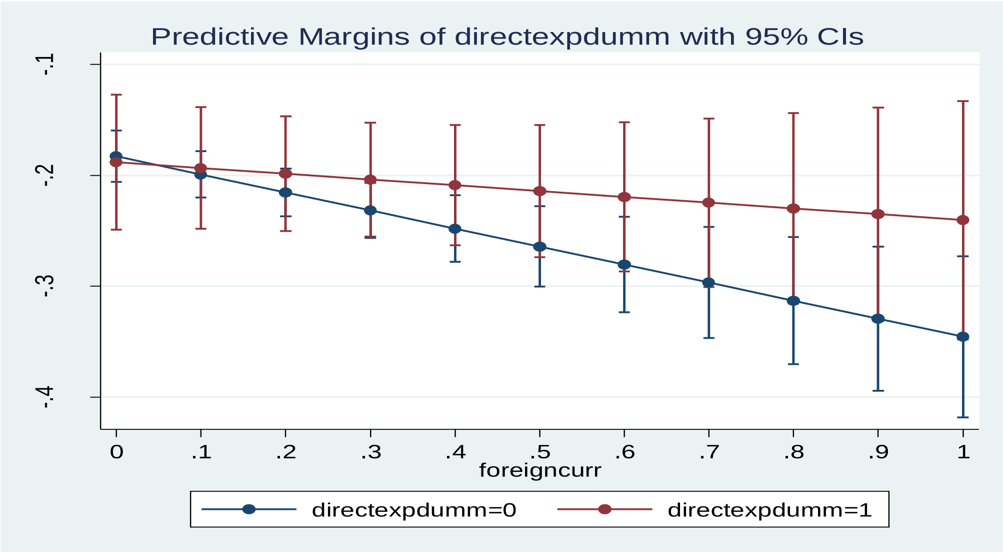


Table 5.11 Contrasts of marginal effects of *foreigncurrr* for exporting vs. non-exporting firms

Exporting vs non-exporting	**Contrast**	**Std. Err.**	**p-value**
Exp. vs. non-exp. at *foreigncurr* = 0	-0.015	0.033	0.646
Exp. vs. non-exp. at *foreigncurr* = 0.1	-0.004	0.030	0.892
Exp. vs. non-exp. at *foreigncurr* = 0.2	0.007	0.029	0.809
Exp. vs. non-exp. at *foreigncurr* = 0.3	0.018	0.029	0.541
Exp. vs. non-exp. at *foreigncurr* = 0.4	0.029	0.032	0.361
Exp. vs. non-exp. at *foreigncurr* = 0.5	0.040	0.036	0.259
Exp. vs. non-exp. at *foreigncurr* = 0.6	0.051	0.040	0.204
Exp. vs. non-exp. at *foreigncurr* = 0.7	0.063	0.046	0.173
Exp. vs. non-exp. at *foreigncurr* = 0.8	0.074	0.052	0.155
Exp. vs. non-exp. at *foreigncurr* = 0.9	0.085	0.058	0.144
Exp. vs. non-exp. at *foreigncurr* = 1	0.096	0.065	0.137

Next, model 5.8 includes the interaction term between *directexdumm* and *foreignown,* which fits a separate slope for the relationship between the share of firms' foreign ownership and the rate of sales growth for exporting firms versus non-exporting firms. The regression results are reported in the third column of results in Table 5.9 and the graphical presentation is illustrated in Figure 5.4. The graph shows almost completely overlapping marginal effects of foreign ownership for exporting and non-exporting firms, indicating that foreign ownership does not affect significantly different exporting and non-exporting firms.

Figure 5.4 Fitted values for *foreignown* and *directexp* interaction

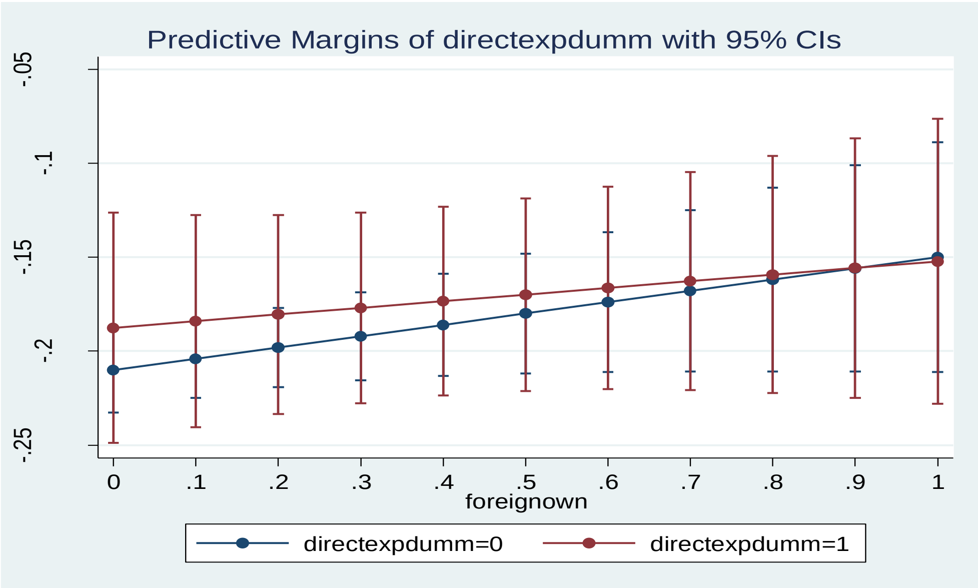


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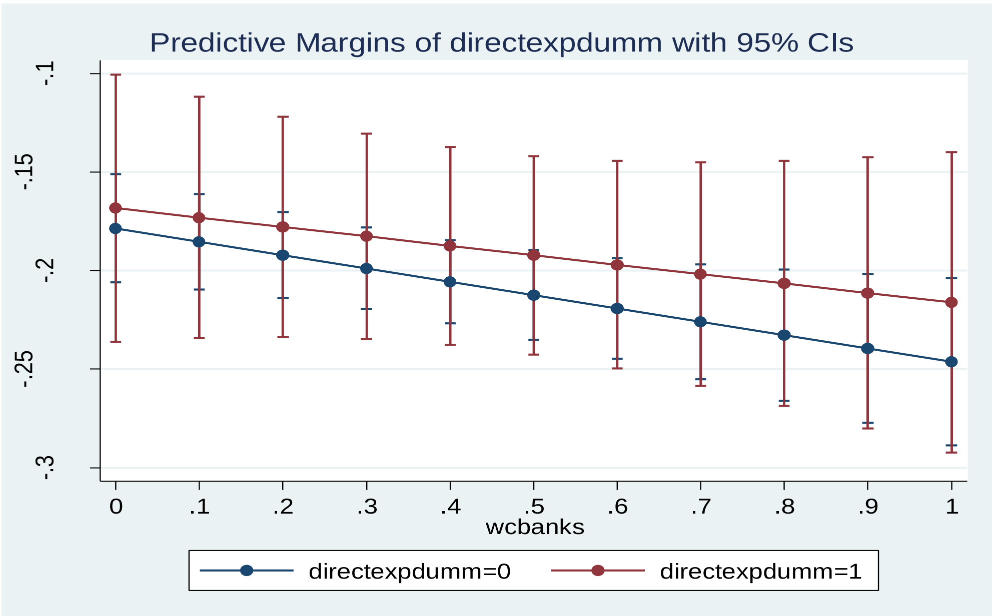
Figure 5.5 Fitted values for *wcbank and directexp* interaction



Model 5.9 includes the interaction term between *directexdumm* and *wcbanks.* The regression results are reported in the fourth column of results in Table 5.9 and the graphical presentation is illustrated in Figure 5.5. The estimated coefficients and the graph suggest that there is no significant difference between the slopes of exporting

and non-exporting firms, indicating that variable working capital financed by banks similarly affects both types of firms.

Further, given the statistical insignificance of the exporting term in all model specifications, we investigate whether currency depreciation during 2009 attenuated the trade channel. Model 5.10 includes an interaction between a dummy variable that controls for currency depreciation (*currdep,* the variable is described in Table 5.1) and *directexpdum.* The results of this model are reported in the first column of results in Table 5.12. Contrary to our expectations, the estimated coefficient on the interaction term suggests that exporting firms operating in countries that experienced currency depreciation during 2009 were more severely affected by the GFC. A potential explanation is that the short-run effect of the currency depreciation on exporting firms would be negative if demand for exports and imports are both inelastic. One the one hand, currency depreciation would have made imports more expensive, while not correspondingly changing their volume. On the other hand, during the GFC there was a global collapse in trade, therefore currency depreciation might not have caused a significant increase in demand for exports. Nevertheless, although the marginal effects presented in Figure 5.6 for both exporters and non-exports are all significantly different from zero, the contrasts between each pair of marginal effects reported in Table 5.13 are statistically non-significant.

Table 5.12 Results of the models (5.10) and (5.11)

Dependent Variable: %ΔSales	**Model (5.10)**	**Model (5.11)**
Constant	-0.0727	-0.071
	[0.0549]	[0.0551]
%ΔEmployment	0.1330***	0.1361***
	[0.0523]	[0.0254]
ΔCapital	-0.005	-0.0048
	[-0.0047]	[0.0046]
Working Capital Banks	-0.0326	-0.0409*
	[0.0238]	[0.0356]
Foreign Currency Loans	-0.1695***	-0.748**
	[0.0345]	[0.0380]
Foreign Ownership	0.0608**	0.0561**
	[0.0275]	[0.0267]
Top Manager Experience	0.0029***	0.0029***
	[0.0011]	[0.0011]
Firm Age	-0.0019*	-0.0020**
	[0.0009]	[0.0009]
Direct Exports Dummy	0.0428	-0.0069
	[0.0336]	[0.0289]
Subsidies	0.0547*	0.0504*
	[0.0282]	[0.02830]
New Product 3 years	0.0480**	0.0471**
	[0.0206]	[0.0205]
Political Instability	-0.0685***	-0.0702***
	[0.0209]	[0.0209]
Currency Depreciation	0.1139***	0.1249***
	[0.0230]	[0.0227]
Firm Size Dummy1	-0.0469	-0.0521
	[0.0387]	[0.0397]
Firm Size Dummy2	-0.022	-0.0273
	[0.0398]	[0.0404]
Firm Size Dummy3	0.0418	0.0325
	[0.0426]	[0.0435]
Directexp#currdep	-0.1153**	
	[0.0542]	
Foreigncurr#currdep		-0.2356***
		[0.0748]
Country Fixed Effects	✓	✓
Industry Fixed Effects	✓	✓

Robust standard errors in parentheses
***** p<0.01; **p<0.05; *p<0.1**

Figure 5.6 Fitted values for *currdep* and *directexp* interaction

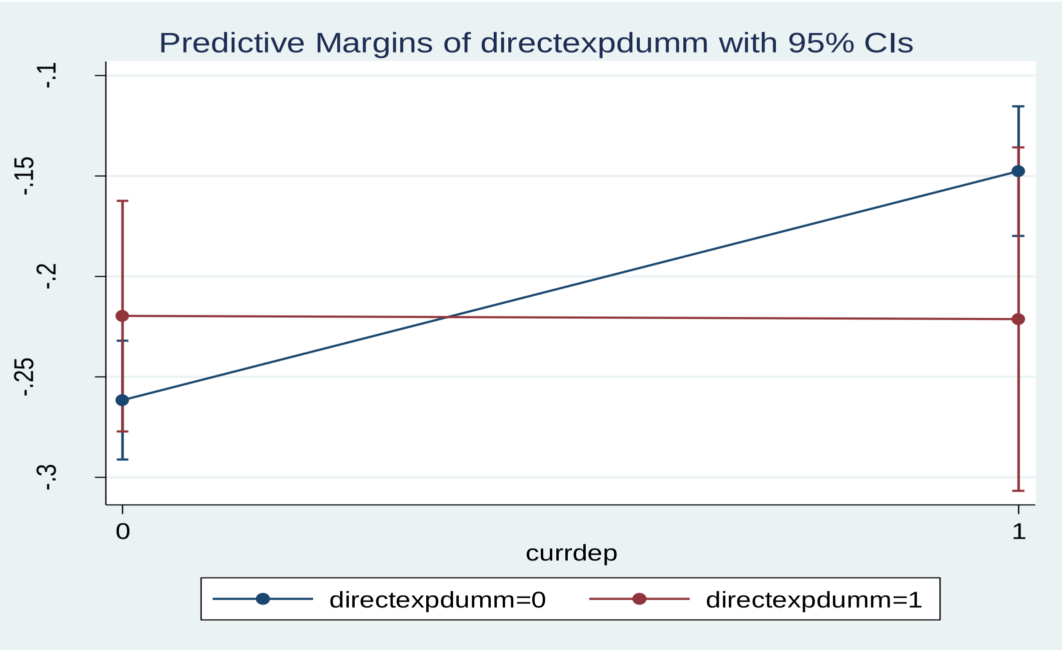


Table 5.13 Contrasts of marginal effects of currdep for exporting vs. non-exporting firms

Exporting vs non-exporting	**Contrast**	**Std. Err.**	**p-value**
Exp. vs. non-exp. at currdep = 0	0.0418	0.0336	0.214
Exp. vs. non-exp. at currdep = 1	-0.0735	0.0467	0.116

Finally, given the consistent negative and statistically significant effect of the variable *foreigncurr (*foreign currency loans) on *salesgrowth*, we also investigate whether this effect was more severe (as emphasized in theoretical review chapter, sub-section 2.3.1) in countries whose currencies depreciated during 2009. Model 5.11 includes the interaction between *currdep* and *foreigncurr,* which fits a separate slope for the relationship between *foreigncurr* and *salesgrowth* for firms operating in countries that experienced currency depreciation in 2009 versus those operating in countries whose currencies did not depreciate in 2009. The results of the regression are reported in the second column of results in Table 5.12. The margins command is used to compute the adjusted means for *foreigncurr* separately for countries that experienced currency depreciation versus those that did not. Then the marginsplot command is used to graph these adjusted means, which are presented in Figure 5.6. Although all marginal effects presented in Figure 5.6 are statistically significant, the contrasts between each pair of marginal effects reported in Table 5.14 are statistically significant for only lower levels of foreign currency loans and they approach borderline levels of statistical significance at the highest levels of foreign currency loans. Nevertheless, the estimated coefficient and the marginal effects presented in Figure 5.7 reinforce the general finding that foreign currency loans had a negative effect on firms during the crisis. These results are also suggestive that firms with higher levels of foreign currency loans operating in countries that experienced currency depreciation in 2009 were more severely affected by the crisis.

Figure 5.7 Fitted values for *foreigncurr* and *currdep* interaction

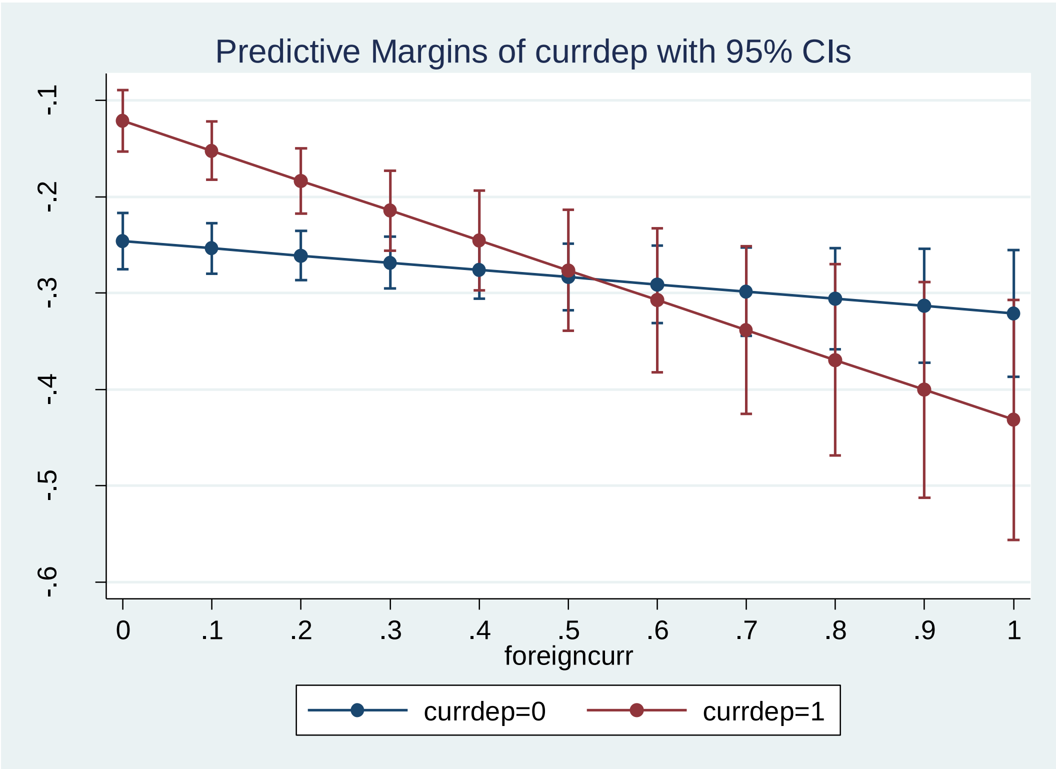


Table 5.14 Contrasts of marginal effects of foreign currency loans for currency depreciation vs. no currency depreciation

Currency depreciation vs. no currency depreciation	**Contrast**	**Std. Err.**	**p-value**
Curr. dep. vs. no curr. dep. at foreigncurr = 0	0.1249	0.2267	0.000
Curr. dep. vs. no curr. dep. at foreigncurr = 0.3	0.0542	0.0258	0.036
Curr. dep. vs. no curr. dep. at foreigncurr = 0.7	-0.0400	0.0497	0.421
Curr. dep. vs. no curr. dep. at foreigncurr = 1	-0.1107	0.0709	0.119

5.6 Discussion and interpretation

One of the most important findings in this study relates to the effect of the financial channel on the transmission of the GFC to ETEs. The robust negative relationship between the growth rate of sales and financial variables in all of the estimated models suggest that the financial channel had played a major role in firms' performance during the GFC. An important transmission mechanism previously identified in the literature has been the global restriction of credit. This is confirmed by this study, as the results from all the models from 5.1 to 5.9 suggest that those firms that depended more on banks to finance their working capital before the crisis appear to have been more significantly affected by the crisis. The level of foreign bank ownership also appears to be a significant channel of transmission of crisis. The results of this study suggest that firms that operated in countries with a higher degree of foreign bank ownership, in particular firms that were more dependent on banks to finance their working capital, had worse performance during the GFC. As argued in Chapter 2, it is well known that a higher level of foreign bank presence may expose a country to foreign shocks and can tighten liquidity conditions during a crisis, as parent banks reallocate capital across borders and, therefore, capital may be withdrawn from the transition country when it is needed in the bank's home country (Cetorelli and Goldberg, 2011). In addition, the literature review in Chapter 3 shows that foreign bank subsidiaries in emerging Europe reduced lending earlier and faster than domestic banks.

The incidence of foreign currency loans appears to be highly significant, both at firm-level and country-level in all the model specifications, which suggests that firms more exposed to loans in foreign currencies and firms that operated in countries with higher levels of foreign currency loans were more severely affected by the GFC. As argued in chapter 2, during the GFC, the depreciation of the domestic currencies prevented some unhedged borrowers from servicing their loans in foreign currencies. Further investigation revealed evidence consistent with this conjecture. The margins and the marginsplot of the interaction term between *foreigncurr* and *currdep* are suggestive that the firms more exposed to loans in foreign currencies operating in countries whose currencies depreciated during 2009 have been more severely affected by the crisis.

The overall size of the coefficients and their level of statistical significance enforces the general finding in the literature that the financial channel does matter in accounting for transmission of the global financial crises and its inclusion in models for transition economies is crucial.

Another finding of this study suggests that the ownership structure of the firms was also important in weathering the GFC. A positive relationship is found between the level of foreign ownership and sales growth during the GFC, which suggest that, ceteris paribus, the foreign-owned firms have been less severely affected by the crisis.

Finally, no significant relationship is found between the dummy variable *directexp* and *salesgrowth*. However, this does not suggest that the trade did not serve as a transmission channel for the GFC for these six countries that participated in this study, it simply suggests that exporting firms have not been affected by the crisis significantly different than non-exporting firms. In addition, the non-significance of the exporting term most probably also reflects the cross-sectional nature of the data and corresponding estimation from between-firm variation only, which enabled a better examination of the relative performance of exporting and non-exporting firms than the performance of exporting firms as such. Moreover, previous empirical studies have documented a superior performance of exporting firms compared to non-exporting firms, which would suggest that exporting firms are more capable of adjusting to difficult circumstances and more flexible when it comes to reallocating output to a different market. Further investigation revealed evidence consistent with this conjecture. The margins and the marginsplot of the interaction term between *directexpm* and *changnatsales,* even though not significant at conventional levels, are suggestive that the exporting firms that have been able to reallocate a higher proportion of their sales to their domestic market have been less severely affected by the crisis. Furthermore, the variable *directexp* appears as highly significant in the model 5.4, which suggests that exporting firms had a higher capacity utilization compared to non-exporting firms during the GFC. The superior performance of exporting firms during the GFC is also indicated by the interaction term between the *directexp* and *foreigncurr*.

5.7 Conclusion

In spite of a number of studies on transmission of the GFC to ETEs, there is a lack of empirical evidence at firm-level. This study contributes to knowledge in this area by providing firm-level evidence from a cross-country investigation of transmission of the GFC to six transition countries. The measure of sales growth from 2008 to 2009 is used to proxy the impact of the GFC on firms. The Cobb-Douglas production function augmented with additional variables of interest was employed to estimate the determinants of changes in sales, which are not explained by changes in inputs. The model was estimated by OLS. Particular attention has been paid to diagnostic tests to ensure the model is statistically well specified and thus produces valid estimates. The major finding of this study is the importance of the financial channel in transmission of the GFC to ETEs: a higher share of working capital financed by banks, a higher share of foreign currency loans and a higher share of foreign bank ownership each increased the impact of the GFC on the firms operating in these countries. With regards to the exports channel, it was found that both exporting and non-exporting firms operating in the six countries covered in this study were significantly affected by the crisis. On the one hand, this finding does not completely confirm the expectation deriving from the theoretical review that exports are one of the main channels of transmission of crisis, as the results suggest that non-exporting firms were slightly more affected by the crisis than exporting firms. On the other hand, the theory also suggests that exporting firms have an overall superior performance compared to non-exporting firms, which is further confirmed in this study by investigating interaction terms. The results of the interaction term between the variables *directexp* and *changnatsales* are suggestive that exporting-firms able to reallocate a higher proportion of their sales to domestic markets were less severely affected by the crisis. In addition, the interaction terms, although not significant at conventional levels, are suggestive that the financial variables, which negatively affect the dependant variable in models 5.1 - 5.6, appear to have affected slightly more severely the non-exporting firms. The superior performance of exporting firms is also confirmed by model 5.4, which shows that exporting firms had a higher rate of capacity utilization during the GFC. In the light of all the evidence presented in this study, the non-significance of the exporting term does not suggest that trade did not serve as a transmission channel of the GFC, but that there were are also other channels which affected the non-exporting firms, particularly the financial channel. Secondly, although there is a trade channel, the exporting firms were able to cope with the crisis better than non-exporting firms due to their overall superior performance. So exports, or more precisely, exporting firms constitute a transmission channel for the impact of GFC. Yet, exporting firms are also more able to offset crisis effects and thus contribute to the resilience of transitional economies.

This study contributes to the empirical literature on transmission of the GFC by investigating the firm-level determinants of the severity of the GFC and by introducing new variables that have affected the firms' performance during that period. However, this chapter is subject to two main limitations. The first limitation is the lack of data for capital growth from 2008 to 2009 and the consequent inclusion in the model of the logarithm of capital purchased in 2007. However, it is not expected that firms purchased significant amounts of capital during a period of tightened liquidity conditions and, even when excluding the variable capital altogether from the model, the results do not change, especially those concerning the variables of interest. The second limitation is the cross-sectional nature of the data, which can only reflect between-firm differences and enabled a better examination of the relative performance of exporting and non-exporting firms than the performance of exporting firms as such. Therefore, the non-significance of the exporting term does not suggest that the trade did not serve as a transmission channel for the GFC for these six countries that participated in this study, it simply suggests that exporting firms have not been affected by the crisis significantly different than non-exporting firms. Nevertheless, within-firm variation over time might have revealed the impact of the GFC on exporting firms as it would shed light on the performance of the exporting firms before and after the GFC. It should be noted that BEEPS has recently introduced a panel dataset and even though it was initially considered to be used in this thesis, it was later deemed as unsuitable for the analysis of the transmission of the GFC, since only a small fraction of firms were included in it and even a smaller fraction of those firms were included in the Financial Crisis Survey. Therefore, a panel covering a longer time span would be worth assessing in the future to provide insights into the impact of the GFC on exporting firms as well as the factors that affected the firms' speed of recovery from the GFC.

CHAPTER 6

CONCLUSIONS

Contents

6.1 Introduction

The aim of this thesis was to investigate the transmission of the GFC to ETEs. One particular feature of the recent GFC has been the speed and synchronicity with which it has spread around the world. Even though it originated in the US, it spread not only to countries that shared similar vulnerabilities, but also to most emerging and advanced countries. Although there have been a few studies that have investigated the transmission of the GFC to ETEs, they have neglected factors such as: the degree of euroisation; integration with the EU; remittances; bank ownership; and foreign credit flows. This thesis fills this gap by exploring the impact of those influences on the transmission of the GFC to ETEs and the nature and the severity of the spillovers. More specifically, it addressed the following research questions:

1) What are the relevant models and empirical evidence on the international transmission of financial crises? What are the gaps in knowledge?

2) Which were the most significant channels of international transmission of shocks to ETEs?

3) Did the degree of euroisation, integration with the EU, remittance inflows, bank ownership and foreign credit flows significantly modify the propagation of the GFC to ETEs?

The objective of this chapter is to: present the key findings of the thesis; establish their contribution to knowledge; examine their policy implications; identify the main limitations of the research and provide recommendations for future research. The rest of this chapter is organized as follows. Section 6.2 summarises and discusses the main findings of the thesis. The main contributions to knowledge of this thesis are discussed in section 6.3. Section 6.4 elaborates the main policy implications emerging from this thesis and suggests a range of policy interventions to reduce the vulnerability of ETEs to future negative global shocks. Section 6.5 summarizes the main limitations that have arisen while conducting the empirical analyses and provides recommendations for future research.

6.2 Findings of the thesis

Chapter 1 provided the context of the research conducted in this thesis. It initially presented an overview of the transition process in the Central and Eastern European countries, focusing on the key areas relevant to the research questions of this thesis. Namely, it started by describing the process of transition from centrally planned economies towards open, market-oriented economies, examined the output, trade, FDI and remittance fluctuations throughout the period and described financial developments and the progress towards integration with the EU during this period. It then continued with an overview of the recent GFC and its impact on the ETEs. Stylized facts showed that the ETEs were severely affected by the GFC with an average GDP decline of around 7 percent in 2009, though the impact of the crisis on economic activity varied extensively across countries in transition.

Having established the importance of an empirical exploration of the influences of exports, euroisation, bank ownership, foreign credit flows, FDI, remittances and EU integration in the transmission of the GFC to ETEs in Chapter 1, the thesis proceeded with a critical review of the theoretical and empirical literature on the transmission of the GFC to transition countries (the first research question). The literature review in Chapters 2 and 3 provided the base for developing the models that were used to explore the international transmission of GFC in the empirical chapters. The literature review disclosed that although there were a large number of studies that have investigated the international transmission of crisis, the literature was still unable to provide conclusive results regarding the determinants of crisis severity across transition countries. A common weakness of empirical studies investigating the impact of the GFC has been argued to be the employment of inappropriate variables to measure the impact of the GFC and the definition of a 'crisis'. The most commonly used measures have been based on a binary definition of the presence of a crisis during a certain year/country or the difference between forecasted and actual GDP growth. It was argued in section 3.6 that the former might not be the most appropriate measure, given that if using binary definition of crisis presence, the classification of the crisis presence in a certain year/country would be subjective. Such variables do not provide a measure of the intensity of the crisis and do not take into account the situations that do not completely fit into a full-scale crisis, even though they might have a certain level of macroeconomic impact. Likewise, using the difference between forecasted and actual GDP growth might lead to distorted results, given that forecasts for GDP growth for 2009 were made during 2008 when the crisis was already present in most of these countries, in which case the forecasted GDP growths for 2009 might have already taken into consideration the effect of crisis. In addition, previous studies have generally not reported diagnostic tests regarding model specification. Furthermore, these studies have generally neglected to address the degree of integration with the EU, bank ownership and, in particular, the level of euroisation and size of foreign credit flows, albeit they are each a common characteristic of ETEs.

Given the severity of the GFC and its impact on ETEs, it is important for policy makers in these countries to understand the international channels of transmission of the crisis in order to reduce their vulnerability to future negative global shocks. Therefore, in an attempt to address research questions 2 and 3, the international transmission of shocks was investigated empirically in chapter 4 and 5. In order to investigate the interdependencies among countries and to understand how shocks were transmitted internationally, a model that accounted for these interdependencies and looked at them from a global perspective was needed. Consequently, Chapter 4 presented analysis of the international transmission of GFC in a global context. More specifically, by employing the recently developed global vector auto-regression (GVAR), Chapter 4 investigated the transmission of the GFC and propagation mechanisms to ETEs. Two samples were employed over the period 2003Q1-2014Q4 and 1999Q1-2014Q4. The first sample encompassed 32 countries (17 ETEs and 15 advanced EU countries) and the second sample encompassed 30 countries (15 ETEs and 15 advanced EU countries).

The methodology proceeded through four stages. First, the variables that entered each country model were selected and the VAR model was extended with the addition of a set of country-specific foreign variables. Guided by the underlying theory presented in Chapters 2 and 3, two types of variables were used to capture the main channels of international financial contagion: trade and financial. The variable used to capture the trade channel was exports. Following the literature on the transmission of the GFC, the following variables were used to capture the effect of transmission of crisis through the financial channel: foreign direct investment inward flows; foreign credit flows; credit flows in foreign currencies; and remittances. In the second stage, the weights for constructing the country-specific foreign variables were computed. Considering the importance of trade and financial linkages between ETEs and European advanced countries highlighted in section 1.2, both trade and financial (FDI and remittances) weights were computed and considered for the estimations. In the third stage, each variable in the model was tested for stationarity and the VECM was specified for each country. Subsequently, different diagnostic tests were checked and the global VAR was solved.

The results suggested that, while trade appeared to be the strongest linkage between EU15 and ETEs, the shocks were propagated by both trade and financial channels. While the estimated spillovers from the GDP and financial shocks in the EU to ETEs were all negative, there were considerable heterogeneities across regions. The Baltic countries displayed the most severe and statistically significant impact from the GDP and financial shocks in the EU15 on their own GDP. The shocks appeared to be transmitted to this region mainly through foreign credit flows, FDI and remittances, suggesting that the financial channel, particularly foreign credit flows, played a major role in the transmission of the shocks to these countries. The Balkan transition countries also displayed a severe impact from the shock to the EU15 GDP. The shock in this region was mainly propagated through exports, FDI and foreign credit flows. However, the region did not appear to be affected by a financial shock in the EU15, possibly due to the relative lack of development of their financial sectors, which in general have not been significantly affected by risky and unsafe financial instruments. The other CE transition countries were less severely affected by the GDP and financial shocks in the EU15, possibly because they represent more advanced transition countries. In general, the institutional characteristics that may help to shape the impact of external shocks are related to the quality of institutions, progress with transition to a market economy and the quality of government policy making. The shock in this region was mainly propagated through the exports channel, probably due to stronger trade linkages with the EU15. In addition, through general forecast error variance decomposition, it was observed that the variables of the EU15 can explain most of the shock on other regions' GDPs, confirming the importance of linkages between the EU15 and ETEs in the transmission of shocks.

The baseline analysis was followed by robustness checks, which in general confirm the results of the baseline model for the core variables representing the main transmission channels: exports; FDI; foreign credit flows; and GDP. The chapter proceeded to analyse the transmission of shocks in various subsamples, which were defined by various country characteristics: degree of euroisation, EU membership and level of openness. The results suggested that the impact of the shock is larger and statistically more significant on the GDPs of highly euroised countries. This finding is in line with the expectations derived from the theoretical review in Chapter 2, which highlighted various costs associated with euoisation that may become more visible during periods of severe financial crisis, such as: inability/ineffectiveness to act as a lender of last resort; adverse currency mismatches and reduction in monetary policy autonomy/effectiveness. Together these factors can increase the vulnerability of the banking system, increase interest spreads and reduce credit supply (Honohan and Shi, 2002; Winkler, et al., 2004; Click, 2007; Honohan, 2007; Chitu, 2013).

The importance of the trade channel in the transmission of the GFC to ETEs was confirmed by a subsequent investigation of sub-samples defined by the level of country openness. The findings suggested that the impact of the shock was larger on the GDPs of the more open economies compared to the less open economies. When it comes to EU membership, it was observed that the impact of the shock in EU GDP is larger on all the variables of the non-EU transition countries compared to the EU transition countries, which suggested the advantages of EU-induced institutional development. In general, the institutional characteristics that may shape the impact of external shocks are related to the quality of developed institutions, progress with transition to a market economy and the quality of government policy-making. Therefore, it seemed that these countries were more able to offset crisis effects and thus contributed to the resilience of the region. This contrast with the Balkan countries, where there may have been some advantages of a lack of financial development, may suggest that while institutional development with respect to governance, including the capacity for monetary and fiscal policy/stabilization, and well-functioning markets are unambiguously positive, from the perspective of adjusting to external shocks financial development may bring both benefits and costs.

Even though the GVAR model is very effective in dealing with interdependencies and international co-movements of business cycles, the use of macro data has often been argued to have some drawbacks when investigating the international transmission of crises. In particular, aggregate proxies for trade and financial links are often correlated and it is difficult to quantify the specific channels. For instance, firms' performance can be worsened by both a decline in exports and a reversal of capital flows. Furthermore, macro data often do not account for all the underlying channels of transmission of crises, such as consumption and investment behaviour. On the other hand, using firm-level data allows the different exposures of firms to the GFC to be distinguished (e.g. firms that were more exposed to exports and those firms that were more dependent on external financing). Therefore, in Chapter 5, the investigation of the international transmission of the GFC to ETEs was complemented by an additional analysis employing firm-level data. The use of both approaches helped overcome weaknesses that this thesis would face if only one approach were to be used.

The firm-level analysis investigated whether their pre-crisis position (from 2007) had an impact on firms' sales during the GFC. The measure of sales growth from 2008 to 2009 was used to proxy the impact of the GFC on firms. A Cobb-Douglas production function augmented with additional variables of interest was employed to estimate the determinants of changes in sales that were not explained by changes in inputs. The data was obtained from the World Bank's *Financial Crisis Survey* conducted in 2010 and the World Bank/EBRD's *Business Environment and Enterprise Performance Survey* (BEEPS) conducted in 2009. The study covered six countries of the Europe and Central Asia region (Bulgaria, Hungary, Latvia, Lithuania, Romania and Kazakhstan). The data from the BEEPS survey of 2009 mostly refers to the fiscal year 2007, which suited this investigation as these data were used to account for the pre-crisis conditions. Accordingly, the variables that were employed to measure the severity of the crisis across these six countries were obtained from the *Financial Crisis Survey* 2010, while the variables that account for the pre-crisis conditions as well as general information about the firms were obtained from the BEEPS 2009. Data from the two surveys was linked together through the common firm ID. This study's intention was to distinguish between the two main channels of transmission as suggested by theory and confirmed by the analysis presented in Chapter 4, namely the trade and financial channels. In order to do that, the following approach was pursued. If the trade channel was important in the severity of the crisis's impact on firms, it would be expected that exporting firms would have been more affected by the GFC. Consequently, a dummy variable for those firms who exported was employed to capture the trade channel. In terms of the financial channel, several indicators were employed to capture its importance. Namely, if the financial channel was important, this would be partly reflected in firms that relied more on external finances for working capital being more affected by the GFC; hence, the variable share of working capital financed by banks was employed to account for this channel. In addition, following the literature review presented in section 2.3 and based on the results from the previous empirical chapter, it was expected that firms with a larger share of foreign currency loans would have been more severely affected by the GFC. Therefore, the variable share of firm's foreign currency loans in total loans was employed. Finally, given the potential importance of the FDI channel in the transmission of the GFC discussed in Chapter 2, this study also investigated whether the share of foreign ownership affected firms' performance during the crisis. In addition, a number of control variables were employed to account for various aspects of sales change during the GFC: the years of top managers' experiences were used as a proxy for the otherwise unobserved top manager's ability. A variable firm age was employed to account for the years of experience of the firms and to investigate whether older or newer firms performed better during the crisis. A variable subsidies was used to investigate whether the firms that received subsidies in the previous three years had better performance during the GFC. The level of innovativeness of the firms was also included as a control variable, which was proxied by a dummy variable for whether the firm had introduced any new products during the last three years. Political instability was captured by a dummy that showed whether or not a firm considered political instability as a main obstacle to its operations. The categorical variables industry and firm size were employed to investigate whether particular industries and firm sizes were more severely affected by the crisis. Finally, country dummies were employed to account for possible heterogeneity of the crisis impact across countries. The model was estimated by OLS. Particular attention was paid to diagnostic tests to ensure the model is statistically well specified and thus produces valid estimates.

One of the most important findings in this study was related to the effect of the financial channel on the transmission of the GFC to ETEs. The robust negative relationship between the growth rate of sales and financial variables in all of the estimated models suggested that the financial channel had played a major role in determining firms' performance during the GFC. An important transmission mechanism previously identified in the literature has been the global restriction of credit. This was confirmed by this study, as the results from all the models suggested that the firms who appeared to have been more significantly affected by the crisis were those firms who before the crisis were more dependent on banks to finance their working capital. The degree of foreign bank ownership also appeared to be a significant channel of transmission of crisis. The results of this study suggested that firms which operated in countries with a higher degree of foreign bank ownership, in particular firms that were more dependent on banks to finance their working capital, had worse performance during the GFC. As argued in Chapter 2, it is well known that a higher level of foreign bank presence may expose a country to foreign shocks and can tighten liquidity conditions during a crisis, as parent banks reallocate capital across borders and therefore capital may be withdrawn from the transition country when it is needed in the bank's home country (Cetorelli and Goldberg, 2011). In addition, the literature review in Chapter 3 showed that foreign bank subsidiaries in emerging Europe typically reduced lending earlier and faster than did domestic banks.

The incidence of foreign currency loans appeared to be highly significant, both at firm-level and country-level, in all the model specifications, which suggested that firms more exposed to loans in foreign currencies and firms that operated in countries with higher levels of foreign currency loans were more severely affected by the GFC. As argued in Chapter 2, during the GFC, the depreciation of the domestic currencies prevented some unhedged borrowers from servicing their loans in foreign currencies. Further investigation revealed that firms more exposed to loans in foreign currencies operating in countries whose currencies depreciated during 2009 had been more severely affected by the crisis.

Another finding of this study suggests that the ownership structure of the firm was also important in weathering the GFC. A positive relationship was found between the level of foreign ownership and sales growth during the GFC, which suggested that, ceteris paribus, the foreign-owned firms have been less severely affected by the crisis. Results for most of the control variables appeared to be statistically significant and their signs were in accordance with theoretical predictions and previous empirical findings. The relationship between the top manager's experience and the growth rate of sales was positive and significant at the 5% level. The level of innovativeness of the firms appeared to be statistically significant as well. Firms that had not introduced new products in the previous 3 years (prior to 2007) experienced more decline in their growth rate of sales than those that had introduced new products. The dummy variable *politicalinstability* was also significant at the 5% level and had a negative relationship with the growth rate of sales. Firms that perceived political instability to be a main obstacle to their operations in 2007 had a more severe decline in the growth rate of sales in 2009 than firms that did not.

Finally, no significant relationship was found between the dummy variable exports and firms' sales. However, this does not suggest that the trade did not serve as a transmission channel for the GFC for these six countries that participated in this study, it simply suggests that exporting firms have not been affected by the crisis significantly different than non-exporting firms. Moreover, previous empirical studies have documented the superior performance of exporting firms compared to non-exporting firms, which would suggest that exporting firms are more capable of adjusting to difficult circumstances and more flexible when it comes to reallocating output to a different market. Further investigation revealed evidence suggesting that exporting firms that had been able to reallocate a higher proportion of their sales to their domestic market were less severely affected by the crisis. In addition, findings suggested that exporting firms had a higher rate of capacity utilization compared to non-exporting firms during the GFC.

In the light of all the evidence presented in this thesis, both trade and financial channels appear to have mattered in the transmission of GFC to ETEs. Nevertheless, the major finding of this thesis is the greater importance of the financial channel in transmission of the GFC to these countries, which was confirmed by both the macro and micro-level studies. The overall size of the coefficients of financial variables and their level of statistical significance reinforces the general finding in the literature that the financial channel does matter when accounting for the transmission of the GFC and its inclusion in models for transition economies is crucial. The results from the macro-level study suggested that foreign credit flows were one of the main channels of the transmission of shocks from the EU15 to ETEs, particularly to countries with a higher degree of foreign bank ownership. Foreign bank ownership was also found to be a significant channel for the transmission of the crisis in the micro-level analysis. The results of the micro-level study suggested that firms which operated in countries with a higher degree of foreign bank ownership, in particular firms that were more dependent on banks to finance their working capital, had worse performance during the GFC. The degree of euroisation appeared as a significant amplification mechanism of the GFC in both empirical studies.

Finally, the results from the macro-level study suggest that exports were a significant channel for the transmission of the crisis, though the exporting term appeared to be insignificant in the firm-level analysis. However, this latter finding does not suggest that trade did not serve as a transmission channel of the GFC, but that there were also other channels affecting the non-exporting firms, particularly the financial channel. In addition, the non-significance of the exporting term most probably also reflects the cross-sectional nature of the data and corresponding estimation from between-firm variation only, which enabled a better examination of the relative performance of exporting and non-exporting firms than the performance of exporting firms as such. Secondly, although there was a trade channel, the exporting firms were able to cope with the crisis better than non-exporting firms due to their overall superior performance. So exports, or more precisely, exporting firms constituted a transmission channel of the GFC. Yet, exporting firms were also more able to offset crisis effects and thus contribute to the resilience of ETEs.

6.3 Contributions to knowledge

In spite of a large number of studies on the international transmission of crises, research is still unable to quantify the determinants of crisis severity across countries. On the one hand, the vast majority of research studies investigating the international transmission of crisis to ETEs at macro level have generally neglected factors such as the degree of euroisation, integration with the EU, remittances, bank ownership and foreign credit flows. On the other hand, there is still a lack of empirical evidence at firm-level. This thesis contributed to knowledge in this area by investigating the impact of the GFC on ETEs at both the macro and micro level. In analysing the transmission of the GFC to these countries and the nature and severity of the spillovers, both trade and financial channels were examined. Particular emphasis was placed on exports, the degree of euroisation, integration with the EU, FDI, remittances, bank ownership and foreign credit flows at either macro level, micro level or both.

This thesis contributes to the literature on the transmission of the GFC to ETEs by being, to the best of our knowledge, the first study that comprehensively investigates the international transmission of shocks from European advanced countries to ETEs using a model that looks at interdependencies among these countries. The thesis explores two main channels of international transmission of shocks, trade and financial, and finds evidence of the importance of both of these channels in the transmission of shocks to ETEs. An additional contribution of this thesis is the investigation of the influence of the degree of euroisation on the crisis severity across transition countries, considering that the previous empirical research on ETEs has neglected this impact. This thesis addressed this gap and confirmed the negative impact of the degree of euroisation on the severity of the impact of the crisis at both, macro and micro level. Furthermore, this thesis explored the importance of foreign credit flows and found evidence that they served as a channel of propagation of crisis, particularly in countries with higher share of foreign bank ownership. A negative impact of the foreign bank ownership on the severity of the crisis across transition countries was also found in the second empirical analysis.

The second empirical analysis contributes to the empirical literature on transmission of the GFC by being, to the best of our knowledge, the first analysis to comprehensively investigate the firm-level determinants of the severity of the GFC and by introducing new variables that have affected the firms' performance during the crisis in 6 transition countries. It investigated whether the initial conditions from 2007 had an impact on the firms' sales during the GFC in 2009 and found evidence of the importance of the financial channel in transmission of the GFC to ETEs: a higher share of working capital financed by banks, a higher share of foreign currency loans and a higher share of foreign bank ownership each increased the impact of the GFC on the firms operating in these countries. With regards to the exports channel, it was found that both exporting and non-exporting firms operating in the countries covered in this study were significantly affected by the crisis. This finding suggests that, although there is a trade channel, the exporting firms were able to cope with the crisis better than non-exporting firms due to their overall superior performance and consequently contribute to the resilience of transitional economies. The cross-sectional nature of the data enabled a better examination of the relative performance of exporting and non-exporting firms than the performance of exporting firms as such.

In terms of modelling framework, the thesis conducted extensive research for the most appropriate empirical approaches to investigate the interdependencies among countries and to understand how shocks are transmitted internationally. Given that we needed a model accounting for these interdependencies and examining them from a global perspective, in this thesis the GVAR modelling approach was used. This modelling framework allows for interdependencies at international level and for long-run and short-run relationships consistent with the theory and data, and provides a coherent and theory-consistent solution to the "curse of dimensionality" in global modelling (Smith and Galessi, 2011). By using GVAR, the limited and quite recent body of literature that uses this modelling framework is extended in several key aspects. Firstly, to the best of our knowledge, this is the first study that uses the GVAR to model the transmission of financial shocks to ETEs. Secondly, this study uses bilateral remittance flows to construct the weights needed for computing the foreign-country specific variables, which, to the best of our knowledge, represents an original contribution to the GVAR modelling framework. Thirdly, this method is applied to deal with country heterogeneity by dividing the countries in sub-samples based on several country characteristics (the level of country openness, the degree of euroisation and EU membership). Last but not least, unlike several other GVAR studies investigating the international transmission of shocks, the model specifications follow the arguments suggested by the literature on financial contagion and international transmission of the GFC to ETEs.

6.4 Policy implications

This thesis has investigated the international transmission of the GFC to ETEs. The findings have several policy implications for ETEs seeking to reduce their vulnerability to future negative global shocks.

The major finding of this thesis is the importance of the financial channel in the transmission of the GFC to ETEs. First, this thesis showed that foreign credit flows in ETEs have increased dramatically since 2000s, which resulted in a credit boom in the transition region that boosted investment and output growth, but also led to large external imbalances financed by cross-border capital flows. As shown in section 1.2, during the GFC and the subsequent eurozone debt crisis, cross-border bank flows declined sharply in the region, contracting by an average of 13% by the first quarter of 2009. The results from the macro-level study suggested that the foreign credit flows were one of the main channels of the transmission of shocks from the EU15 to ETEs, particularly to the Baltic and Balkan countries. Second, an important transmission mechanism previously identified in the literature has been the global restriction of credit. This was confirmed by the micro-level study, as the results from the estimated models suggested that those firms that depended more on banks to finance their working capital before the crisis appeared to have been more significantly affected by the crisis. Third, the level of foreign bank ownership also appears to have been a significant channel of transmission of crisis. Section 1.2 showed the dominance of foreign bank ownership in ETEs. The results of the micro-level study suggested that firms which operated in countries with a higher degree of foreign bank ownership, in particular firms that were more dependent on banks to finance their working capital, had worse performance during the GFC. Fourth, this thesis has shown that a high degree of euroisation is a common characteristic of ETEs. Section 1.2 showed that high levels of credit euroisation (the share of foreign currency loans in total loans) and deposit euroisation (the share of foreign currency deposits in total deposits) are prevalent in all transition countries, particularly in SEE countries. Further, section 2.3 highlighted the main costs associated with euroisation and argued that these might become more evident during periods of severe financial crisis. The findings from the macro-level study in Chapter 4 suggested that the impact of the shocks was larger and statistically more significant on the GDPs of highly euroised countries.

Additionally, the incidence of foreign currency loans appeared to be highly significant, both at firm-level and country-level in all the model specifications in the micro-level study, which suggested that firms more exposed to loans in foreign currencies and firms operating in countries with higher shares of foreign currency loans as well as firms operating in countries that experienced currency depreciation during 2009 were more severely affected by the GFC.

The recent financial crisis reflected weaknesses in previous economic policies at both national and supra-national level. There is still much to be done regarding the policy and reform agenda. Given the importance of financial development in terms of economic growth in ETEs, policymakers in these countries are faced with additional challenges to reform their financial system in order to mitigate the risk of international transmission of global shocks through the financial channel in the future. They have to be cautious of the impact of such reforms and policies on exchange rates and the wider financial sector development. The thesis has shown that international financial flows can grow very rapidly and then suddenly reverse, having a potential severe impact on economic activity in these countries. Policymakers in transition countries are still faced with the challenge of handling surges in cross-border bank flows in order to make these countries less vulnerable to future negative global shocks. In the aftermath of the GFC, capital controls have been receiving increasing attention as a tool to manage the surge in financial flows. Of course, given the importance of the cross-border financial flows to ETEs, the potential benefits of capital controls should be assessed against their costs before introducing/strengthening them. In addition to capital controls, macroprudential policies such as additional capital requirements and limits on foreign exchange lending to unhedged borrowers should be used to manage the volume, maturity and currency composition of cross-border bank flows. Besides policies at national level, additional collective policies at supra-national level and their implications for global liquidity, leverage, and exposures, and the appropriateness of joint money and credit policies from the point of view of financial stability should also be considered carefully. For example, during the GFC the Vienna Initiative helped to ensure that an immediate large-scale withdrawal of foreign banks from the ETEs did not occur, thus it stabilised lending temporarily by the 17 banks that signed commitment letters.

Finally, greater reliance on local savings would make these countries less vulnerable to future negative global shocks and subsequent reversals of cross-border bank flows. One approach to incentivize local savings would be through increasing interest rates and/or reducing tax on interest income. Moreover, deposit insurance schemes could be introduced and/or strengthened to protect depositors from loss in case of closure of a bank. Additionally, given the prevalence of high levels of euroisation in ETEs, policymakers should undertake actions to reduce the degree of euroisation in these countries. Most importantly, given that, as discussed in section 2.3, euroization weakens central bank's ability to act as a lender of last resort and reduces monetary policy's autonomy/effectiveness, substituting foreign currency lending with the local currency lending, particularly to unhedged borrowers, would make these countries less vulnerable to sudden exchange rate depreciations. Again, this thesis suggests using/strengthening macroprudential policy instruments (i.e. limits on net open currency position; caps on foreign currency lending; limits on foreign currency lending etc.) as a tool to reduce the levels of euroization in ETEs.

Lastly, policymakers in ETEs should carefully consider the financial implications of any further increases in the market share of foreign banks. Of course, given the importance of the foreign banks financial flows to ETEs, the potential benefits of capital controls should be assessed against their costs before As argued in Chapter 2, it is well known that a higher level of foreign bank presence may increase the exposure of a country to foreign shocks and can tighten liquidity conditions during a crisis, as parent banks reallocate capital across borders and therefore capital may be withdrawn from the transition country when it is needed in the bank's home country.

Taking this into consideration, and given the significance of the empirical results related to foreign bank ownership and firms' dependence on banks to finance their working capital presented in Chapter 5, enhanced supervisory and regulatory frameworks are required to reduce the vulnerability of banking sector in transition countries to future negative global shocks. One approach would be to introduce the countercyclical capital buffer which requires banks to add capital at times when credit is growing rapidly so that the buffer can be reduced when the financial cycle turns and it could protect the banking sector against losses that could be caused by cyclical systemic risks. In combination with other measures, these regulations are likely to help produce a more stable financial system. In turn, greater financial stability will help produce steady economic growth, with less risk for crisis fuelled recessions such as the GFC.

The somewhat mixed evidence on the importance of the trade channel in the transmission of the GFC makes it trickier to suggest related policy interventions. On the one hand, the results from the macro-level study suggested that trade is the strongest linkage between EU15 and ETEs and, in line with theoretical expectations, the results suggested that trade served as a channel of international transmission of GDP and financial shocks, particularly in countries with stronger trade linkages with the EU15. The importance of the trade channel in the transmission of the GFC to ETEs was confirmed by a subsequent investigation is sub-samples defined by the level of country openness (exports to GDP ratio). The findings suggested that the impact of the shocks was larger on the GDPs of the more open economies compared to the less open economies.

On the other hand, the findings of the micro-level study provided contrary evidence which suggested that exporting and non-exporting firms were affected similarly by the GFC. It has been argued that exporting firms have an overall superior performance compared to non-exporting firms, which was further confirmed in the micro-level study with interaction terms. The results suggested that exporting-firms were able to reallocate a higher proportion of their sales to domestic markets were less severely affected by the crisis, which implies that exporting firms are more capable of adjusting to difficult circumstances and more flexible when it comes to reallocating output to a different market. In addition, findings suggested that exporting firms had a higher rate of capacity utilization compared to non-exporting firms during the GFC. So, even though exports constituted an international transmission channel of the GFC, exporting firms were more able to offset crisis effects and thus contribute to the resilience of ETEs. Therefore, assuming that ETEs will most probably continue relying on an increase in exports as a major source of growth, policy measures will be necessary to sustain export growth. A survey of the literature on successful measures for promoting exports in developing countries is provided by Belloc and Di Maio (2012). The authors highlight the following measures: creating a more favourable environment for exporters by stimulating institutional development, reducing corruption and improving the rule of law and customs procedures; entering into regional trade agreements; encouraging strategic collaboration between private and public actors and cooperation among producers, exporters and the policy makers; incentivizing innovation; and promoting the country in foreign markets.

This thesis has showed that ETEs have strong trade ties with the EU15, which makes these countries more vulnerable to the future negative shocks in the EU15. Taking this into consideration and given the growing consensus on the role of export diversification as a mechanism for protection against crises and shocks (Karahan, 2017), policymakers in these countries should consider promoting export diversification through negotiations for a favourable international environment and by lowering non-tariff trade barriers (e.g. quotas, embargoes, sanctions, customs delays, technical barriers, voluntary export restraints etc.) that impede new export markets.

6.5 Limitations and recommendations for future research

The limitations of this thesis are mainly related to the length, the frequency and the quality of the data available. Due to the lack of quarterly data for earlier years, this thesis used data from 1999Q1-2014Q4. The relatively small number of observations and large number of variables included in the baseline model reduced the degrees of freedom available to estimate the parameters', which might have led to statistical insignificance or borderline significance of the impulse response functions in some cases. Nevertheless, it was shown that the statistical significance of the impulse responses of the main variables did not change significantly when the number of variables in the model was reduced. Yet, GVAR is known for providing more efficient estimates when using longer time series and higher frequency data. In addition, as explained in section 4.4, data for several variables and countries were not available on quarterly basis for some of the earlier years, therefore, the cubic spline interpolation was used to convert annual data into quarterly data in these cases. As noted in section 4.4, this technique can only provide estimates of data between know data points, it cannot create new "unknown" data. Enriching the dataset in the years to come most probably could produce more efficient estimates with less statistical problems. In addition, as more years of data become available and countries continue to recover from the recent Eurozone debt crisis, more investigation will provide further insights into the channels of transmission of shocks to ETEs, as well as the effect of policy responses and other factors on the duration of recessions and the speed and shape of recovery.

Another important limitation of the investigation presented in Chapter 4 is related to the period under analysis, which includes the GFC. The implicit assumption in the GVAR analysis is that there are no structural breaks. However, the results of the tests suggested that there was structural instability, but it seemed to be present mainly in the error variances. GVAR is a relatively new empirical application and it relies mostly on user-written codes. The code used in this thesis, while fairly comprehensive, still does not have the ability to model intercept and/or trend breaks to account for the otherwise un-modelled impact of the GFC. Therefore, a conservative approach to inference was adopted using bootstrap medians and confidence intervals when interpreting the impulse responses. This was argued to account for structural instability in the error variances. If, however, this approach was unable to fully address the issue of structural instability, then the use of the GVAR would not be entirely appropriate, and consequently the validity of the results would be impaired. Although the ability to overcome this problem is currently limited, this opens up opportunities for future research.

The analysis presented in Chapter 5 is also subject to a couple of limitations. The first limitation relates to the lack of data for capital growth from 2008 to 2009 and the consequent inclusion in the model of capital purchased in 2007. However, it was not expected that firms purchased significant amounts of capital during a period of tightened liquidity conditions and, even when excluding the variable capital altogether from the model, the results did not change, especially those concerning the variables of interest. The second limitation relates to the lack of data available for capacity utilization for 2007 when this variable was employed as a dependent variable to run a robustness check. Section 5.5 pointed out that the results of that model should be considered with caution due to data limitations (the capacity utilization data for 2007 were available only for a very small number of firms). It was not possible to calculate the growth rate of the capacity utilization from 2007 to 2009, therefore only the 2009 value was used. Another limitation of the data analysed in Chapter 5 is its cross sectional nature, which can only reflect between-firm differences. This might have resulted in the non-significance of the exporting term, suggesting that exporting firms have not been affected by the crisis more severely than non-exporting firms. Cross-section data allowed for a better examination of the relative performance of exporting and non-exporting firms than the performance of exporting firms as such. However, within-firm variation over time might have revealed the impact of the GFC on exporting firms. It should be noted that BEEPS has recently introduced a panel dataset and even though it was initially considered to be used in this thesis, it was later deemed as unsuitable for the analysis of the transmission of the GFC, since only a small fraction of firms were included in it and even a smaller fraction of those firms were included in the Financial Crisis Survey. Therefore, a panel covering a longer time span would be worth assessing in the future to provide insights into the impact of the GFC on exporting firms as well as the factors that affected the firms' speed of recovery from the GFC.

Finally, this thesis focused on the transmission of the GFC, which was a unique crisis and we are uncertain how general these findings are to the other crises. Nevertheless, the research programme reported in this thesis has shown the importance of the financial channel in the transmission of the GFC to ETEs, which was confirmed by both the macro and micro-level studies. The results presented in this thesis reinforce a general finding in the literature that the financial channel does matter when accounting for the international transmission of shocks and its inclusion in models for transition economies is crucial. In regard to the trade channel, this thesis has shown that while exports constituted a transmission channel of the GFC, exporting firms were also more able to offset the crisis effects and thus contribute to the resilience of ETEs.

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Appendix to Chapter 4

Table A4.6 Unit root tests for the domestic variables at 5% significance level

Note: The results at the 5% significance level suggest that the majority of the variables are unable to reject the null of non-stationarity. WS statistics are weighted symmetric estimations of ADF type regressions introduced by Park and Fuller (1995).

Domestic Variables	Statistic	Critical Value	ALBANIA	BOSNIA	BULGARIA	CROATIA	CZECK REPUBLIC	ESTONIA	EURO	HUNGARY	KOSOVO	LATVIA	LITHUANIA	MACEDONIA	MONTENEGRO	POLAND	ROMANIA	SERBIA	SLOVAK REPUBLIC	SLOVENIA
gdp (with trend)	ADF	-3.45	-0.93	-0.88	-1.75	-1.90	-2.12	-1.88	-2.21	-2.46	-2.66	-2.22	-2.04	-4.23	-0.85	-0.89	-2.04	-1.20	-4.28	-2.35
gdp (with trend)	WS	-3.24	-1.03	-1.29	-0.58	-0.67	-1.38	-1.60	-1.62	-1.54	-1.81	-1.80	-1.65	-4.36	-1.22	-0.72	-1.42	-0.21	-4.20	-1.95
gdp (no trend)	ADF	-2.89	-2.17	-1.60	-3.22	-1.98	-2.60	-1.82	-2.15	-2.49	0.24	-2.28	-1.99	-1.24	-1.74	-2.02	-1.98	-3.13	-1.92	-2.60
gdp (no trend)	WS	-2.55	0.77	0.48	1.04	-0.57	0.01	-0.51	0.00	-0.73	0.75	-1.06	-0.06	-0.03	0.45	1.43	0.41	1.02	-0.77	-1.24
Dgdp	ADF	-2.89	-6.27	-6.05	-3.25	-2.90	-2.65	-2.70	-2.72	-3.47	-7.02	-2.19	-3.18	-7.59	-5.91	-3.52	-3.86	-4.29	-12.50	-2.86
Dgdp	WS	-2.55	-6.50	-6.29	-3.50	-3.07	-2.88	-2.91	-2.98	-3.62	-7.30	-2.38	-3.38	-7.90	-6.15	-3.35	-4.06	-4.55	-12.82	-3.12
DDgdp	ADF	-2.89	-7.84	-7.84	-8.30	-6.17	-5.80	-8.15	-6.01	-6.74	-7.84	-6.75	-7.33	-7.38	-7.84	-10.07	-6.59	-10.38	-10.96	-5.32
DDgdp	WS	-2.55	-8.18	-8.18	-8.61	-6.46	-6.09	-8.48	-5.94	-7.06	-8.18	-7.04	-7.65	-7.71	-8.18	-9.99	-6.83	-10.75	-11.32	-5.57
exp (with trend)	ADF	-3.45	-3.32		-3.14	-1.86	-2.23	-1.98	-2.55	-1.84	-1.58	-2.27	-2.76	-2.44	-3.98	-2.47	-3.54	-2.04	-2.17	-2.67
exp (with trend)	WS	-3.24	-3.37		-3.39	-1.82	-1.88	-2.00	-2.47	-0.85	-1.40	-2.44	-3.03	-1.54	-4.25	-0.75	-3.07	-2.42	-2.30	-2.16
exp (no trend)	ADF	-2.89	-0.98		-1.37	-1.90	-1.98	-1.74	-2.14	-2.73	-2.05	-0.43	-1.28	-1.90	-2.46	-2.55	-1.36	-1.41	-1.44	-2.45
exp (no trend)	WS	-2.55	-0.52		-0.78	-1.81	0.48	-0.44	-0.70	0.71	0.24	0.79	-0.22	0.82	-2.33	1.16	0.98	-0.67	0.04	-0.35
Dexp	ADF	-2.89	-5.56		-6.62	-5.67	-4.19	-3.53	-3.99	-2.94	-5.49	-5.64	-5.45	-5.25	-11.36	-4.56	-5.84	-4.34	-3.92	-3.79
Dexp	WS	-2.55	-5.79		-6.92	-6.04	-4.45	-3.77	-4.23	-3.00	-5.72	-5.88	-5.66	-5.51	-10.26	-3.53	-5.69	-4.17	-4.12	-4.05
DDexp	ADF	-2.89	-8.72		-10.96	-9.29	-7.01	-7.31	-7.49	-6.09	-8.13	-9.33	-8.09	-11.18	-10.76	-6.81	-8.29	-7.41	-7.00	-5.82
DDexp	WS	-2.55	-9.00		-11.31	-8.69	-7.28	-7.61	-7.59	-6.28	-8.48	-9.70	-8.19	-11.61	-10.02	-7.09	-8.37	-7.72	-7.20	-6.07
FDI (with trend)	ADF	-3.45	-1.99	-1.45	-1.48	-1.48	-2.32	-3.25	-1.54	-3.32		-1.27	-2.03	-6.12	-4.62	-2.21	-1.56	-4.45	-0.16	-0.95
FDI (with trend)	WS	-3.24	-2.15	-0.23	0.27	-0.85	0.69	-0.62	-1.74	-1.77		-1.41	-1.71	1.84	1.25	-0.06	-0.62	1.57	-0.23	-1.25
FDI (no trend)	ADF	-2.89	-1.90	-3.43	-4.19	-2.27	-4.92	-3.21	-1.64	-3.39		-1.48	-2.16	-6.05	-5.96	-3.26	-3.35	-5.83	-3.16	-1.63
FDI (no trend)	WS	-2.55	-1.15	1.01	1.35	-0.02	1.75	1.05	0.78	-0.44		0.70	-0.34	2.74	2.32	1.50	0.43	2.69	0.36	-0.10
DFDI	ADF	-2.89	-6.65	-2.99	-2.96	-2.35	-3.32	-3.56	-4.39	-5.25		-2.90	-3.46	-4.08	-6.36	-4.11	-2.85	-6.30	-2.36	-3.22
DFDI	WS	-2.55	-6.91	-3.16	-2.52	-2.62	-2.57	-2.89	-4.65	-5.52		-3.16	-3.65	1.79	3.79	-3.66	-3.11	3.75	-2.60	-3.48
DDFDI	ADF	-2.89	-10.07	-7.12	-9.24	-5.98	-8.72	-5.52	-8.79	-7.91		-6.44	-5.52	-5.31	-7.15	-7.77	-7.91	-6.92	-6.89	-6.80
DDFDI	WS	-2.55	-10.45	-7.44	-9.37	-6.24	-9.08	-5.73	-9.16	-7.84		-6.68	-5.79	-5.14	-0.44	-8.07	-8.21	-0.08	-7.12	-7.08
rem (with trend)	ADF	-3.45	-3.33	-2.79	-5.40		-2.10	-3.02	-2.39	-4.09	-3.75	-1.93	-2.44	-1.47	-1.95	-4.34	-2.14		-2.25	-2.24
rem (with trend)	WS	-3.24	-3.57	-3.01	-5.66		-1.59	-1.95	-2.68	-1.33	-4.01	-1.72	-1.57	-1.86	-2.19	-2.56	-1.74		-2.36	-2.27
rem (no trend)	ADF	-2.89	-2.69	-2.76	-3.95		-2.47	-3.15	-2.30	-4.54	-3.11	-2.31	-2.79	-1.74	-1.33	-4.66	-2.26		-2.02	-0.90
rem (no trend)	WS	-2.55	-2.90	-3.01	-4.14		-0.66	-1.85	-1.70	-0.48	-3.26	-0.85	-0.23	-1.93	-1.30	-1.93	-1.68		-1.15	-1.14
Drem	ADF	-2.89	-6.38	-6.82	-11.36		-4.61	-5.17	-4.17	-4.65	-8.44	-4.62	-6.90	-5.53	-6.18	-5.70	-4.52		-6.07	-7.86
Drem	WS	-2.55	-6.66	-7.09	-11.70		-4.87	-5.43	-4.44	-4.92	-8.67	-4.86	-7.18	-5.71	-6.45	-5.65	-4.77		-6.36	-8.19
DDrem	ADF	-2.89	-8.90	-9.29	-12.40		-7.84	-6.52	-6.88	-7.84	-9.54	-7.84	-9.84	-8.18	-9.38	-8.07	-6.86		-9.20	-12.14
DDrem	WS	-2.55	-9.27	-9.61	-12.70		-8.19	-6.81	-7.19	-8.19	-9.92	-8.16	-10.24	-8.49	-9.76	-7.90	-7.16		-9.58	-12.61
fbo (with trend)	ADF	-3.45	-2.24	-1.41	-0.55	-2.94	-2.27	-2.72	-2.80	-4.00		-0.85	-3.71	-1.42		-2.02	-1.67	-3.01	-2.48	-2.14
fbo (with trend)	WS	-3.24	-1.50	-0.84	-0.87	-3.18	-2.21	-2.98	-2.80	-3.36		-1.00	-3.09	-1.71		-1.51	-1.82	-1.17	-2.70	-1.87
fbo (no trend)	ADF	-2.89	-2.64	-2.37	-0.76	-2.59	-2.42	-2.23	-2.49	-3.67		-1.60	-3.73	-1.73		-0.66	-1.82	-3.39	-1.85	-1.92
fbo (no trend)	WS	-2.55	-1.08	-0.54	-0.90	-2.79	-1.37	-2.43	-1.72	-2.24		-0.88	-2.79	-0.71		-1.16	-1.62	-0.26	-1.98	0.03
Dfbo	ADF	-2.89	-4.83	-4.61	-3.60	-4.31	-4.48	-4.40	-4.84	-4.93		-3.96	-5.03	-4.83		-3.89	-2.79	-4.97	-3.66	-4.48
Dfbo	WS	-2.55	-5.09	-4.87	-3.86	-4.57	-4.74	-4.67	-5.11	-5.20		-4.21	-5.30	-5.09		-4.15	-3.06	-5.23	-3.91	-4.73
DDfbo	ADF	-2.89	-8.08	-7.63	-7.73	-6.96	-7.42	-7.04	-7.62	-6.88		-7.71	-7.24	-7.81		-7.00	-5.61	-7.72	-6.30	-7.13
DDfbo	WS	-2.55	-8.42	-7.97	-8.07	-7.28	-7.75	-7.35	-7.95	-7.20		-8.05	-7.57	-8.16		-7.31	-5.90	-8.06	-6.60	-7.45

eur (with trend)	ADF	-3.45	-1.01	-0.99	-1.51	-1.18	-1.36	-1.77	-1.50	-3.02	-2.53	-1.86	-0.76	-3.12		-3.48	-1.13	-3.52	-1.78	-1.86
eur (with trend)	WS	-3.24	-1.43	-0.99	-1.66	-1.24	-1.64	-1.84	-1.65	-3.16	-0.94	-2.12	-1.04	-3.02		-3.34	-1.33	-3.72	-1.87	-2.19
eur (no trend)	ADF	-2.89	-1.51	-1.79	-1.39	-0.67	-1.90	-1.14	-0.24	-2.68	-2.53	0.16	-2.20	-2.16		-3.30	-0.93	-2.35	-0.90	-1.44
eur (no trend)	WS	-2.55	-0.63	-0.79	-1.77	-0.98	-1.12	-1.52	-0.52	-2.95	1.22	-0.04	-0.49	-2.45		-2.73	-0.92	-1.80	-0.88	-1.10
Deur	ADF	-2.89	-4.91	-4.47	-6.19	-4.03	-5.47	-4.84	-3.99	-4.56	-5.04	-5.50	-3.33	-7.52		-4.48	-4.13	-8.08	-4.60	-4.79
Deur	WS	-2.55	-5.17	-4.73	-6.49	-4.29	-5.57	-5.10	-4.25	-4.82	-5.09	-5.77	-3.54	-7.07		-4.74	-4.38	-8.41	-4.85	-5.05
DDeur	ADF	-2.89	-8.71	-8.59	-9.98	-6.35	-6.97	-7.84	-7.19	-7.71	-7.24	-7.59	-5.71	-11.08		-6.01	-8.95	-9.76	-8.07	-7.72
DDeur	WS	-2.55	-9.07	-8.95	-10.40	-6.62	-7.19	-8.18	-7.51	-8.05	-7.51	-7.92	-6.00	-10.08		-6.31	-9.32	-10.17	-8.42	-8.06
eu (with trend)	ADF	-3.45	-2.09	-2.88	-5.97	-4.65	-3.89	-3.47	-1.38	-4.14	-4.05	-3.88	-3.80	-2.66	-2.17	-1.72	-2.54	-2.80	-2.78	-3.73
eu (with trend)	WS	-3.24	-2.31	-3.13	-6.12	-4.89	-4.15	-3.70	-1.67	-4.47	-4.34	-3.84	-3.89	-2.93	-2.29	-2.05	-2.79	-3.02	-3.01	-3.68
eu (no trend)	ADF	-2.89	-2.08	-2.83	-5.90	-4.17	-3.95	-3.38	-1.48	-3.03	-4.11	-3.81	-3.68	-2.70	-1.79	-1.76	-2.36	-2.80	-2.59	-2.37
eu (no trend)	WS	-2.55	-2.36	-3.09	-6.09	-4.14	-4.18	-3.42	-1.82	-3.11	-4.36	-3.39	-3.86	-2.97	-2.11	-2.08	-2.45	-3.05	-2.63	-2.60
Deu	ADF	-2.89	-4.52	-4.03	-8.89	-9.51	-7.42	-7.19	-4.88	-9.47	-6.76	-4.89	-7.11	-6.09	-4.55	-5.41	-8.50	-5.90	-6.93	-7.06
Deu	WS	-2.55	-4.79	-4.27	-9.22	-7.42	-7.68	-7.23	-5.05	-9.77	-7.05	-5.00	-7.41	-6.32	-4.81	-5.07	-7.05	-5.31	-6.17	-7.28
DDeu	ADF	-2.89	-9.30	-5.96	-8.60	-12.48	-8.36	-8.66	-8.49	-9.80	-6.99	-6.85	-7.54	-7.57	-7.28	-7.11	-9.63	-9.23	-7.02	-7.01
DDeu	WS	-2.55	-9.66	-6.24	-8.66	-8.26	-8.37	-8.48	-8.74	-10.18	-7.15	-6.92	-7.87	-7.82	-7.59	-6.77	-8.47	-8.17	-7.23	-7.26

Table A4.7 Unit root tests for the foreign variables at 5% significance level

Note: The results at the 5% significance level suggest that the majority of the variables are unable to reject the null of non-stationarity. WS statistics are weighted symmetric estimations of ADF type regressions introduced by Park and Fuller (1995).

Foreign Variables	Statis.	Critical Value	ALBANIA	BOSNIA	BULGARIA	CROATIA	CZECK REPUBLIC	ESTONIA	EURO	HUNGARY	KOSOVO	LATVIA	LITHUANIA	MACEDONIA	MONTENEGRO	POLAND	ROMANIA	SERBIA	SLOVAK REPUBLIC	SLOVENIA
gdps (with trend)	ADF	-3.45	-2.31	-1.83	-2.30	-1.78	-2.15	-2.06	-2.21	-1.94	-2.43	-1.50	-2.00	-1.98	-2.40	-2.29	-1.60	-2.18	-2.24	-1.84
gdps (with trend)	WS	-3.24	-1.89	-1.21	-1.90	-1.35	-1.74	-1.64	-1.80	-1.34	-1.96	-1.13	-1.51	-1.46	-1.97	-1.88	-1.07	-1.74	-1.80	-1.13
gdps (no trend)	ADF	-2.89	-2.54	-2.29	-2.43	-2.20	-2.48	-2.31	-2.45	-2.17	-2.45	-2.34	-2.35	-2.19	-2.58	-2.54	-2.27	-2.49	-2.53	-2.09
gdps (no trend)	WS	-2.55	-0.99	-0.01	-0.70	0.02	-0.61	-0.20	-0.64	0.31	-0.74	0.61	-0.25	-0.04	-1.06	-0.86	0.56	-0.53	-0.76	0.62
Dgdps	ADF	-2.89	-2.92	-5.45	-2.83	-3.91	-2.51	-2.27	-2.64	-3.44	-1.96	-3.07	-3.15	-3.79	-2.86	-2.74	-3.68	-2.58	-2.61	-3.02
Dgdps	WS	-2.55	-3.17	-5.64	-3.09	-4.14	-2.79	-2.55	-2.91	-3.63	-2.24	-3.33	-3.39	-4.00	-3.11	-3.01	-3.91	-2.85	-2.87	-3.19
DDgdps	ADF	-2.89	-5.50	-10.28	-5.09	-8.39	-4.43	-4.42	-4.71	-7.02	-3.87	-5.70	-6.33	-7.50	-5.27	-4.97	-7.07	-4.72	-4.67	-7.71
DDgdps	WS	-2.55	-5.76	-10.67	-5.36	-8.74	-4.68	-4.66	-4.97	-7.33	-4.13	-5.98	-6.64	-7.82	-5.53	-5.22	-7.39	-4.97	-4.91	-8.01
exps (with trend)	ADF	-3.45	-2.64	-2.42	-2.54	-2.51	-2.26	-1.96	-2.36	-2.84	-2.48	-1.72	-2.45	-2.65	-2.59	-2.47	-2.62	-2.20	-2.67	-2.12
exps (with trend)	WS	-3.24	-2.20	-2.14	-2.11	-2.19	-2.07	-1.53	-2.03	-2.77	-2.30	-1.49	-2.15	-2.21	-2.14	-2.13	-2.29	-1.90	-2.28	-2.02
exps (no trend)	ADF	-2.89	-2.39	-2.06	-2.40	-2.30	-2.39	-2.24	-2.43	-1.78	-2.05	-2.23	-2.14	-1.89	-2.36	-2.44	-2.21	-2.37	-2.33	-1.88
exps (no trend)	WS	-2.55	-0.33	-0.12	-0.24	-0.32	-0.48	0.30	-0.33	-0.02	-0.28	0.11	-0.11	0.35	-0.25	-0.43	-0.25	-0.22	-0.32	0.14
Dexps	ADF	-2.89	-3.75	-3.99	-3.49	-3.43	-4.05	-3.77	-3.59	-4.03	-4.42	-4.53	-3.65	-3.97	-3.73	-3.58	-3.71	-3.66	-3.80	-3.60
Dexps	WS	-2.55	-4.00	-4.23	-3.75	-3.69	-4.08	-4.02	-3.77	-4.29	-4.46	-4.58	-3.90	-4.18	-3.99	-3.80	-3.96	-3.75	-4.04	-3.86
DDexps	ADF	-2.89	-5.97	-5.91	-5.65	-5.56	-6.79	-6.53	-6.09	-6.32	-7.24	-7.78	-6.51	-6.08	-5.76	-6.12	-6.14	-6.38	-5.88	-6.39
DDexps	WS	-2.55	-6.19	-6.12	-5.72	-5.70	-6.47	-6.68	-5.93	-6.56	-7.08	-7.51	-6.72	-6.37	-6.01	-6.08	-6.28	-5.99	-5.99	-6.63
FDIs (with trend)	ADF	-3.45	-0.97	-1.09	-0.91	-0.87	-1.87	-0.94	-0.93	-0.88	-0.92	-2.68	-0.73	-0.95	-0.94	-0.93	-0.96	-1.42	-0.95	-5.08
FDIs (with trend)	WS	-3.24	-1.22	-0.73	-1.09	-1.11	0.75	-1.19	-0.68	-1.16	-0.88	0.99	-0.89	-1.24	-1.20	-1.20	-1.23	0.40	-0.83	1.32

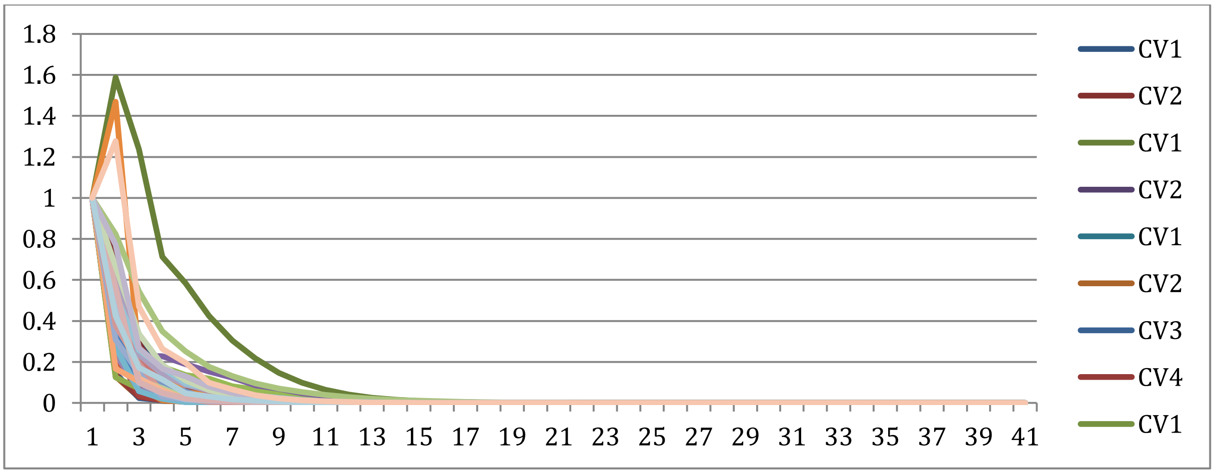
FDIs (no trend)	ADF	-2.89	-1.69	-2.22	-1.78	-1.75	-3.43	-1.68	-2.13	-1.70	-1.98	-4.48	-1.96	-1.63	-1.67	-1.67	-1.66	-4.22	-2.09	-6.23
FDIs (no trend)	WS	-2.55	-0.02	0.26	0.16	0.08	1.99	0.02	0.67	-0.01	0.52	2.02	0.27	-0.08	-0.03	0.02	-0.05	1.47	0.24	2.24
DFDIs	ADF	-2.89	-3.17	-2.36	-3.13	-3.09	-3.79	-3.19	-3.13	-3.13	-3.06	-3.93	-2.89	-3.20	-3.20	-3.15	-3.19	-2.75	-2.71	-5.46
DFDIs	WS	-2.55	-3.43	-2.63	-3.37	-3.34	-0.56	-3.44	-3.09	-3.39	-3.20	1.10	-3.14	-3.46	-3.45	-3.40	-3.45	-2.12	-2.96	2.56
DDFDIs	ADF	-2.89	-6.65	-6.64	-6.72	-6.81	-6.39	-6.78	-6.72	-6.84	-6.69	-6.52	-6.86	-6.76	-6.79	-6.67	-6.72	-8.41	-6.84	-6.83
DDFDIs	WS	-2.55	-6.94	-6.95	-6.99	-7.10	-5.35	-7.06	-6.89	-7.12	-6.91	-4.51	-7.15	-7.05	-7.08	-6.95	-7.01	-8.72	-7.15	-4.04
rems (with trend)	ADF	-3.45	-2.25	-2.26	-2.29	-2.36	-2.28	-2.44	-2.28	-2.45	-2.45	-2.78	-2.47	-2.35	-2.26	-2.27	-2.38	-2.35	-2.38	-1.47
rems (with trend)	WS	-3.24	-2.28	-2.48	-2.36	-2.46	-2.30	-2.50	-2.36	-2.59	-2.72	-2.93	-2.67	-2.63	-2.29	-2.31	-2.44	-2.45	-2.62	-1.35
rems (no trend)	ADF	-2.89	-0.92	-1.59	-0.91	-0.94	-0.90	-0.85	-0.93	-0.91	-1.31	-1.02	-1.09	-1.31	-0.90	-0.91	-0.92	-0.93	-1.17	-2.32
rems (no trend)	WS	-2.55	-1.16	-0.88	-1.08	-1.03	-1.13	-0.94	-1.11	-0.90	-1.07	-0.91	-0.93	-0.88	-1.13	-1.13	-1.05	-1.01	-1.01	-0.25
Drems	ADF	-2.89	-7.86	-6.99	-7.88	-7.85	-7.87	-8.14	-7.85	-7.47	-7.27	-7.80	-7.72	-7.49	-7.87	-7.87	-7.84	-7.89	-7.52	-5.56
Drems	WS	-2.55	-8.20	-7.29	-8.21	-8.18	-8.21	-8.46	-8.18	-7.79	-7.58	-8.11	-8.04	-7.81	-8.20	-8.21	-8.17	-8.22	-7.84	-5.75
DDrems	ADF	-2.89	-12.11	-11.06	-12.16	-12.18	-12.12	-13.16	-12.04	-11.33	-10.72	-12.11	-11.84	-11.83	-12.14	-12.13	-12.04	-12.11	-11.82	-8.16
DDrems	WS	-2.55	-12.58	-11.51	-12.63	-12.66	-12.59	-13.67	-12.51	-11.78	-11.15	-12.59	-12.31	-12.29	-12.61	-12.60	-12.50	-12.58	-12.29	-8.45
fbos (with trend)	ADF	-3.45	-2.00	-2.20	-2.00	-1.90	-2.35	-1.87	-2.14	-1.37	-1.49	-2.06	-1.61	-1.47	-2.11	-2.03	-1.65	-2.02	-1.97	-1.93
fbos (with trend)	WS	-3.24	-1.74	-2.01	-1.63	-1.52	-1.34	-1.55	-1.54	-1.52	-1.22	-1.76	-1.37	-1.39	-1.63	-1.61	-1.27	-1.85	-1.51	-0.92
fbos (no trend)	ADF	-2.89	-2.00	-2.22	-2.15	-2.24	-2.56	-2.10	-2.29	-1.85	-2.23	-2.01	-2.12	-1.93	-2.13	-2.11	-2.35	-1.86	-2.20	-1.86
fbos (no trend)	WS	-2.55	-0.08	-1.21	-0.24	-0.29	0.41	0.07	0.03	-1.21	-0.15	-0.05	-0.42	-0.71	0.12	0.12	-0.13	-0.20	0.06	-0.91
Dfbos	ADF	-2.89	-4.37	-4.17	-4.48	-4.31	-5.11	-4.56	-4.74	-2.93	-4.42	-4.43	-3.93	-3.72	-4.68	-4.57	-3.87	-4.41	-4.57	-4.02
Dfbos	WS	-2.55	-4.61	-4.42	-4.72	-4.55	-5.36	-4.80	-4.99	-3.19	-4.67	-4.67	-4.17	-3.97	-4.93	-4.81	-4.11	-4.66	-4.81	-4.28
DDfbos	ADF	-2.89	-7.07	-6.91	-7.17	-7.02	-7.50	-7.23	-7.29	-6.16	-7.41	-7.15	-6.90	-6.83	-7.25	-7.21	-6.88	-7.07	-7.22	-7.30
DDfbos	WS	-2.55	-7.39	-7.22	-7.50	-7.34	-7.83	-7.55	-7.62	-6.46	-7.74	-7.48	-7.22	-7.14	-7.58	-7.53	-7.19	-7.39	-7.54	-7.62
eurs (with trend)	ADF	-3.45	-1.89	-1.62	-1.93	-1.97	-1.91	-1.86	-1.85	-3.06	-2.09	-2.00	-1.93	-2.08	-1.89	-1.96	-2.05	-1.94	-1.89	-1.40
eurs (with trend)	WS	-3.24	-2.22	-1.97	-2.25	-2.28	-2.23	-2.19	-2.18	-3.26	-2.39	-2.31	-2.25	-2.39	-2.21	-2.27	-2.35	-2.26	-2.22	-1.56
eurs (no trend)	ADF	-2.89	-1.44	-1.46	-1.43	-1.36	-1.41	-1.45	-1.44	-2.08	-1.39	-1.38	-1.48	-1.49	-1.42	-1.39	-1.36	-1.36	-1.45	-0.28
eurs (no trend)	WS	-2.55	-1.11	-1.03	-1.09	-1.03	-1.08	-1.10	-1.10	-2.23	-1.08	-1.04	-1.13	-1.14	-1.06	-1.02	-1.05	-0.97	-1.11	-0.62
Deurs	ADF	-2.89	-4.80	-4.59	-4.80	-4.83	-4.76	-4.80	-4.76	-5.19	-4.84	-4.81	-4.77	-4.88	-4.79	-4.81	-4.82	-4.80	-4.76	-4.11
Deurs	WS	-2.55	-5.06	-4.85	-5.06	-5.09	-5.02	-5.06	-5.02	-5.46	-5.11	-5.07	-5.04	-5.14	-5.05	-5.07	-5.08	-5.06	-5.02	-4.37
DDeurs	ADF	-2.89	-7.73	-7.77	-7.72	-7.78	-7.75	-7.73	-7.73	-7.61	-7.68	-7.69	-7.65	-7.66	-7.73	-7.74	-7.88	-7.75	-7.76	-6.83
DDeurs	WS	-2.55	-8.06	-8.11	-8.06	-8.12	-8.09	-8.07	-8.07	-7.95	-8.01	-8.03	-7.99	-8.00	-8.07	-8.08	-8.22	-8.09	-8.10	-7.14
eus (with trend)	ADF	-3.45	-3.81	-3.99	-3.74	-3.62	-3.44	-3.72	-3.61	-3.98	-3.80	-3.74	-3.52	-3.09	-3.75	-3.67	-3.80	-3.76	-3.74	-2.47
eus (with trend)	WS	-3.24	-3.78	-3.96	-3.69	-3.56	-3.35	-3.72	-3.53	-4.23	-3.93	-3.66	-3.51	-3.08	-3.70	-3.61	-3.79	-3.69	-3.68	-2.77
eus (no trend)	ADF	-2.89	-2.44	-2.58	-2.40	-2.43	-2.10	-2.23	-2.26	-3.98	-2.07	-2.17	-2.49	-2.71	-2.36	-2.27	-2.52	-2.30	-2.32	-2.58
eus (no trend)	WS	-2.55	-2.67	-2.82	-2.63	-2.64	-2.33	-2.48	-2.49	-4.22	-2.32	-2.43	-2.72	-2.86	-2.59	-2.50	-2.75	-2.54	-2.55	-2.79
Deus	ADF	-2.89	-7.00	-7.30	-6.98	-6.98	-6.96	-7.10	-7.00	-7.02	-6.72	-7.33	-6.85	-7.02	-7.05	-7.00	-6.90	-7.10	-7.05	-6.13
Deus	WS	-2.55	-7.22	-7.53	-7.19	-7.19	-7.18	-7.33	-7.22	-7.16	-6.95	-7.58	-7.09	-7.12	-7.27	-7.22	-7.13	-7.33	-7.28	-6.40
DDeus	ADF	-2.89	-6.89	-6.79	-6.87	-6.86	-6.95	-7.02	-6.92	-6.69	-6.87	-7.15	-6.74	-7.02	-6.96	-6.92	-6.70	-6.87	-6.92	-7.76
DDeus	WS	-2.55	-7.14	-6.99	-7.12	-7.12	-7.20	-7.28	-7.17	-6.97	-7.11	-7.42	-7.01	-7.29	-7.21	-7.17	-6.96	-7.13	-7.17	-7.82

Table A4.8 Tests of residual serial correlation for country-specific VARX* models

Countries		Fcrit_0.05	gdp	exp	FDI	fcl	rem	eur
ALBANIA	F(4,33)	2.66	0.49	2.86	4.23	2.86	1.57	4.38
BOSNIA	F(4,33)	2.66	**7.53**		2.33	1.34	1.03	1.35
BULGARIA	F(4,31)	2.68	2.18	**3.60**	1.64	0.66	1.31	0.66
CROATIA	F(4,32)	2.67	0.76	0.99	1.36	1.32		1.31
CZECK REPUBLIC	F(4,31)	2.68	**4.10**	0.17	0.77	2.65	0.43	2.91
ESTONIA	F(4,32)	2.67	2.18	2.51	1.58	1.17	0.82	1.17
EURO	F(4,41)	2.60	**2.99**	0.41	0.03	**3.87**	0.03	0.49
HUNGARY	F(4,33)	2.66	1.47	0.57	0.48	0.85	0.12	0.63
KOSOVO	F(4,33)	2.66	1.40	0.78			0.55	
LATVIA	F(4,31)	2.68	0.50	1.61	1.13	2.51	0.07	2.35
LITHUANIA	F(4,32)	2.67	0.82	**3.63**	2.39	0.45	1.59	0.52
MACEDONIA	F(4,32)	2.67	5.08	1.55	1.72	0.38	1.62	0.36
MONTENEGRO	F(4,34)	2.65	**10.57**	**7.85**	1.52		2.17	
POLAND	F(4,32)	2.67	2.08	**3.07**	0.82	0.66	1.16	0.67
ROMANIA	F(4,32)	2.67	0.51	1.63	1.85	1.33	1.07	1.31
SERBIA	F(4,33)	2.66	2.49	**5.99**	1.12			
SLOVAK REPUBLIC	F(4,32)	2.67	**10.61**	1.76	1.16	0.40	2.60	0.40
SLOVENIA	F(4,31)	2.68	0.99	0.63	0.29	3.38	**4.18**	1.56

Note: The numbers in bold indicate the rejection of null hypothesis of no serial correlation at 5% significance level.

Figure A4.8 Persistence profiles for the baseline model



Note: Persistence profiles refer to the time profiles of the effects of system or variable-specific shocks on the cointegrating relations in the GVAR model and they have a value of unity on impact, while they should tend to zero as n→∞. The Figure above shows that all persistence profiles converge to zero by the 15th quarter.

Table A4.9 Contemporaneous effects of foreign variables on domestic counterparts

Country	Coefficient	gdp	exp	FDI	fcl	rem	eur
ALBANIA	Newey-West's adjusted SE	**0.04**	**0.38**	1.08	3.11	0.23	1.85
	t-ratio_NeweyWest	5.23	2.10	1.17	0.16	1.01	0.20
BOSNIA	Newey-West's adjusted SE	**0.07**		0.09	0.80	**0.33**	**0.74**
	t-ratio_NeweyWest	2.98		0.43	-1.24	2.30	2.13
BULGARIA	Newey-West's adjusted SE	**0.20**	0.91	**0.36**	0.37	**0.18**	**0.28**
	t-ratio_NeweyWest	4.56	1.04	2.48	1.42	3.66	4.64
CROATIA	Newey-West's adjusted SE	0.12	**0.23**	**0.22**	**0.26**		**0.23**
	t-ratio_NeweyWest	1.87	5.55	5.26	2.01		3.54
CZECK REPUBLIC	Newey-West's adjusted SE	**0.06**	**0.20**	**0.20**	0.30	0.10	0.28
	t-ratio_NeweyWest	9.01	2.06	2.18	1.68	1.82	1.28
ESTONIA	Newey-West's adjusted SE	0.23	**0.15**	**0.42**	**0.33**	**0.26**	0.25
	t-ratio_NeweyWest	-0.19	4.26	2.47	3.43	2.91	1.14
EURO	Newey-West's adjusted SE						
	t-ratio_NeweyWest						
HUNGARY	Newey-West's adjusted SE	**0.04**	**0.13**	**0.25**	**0.23**	**0.53**	**0.18**
	t-ratio_NeweyWest	11.27	6.33	4.23	2.91	2.64	5.11
KOSOVO	Newey-West's adjusted SE	0.12	**0.75**			**0.07**	
	t-ratio_NeweyWest	-0.11	2.76			-3.27	
LATVIA	Newey-West's adjusted SE	**0.20**	0.11	0.05	0.34	**0.26**	**0.36**
	t-ratio_NeweyWest	5.24	0.23	0.97	0.75	2.53	2.67
LITHUANIA	Newey-West's adjusted SE	**0.21**	**0.20**	**0.19**	**0.33**	**0.19**	0.37
	t-ratio_NeweyWest	3.57	3.14	6.51	3.83	2.42	1.24
MACEDONIA	Newey-West's adjusted SE	**0.88**	0.46	0.10	0.80	0.31	**0.61**
	t-ratio_NeweyWest	4.82	1.27	0.52	-0.22	-0.13	2.32
MONTENEGRO	Newey-West's adjusted SE	**1.02**	1.29	0.19		0.10	
	t-ratio_NeweyWest	3.41	-0.82	-0.71		0.78	
POLAND	Newey-West's adjusted SE	0.11	**0.12**	**0.22**	**0.33**	0.22	0.29
	t-ratio_NeweyWest	0.05	6.56	4.03	2.65	1.90	1.83
ROMANIA	Newey-West's adjusted SE	**0.11**	**0.32**	**0.23**	**0.35**	**0.09**	**0.22**
	t-ratio_NeweyWest	3.53	2.39	9.70	2.37	-2.53	4.04
SERBIA	Newey-West's adjusted SE	0.27	**0.20**	0.09			
	t-ratio_NeweyWest	-0.37	3.58	-1.59			
SLOVAK REPUBLIC	Newey-West's adjusted SE	**0.63**	**0.21**	0.04	**0.62**	0.09	0.54
	t-ratio_NeweyWest	8.32	3.64	1.61	2.13	-0.78	0.84
SLOVENIA	Newey-West's adjusted SE	**0.13**	**0.10**	**0.14**	0.19	**0.13**	**0.18**
	t-ratio_NeweyWest	4.96	4.94	6.35	0.72	9.43	6.95

Table A4.10 Average pairwise cross-section correlations: variables and residuals

	gdp			exports			FDI			fcf			rem			eur		
Countries	Xits	Δ xit	Resx	Xits	Δ xit	Resx	Xits	Δ xit	Resx	Xits	Δ xit	Resx	Xits	Δ xit	Resx	Xits	Δ xit	Resx
ALBANIA	0.84	0.44	0.04	0.85	0.31	0.05	0.77	0.03	-0.03	0.46	0.01	0.05	0.30	0.13	0.09	0.61	0.05	0.02
BOSNIA	0.84	0.42	0.02				0.94	0.25	0.07	0.84	0.11	0.00	0.41	0.29	0.11	0.83	0.22	0.01
BULGARIA	0.87	0.47	-0.01	0.83	0.15	-0.07	0.95	0.47	0.09	0.85	0.19	0.01	0.33	0.15	0.08	0.83	0.23	0.00
CROATIA	0.48	0.43	0.00	0.08	0.05	0.03	0.89	0.44	0.14	0.85	0.15	-0.01				0.84	0.22	-0.01
CZECK REPUBLIC	0.88	0.54	0.02	0.90	0.37	0.06	0.94	0.39	0.08	0.76	0.04	0.00	0.44	0.46	0.26	0.71	0.07	-0.02
ESTONIA	0.73	0.37	-0.02	0.83	0.35	0.03	0.91	0.42	0.07	0.80	0.20	-0.01	0.28	0.32	0.20	0.78	0.19	0.01
EURO	0.87	0.49	0.04	0.89	0.50	0.10	0.87	0.41	0.12	0.78	0.13	0.01	0.43	0.42	0.22	0.69	0.24	0.01
HUNGARY	0.68	0.49	0.05	0.89	0.45	0.03	0.91	0.42	0.03	0.66	0.21	-0.03	0.39	0.45	0.19	0.59	0.25	-0.04
KOSOVO	0.73	0.19	0.06	0.85	0.33	0.03							-0.14	-0.11	0.01			
LATVIA	0.73	0.37	0.01	0.87	0.21	-0.08	0.91	0.24	0.07	0.84	0.14	0.00	0.35	0.35	0.24	0.82	0.18	0.00
LITHUANIA	0.85	0.47	-0.03	0.87	0.27	0.02	0.93	0.45	0.14	0.85	0.23	-0.05	0.05	0.25	0.09	0.82	0.23	-0.04
MACEDONIA	0.78	0.17	0.03	0.85	0.25	0.01	0.92	0.27	0.08	0.59	0.03	0.04	0.31	0.20	0.08	0.57	0.08	0.04
MONTENEGRO	0.79	0.22	0.00	0.79	0.08	-0.04	0.93	0.29	0.02				-0.16	0.00	-0.04			
POLAND	0.79	0.23	0.02	0.89	0.38	0.08	0.94	0.43	0.08	0.84	0.18	0.00	0.43	0.45	0.27	0.81	0.20	0.01
ROMANIA	0.87	0.48	-0.02	0.87	0.27	-0.04	0.95	0.52	0.05	0.86	0.20	-0.02	-0.19	0.04	0.00	0.84	0.22	-0.03
SERBIA	0.85	0.26	0.03	0.88	0.29	0.07	0.90	0.22	0.02									
SLOVAK REPUBLIC	0.82	0.23	0.03	0.89	0.41	0.06	0.94	0.30	0.03	0.64	0.10	0.03	0.22	-0.07	-0.04	0.59	0.04	0.03
SLOVENIA	0.79	0.56	-0.08	0.88	0.49	-0.06	0.92	0.35	-0.16	0.80	0.26	-0.08	0.29	0.30	-0.16	0.78	0.33	-0.09

Note: xit corresponds to the variables in log-levels; Δ xit corresponds to the variables in log-differences; Resx relates to the VECMX model's residuals

Table A4.11 Proportion of the N-step ahead forecast error variance of Balkan GDP explained by conditioning on contemporaneous and future innovations of the country equations

Quarters		**0**	**1**	**2**	**4**	**6**	**8**	**12**	**24**	**40**
Regions	**Variables**									
Balkan region	gdp	12%	14%	14%	14%	13%	13%	13%	12%	12%
	exp	10%	12%	13%	13%	13%	13%	13%	12%	12%
	fdi	3%	4%	5%	5%	5%	5%	5%	4%	4%
	fcl	4%	6%	6%	7%	8%	8%	8%	7%	7%
	rem	3%	3%	3%	3%	3%	3%	2%	2%	2%
	eur	2%	4%	4%	5%	5%	5%	5%	5%	5%
Total Balkan region		**35%**	**43%**	**45%**	**47%**	**47%**	**46%**	**45%**	**43%**	**43%**
Baltic region	gdp	0%	0%	0%	0%	0%	0%	0%	0%	0%
	exp	1%	1%	1%	1%	1%	1%	1%	1%	1%
	fdi	1%	1%	1%	0%	0%	0%	1%	1%	1%
	fcl	1%	2%	1%	1%	1%	1%	1%	2%	2%
	rem	5%	4%	3%	3%	3%	3%	3%	3%	3%
	eur	1%	1%	1%	1%	1%	1%	1%	2%	2%
Total Baltic region		**8%**	**9%**	**8%**	**7%**	**7%**	**7%**	**7%**	**8%**	**8%**
CE region	gdp	1%	1%	1%	1%	1%	1%	1%	1%	1%
	exp	0%	1%	1%	1%	1%	1%	1%	2%	2%
	fdi	1%	2%	1%	1%	1%	1%	2%	2%	2%
	fcl	4%	3%	4%	3%	3%	2%	2%	2%	2%
	rem	7%	6%	6%	5%	5%	5%	4%	4%	4%
	eur	4%	3%	4%	3%	3%	2%	2%	2%	2%
Total CE region		**19%**	**17%**	**16%**	**15%**	**14%**	**13%**	**13%**	**13%**	**13%**
Euro region	gdp	8%	6%	7%	9%	11%	11%	12%	13%	14%
	exp	5%	5%	5%	8%	9%	10%	11%	12%	12%
	fdi	0%	1%	1%	1%	0%	0%	0%	0%	0%
	fcl	1%	3%	2%	2%	3%	3%	3%	3%	3%
	rem	18%	12%	12%	10%	9%	8%	8%	8%	7%
	eur	6%	5%	4%	2%	1%	1%	1%	0%	0%
Total Euro region		**38%**	**31%**	**31%**	**31%**	**32%**	**34%**	**35%**	**36%**	**36%**
Total		**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Table A4.12 Proportion of the N-step ahead forecast error variance of Baltic GDP explained by conditioning on contemporaneous and future innovations of the country equations

Quarters		**0**	**1**	**2**	**4**	**8**	**12**	**24**	**40**
Regions	**Variables**								
Balkan region	gdp	2%	4%	5%	6%	7%	7%	7%	7%
	exp	6%	9%	10%	9%	9%	9%	8%	8%
	fdi	2%	3%	4%	4%	3%	3%	3%	3%
	fcl	2%	5%	5%	6%	5%	5%	5%	5%
	rem	0%	1%	0%	0%	1%	1%	1%	1%
	eur	1%	3%	3%	3%	4%	4%	4%	4%
Total Balkan region		**14%**	**24%**	**27%**	**28%**	**28%**	**28%**	**28%**	**28%**
Baltic region	gdp	7%	5%	4%	4%	3%	3%	3%	3%
	exp	0.1%	0%	1%	1%	1%	1%	1%	1%
	fdi	1%	1%	1%	2%	2%	2%	3%	3%
	fcl	5%	5%	5%	4%	4%	4%	4%	4%
	rem	0.3%	0%	0%	1%	1%	2%	2%	2%
	eur	5%	5%	5%	4%	4%	4%	4%	4%
Total Baltic region		**18%**	**17%**	**16%**	**16%**	**16%**	**16%**	**16%**	**16%**
CE region	gdp	1%	1%	1%	2%	2%	3%	3%	3%
	exp	2%	2%	3%	3%	3%	3%	3%	3%
	fdi	1%	1%	1%	2%	2%	2%	2%	2%
	fcl	2%	1%	1%	1%	1%	1%	1%	1%
	rem	2%	2%	1%	1%	1%	1%	1%	1%
	eur	2%	2%	1%	1%	1%	1%	1%	1%
Total CE region		**10%**	**9%**	**9%**	**10%**	**11%**	**11%**	**11%**	**11%**
Euro region	gdp	28%	22%	20%	19%	19%	19%	19%	19%
	exp	18%	17%	17%	17%	17%	18%	18%	18%
	fdi	0%	1%	1%	1%	1%	1%	1%	1%
	fcl	3%	6%	6%	5%	4%	4%	4%	3%
	rem	8%	5%	4%	4%	3%	3%	3%	3%
	eur	0%	0%	0%	0%	0%	0%	0%	0%
Total Euro region		**57%**	**51%**	**48%**	**46%**	**45%**	**45%**	**45%**	**45%**
Total		**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Table A4.13 Proportion of the N-step ahead forecast error variance of CE GDP explained by conditioning on contemporaneous and future innovations of the country equations

Quarters		0	1	2	4	8	12	24	40
Regions	**Variables**								
Balkan region	gdp	6%	8%	9%	9%	9%	9%	9%	9%
	exp	7%	10%	10%	10%	9%	9%	9%	9%
	fdi	2%	3%	3%	3%	3%	3%	3%	3%
	fcl	2%	4%	5%	6%	6%	6%	6%	6%
	rem	3%	3%	2%	2%	2%	2%	2%	2%
	eur	0%	3%	3%	3%	3%	4%	4%	4%
Total Balkan region		**19%**	**30%**	**33%**	**33%**	**33%**	**32%**	**32%**	**32%**
Baltic region	gdp	0%	1%	1%	1%	1%	1%	1%	1%
	exp	1%	1%	0%	1%	1%	1%	1%	1%
	fdi	0%	1%	1%	1%	1%	2%	2%	2%
	fcl	2%	3%	2%	3%	3%	3%	3%	3%
	rem	3%	2%	2%	2%	3%	3%	3%	3%
	eur	2%	3%	2%	3%	3%	3%	3%	3%
Total Baltic region		**9%**	**10%**	**9%**	**10%**	**11%**	**11%**	**12%**	**12%**
CE region	gdp	2%	2%	2%	2%	3%	3%	3%	3%
	exp	1%	2%	2%	2%	2%	2%	2%	2%
	fdi	2%	2%	2%	2%	3%	3%	3%	3%
	fcl	3%	3%	3%	2%	2%	2%	2%	2%
	rem	10%	7%	5%	4%	4%	3%	3%	3%
	eur	3%	3%	3%	2%	2%	2%	2%	2%
Total CE region		**22%**	**18%**	**17%**	**15%**	**14%**	**14%**	**14%**	**14%**
Euro region	gdp	17%	13%	14%	15%	16%	16%	16%	16%
	exp	11%	11%	12%	13%	15%	15%	15%	15%
	fdi	0%	2%	1%	1%	1%	0%	0%	0%
	fcl	0%	3%	3%	3%	3%	3%	2%	2%
	rem	18%	11%	11%	9%	8%	7%	7%	7%
	eur	4%	1%	1%	1%	1%	1%	1%	1%
Total Euro region		**50%**	**42%**	**42%**	**42%**	**42%**	**42%**	**42%**	**42%**
Total		**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Table A4.14 Unit Root Tests for the Domestic Variables at 5% significance level

Note: The results at the 5% significance level suggest that the majority of the variables are unable to reject the null of non-stationarity. WS statistics are weighted symmetric estimations of ADF type regressions introduced by Park and Fuller (1995).

Statistic	Critical Value	ALBANIA	BOSNIA	BULGARIA	CROATIA	CZECK REPUBLIC	ESTONIA	EURO	HUNGARY	KOSOVO	LATVIA	LITHUANIA	MACEDONIA	MONTE NEGRO	POLAND	ROMANIA	SERBIA	SLOVAK REPUBLIC	SLOVENIA
ADF	-3.45	-1.39	0.03	-2.57	-2.25	-2.12	-3.31	-2.79	-2.46	-1.38	-3.36	-2.04	-0.64	-2.29	-2.10	-2.04	-2.45	-1.04	-2.35
WS	-3.24	-0.58	0.23	-2.17	-1.67	-1.38	-3.21	-2.24	-1.54	-0.57	-3.01	-1.65	-1.03	-1.76	-2.02	-1.42	-1.10	-2.28	-1.95
ADF	-2.89	-0.58	-1.42	-2.46	-2.25	-2.60	-2.80	-2.36	-2.49	2.41	-3.21	-1.99	-1.70	1.67	-1.63	-1.98	-3.86	-1.26	-2.60
WS	-2.55	1.70	0.33	-0.52	-1.61	0.01	-2.00	-0.56	-0.73	1.94	-2.18	-0.06	2.35	1.70	0.62	0.41	-0.28	-0.26	-1.24
ADF	-2.89	-2.01	-0.62	-2.10	-2.90	-2.65	-2.35	-3.07	-3.47	-1.82	-2.19	-3.18	-3.95	-1.25	-2.50	-3.86	-2.21	-1.91	-2.86
WS	-2.55	-0.22	0.03	-2.36	-3.07	-2.88	-2.58	-3.53	-3.62	-0.49	-2.38	-3.38	-3.73	-1.62	-2.51	-4.06	-2.47	-2.24	-3.12
ADF	-2.89	-2.68	-3.48	-3.62	-6.81	-5.80	-3.78	-3.40	-6.74	-3.16	-6.75	-7.33	-7.89	-2.06	-10.07	-5.73	-6.26	-33.05	-5.32
WS	-2.55	-2.42	-2.08	-3.90	-7.23	-6.09	-4.05	-4.12	-7.06	0.52	-7.04	-7.65	-5.77	-1.63	-9.99	-6.18	-6.39	-31.89	-5.57
ADF	-3.45	-3.32		-3.51	-1.86	-2.23	-2.43	-2.55	-1.84	-1.58	-2.97	-2.76	-3.57	-1.76	-2.47	-3.54	-2.04	-2.17	-2.67
WS	-3.24	-3.37		-3.85	-1.82	-1.88	-2.18	-2.47	-0.85	-1.40	-2.95	-3.03	-2.50	-1.88	-0.75	-3.07	-2.42	-2.30	-2.16
ADF	-2.89	-0.98		-1.03	-1.90	-1.98	-2.23	-2.14	-2.73	-2.05	-0.58	-1.28	-2.19	-2.14	-2.55	-1.36	-1.41	-1.44	-2.45
WS	-2.55	-0.52		-0.20	-1.81	0.48	-0.64	-0.70	0.71	0.24	1.33	-0.22	0.01	-0.46	1.16	0.98	-0.67	0.04	-0.35
ADF	-2.89	-5.56		-4.38	-5.67	-4.19	-3.53	-3.99	-2.94	-3.16	-5.64	-5.45	-3.12	-3.43	-2.33	-5.84	-4.34	-3.92	-3.79
WS	-2.55	-5.79		-4.76	-6.04	-4.45	-3.77	-4.23	-3.00	-3.54	-5.88	-5.66	-3.01	-3.72	-2.30	-5.69	-4.17	-4.12	-4.05
ADF	-2.89	-8.72		-10.96	-5.85	-5.27	-7.31	-7.49	-6.09	-9.00	-7.53	-6.44	-11.18	-13.85	-7.40	-5.49	-5.35	-7.00	-5.82
WS	-2.55	-9.00		-11.31	-4.02	-4.90	-7.61	-7.59	-6.28	-9.44	-7.91	-6.81	-11.61	-14.11	-6.69	-5.82	-5.74	-7.20	-6.07
ADF	-3.45	-1.99	-1.81	0.40	-1.72	-0.24	-1.95	-0.33	-1.79		-1.68	-1.48	-2.44	-3.46	-0.50	-0.38	-3.06	-1.56	-0.06
WS	-3.24	-2.15	-0.32	-0.02	-1.12	-0.84	-0.84	-1.05	-1.02		-1.65	-1.49	0.17	0.86	-0.62	0.05	0.76	-1.55	-0.62
ADF	-2.89	-1.90	-3.86	-2.94	-2.87	-1.87	-2.89	-1.65	-3.06		-1.82	-2.74	-2.25	-5.00	-2.52	-3.36	-4.46	-4.47	-1.89
WS	-2.55	-1.15	0.77	0.50	-0.42	-0.18	0.26	-0.93	-0.20		0.33	-0.64	1.53	2.04	0.31	0.59	1.37	-1.50	-0.09
ADF	-2.89	-6.65	-2.99	-0.71	-2.55	-3.79	-4.48	-4.41	-4.86		-2.90	-3.51	-5.83	-4.49	-4.57	-3.15	-4.72	-0.87	-3.55
WS	-2.55	-6.91	-3.16	-1.24	-2.81	-4.04	-4.34	-4.67	-5.12		-3.16	-3.70	1.55	2.84	-4.83	-3.40	2.62	-1.33	-3.76
ADF	-2.89	-6.25	-6.21	-6.98	-6.34	-7.31	-5.55	-5.98	-6.97		-3.07	-5.28	-4.91	-5.78	-6.14	-6.49	-6.31	-6.29	-5.98
WS	-2.55	-6.29	-6.69	-7.27	-6.64	-7.60	-5.85	-6.23	-7.08		-2.78	-5.58	-1.26	1.35	-6.53	-6.69	1.43	-5.12	-6.32

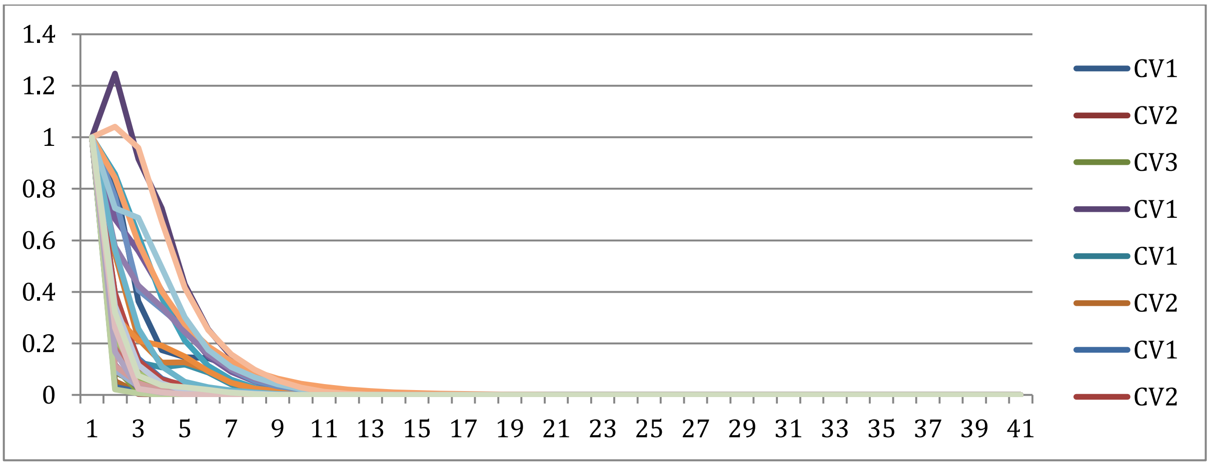
ADF	-3.45	-5.11	-1.64	-1.86	-0.79	-1.80	-1.95	-2.75	-1.05	-1.36	-1.22	-1.33	-0.85	-1.76	-3.36	-0.54
WS	-3.24	-5.38	0.22	-1.73	-0.89	-1.87	-0.43	-1.62	-0.08	0.34	-1.15	-1.41	-0.65	-1.43	-2.67	0.04
ADF	-2.89	-3.29	-3.43	-3.27	-1.95	-1.77	-3.01	-3.03	-1.56	-2.00	-2.04	-1.02	-2.57	-2.98	-2.65	-2.25
WS	-2.55	-3.22	0.84	-1.08	-0.45	-0.55	-1.16	-0.98	-0.98	-0.56	-1.13	-0.59	0.32	-0.85	-0.53	-0.95
ADF	-2.89	-5.44	-5.29	-2.02	-1.90	-4.09	-2.08	-2.01	-1.66	-1.72	-1.10	-5.20	-4.72	-0.96	-7.21	-2.61
WS	-2.55	-5.82	-5.09	-2.37	-2.01	-3.82	-2.40	-1.81	-1.78	-1.25	-1.45	-5.42	-4.98	-1.51	-7.45	-2.85
ADF	-2.89	-5.58	-5.52	-4.52	-9.77	-6.88	-9.54	-11.67	-7.00	-3.98	-8.01	-7.94	-7.69	-5.47	-6.62	-8.14
WS	-2.55	-6.21	-5.92	-2.85	-10.26	-7.34	-9.59	-11.62	-7.21	-3.22	-7.95	-6.41	-8.01	-5.58	-7.06	-8.47

Table A4.15 Weak exogeneity

Country	F test	Fcrit_0.05	gdps	exps	FDIs	fcls	poil
ALBANIA	F(3,33)	2.891564	0.673077	0.945452	0.730948	0.743629	1.836009
BOSNIA	F(1,30)	4.170877	1.619016	**8.700111**	0.676834	1.146968	0.270416
BULGARIA	F(2,24)	3.402826	1.169638	0.443002	1.135797	1.279418	0.020799
CROATIA	F(2,34)	3.275898	0.484295	0.347486	0.987697	0.307618	1.62131
CZECK REPUBLIC	F(2,34)	3.275898	0.398117	0.066983	1.990285	0.137638	0.050562
ESTONIA	F(1,35)	4.121338	0.205629	0.945624	2.658403	0.256397	1.49481
EURO	F(0,30)						
HUNGARY	F(2,34)	3.275898	0.08568	1.130743	0.489694	0.050032	1.091419
KOSOVO	F(1,37)	4.105456	2.103334	2.208965	1.313765	1.705628	0.064116
LATVIA	F(3,33)	2.891564	0.352461	0.125132	0.505671	0.636461	0.510951
LITHUANIA	F(2,34)	3.275898	1.083029	0.083015	1.798521	2.738068	1.28156
MACEDONIA	F(4,26)	2.742594	0.897597	**2.827484**	0.723806	0.900173	1.948165
MONTENEGRO	F(1,27)	4.210008	**5.94E-05**	0.793536	4.085791	**5.228221**	0.064624
POLAND	F(2,34)	3.275898	0.877794	0.472863	0.73746	2.535943	0.402877
ROMANIA	F(2,34)	3.275898	0.905627	2.648081	1.359846	1.587248	0.255426
SERBIA	F(2,35)	3.267424	1.079459	0.614889	0.438104	0.461656	0.690219
SLOVAK REPUBLIC	F(2,34)	3.275898	0.391767	0.07409	0.064201	0.683688	0.350556
SLOVENIA	F(1,35)	4.121338	0.328679	3.505118	0.091293	0.149167	0.358508

Note: The numbers in bold indicate the rejection of null hypothesis of weak exogeneity at 5% significance level

Figure A4.9 Persistence profiles of model 4.2



Note: Persistence profiles refer to the time profiles of the effects of system or variable-specific shocks on the cointegrating relations in the GVAR model and they have a value of unity on impact, while they should tend to zero as n→∞. The Figure above shows that all persistence profiles converge to zero by the 17th quarter.

Table A4.16 Serial correlation

Country	**F test**	Fcrit_0.05	gdp	exp	FDI	fcl
ALBANIA	F(4,34)	2.649894	**7.784959**	2.205138	1.609392	1.950175
BOSNIA	F(4,36)	2.633532	**6.148891**		0.584639	0.771242
BULGARIA	F(4,35)	2.641465	2.433228	**3.874887**	2.266085	0.918138
CROATIA	F(4,35)	2.641465	1.507418	1.587211	**3.047657**	1.813696
CZECK REPUBLIC	F(4,35)	2.641465	1.269998	1.113074	0.421766	0.948538
ESTONIA	F(4,36)	2.633532	**2.868615**	0.887678	1.609392	0.604641
EURO	F(4,41)	2.599969	**2.991799**	0.414499	0.025118	3.870919
HUNGARY	F(4,35)	2.641465	1.343787	1.342288	0.47919	1.607022
KOSOVO	F(4,36)	2.633532	2.278627	1.241103		
LATVIA	F(4,34)	2.649894	1.950175	1.888883	1.054668	1.677691
LITHUANIA	F(4,35)	2.641465	1.258567	**4.491848**	1.997691	0.379074
MACEDONIA	F(4,33)	2.658867	**10.6887**	2.433228	**3.329532**	0.320343
MONTENEGRO	F(4,36)	2.633532	**10.49001**	**10.12191**	2.40308	
POLAND	F(4,35)	2.641465	0.93613	2.528115	0.82517	1.367222
ROMANIA	F(4,35)	2.641465	0.662204	0.494119	0.250509	1.450806
SERBIA	F(4,35)	2.641465	1.865061	**7.838646**	1.473071	
SLOVAK REPUBLIC	F(4,35)	2.641465	**15.04171**	0.674485	0.734694	0.309794
SLOVENIA	F(4,36)	2.633532	2.057576	0.687224	0.492377	1.707076

Note: The numbers in bold indicate the rejection of null hypothesis of no serial correlation at 5% significance level.

Table A4.17 Unit root tests for the domestic variables at 5% significance level

Note: The results at the 5% significance level suggest that the majority of the variables are unable to reject the null of non-stationarity. WS statistics are weighted symmetric estimations of ADF type regressions introduced by Park and Fuller (1995).

Domestic Variables	Statistic	Critical Value	ALBANIA	BOSNIA	BULGARIA	CROATIA	CZECK REPUBLIC	ESTONIA	EURO	HUNGARY	LATVIA	LITHUANIA	MACEDONIA	POLAND	ROMANIA	SERBIA	SLOVAK REPUBLIC	SLOVENIA
gdp (with trend)	ADF	-3.45	-2.18		-0.57	-2.16	-1.87	-2.08	-2.26	-1.17	-1.70	-2.14	-2.99	-2.66	-2.22	-1.38		-1.14
gdp (with trend)	WS	-3.24	-1.53		-1.06	-2.50	-2.00	-2.04	-1.96	-1.34	-1.43	-2.38	-3.15	-1.69	-1.82	-1.78		-0.96
gdp (no trend)	ADF	-2.89	-2.48		-0.53	-2.13	-0.64	-1.50	-1.97	-1.77	-2.46	-1.31	-0.57	-0.06	-0.26	-1.40		-2.33
gdp (no trend)	WS	-2.55	-0.83		0.20	-2.33	-0.04	0.08	0.27	-1.16	-1.14	-0.44	0.85	-0.41	-0.21	-0.41		0.50
Dgdp	ADF	-2.89	-4.99		-3.98	-2.72	-3.33	-3.16	-3.07	-1.98	-3.77	-2.61	-4.29	-2.03	-3.72	-6.61		-3.60
Dgdp	WS	-2.55	-5.19		-4.20	-2.99	-3.54	-3.24	-3.33	-2.16	-3.95	-2.77	-4.50	-2.05	-3.94	-6.48		-3.76
DDgdp	ADF	-2.89	-7.71		-9.36	-8.74	-5.30	-8.98	-15.95	-6.31	-6.40	-10.85	-8.32	-12.72	-7.71	-6.57		-7.95
DDgdp	WS	-2.55	-8.00		-9.20	-9.06	-5.43	-9.22	-16.46	-6.73	-6.48	-10.59	-8.56	-13.03	-7.62	-6.42		-8.15
rem (with trend)	ADF	-3.45	-2.70	-3.21	-2.24		-6.80	-1.37	-2.56	-3.21	-1.77	-1.57	-2.66	-2.50	-2.44		-3.50	-1.54
rem (with trend)	WS	-3.24	-2.95	-3.42	-2.30		-3.42	-1.68	-2.30	-3.22	-1.76	-1.82	-2.78	-2.65	-1.98		-3.72	-1.84
rem (no trend)	ADF	-2.89	-2.41	-1.60	-2.29		-7.74	-2.04	-1.54	-2.99	-2.03	-2.02	-2.76	-2.57	-3.28		-1.60	-1.74
rem (no trend)	WS	-2.55	-2.25	-1.32	-1.93		-2.89	-0.99	-1.86	-2.57	-0.41	-0.70	-2.76	-2.64	-1.49		-1.32	-1.54
Drem	ADF	-2.89	-6.38	-7.11	-6.79		-6.57	-4.02	-6.29	-6.18	-8.62	-5.55	-5.97	-6.20	-5.64		-5.91	-7.48
Drem	WS	-2.55	-5.95	-7.33	-6.92		-5.12	-4.04	-6.03	-6.36	-8.86	-5.40	-5.91	-6.18	-5.38		-6.09	-7.70
DDrem	ADF	-2.89	-7.37	-7.90	-7.68		-9.58	-9.73	-8.37	-8.39	-7.55	-6.29	-6.62	-7.80	-7.26		-7.64	-7.70
DDrem	WS	-2.55	-7.60	-8.26	-7.92		-4.40	-10.01	-8.41	-8.69	-7.90	-6.15	-6.87	-7.98	-7.34		-7.94	-8.05
forcla (with trend)	ADF	-3.45	-5.98	-0.28	-1.75	0.39	-2.69	-1.91	-1.75	0.72	-1.04	-0.57	-2.53	-0.01	-1.92		-3.65	1.28
forcla (with trend)	WS	-3.24	-6.14	-0.41	-1.10	1.02	-2.77	-0.27	-1.55	0.55	-1.33	-0.36	-1.82	-0.39	-2.02		-3.10	0.36
forcla (no trend)	ADF	-2.89	-1.55	-3.33	-0.51	-3.43	-1.50	-3.35	-3.41	-1.88	-2.92	-1.91	-2.06	-4.33	-0.85		-2.08	-1.88
forcla (no trend)	WS	-2.55	-1.60	0.40	-0.83	1.58	-0.22	0.82	-0.12	-0.14	-0.53	0.39	0.85	0.38	-0.67		-0.12	0.75
Dforcla	ADF	-2.89	-7.01	-4.99	-7.84	-2.87	-8.14	-3.01	-2.07	-1.77	-1.64	-2.12	-6.30	-3.19	-2.76		-8.32	-2.50
Dforcla	WS	-2.55	-7.36	-5.30	-7.94	-2.55	-8.37	-2.52	-2.31	-1.86	-2.01	-1.04	-5.02	-3.48	-2.82		-8.49	-2.11

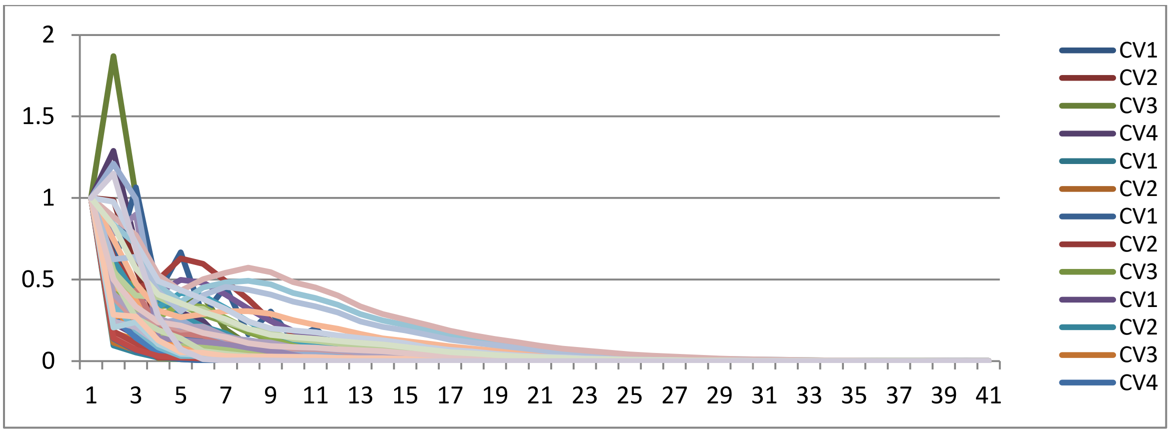
DDforcla	ADF	-2.89	-7.80	-9.73	-7.29	-7.72	-7.34	-7.16	-15.49	-7.40	-7.51	-8.03	-9.64	-8.96	-6.98		-8.43	-5.87
DDforcla	WS	-2.55	-8.21	-8.90	-7.60	-7.98	-9.27	-4.79	-15.70	-8.09	-5.29	-8.34	-8.38	-8.37	-7.29		-8.79	-4.23
FDI (with trend)	ADF	-3.45	-2.95	-1.04	0.61	-1.33	-0.58	-1.26	-1.22	-2.99	-2.10	-2.17	-4.30	-1.04	-0.84	-1.56	0.08	-1.04
FDI (with trend)	WS	-3.24	-3.14	0.16	-0.50	-0.47	-1.82	1.36	0.81	2.00	1.32	1.80	-4.47	0.20	-1.39	-1.89	-0.73	0.76
FDI (no trend)	ADF	-2.89	-2.00	-1.58	-1.32	-2.07	-2.80	-3.87	-3.29	-5.19	-2.28	-4.46	-2.77	-3.63	-1.48	-0.71	-3.37	-2.63
FDI (no trend)	WS	-2.55	-2.14	1.58	0.41	1.22	-1.18	2.13	2.19	2.74	1.80	2.38	-2.06	1.27	-0.40	0.04	-0.39	1.77
DFDI	ADF	-2.89	-6.22	-6.03	-2.34	-4.52	-3.89	-4.81	-15.11	-3.40	-7.25	-4.40	-5.99	-3.13	-4.08	-5.14	-3.86	-4.85
DFDI	WS	-2.55	-6.21	-0.06	0.09	-0.50	-3.09	-3.12	-0.33	-1.06	0.06	-2.04	-5.50	-3.34	-4.25	-3.02	-3.43	-0.64
DDFDI	ADF	-2.89	-7.89	-6.68	-8.21	-8.31	-8.81	-6.82	-7.78	-7.19	-7.41	-6.53	-7.93	-7.61	-7.66	-5.84	-6.87	-6.31
DDFDI	WS	-2.55	-8.20	-1.44	-8.41	-8.29	-9.02	-6.47	-2.12	-7.29	-1.38	-6.07	-5.65	-7.78	-7.90	-5.00	-6.61	-4.74
exp (with trend)	ADF	-3.45	-2.44		-3.40	-1.51	-1.62	-3.74	-2.93	-2.15	-3.20	-3.60	-1.91	-2.71	-2.84	-2.73	-1.68	-2.29
exp (with trend)	WS	-3.24	-2.43		-3.59	-1.82	-1.77	-3.09	-2.39	-1.32	-3.32	-3.71	-2.19	-2.86	-2.87	-3.03	-1.97	-2.52
exp (no trend)	ADF	-2.89	-2.69		-0.82	-0.82	-1.60	-1.91	-1.89	-2.22	-0.91	-0.97	-1.93	-1.36	-0.29	-1.20	-1.39	-1.20
exp (no trend)	WS	-2.55	-2.98		0.08	0.31	0.79	1.03	0.53	1.03	0.82	0.69	-2.17	0.62	0.90	0.41	0.50	0.36
Dexp	ADF	-2.89	-4.53		-6.96	-5.67	-4.92	-4.21	-4.28	-3.81	-4.67	-5.38	-5.85	-5.48	-5.74	-5.55	-3.84	-4.18
Dexp	WS	-2.55	-4.42		-7.18	-5.86	-5.11	-4.40	-4.48	-3.88	-4.63	-5.56	-6.05	-5.55	-5.92	-5.77	-3.91	-4.38
DDexp	ADF	-2.89	-9.32		-6.93	-10.06	-7.58	-8.11	-7.82	-7.03	-6.38	-9.33	-6.25	-7.05	-9.53	-7.11	-7.17	-6.57
DDexp	WS	-2.55	-9.56		-7.24	-10.33	-7.82	-8.26	-7.96	-7.11	-6.69	-9.57	-6.56	-7.11	-9.79	-7.45	-7.38	-6.70
eur (with trend)	ADF	-3.45	-5.58	-0.87	-1.92	-0.98	-3.39	-2.64	-2.33	-0.27	-1.56	-1.25	-2.61	-2.59	-1.39		-4.59	-0.30
eur (with trend)	WS	-3.24	-5.77	-0.64	-1.61	0.86	-2.78	-0.53	-0.47	0.48	-1.31	0.00	-1.58	-0.64	-1.73		-3.22	0.57
eur (no trend)	ADF	-2.89	-1.70	-3.30	-0.64	-3.58	-2.05	-3.52	-3.51	-3.21	-3.24	-2.65	-2.29	-4.51	-0.87		-2.51	-2.87
eur (no trend)	WS	-2.55	-1.54	0.32	-0.75	1.84	-0.27	0.76	1.03	0.83	-0.21	0.94	0.89	0.85	-0.28		0.03	1.38
Deur	ADF	-2.89	-7.10	-4.94	-7.88	-6.48	-7.50	-3.24	-3.31	-2.73	-2.42	-2.56	-6.03	-3.31	-3.49		-5.13	-3.75
Deur	WS	-2.55	-7.45	-5.22	-8.01	-5.35	-7.72	-2.68	-3.43	-2.64	-2.66	-1.36	-4.73	-3.49	-3.52		-4.48	-2.99
DDeur	ADF	-2.89	-7.79	-9.44	-7.24	-7.60	-7.50	-6.66	-7.06	-7.65	-7.09	-7.86	-9.48	-8.85	-8.03		-8.09	-8.67
DDeur	WS	-2.55	-8.32	-8.56	-7.57	-7.89	-7.64	-4.92	-7.27	-8.33	-5.33	-8.21	-8.20	-8.27	-8.30		-8.43	-8.19

Table A4.18 Weak exogeneity

Country	F test	Fcri_0.05	gdps	rems	forclas	FDIs	exps	eurs	poil	ciss
ALBANIA	F(4,55)	2.54	0.80	0.52	0.28	0.78	1.29	0.40	0.98	0.11
BOSNIA	F(2,59)	3.15	0.28	0.98	0.39	0.03	0.76	0.10	0.13	0.59
BULGARIA	F(3,56)	2.77	1.35	0.83	0.75	1.10	1.05	0.67	0.51	0.52
CROATIA	F(4,56)	2.54	0.43	1.61	1.87	0.78	0.71	1.94	0.38	0.59
CZECK REPUBLIC	F(5,45)	2.42	0.60	0.32	0.88	**3.21**	0.61	0.61	0.51	1.61
ESTONIA	F(2,57)	3.16	0.45	0.93	0.33	0.08	0.28	0.14	0.21	0.53
EURO	F(3,41)	2.83							1.83	0.26
HUNGARY	F(4,55)	2.54	1.02	0.12	1.06	0.21	0.52	0.45	0.72	0.40
LATVIA	F(3,56)	2.77	1.26	1.24	0.34	0.51	1.73	0.83	0.38	0.44
LITHUANIA	F(3,47)	2.80	1.68	1.97	1.73	0.41	0.80	3.31	1.01	1.62
MACEDONIA	F(4,55)	2.54	1.58	0.26	0.16	1.20	1.23	0.37	1.57	1.93
POLAND	F(3,56)	2.77	0.97	0.21	1.07	0.22	0.14	0.94	0.04	0.47
ROMANIA	F(3,56)	2.77	0.15	0.46	0.40	0.19	0.79	0.09	0.69	2.12
SERBIA	F(1,61)	4.00	1.16	1.17	**4.16**	2.85	0.62	1.74	1.17	1.44
SLOVAK REPUBLIC	F(3,57)	2.77	0.56	0.75	0.57	1.16	0.21	1.85	0.04	0.77
SLOVENIA	F(3,56)	2.77	2.20	0.27	1.38	1.51	1.38	0.53	1.93	1.15

Note: The numbers in bold indicate the rejection of null hypothesis of weak exogeneity at 5% significance level.

Figure A4.10 Persistence profiles of model 4.3



Note: Persistence profiles refer to the time profiles of the effects of system or variable-specific shocks on the cointegrating relations in the GVAR model and they have a value of unity on impact, while they should tend to zero as $n \rightarrow \infty$. The Figure above shows that all persistence profiles converge to zero by the 17th quarter.

Table A4.19 Serial correlation

Countries	F test	Fcri_0.05	gdp	rem	Forcla	FDI	exp	eur
ALBANIA	F(4,51)	2.553395	0.777411	2.835887	**7.110554**	0.034421	0.162118	**5.726621**
BOSNIA	F(4,55)	2.539689		1.774146	1.4582	0.157692		1.557756
BULGARIA	F(4,52)	2.549763	1.353505	0.423183	1.492585	1.039938	1.586382	1.495164
CROATIA	F(4,57)	2.533583	1.410905		2.361817	1.474168	2.311616	2.374164
CZECK REPUBLIC	F(4,50)	2.557179	**6.641203**	**8.538251**	0.953668	1.528312	2.492322	0.955121
ESTONIA	F(4,53)	2.546273	0.645088	1.296163	0.701886	0.963302	2.223254	0.701859
EURO	F(4,58)	2.530694	**12.08307**	0.338744	**5.43414**	1.451379	0.745977	1.348394
HUNGARY	F(4,57)	2.533583	2.769941	0.198589	1.719512	2.145162	0.918139	1.719738
LATVIA	F(4,52)	2.549763	0.122055	1.144449	1.013686	0.049879	0.141659	1.013671
LITHUANIA	F(4,52)	2.549763	1.240039	0.794439	0.307517	0.911858	1.353505	0.340236
MACEDONIA	F(4,51)	2.553395	1.54068	0.87465	0.851012	0.398901	0.947636	0.851178
POLAND	F(4,52)	2.549763	**3.093872**	1.39891	1.33193	0.446408	0.537017	1.322628
ROMANIA	F(4,51)	2.553395	0.897781	0.290299	1.388982	0.933784	0.707466	1.364596
SERBIA	F(4,57)	2.533583	0.597149			0.434337	1.314563	
SLOVAK REPUBLIC	F(4,53)	2.546273		**3.899935**	1.330152	1.000606	0.913007	1.321524
SLOVENIA	F(4,58)	2.530694	0.625969	0.322029	1.408096	1.243798	1.063024	1.112039

Note: The numbers in bold indicate the rejection of null hypothesis of no serial correlation at 5% significance level.

Appendix to Chapter 5

A5.1 Model 5.1 - estimated results

```
regress salesgrowth c.capitalpurch c.foreignown i.directexp c.emplgrowth c.wcbanks c.foreigncurr
i.subsidies i.industry i.country1 i.country2 i.country3 i.country4 i.country5i.country6
topmanagerexp i.firmsize c.firmage i.newproduct3years i.politicalinstability
Note: 1.country6 omitted because of collinearity

      Source |       SS       df       MS              Number of obs =     972
-------------+------------------------------           F( 22,   949) =    8.61
       Model |  16.8699296    22  .766814982           Prob > F      =  0.0000
    Residual |  84.5148194   949  .089056712           R-squared     =  0.1664
-------------+------------------------------           Adj R-squared =  0.1471
       Total |  101.384749   971  .104412718           Root MSE      =  .29842

------------------------------------------------------------------------------------------
           salesgrowth |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-----------------------+------------------------------------------------------------------
          capitalpurch |  -.0042864     .00458    -0.94   0.350    -.0132746    .0047017
            foreignown |    .057633   .0332814     1.73   0.084    -.0076807    .1229466
       1.directexp |   .0079668   .0291411     0.27   0.785    -.0492216    .0651553
            emplgrowth |    .125113   .0208496     6.00   0.000     .0841964    .1660297
               wcbanks |  -.0660177   .0264821    -2.49   0.013     -.117988   -.0140474
           foreigncurr |  -.1384894   .0366834    -3.78   0.000    -.2104793   -.0664995
           1.subsidies |   .0690813   .0306606     2.25   0.024     .1292518    .0089108
                       |
              industry |
                     2 |  -.0113732   .0251791    -0.45   0.652    -.0607863    .0380399
                     3 |  -.0696036    .037962    -1.83   0.067    -.1441028    .0048955
                     4 |  -.0279327   .0262101    -1.07   0.287    -.0793692    .0235038
                       |
            1.country1 |  -.0145911   .0376917    -0.39   0.699    -.0885599    .0593776
            1.country2 |   .0971389   .0401735     2.42   0.016     .0182997    .1759782
            1.country3 |   .1662858   .0337377     4.93   0.000     .1000767    .2324948
            1.country4 |  -.0030422   .0313422    -0.10   0.923    -.0645502    .0584658
            1.country5 |   -.040266   .0329422    -1.22   0.222     -.104914    .0243819
            1.country6 |          0  (omitted)
         topmanagerexp |   .0027655   .0010157     2.72   0.007     .0007722    .0047588
                       |
              firmsize |
                     1 |  -.0515798   .0560603    -0.92   0.358    -.1615962    .0584366
                     2 |  -.0326018   .0565542    -0.58   0.564    -.1435877     .078384
                     3 |   .0225969   .0588348     0.38   0.701    -.0928644    .1380581
                       |
               firmage |  -.0013193   .0008479    -1.56   0.120    -.0029833    .0003446
    1.newproduct3years |   .0494467    .020317     2.43   0.015     .0893181    .0095753
1.politicalinstability |  -.0528234   .0207232    -2.55   0.011    -.0934919   -.0121548
                 _cons |  -.0383325   .0701684    -0.55   0.585    -.1760356    .0993706
------------------------------------------------------------------------------------------
```

A5.2 Model 5.1 – diagnostic tests

Check for multicollinearity - VIF command - Model 5.1

```
. vif

    Variable |       VIF       1/VIF
-------------+----------------------
capitalpurch |      1.29    0.773039
  foreignown |      1.16    0.859329
1.directex~m |      1.34    0.744205
  emplgrowth |      1.06    0.946527
     wcbanks |      1.30    0.767505
 foreigncurr |      1.14    0.875153
 2.subsidies |      1.05    0.948634
```

```
     industry |
           2  |       1.47    0.678528
           3  |       1.17    0.851445
           4  |       1.41    0.707447
   1.country1 |       1.47    0.680744
   1.country2 |       1.88    0.532247
   1.country3 |       2.01    0.498121
   1.country4 |       1.67    0.600293
   1.country5 |       1.76    0.569381
topmanager~p |       1.13    0.883798
    firmsize |
           1  |       7.69    0.130009
           2  |       7.80    0.128128
           3  |       7.78    0.128519
     firmage |       1.13    0.884307
2.newprodu~s |       1.12    0.894536
1.politica~y |       1.09    0.918072
-------------+----------------------
    Mean VIF |       2.22
```

Tests for homoscedasticity - Model 5.1

```
. estat imtest

Cameron & Trivedi's decomposition of IM-test

---------------------------------------------------
              Source |       chi2     df      p
---------------------+-----------------------------
  Heteroskedasticity |     294.37    244    0.0150
            Skewness |      25.14     22    0.2903
            Kurtosis |      14.08      1    0.0002
---------------------+-----------------------------
               Total |     333.59    267    0.0035
---------------------------------------------------

. estat hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of salesgrowth

         chi2(1)      =     1.26
         Prob > chi2  =   0.2621
```

Tests for model specification - Model 5.1

```
. linktest

      Source |       SS       df       MS              Number of obs =     972
-------------+------------------------------           F(  2,   969) =   97.15
       Model |  16.9340105     2  8.46700523           Prob > F      =  0.0000
    Residual |  84.4507385   969  .087152465           R-squared     =  0.1670
-------------+------------------------------           Adj R-squared =  0.1653
       Total |  101.384749   971  .104412718           Root MSE      =  .29522

------------------------------------------------------------------------------
 salesgrowth |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   .8812726   .1560048     5.65   0.000     .5751265    1.187419
      _hatsq |  -.3266976    .380997    -0.86   0.391    -1.074372    .4209767
       _cons |  -.0049804    .018289    -0.27   0.785    -.0408711    .0309103
------------------------------------------------------------------------------

. ovtest
```

```
Ramsey RESET test using powers of the fitted values of salesgrowth
       Ho:  model has no omitted variables
                 F(3, 946) =      1.06
                Prob > F =      0.3668
```

A5.3 Model 5.1 - estimated results (robust standard errors)

```
.regress c.salesgrowth c.capitalpurch c.foreignown i.directexp c.emplgrowth c.wcbanks
c.foreigncurr i.subsidies i.industry
>  i.country1 i.country2 i.country3 i.country4 i.country5 i.country6 topmanagerexp i.firmsize
c.firmage i.newproduct3years i.poli
> ticalinstability, robust
```

Note: 1.country6 omitted because of collinearity

```
Linear regression                                      Number of obs =     972
                                                       F( 22,    949) =    8.15
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.1664
                                                       Root MSE      =  .29842

------------------------------------------------------------------------------------
                       |               Robust
           salesgrowth |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-----------------------+------------------------------------------------------------
          capitalpurch |  -.0042864    .004589    -0.93   0.351    -.0132922    .0047194
            foreignown |    .057633   .0274829     2.10   0.036     .0036988    .1115672
        1.directexp |   .0079668   .0289567     0.28   0.783    -.0488598    .0647934
            emplgrowth |    .125113   .0252644     4.95   0.000     .0755326    .1746935
               wcbanks |  -.0660177   .0258719    -2.55   0.011    -.1167904    -.015245
           foreigncurr |  -.1384894   .0354681    -3.90   0.000    -.2080944   -.0688844
           1.subsidies |   .0690813   .0290239     2.38   0.018     .1260397    .0121229
                       |
              industry |
                    2  |  -.0113732   .0237348    -0.48   0.632    -.0579519    .0352055
                    3  |  -.0696036   .0445099    -1.56   0.118    -.1569529    .0177456
                    4  |  -.0279327   .0285263    -0.98   0.328    -.0839147    .0280493
                       |
            1.country1 |  -.0145911   .0396365    -0.37   0.713    -.0923764    .0631942
            1.country2 |   .0971389   .0362757     2.68   0.008     .0259491    .1683288
            1.country3 |   .1662858   .0385082     4.32   0.000     .0907146    .2418569
            1.country4 |  -.0030422   .0325502    -0.09   0.926     -.066921    .0608365
            1.country5 |   -.040266    .034658    -1.16   0.246    -.1082813    .0277492
            1.country6 |          0  (omitted)
         topmanagerexp |   .0027655   .0010868     2.54   0.011     .0006326    .0048984
                       |
              firmsize |
                    1  |  -.0515798   .0412082    -1.25   0.211    -.1324495      .02929
                    2  |  -.0326018   .0422744    -0.77   0.441     -.115564    .0503603
                    3  |   .0225969   .0446552     0.51   0.613    -.0650374    .1102312
                       |
               firmage |  -.0013193   .0009202    -1.43   0.152    -.0031252    .0004865
    1.newproduct3years |   .0494467    .020699     2.39   0.017     .0900679    .0088255
1.politicalinstability |  -.0528234   .0213093    -2.48   0.013    -.0946422   -.0110046
                 _cons |  -.0383325   .0617025    -0.62   0.535    -.1594217    .0827567
------------------------------------------------------------------------------------
```

A5.4 Model 5.2 - estimated results (robust standard errors)

```
. . regress c.salesgrowth c.capitalpurch c.foreignown i.directexp c.emplgrowth c.wcbanks
c.foreigncurr i.subsidies i.industry
>  topmanagerexp i.firmsize c.firmage i.newproduct3years i.politicalinstability exportsgdp
foreignbankownership foreigncurrrloans
> , robust

Linear regression                                      Number of obs =     972
                                                       F( 20,    951) =    8.15
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.1648
                                                       Root MSE      =  .29839
```

salesgrowth	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
capitalpurch	-.0050364	.0045089	-1.12	0.264	-.0138849	.0038121
foreignown	.0602498	.0273791	2.20	0.028	.0065193	.1139803
1.directexp	.0057054	.0288298	0.20	0.843	-.0508721	.0622828
emplgrowth	.1264207	.025222	5.01	0.000	.0769234	.1759179
wcbanks	-.0622592	.0253858	-2.45	0.014	-.1120778	-.0124407
foreigncurr	-.1402759	.0354974	-3.95	0.000	-.2099383	-.0706136
1.subsidies	.072847	.0291969	2.50	0.013	.1301448	.0155492
industry						
2	-.0128481	.0235944	-0.54	0.586	-.0591513	.033455
3	-.072464	.0441443	-1.64	0.101	-.1590955	.0141674
4	-.0279685	.02852	-0.98	0.327	-.0839379	.0280009
topmanagerexp	.0028435	.0010793	2.63	0.009	.0007254	.0049617
firmsize						
1	-.0496189	.0417536	-1.19	0.235	-.1315588	.0323211
2	-.0280953	.0428819	-0.66	0.513	-.1122494	.0560588
3	.029686	.044882	0.66	0.509	-.0583932	.1177651
firmage	-.001339	.0009083	-1.47	0.141	-.0031215	.0004434
1.newproduct3years	.0481239	.0202606	2.38	0.018	.0878845	.0083633
1.politicalinstability	-.0477444	.0205889	-2.32	0.021	-.0881493	-.0073395
exportsgdp	.0038651	.0759547	0.05	0.959	-.1451931	.1529234
foreignbankownership	-.331152	.0576739	-5.74	0.000	-.4443348	-.2179691
foreigncurrrloans	-.1889029	.0686363	-2.75	0.006	-.323599	-.0542069
_cons	.3325962	.1006924	3.30	0.001	.1349912	.5302013

A5.5 Model 5.2 – diagnostic tests

Check for multiocollinearity - model 5.2. Vif

.vif

Variable	VIF	1/VIF
capitalpurch	1.27	0.789096
foreignown	1.15	0.870088
1.directex~m	1.34	0.746716
emplgrowth	1.05	0.948659
wcbanks	1.26	0.791043
foreigncurr	1.14	0.877565
2.subsidies	1.04	0.957126
industry		
2	1.47	0.680209
3	1.17	0.856341
4	1.41	0.707465
topmanager~p	1.12	0.895034
firmsize		
1	7.65	0.130733
2	7.74	0.129174
3	7.69	0.130085
firmage	1.12	0.891610
2.newprodu~s	1.10	0.912273
1.politica~y	1.05	0.949940
foreignban~p	1.28	0.780705
foreigncur~s	1.24	0.807895
exportsgdp	1.49	0.672287
Mean VIF	2.19	

Tests for homoscedasticity - Model 5.2

```
estat imtest

Cameron & Trivedi's decomposition of IM-test

---------------------------------------------------
              Source |       chi2     df      p
---------------------+-----------------------------
  Heteroskedasticity |     257.72    210    0.0137
            Skewness |      23.24     20    0.2772
            Kurtosis |      13.51      1    0.0002
---------------------+-----------------------------
               Total |     294.48    231    0.0030
---------------------------------------------------

. estat hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of salesgrowth

         chi2(1)      =     1.11
         Prob > chi2  =   0.2930
```

Tests for model specification - Model 5.2

```
. linktest

      Source |       SS       df       MS              Number of obs =     972
-------------+------------------------------           F(  2,    969) =   96.17
       Model |  16.7916508     2  8.39582541           Prob > F      =  0.0000
    Residual |  84.5930981   969  .087299379           R-squared     =  0.1656
-------------+------------------------------           Adj R-squared =  0.1639
       Total |  101.384749   971  .104412718           Root MSE      =  .29546

------------------------------------------------------------------------------
 salesgrowth |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   .8675333   .1551983     5.59   0.000     .5629699    1.172097
      _hatsq |  -.3683458   .3818967    -0.96   0.335    -1.117786    .3810941
       _cons |  -.0053935   .0182907    -0.29   0.768    -.0412874    .0305004
------------------------------------------------------------------------------

. ovtest
Ramsey RESET test using powers of the fitted values of salesgrowth
       Ho:  model has no omitted variables
                 F(3, 948) =      0.90
                  Prob > F =      0.4403
```

A5.6 Model 5.3 - estimated results

```
regress c.salesgrowth c.capitalpurch c.foreignown c.emplgrowth c.foreigncurr i.subsidies
i.industry topmanagerexp i.firmsize c.firmage i.newproduct3years i.politicalinstability
i.directexp##c.exportsgdp c.wcbanks##c.foreignbankownership c.wcbanks##c.foreigncurrrloans,
robust
note: wcbanks omitted because of collinearity

Linear regression                                      Number of obs =     972
                                                       F( 23,    948) =    7.47
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.1666
                                                       Root MSE      =  .29854

--------------------------------------------------------------------------------------
                             |               Robust
```

```
                     salesgrowth |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
---------------------------------+----------------------------------------------------------------
                     capitalpurch |   -.005029   .0045194    -1.11   0.266    -.0138982    .0038402
                      foreignown |   .0582247   .0275773     2.11   0.035      .004105    .1123443
                      emplgrowth |   .1281899   .0252785     5.07   0.000     .0785816    .1777982
                     foreigncurr |  -.1395097   .0356267    -3.92   0.000     -.209426   -.0695933
                     1.subsidies |   .0715156   .0294416     2.43   0.015     .1292939    .0137373
                                 |
                        industry |
                              2  |  -.0135385   .0237176    -0.57   0.568    -.0600837    .0330066
                              3  |  -.0717449   .0443521    -1.62   0.106    -.1587846    .0152948
                              4  |  -.0269138   .0284935    -0.94   0.345    -.0828315    .0290039
                                 |
                   topmanagerexp |   .0027913   .0010823     2.58   0.010     .0006674    .0049152
                                 |
                        firmsize |
                              1  |  -.0501586   .0424244    -1.18   0.237    -.1334151    .0330979
                              2  |  -.0276534   .0435814    -0.63   0.526    -.1131805    .0578737
                              3  |   .0296332   .0456034     0.65   0.516    -.0598621    .1191286
                                 |
                         firmage |   -.001326    .000902    -1.47   0.142    -.0030962    .0004443
               1.newproduct3years |   .0462337   .0203475     2.27   0.023     .0861652    .0063023
          1.politicalinstability |  -.0470088   .0206359    -2.28   0.023    -.0875062   -.0065115
                 1.directexp |  -.0912256   .086374    -1.06   0.291    -.2607319    .0782808
                      exportsgdp |  -.0259751   .0787873    -0.33   0.742    -.1805928    .1286426
                                 |
       directexp#c.exportsgdp |
                              1  |   .2008689   .1532926     1.31   0.190    -.0999632    .5017011
                                 |
                          wcbanks |   -.052244   .1276695    -0.41   0.682    -.3027914    .1983035
            foreignbankownership |  -.2995911   .0728641    -4.11   0.000    -.4425847   -.1565976
                                 |
c.wcbanks#c.foreignbankownership |  -.0962162   .1262359    -0.76   0.446    -.3439503    .1515178
                                 |
                          wcbanks |          0  (omitted)
               foreigncurrrloans |  -.2024756   .0791709    -2.56   0.011     -.357846   -.0471052
                                 |
   c.wcbanks#c.foreigncurrrloans |   .0947326   .1632579     0.58   0.562     -.225656    .4151212
                                 |
                           _cons |   .3311697   .1060759     3.12   0.002     .1229991    .5393403
--------------------------------------------------------------------------------------------------
```

A5.7 Model 5.3 – diagnostic tests

Check for multiocollinearity - model 5.3 Vif

```
. vif

    Variable |       VIF       1/VIF
-------------+----------------------
capitalpurch |      1.27    0.784733
  foreignown |      1.16    0.858875
  emplgrowth |      1.06    0.944508
 foreigncurr |      1.14    0.873503
 2.subsidies |      1.05    0.950518
    industry |
          2  |      1.47    0.678862
          3  |      1.17    0.852581
          4  |      1.43    0.698943
topmanager~p |      1.13    0.884179
    firmsize |
          1  |      9.02    0.110877
          2  |      9.15    0.109325
          3  |      9.04    0.110635
     firmage |      1.12    0.890386
2.newprodu~s |      1.11    0.901538
1.politica~y |      1.09    0.921495
1.directex~m |     12.28    0.081432
  exportsgdp |      1.81    0.552635
directexpd~m#|
c.exportsgdp |
          1  |     12.43    0.080427
1.accessfi~m |     14.21    0.070381
foreignban~p |      2.57    0.389637
```

```
accessfind~m#|
          c. |
foreignban~p |
          1  |      15.61    0.064046
     wcbanks |      19.98    0.050056
foreigncur~s |       1.90    0.526890
   c.wcbanks#|
          c. |
foreigncur~s |      18.86    0.053015
-------------+----------------------
    Mean VIF |       5.88
```

Test for homoscedasticity - model 5.3

```
. estat imtest

Cameron & Trivedi's decomposition of IM-test

---------------------------------------------------
              Source |       chi2     df      p
---------------------+-----------------------------
  Heteroskedasticity |     335.87    291    0.0360
            Skewness |      25.77     24    0.3649
            Kurtosis |      11.52      1    0.0007
---------------------+-----------------------------
               Total |     373.16    316    0.0148
---------------------------------------------------
```

Test for functional form - model 5.3

```
. ovtest

Ramsey RESET test using powers of the fitted values of salesgrowth
       Ho:  model has no omitted variables
                 F(3, 914) =      1.53
                  Prob > F =      0.2049

5.14 Margins of interaction between directexp and exoirtsgdp

. margins r.directexp, at (exportsgdp = (0.2914506  .3851856 .4931282 .5041728  .7832868))
contrast (nowald effects)

Contrasts of predictive margins
Model VCE    : Robust

Expression   : Linear prediction, predict()

1._at        : exportsgdp      =    .2914506
2._at        : exportsgdp      =    .3851856
3._at        : exportsgdp      =    .4931282
4._at        : exportsgdp      =    .5041728
5._at        : exportsgdp      =    .7832868

------------------------------------------------------------------------------------
                  |            Delta-method
                  |   Contrast   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------------+-----------------------------------------------------------------
directexp@_at |
      (1 vs 0) 1  |  -.0326822   .0461935    -0.71   0.479    -.1233355    .0579711
      (1 vs 0) 2  |  -.0138537    .035625    -0.39   0.697    -.0837667    .0560592
      (1 vs 0) 3  |   .0078286   .0280167     0.28   0.780    -.0471533    .0628104
      (1 vs 0) 4  |   .0100471   .0276816     0.36   0.717    -.0442772    .0643714
      (1 vs 0) 5  |   .0661124     .04688     1.41   0.159    -.0258881     .158113
------------------------------------------------------------------------------------
```

A5.8 Margins of interaction between wcbanks and foreigncurrloans

```
. margins, dydx(wcbanks) at (foreigncurrrloans = (.427089 .497385 .5314689 .5421005
.547776.8648633 ))

Average marginal effects                          Number of obs     =        972
Model VCE     : Robust

Expression    : Linear prediction, predict()
dy/dx w.r.t. : wcbanks

1._at         : foreigncur~s    =     .427089
2._at         : foreigncur~s    =     .497385
3._at         : foreigncur~s    =    .5314689
4._at         : foreigncur~s    =    .5421005
5._at         : foreigncur~s    =     .547776
6._at         : foreigncur~s    =    .8648633

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
wcbanks      |
         _at |
          1  |  -.0279687   .0380694    -0.73   0.463    -.1026785    .0467412
          2  |   -.036642   .0303324    -1.21   0.227    -.0961682    .0228842
          3  |  -.0408474   .0276105    -1.48   0.139     -.095032    .0133373
          4  |  -.0421591   .0269511    -1.56   0.118    -.0950497    .0107315
          5  |  -.0428594   .0266407    -1.61   0.108    -.0951408    .0094221
          6  |  -.0819824   .0512363    -1.60   0.110    -.1825317    .0185669
------------------------------------------------------------------------------
```

A5.9 Margins of interaction between wcbanks and foreignabnkownership

```
. margins, dydx(wcbanks) at (foreignbankownership = (0.38 0.61 0.8230277 0.87 0.92))

Average marginal effects                          Number of obs     =        972
Model VCE     : Robust

Expression    : Linear prediction, predict()
dy/dx w.r.t. : wcbanks

1._at         : foreignban~p    =         .38
2._at         : foreignban~p    =         .61
3._at         : foreignban~p    =    .8230277
4._at         : foreignban~p    =         .87
5._at         : foreignban~p    =         .92
------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
wcbanks      |
         _at |
          1  |  -.0342511    .046867    -0.73   0.465    -.1262261    .0577239
          2  |  -.0563808   .0271482    -2.08   0.038    -.1096584   -.0031033
          3  |  -.0768776   .0298192    -2.58   0.010    -.1353968   -.0183583
          4  |  -.0813971   .0334268    -2.44   0.015    -.1469962    -.015798
          5  |  -.0862079   .0379143    -2.27   0.023    -.1606135   -.0118023
------------------------------------------------------------------------------
```

A5.10 Model 5.4 - estimated results

```
. regress c.utilcapacity c.capitalpurch c.foreignown i.directexp c.emplgrowth c.wcbanks
c.foreigncurr i.subsidies i.industry i.country1 i.
> country2 i.country3 i.country4 i.country5 i.country6 topmanagerexp i.firmsize c.firmage
i.newproduct3years i.politicalinstability, robust
```

```
Note: 1.country6 omitted because of collinearity

Linear regression                                      Number of obs =     751
                                                       F( 22,    728) =   11.87
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.2361
                                                       Root MSE      =  27.223

---------------------------------------------------------------------------------------
                       |               Robust
           utilcapacity |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-----------------------+---------------------------------------------------------------
          capitalpurch |    -.38755   .4928133    -0.79   0.432    -1.355055    .5799548
            foreignown |   6.372253   2.898638     2.20   0.028     .6815654    12.06294
1.directexp|    8.169722   2.58488     3.16    0.002     3.095013     13.24443
           emplgrowth |   9.561097   2.520129     3.79   0.000      4.61351    14.50868
              wcbanks |    -5.2328   3.050489    -1.72   0.087     -11.2216    .7560051
          foreigncurr |  -4.979401   3.639881    -1.37   0.172    -12.12532    2.166515
          1.subsidies |   .8287278   2.614714     0.32   0.751     5.962008    4.304553
                       |
             industry |
                    2  |    10.4259   2.583102     4.04   0.000     5.354683    15.49712
                    3  |   5.306713   3.764399     1.41   0.159    -2.083659    12.69709
                    4  |  -4.523032   2.882804    -1.57   0.117    -10.18263    1.136569
                       |
           1.country1 |  -10.34464   3.854197    -2.68   0.007     -17.9113   -2.777968
           1.country2 |   15.21806    3.47097     4.38   0.000      8.40376    22.03237
           1.country3 |  -21.92102   7.003018    -3.13   0.002    -35.66954     -8.1725
           1.country4 |  -14.69637   2.936204    -5.01   0.000    -20.46081   -8.931932
           1.country5 |  -14.87181   3.182723    -4.67   0.000    -21.12022   -8.623397
           1.country6 |          0  (omitted)
        topmanagerexp |  -.0562413   .1107385    -0.51   0.612    -.2736462    .1611635
                       |
             firmsize |
                    1  |   4.682773   5.967666     0.78   0.433    -7.033116    16.39866
                    2  |    7.57605   5.987467     1.27   0.206    -4.178713    19.33081
                    3  |    13.8414   6.202596     2.23   0.026     1.664287     26.0185
                       |
              firmage |  -.0131667   .0723669    -0.18   0.856    -.1552394    .1289061
     1.newproduct3years |  -1.628851   2.168827    - 0.75   0.453     -2.62905   -5.886753
1.politicalinstability |   -1.35815   2.209718    -0.61   0.539     -5.69633     2.98003
                 _cons |   59.54108   7.165954     8.31   0.000     45.47267    73.60948
---------------------------------------------------------------------------------------
```

A5.11 Model 5.4 – diagnostic tests

Check for multicollinearity - model 5.4

```
. vif

    Variable |       VIF       1/VIF
-------------+----------------------
capitalpurch |      1.32    0.756792
  foreignown |      1.16    0.861096
1.directex~m |      1.37    0.730497
  emplgrowth |      1.05    0.949351
     wcbanks |      1.38    0.723266
 foreigncurr |      1.13    0.887230
 2.subsidies |      1.05    0.956271
    industry |
          2  |      1.48    0.675593
          3  |      1.15    0.866532
          4  |      1.42    0.703978
  1.country1 |      1.43    0.700967
  1.country2 |      1.99    0.503417
  1.country3 |      1.24    0.806305
  1.country4 |      1.58    0.631641
  1.country5 |      1.67    0.599378
topmanager~p |      1.13    0.886454
```

```
    firmsize |
          1  |      7.09    0.140949
          2  |      6.89    0.145185
          3  |      6.92    0.144541
     firmage |      1.11    0.897101
2.newprodu~s |      1.12    0.891890
1.politica~y |      1.08    0.927139
-------------+----------------------
    Mean VIF |      2.08
```

Test for homoscedasticity - model 5.4

```
. estat imtest

Cameron & Trivedi's decomposition of IM-test

---------------------------------------------------
              Source |       chi2     df      p
---------------------+-----------------------------
  Heteroskedasticity |     272.85    243    0.0914
            Skewness |      82.12     22    0.0000
            Kurtosis |      10.06      1    0.0015
---------------------+-----------------------------
               Total |     365.03    266    0.0001
---------------------------------------------------

. estat hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of utilcapacity

         chi2(1)      =    30.52
         Prob > chi2  =   0.0000
```

Test for functional form - model 5.4

```
. ovtest

Ramsey RESET test using powers of the fitted values of utilcapacity
       Ho:  model has no omitted variables
                 F(3, 725) =      5.34
                  Prob > F =      0.05
```

A5.12 Model 5.5 - estimated results

```
. regress c.emplgrowth c.foreignown i.directexp c.wcbanks c.foreigncurr i.subsidies i.industry
i.country1 i.country2 i.country3 i.country4 i.country5 i.country6 topmanagerexp i.firmsize
c.firmage i.newproduct3years i.politicalinstability, robust
```
Note: `1.country6 omitted because of collinearity`

```
Linear regression                                      Number of obs =     972
                                                       F( 20,    951) =    2.44
                                                       Prob > F      =  0.0004
                                                       R-squared     =  0.0535
                                                       Root MSE      =  .46414

------------------------------------------------------------------------------------------
                       |               Robust
            emplgrowth |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-----------------------+------------------------------------------------------------------
            foreignown |   .0265615   .0404732     0.66   0.512    -.0528656    .1059885
       1.directexp |   .0336926   .0403484     0.84   0.404    -.0454896    .1128748
               wcbanks |  -.0623493   .0437451    -1.43   0.154    -.1481973    .0234988
           foreigncurr |   .0979953   .0634533     1.54   0.123    -.0265294      .22252
           1.subsidies |   .0529026   .0436689     1.21   0.226     .1386012    -.032796
```

```
                     |
            industry |
                  2  |   .0784293    .039497     1.99   0.047     .0009179    .1559407
                  3  |   .0314543   .0598968     0.53   0.600    -.0860909    .1489994
                  4  |   -.001553   .0429878    -0.04   0.971    -.0859149     .082809
                     |
          1.country1 |  -.0141464   .0548263    -0.26   0.796     -.121741    .0934482
          1.country2 |   .1358455   .0714513     1.90   0.058    -.0043748    .2760659
          1.country3 |   .2059657   .0545194     3.78   0.000     .0989735     .312958
          1.country4 |  -.0774589   .0457426    -1.69   0.091     -.167227    .0123093
          1.country5 |  -.0575682   .0429842    -1.34   0.181    -.1419232    .0267867
          1.country6 |          0  (omitted)
       topmanagerexp |  -.0004539   .0014424    -0.31   0.753    -.0032846    .0023767
                     |
            firmsize |
                  1  |  -.1355214   .1242067    -1.09   0.276    -.3792723    .1082294
                  2  |  -.1959559    .124023    -1.58   0.114    -.4393464    .0474345
                  3  |  -.2064599   .1245457    -1.66   0.098     -.450876    .0379562
                     |
             firmage |   .0014432   .0010564     1.37   0.172      -.00063    .0035164
   1.newproduct3years|   .0286558   .0304318     0.94   0.347     .0883771   -.0310655
1.politicalinstability|  -.0225243   .0317396    -0.71   0.478     -.084812    .0397635
               _cons |  -.0045984   .1360427    -0.03   0.973     -.271577    .2623802
--------------------------------------------------------------------------------------
```

A5.13 Model 5.5 – diagnostic tests

Check for multicollinearity - model 5.5

```
. vif

    Variable |       VIF       1/VIF
-------------+----------------------
  foreignown |      1.16    0.859717
1.directex~m |      1.34    0.747957
     wcbanks |      1.30    0.770046
 foreigncurr |      1.14    0.878127
 2.subsidies |      1.05    0.950723
    industry |
          2  |      1.46    0.682906
          3  |      1.17    0.851705
          4  |      1.41    0.709394
  1.country1 |      1.47    0.680834
  1.country2 |      1.84    0.543027
  1.country3 |      1.97    0.507787
  1.country4 |      1.64    0.611601
  1.country5 |      1.74    0.573318
topmanager~p |      1.13    0.885745
    firmsize |
          1  |      7.63    0.131012
          2  |      7.66    0.130599
          3  |      7.42    0.134739
     firmage |      1.13    0.886303
2.newprodu~s |      1.09    0.920984
1.politica~y |      1.09    0.918592
-------------+----------------------
    Mean VIF |      2.29
```

Test for homoscedasticity - model 5.5

```
. estat imtest

Cameron & Trivedi's decomposition of IM-test
```

```
Source         chi2     df      p
Heteroskedasticity      239.90    199    0.0252
Skewness       46.46     20    0.0007
Kurtosis       14.29      1    0.0002
Total      300.65    220    0.0002


. estat hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of emplgrowth

chi2(1)      =    47.06
Prob > chi2  =   0.0000
```

Test for functional form - model 5.5

```
. ovtest
Ramsey RESET test using powers of the fitted values  of      emplgrowth
Ho:  model has no omitted variables
F(3, 948) =      1.23
Prob > F =      0.2967
```

Graphic checks to support diagnostic tests

Figure A5.1 Standardized residuals versus predictor variables

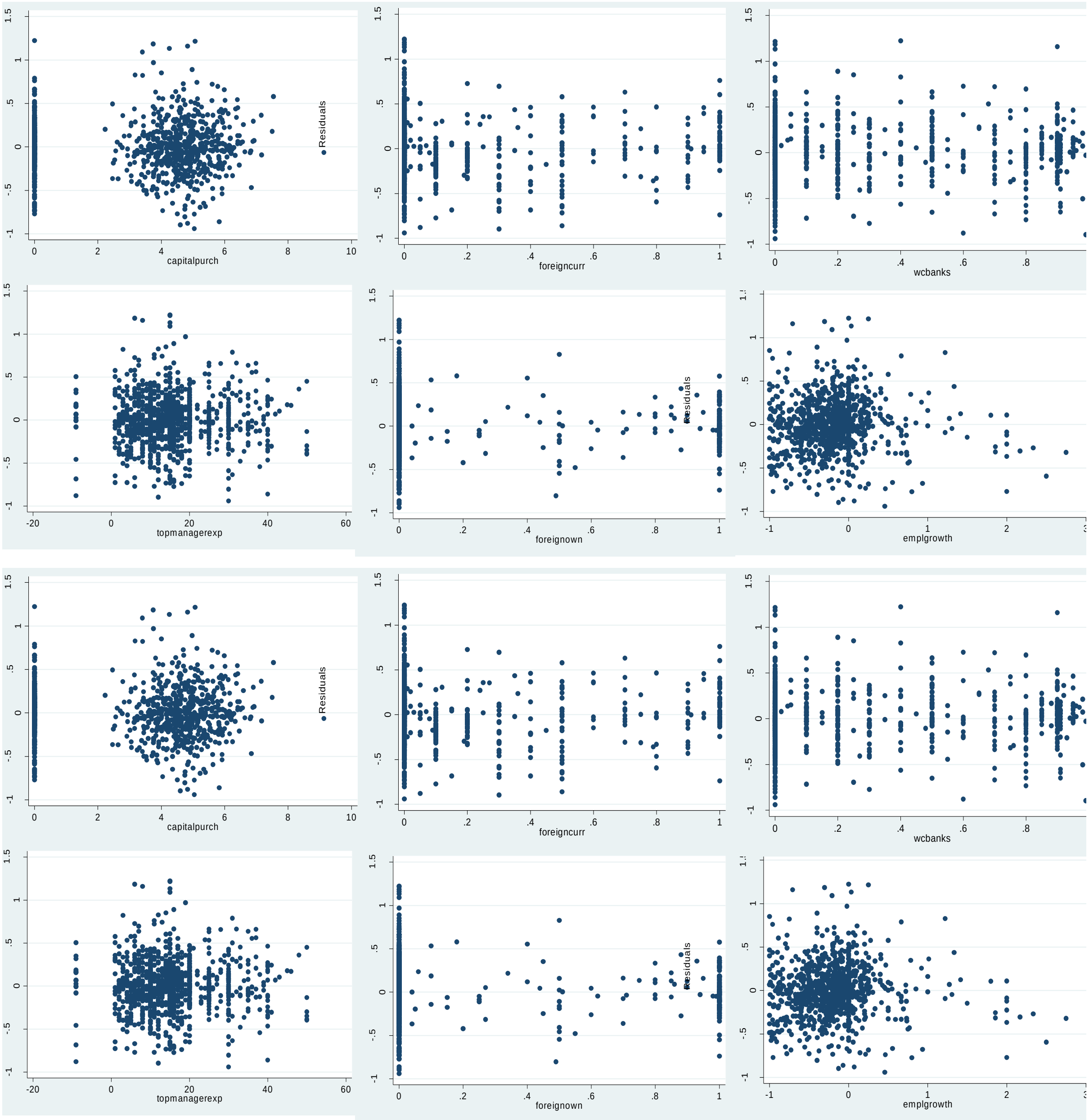


Figure A5.2 Augmented plus residual plot

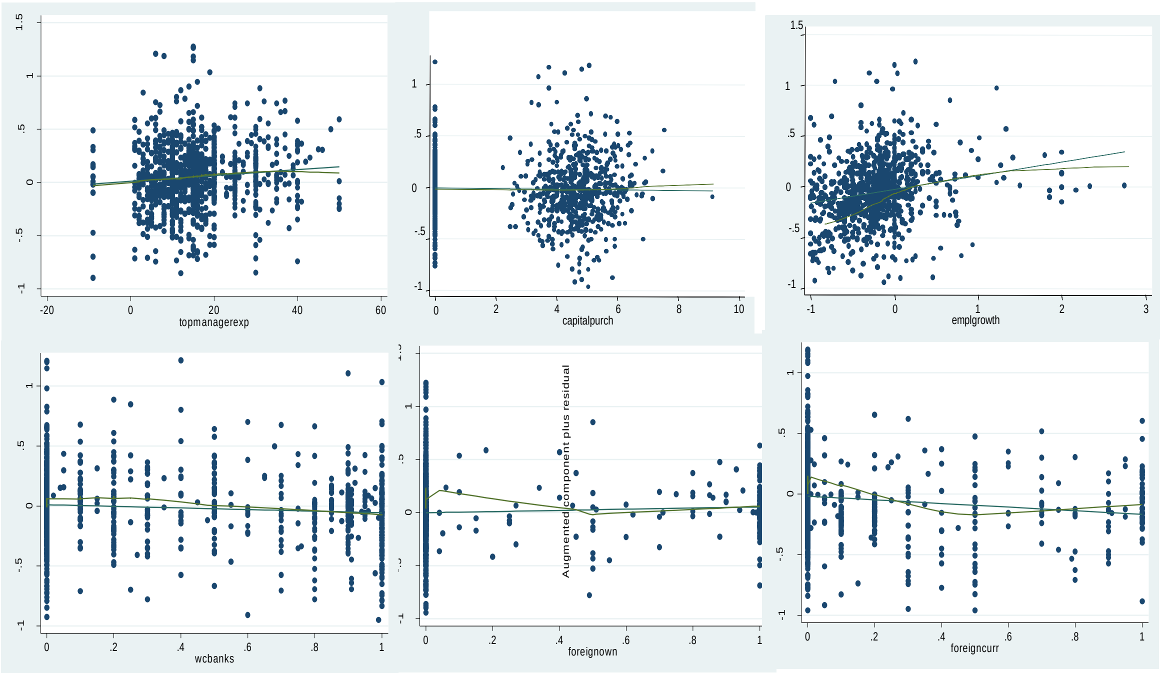


Figure A5.3 Kemel density plot

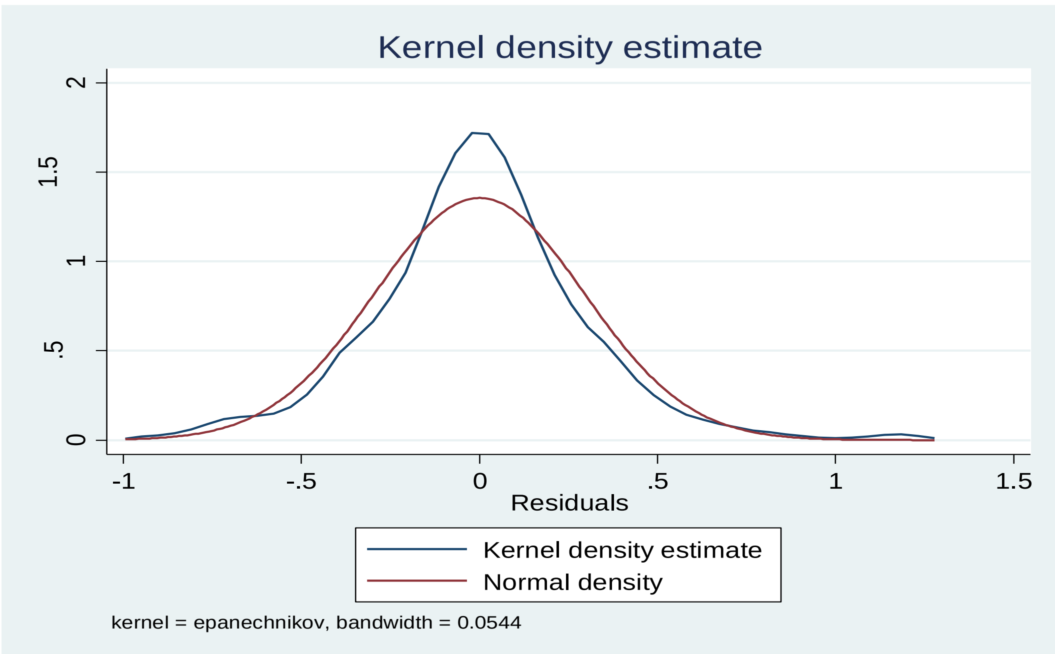
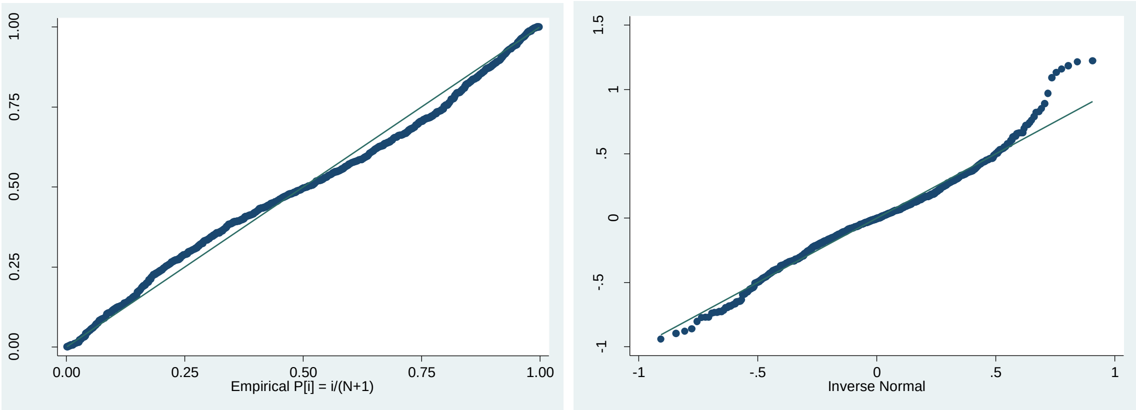


Figure A5.4 pnorm and qnorm plots



A5.14 Model 5.6 - estimated results

```
. regress c.salesgrowth c.capitalpurch c.foreignown i.directexp##c.changnatsales c.emplgrowth
c.wcbanks c.foreigncurr i.subsidies i.industry i.country1 i.country2 i.country3 i.country4
i.country5 i.country6 topmanagerexp i.firmsize c.firmage i.newproduct3years
i.politicalinstability, robust
Note: 1.country6 omitted because of collinearity

Linear regression                                       Number of obs =     955
F( 24,    930) =     7.65
Prob > F       =   0.0000
R-squared      =   0.1759
Root MSE       =    .2966
----------------------------+----------------------------------------------------------------
                            |               Robust
                salesgrowth |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------------------- +----------------------------------------------------------------
               capitalpurch |  -.0040398   .0045954    -0.88   0.380    -.0130583    .0049788
                 foreignown |   .0475537   .0280948     1.69   0.091    -.0075828    .1026902
            1.directexp |  .0226834   .0298153     0.76   0.447    -.0358296    .0811964
              changnatsales |  -.0686885   .0521019    -1.32   0.188    -.1709393    .0335623
                            |
directexp#c.changnatsales |
                          1  |   .0761294   .0557122     1.37   0.172    -.0332067    .1854655
                            |
                 emplgrowth |   .1533962   .0260123     5.90   0.000     .1023466    .2044458
                    wcbanks |  -.0673179   .0262865    -2.56   0.011    -.1189055   -.0157302
                foreigncurr |  -.1327863   .0357443    -3.71   0.000    -.2029352   -.0626375
                1.subsidies |   .0676355   .0295398     2.29   0.022      .125608     .009663
                            |
                   industry |
                          2 |  -.0057092   .0240414    -0.24   0.812    -.0528908    .0414725
                          3 |   -.059473    .044265    -1.34   0.179    -.1463438    .0273978
                          4 |  -.0202033   .0289253    -0.70   0.485    -.0769698    .0365631
                            |
                 1.country1 |  -.0165329   .0390571    -0.42   0.672    -.0931832    .0601174
                 1.country2 |   .0928257   .0364676     2.55   0.011     .0212573     .164394
                 1.country3 |   .1597575   .0384911     4.15   0.000     .0842181     .235297
                 1.country4 |  -.0079092   .0327517    -0.24   0.809    -.0721851    .0563667
                 1.country5 |  -.0576227   .0346844    -1.66   0.097    -.1256915     .010446
                 1.country6 |          0  (omitted)
              topmanagerexp |    .002682   .0010925     2.45   0.014     .0005379    .0048261
                            |
                   firmsize |
                          1 |  -.0368749   .0409645    -0.90   0.368    -.1172684    .0435187
                          2 |  -.0270122   .0422417    -0.64   0.523    -.1099122    .0558879
                          3 |   .0198143   .0446759     0.44   0.657    -.0678629    .1074915
                            |
                    firmage |  -.0013637   .0009585    -1.42   0.155    -.0032449    .0005174
         1.newproduct3years |   .0503753   .0208335     2.42   0.016     .0912614    .0094892
```

```
       1.politicalinstability |  -.0549248   .0213176    -2.58   0.010     -.0967609   -.0130887
                        _cons |  -.0389558   .0619056    -0.63   0.529     -.1604467    .0825351
----------------------------+----------------------------------------------------------------
```

A5.15 Model 5.6 – diagnostic tests

Check for multicollineaarity - model 5.6

```
. vif
    Variable |       VIF       1/VIF
-------------+----------------------
capitalpurch |      1.28    0.780970
  foreignown |      1.19    0.838551
1.directex~m |      1.37    0.731920
changnatsa~s |      5.37    0.186221
directexpd~m#|
          c. |
changnatsa~s |
          1  |      5.31    0.188412
  emplgrowth |      1.06    0.940073
     wcbanks |      1.31    0.763063
 foreigncurr |      1.14    0.876553
 2.subsidies |      1.05    0.948089
    industry |
          2  |      1.49    0.671578
          3  |      1.18    0.848822
          4  |      1.43    0.698054
  1.country1 |      1.47    0.680040
  1.country2 |      1.87    0.534488
  1.country3 |      2.02    0.494939
  1.country4 |      1.69    0.592998
  1.country5 |      1.74    0.576110
topmanager~p |      1.14    0.880775
    firmsize |
          1  |      7.58    0.131839
          2  |      7.69    0.129964
          3  |      7.66    0.130508
     firmage |      1.13    0.883383
2.newprodu~s |      1.12    0.896533
1.politica~y |      1.09    0.914030
-------------+----------------------
    Mean VIF |      2.47
```

Test for homoscedasticity - model 5.6

```
. estat imtest
Cameron & Trivedi's decomposition of IM-test

---------------------------------------------------
              Source |       chi2     df      p
---------------------+-----------------------------
  Heteroskedasticity |     331.13    290    0.0484
            Skewness |      24.75     24    0.4194
            Kurtosis |      14.42      1    0.0001
---------------------+-----------------------------
               Total |     370.30    315    0.0173
---------------------------------------------------
```

Test for functional form - model 5.6

```
. ovtest
Ramsey RESET test using powers of the fitted values of salesgrowth
       Ho:  model has no omitted variables
                 F(3, 927) =      1.69
                  Prob > F =      0.1681
```

A5.16 Predictive margins - model 5.6

```
. margins directexp, at (changnatsales=( -1(0.1) 1.777778))

Predictive margins                              Number of obs    =        955
Model VCE     : Robust

Expression    : Linear prediction, predict()

1._at         : changnatsa~s     =            -1
2._at         : changnatsa~s     =           -.9
3._at         : changnatsa~s     =           -.8
4._at         : changnatsa~s     =           -.7
5._at         : changnatsa~s     =           -.6
6._at         : changnatsa~s     =           -.5
7._at         : changnatsa~s     =           -.4
8._at         : changnatsa~s     =           -.3
9._at         : changnatsa~s     =           -.2
10._at        : changnatsa~s     =           -.1
11._at        : changnatsa~s     =             0
12._at        : changnatsa~s     =            .1
13._at        : changnatsa~s     =            .2
14._at        : changnatsa~s     =            .3
15._at        : changnatsa~s     =            .4
16._at        : changnatsa~s     =            .5
17._at        : changnatsa~s     =            .6
18._at        : changnatsa~s     =            .7
19._at        : changnatsa~s     =            .8
20._at        : changnatsa~s     =            .9
21._at        : changnatsa~s     =             1
22._at        : changnatsa~s     =           1.1
23._at        : changnatsa~s     =           1.2
24._at        : changnatsa~s     =           1.3
25._at        : changnatsa~s     =           1.4
26._at        : changnatsa~s     =           1.5
27._at        : changnatsa~s     =           1.6
28._at        : changnatsa~s     =           1.7


Delta-method
Margin   Std. Err.      t    P>t     [95% Conf. Interval]

_at#directexp
1 0     -.1390261   .0498704   -2.79   0.005    -.2368977   -.0411544
1 1     -.1924721   .0384684   -5.00   0.000     -.267967   -.1169772
2 0     -.1458949   .0447927   -3.26   0.001    -.2338014   -.0579884
2 1      -.191728   .0369257   -5.19   0.000    -.2641954   -.1192607
3 0     -.1527638   .0397493   -3.84   0.000    -.2307725    -.074755
3 1     -.1909839   .0354413   -5.39   0.000    -.2605381   -.1214297
4 0     -.1596326   .0347551   -4.59   0.000    -.2278402   -.0914251
4 1     -.1902398   .0340228   -5.59   0.000    -.2570102   -.1234695
5 0     -.1665015   .0298349   -5.58   0.000     -.225053   -.1079499
5 1     -.1894957   .0326788   -5.80   0.000    -.2536284   -.1253631
6 0     -.1733703   .0250323   -6.93   0.000    -.2224967   -.1242439
6 1     -.1887516   .0314188   -6.01   0.000    -.2504116   -.1270917
7 0     -.1802392   .0204305   -8.82   0.000    -.2203344    -.140144
7 1     -.1880076   .0302533   -6.21   0.000    -.2473803   -.1286348
8 0      -.187108   .0162014  -11.55   0.000    -.2189035   -.1553125
8 1     -.1872635   .0291938   -6.41   0.000    -.2445568   -.1299702
9 0     -.1939769   .0127223  -15.25   0.000    -.2189446   -.1690091
9 1     -.1865194    .028252   -6.60   0.000    -.2419644   -.1310743
10 0     -.2008457   .0107481  -18.69   0.000     -.221939   -.1797525
10 1     -.1857753   .0274401   -6.77   0.000     -.239627   -.1319236
11 0     -.2077146    .011112  -18.69   0.000    -.2295221   -.1859071
11 1     -.1850312     .02677   -6.91   0.000    -.2375677   -.1324947
12 0     -.2145834   .0136281  -15.75   0.000    -.2413288   -.1878381
12 1     -.1842871   .0262524   -7.02   0.000    -.2358079   -.1327663
13 0     -.2214523   .0173858  -12.74   0.000    -.2555722   -.1873324
13 1      -.183543   .0258966   -7.09   0.000    -.2343655   -.1327205
14 0     -.2283211   .0217508  -10.50   0.000    -.2710075   -.1856348
```

```
14 1    -.1827989   .0257092    -7.11   0.000    -.2332537   -.1323441
15 0      -.23519   .0264239    -8.90   0.000    -.2870473   -.1833326
15 1    -.1820548    .025694    -7.09   0.000    -.2324798   -.1316298
16 0    -.2420588   .0312672    -7.74   0.000    -.3034213   -.1806964
16 1    -.1813107   .0258513    -7.01   0.000    -.2320443   -.1305772
17 0    -.2489277   .0362125    -6.87   0.000    -.3199954     -.17786
17 1    -.1805666   .0261778    -6.90   0.000    -.2319411   -.1291922
18 0    -.2557965   .0412231    -6.21   0.000    -.3366977   -.1748954
18 1    -.1798225   .0266675    -6.74   0.000     -.232158   -.1274871
19 0    -.2626654   .0462778    -5.68   0.000    -.3534865   -.1718443
19 1    -.1790785   .0273116    -6.56   0.000    -.2326779    -.125479
20 0    -.2695342   .0513636    -5.25   0.000    -.3703363   -.1687322
20 1    -.1783344   .0280993    -6.35   0.000    -.2334798   -.1231889
21 0    -.2764031   .0564721    -4.89   0.000    -.3872306   -.1655755
21 1    -.1775903   .0290191    -6.12   0.000    -.2345408   -.1206397
22 0    -.2832719   .0615976    -4.60   0.000    -.4041584   -.1623855
22 1    -.1768462   .0300588    -5.88   0.000    -.2358372   -.1178551
23 0    -.2901408   .0667363    -4.35   0.000    -.4211119   -.1591696
23 1    -.1761021   .0312065    -5.64   0.000    -.2373454   -.1148588
24 0    -.2970096   .0718852    -4.13   0.000    -.4380856   -.1559336
24 1     -.175358   .0324506    -5.40   0.000    -.2390429   -.1116731
25 0    -.3038785   .0770424    -3.94   0.000    -.4550755   -.1526814
25 1    -.1746139   .0337806    -5.17   0.000    -.2409089   -.1083189
26 0    -.3107473   .0822062    -3.78   0.000    -.4720786   -.1494161
26 1    -.1738698   .0351866    -4.94   0.000    -.2429242   -.1048154
27 0    -.3176162   .0873756    -3.64   0.000    -.4890924     -.14614
27 1    -.1731257     .03666    -4.72   0.000    -.2450717   -.1011798
28 0     -.324485   .0925495    -3.51   0.000    -.5061152   -.1428549
28 1    -.1723816   .0381929    -4.51   0.000     -.247336   -.0974273
```

A5.17 Margins of interaction between directexodumm and changnatsales

```
. margins r.directexp, at (changnatsales =(-1 (0.1) 1)) contrast (nowald effects)

Contrasts of predictive margins
Model VCE     : Robust

Expression    : Linear prediction, predict()

1._at         : changnatsa~s    =          -1
2._at         : changnatsa~s    =         -.9
3._at         : changnatsa~s    =         -.8
4._at         : changnatsa~s    =         -.7
5._at         : changnatsa~s    =         -.6
6._at         : changnatsa~s    =         -.5
7._at         : changnatsa~s    =         -.4
8._at         : changnatsa~s    =         -.3
9._at         : changnatsa~s    =         -.2
10._at        : changnatsa~s    =         -.1
11._at        : changnatsa~s    =           0
12._at        : changnatsa~s    =          .1
13._at        : changnatsa~s    =          .2
14._at        : changnatsa~s    =          .3
15._at        : changnatsa~s    =          .4
16._at        : changnatsa~s    =          .5
17._at        : changnatsa~s    =          .6
18._at        : changnatsa~s    =          .7
19._at        : changnatsa~s    =          .8
20._at        : changnatsa~s    =          .9
21._at        : changnatsa~s    =           1

------------------------------------------------------------------------------------
                  |            Delta-method
                  |   Contrast   Std. Err.      t     P>|t|     [95% Conf. Interval]
------------------+-----------------------------------------------------------------
directexp@_at |
     (1 vs 0)  1  |  -.0547827   .0551698    -0.99   0.321    -.1630525    .0534871
     (1 vs 0)  2  |  -.0478041   .0507956    -0.94   0.347    -.1474897    .0518814
     (1 vs 0)  3  |  -.0408256   .0465961    -0.88   0.381    -.1322696    .0506184
```

```
      (1 vs 0)  4  |   -.033847   .0426229   -0.79   0.427   -.1174937   .0497996
      (1 vs 0)  5  |  -.0268685   .0389453   -0.69   0.490   -.1032979    .049561
      (1 vs 0)  6  |  -.0198899    .035655   -0.56   0.577   -.0898622   .0500823
      (1 vs 0)  7  |  -.0129114   .0328684   -0.39   0.695    -.077415   .0515923
      (1 vs 0)  8  |  -.0059328    .030723   -0.19   0.847   -.0662261   .0543605
      (1 vs 0)  9  |   .0010457   .0293596    0.04   0.972   -.0565719   .0586633
      (1 vs 0) 10  |   .0080243   .0288891    0.28   0.781   -.0486701   .0647186
      (1 vs 0) 11  |   .0150028   .0293546    0.51   0.609    -.042605   .0726107
      (1 vs 0) 12  |   .0219814   .0307134    0.72   0.474   -.0382932    .082256
      (1 vs 0) 13  |   .0289599    .032855    0.88   0.378   -.0355175   .0934374
      (1 vs 0) 14  |   .0359385   .0356385    1.01   0.314   -.0340015   .1058785
      (1 vs 0) 15  |    .042917   .0389265    1.10   0.271   -.0334755   .1193096
      (1 vs 0) 16  |   .0498956   .0426023    1.17   0.242   -.0337106   .1335018
      (1 vs 0) 17  |   .0568741   .0465741    1.22   0.222   -.0345267    .148275
      (1 vs 0) 18  |   .0638527   .0507726    1.26   0.209   -.0357876    .163493
      (1 vs 0) 19  |   .0708313   .0551459    1.28   0.199   -.0373917   .1790542
      (1 vs 0) 20  |   .0778098   .0596558    1.30   0.192   -.0392636   .1948832
      (1 vs 0) 21  |   .0847884   .0642733    1.32   0.187   -.0413469   .2109237
-----------------------------------------------------------------------------------
```

A5.18 Model 5.7 - estimated results

```
. regress c.salesgrowth c.capitalpurch c.foreignown i.directexp##c.foreigncurr c.emplgrowth
c.wcbanks i.subsidies i.industry i.country1 i.country2 i.country3 i.country4 i.country5
i.country6 topmanagerexp i.firmsize c.firmage i.newproduct3years i.politicalinstability, robust
Note: 1.country6 omitted because of collinearity

Linear regression                                      Number of obs =     955
                                                       F( 23,    931) =    7.71
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.1757
                                                       Root MSE      =  .29647

---------------------------------------------------------------------------------------------
                            |               Robust
                salesgrowth |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
----------------------------+----------------------------------------------------------------
               capitalpurch |  -.0038529   .0046055    -0.84   0.403    -.0128912    .0051855
                 foreignown |   .0538036   .0275944     1.95   0.051    -.0003509     .107958
            1.directexp |   -.005166   .0338529    -0.15   0.879    -.0716028    .0612707
                foreigncurr |  -.1625775   .0406594    -4.00   0.000    -.2423722   -.0827827
                            |
directexp#c.foreigncurr |
                          1  |   .1103522   .0741834     1.49   0.137    -.0352339    .2559382
                            |
                 emplgrowth |   .1515807   .0260041     5.83   0.000     .1005472    .2026142
                    wcbanks |  -.0653196   .0261453    -2.50   0.013    -.1166302   -.0140091
                1.subsidies |    .067283   .0292836     2.30   0.022     .1247525    .0098135
                            |
                   industry |
                          2  |  -.0095386   .0239076    -0.40   0.690    -.0564576    .0373804
                          3  |  -.0604223   .0441792    -1.37   0.172    -.1471247    .0262801
                          4  |  -.0204026   .0289228    -0.71   0.481     -.077164    .0363588
                            |
                 1.country1 |  -.0201469   .0391114    -0.52   0.607    -.0969036    .0566098
                 1.country2 |   .0901933   .0365619     2.47   0.014     .0184401    .1619465
                 1.country3 |    .153369   .0387838     3.95   0.000     .0772552    .2294829
                 1.country4 |  -.0077571    .032258    -0.24   0.810    -.0710639    .0555497
                 1.country5 |   -.059074   .0350837    -1.68   0.093    -.1279264    .0097783
                 1.country6 |          0  (omitted)
              topmanagerexp |    .002707   .0010911     2.48   0.013     .0005656    .0048483
                            |
                   firmsize |
                          1  |  -.0359946    .041411    -0.87   0.385    -.1172644    .0452752
                          2  |  -.0249882   .0426953    -0.59   0.559    -.1087784    .0588019
                          3  |   .0233391   .0450529     0.52   0.605    -.0650779    .1117561
                            |
                    firmage |  -.0013937   .0009288    -1.50   0.134    -.0032164     .000429
         1.newproduct3years |   .0479269   .0207851     2.31   0.021     .0887179    .0071358
```

```
     1.politicalinstability |  -.0546395   .0214081    -2.55   0.011    -.0966532   -.0126259
                      _cons |  -.0333938   .0622046    -0.54   0.592    -.1554711    .0886836

               capitalpurch |  -.0038529   .0046055    -0.84   0.403    -.0128912    .0051855
                 foreignown |   .0538036   .0275944     1.95   0.051    -.0003509     .107958
            1.directexp |   -.005166   .0338529    -0.15   0.879    -.0716028    .0612707
                foreigncurr |  -.1625775   .0406594    -4.00   0.000    -.2423722   -.0827827
                            |
directexp#c.foreigncurr |
                         1  |   .1103522   .0741834     1.49   0.137    -.0352339    .2559382
                            |
                 emplgrowth |   .1515807   .0260041     5.83   0.000     .1005472    .2026142
                    wcbanks |  -.0653196   .0261453    -2.50   0.013    -.1166302   -.0140091
                1.subsidies |    .067283   .0292836     2.30   0.022     .1247525    .0098135
                            |
                   industry |
                         2  |  -.0095386   .0239076    -0.40   0.690    -.0564576    .0373804
                         3  |  -.0604223   .0441792    -1.37   0.172    -.1471247    .0262801
                         4  |  -.0204026   .0289228    -0.71   0.481     -.077164    .0363588
                            |
                 1.country1 |  -.0201469   .0391114    -0.52   0.607    -.0969036    .0566098
                 1.country2 |   .0901933   .0365619     2.47   0.014     .0184401    .1619465
                 1.country3 |    .153369   .0387838     3.95   0.000     .0772552    .2294829
                 1.country4 |  -.0077571    .032258    -0.24   0.810    -.0710639    .0555497
                 1.country5 |   -.059074   .0350837    -1.68   0.093    -.1279264    .0097783
                 1.country6 |          0  (omitted)
              topmanagerexp |    .002707   .0010911     2.48   0.013     .0005656    .0048483
                            |
                   firmsize |
                         1  |  -.0359946    .041411    -0.87   0.385    -.1172644    .0452752
                         2  |  -.0249882   .0426953    -0.59   0.559    -.1087784    .0588019
                         3  |   .0233391   .0450529     0.52   0.605    -.0650779    .1117561
                            |
                    firmage |  -.0013937   .0009288    -1.50   0.134    -.0032164     .000429
         1.newproduct3years |   .0479269   .0207851     2.31   0.021     .0887179    .0071358
     1.politicalinstability |  -.0546395   .0214081    -2.55   0.011    -.0966532   -.0126259
                      _cons |  -.0333938   .0622046    -0.54   0.592    -.1554711    .0886836
----------------------------------------------------------------------------------------------
```

A5.19 Model 5.7 – diagnostic tests

Test for homosecdasticity - model 5.7

```
. estat imtest

Cameron & Trivedi's decomposition of IM-test

---------------------------------------------------
              Source |       chi2     df      p
---------------------+-----------------------------
  Heteroskedasticity |     305.63    265    0.0436
            Skewness |      25.09     23    0.3456
            Kurtosis |      14.68      1    0.0001
---------------------+-----------------------------
               Total |     345.40    289    0.0127
---------------------------------------------------
```

Test for functional form - model 5.7

```
. estat ovtest

Ramsey RESET test using powers of the fitted values of salesgrowth
       Ho:  model has no omitted variables
                 F(3, 928) =      2.52
                  Prob > F =      0.0564

. estat linktest
```

```
invalid subcommand linktest
r(321);

. linktest

      Source |       SS       df       MS              Number of obs =     955
-------------+------------------------------           F(  2,   952) =  101.84
       Model |  17.4970492     2  8.74852461           Prob > F      =  0.0000
    Residual |  81.7799292   952  .085903287           R-squared     =  0.1762
-------------+------------------------------           Adj R-squared =  0.1745
       Total |  99.2769784   954  .104063919           Root MSE      =  .29309

------------------------------------------------------------------------------
 salesgrowth |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   .9032781   .1453551     6.21   0.000     .6180246    1.188531
      _hatsq |   -.264777   .3484769    -0.76   0.448    -.9486485    .4190945
       _cons |  -.0039115   .0177297    -0.22   0.825    -.0387053    .0308824
------------------------------------------------------------------------------
```

A5.20 Predicive margins form - model 5.7

```
. margins directexp, at ( foreigncurr = ( 0(0.1)  1))

Predictive margins                                Number of obs   =        955
Model VCE    : Robust

Expression   : Linear prediction, predict()

1._at        : foreigncurr     =           0
2._at        : foreigncurr     =          .1
3._at        : foreigncurr     =          .2
4._at        : foreigncurr     =          .3
5._at        : foreigncurr     =          .4
6._at        : foreigncurr     =          .5
7._at        : foreigncurr     =          .6
8._at        : foreigncurr     =          .7
9._at        : foreigncurr     =          .8
10._at       : foreigncurr     =          .9
11._at       : foreigncurr     =           1

-----------------------------------------------------------------------------------
                  |            Delta-method
                  |     Margin   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------------+----------------------------------------------------------------
_at#directexp |
             1 0  |  -.1828785   .0118132   -15.48   0.000      -.206062    -.159695
             1 1  |  -.1880445   .0310092    -6.06   0.000     -.2489006   -.1271885
             2 0  |  -.1991362    .010655   -18.69   0.000     -.2200468   -.1782256
             2 1  |  -.1932671    .028026    -6.90   0.000     -.2482686   -.1382655
             3 0  |   -.215394   .0109805   -19.62   0.000     -.2369433   -.1938446
             3 1  |  -.1984896   .0263377    -7.54   0.000     -.2501777   -.1468014
             4 0  |  -.2316517   .0126758   -18.28   0.000     -.2565282   -.2067752
             4 1  |  -.2037121   .0261958    -7.78   0.000     -.2551217   -.1523025
             5 0  |  -.2479095    .015292   -16.21   0.000     -.2779203   -.2178987
             5 1  |  -.2089346   .0276241    -7.56   0.000     -.2631474   -.1547219
             6 0  |  -.2641672   .0184412   -14.32   0.000     -.3003584    -.227976
             6 1  |  -.2141572   .0304022    -7.04   0.000     -.2738219   -.1544925
             7 0  |   -.280425   .0218947   -12.81   0.000     -.3233936   -.2374564
             7 1  |  -.2193797   .0342026    -6.41   0.000     -.2865029   -.1522565
             8 0  |  -.2966827   .0255291   -11.62   0.000      -.346784   -.2465814
             8 1  |  -.2246022   .0387256    -5.80   0.000     -.3006019   -.1486026
             9 0  |  -.3129405   .0292773   -10.69   0.000     -.3703976   -.2554833
             9 1  |  -.2298248   .0437477    -5.25   0.000     -.3156802   -.1439693
            10 0  |  -.3291982   .0331006    -9.95   0.000     -.3941586   -.2642378
            10 1  |  -.2350473   .0491159    -4.79   0.000      -.331438   -.1386566
            11 0  |  -.3454559   .0369757    -9.34   0.000     -.4180213   -.2728906
            11 1  |  -.2402698   .0547285    -4.39   0.000     -.3476754   -.1328642
-----------------------------------------------------------------------------------
```

A5.21 Margins of interaction term between directexp and foreigncurr

```
. margins r.directexp, at (foreigncurr =(0 (0.1) 1)) contrast (nowald effects)

Contrasts of predictive margins
Model VCE    : Robust

Expression   : Linear prediction, predict()

1._at        : foreigncurr     =           0
2._at        : foreigncurr     =          .1
3._at        : foreigncurr     =          .2
4._at        : foreigncurr     =          .3
5._at        : foreigncurr     =          .4
6._at        : foreigncurr     =          .5
7._at        : foreigncurr     =          .6
8._at        : foreigncurr     =          .7
9._at        : foreigncurr     =          .8
10._at       : foreigncurr     =          .9
11._at       : foreigncurr     =           1

------------------------------------------------------------------------------------
                  |            Delta-method
                  |   Contrast   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------------+-----------------------------------------------------------------
directexp@_at |
     (1 vs 0)  1  |  -.0152552   .0331796    -0.46   0.646    -.0803691    .0498587
     (1 vs 0)  2  |  -.0041139   .0303327    -0.14   0.892    -.0636409    .0554131
     (1 vs 0)  3  |   .0070274   .0291188     0.24   0.809    -.0501174    .0641721
     (1 vs 0)  4  |   .0181686   .0297386     0.61   0.541    -.0401924    .0765297
     (1 vs 0)  5  |   .0293099   .0320859     0.91   0.361    -.0336577    .0922775
     (1 vs 0)  6  |   .0404512   .0358228     1.13   0.259      -.02985    .1107523
     (1 vs 0)  7  |   .0515925    .040567     1.27   0.204    -.0280191    .1312041
     (1 vs 0)  8  |   .0627337   .0460081     1.36   0.173    -.0275557    .1530231
     (1 vs 0)  9  |    .073875   .0519273     1.42   0.155    -.0280307    .1757807
  (1 vs 0) 10  |   .0850163   .0581789     1.46   0.144    -.0291581    .1991907
  (1 vs 0) 11  |   .0961576   .0646667     1.49   0.137    -.0307488    .2230639
------------------------------------------------------------------------------------
```

A5.22 Model 5.8 - estimated results

```
. regress c.salesgrowth c.capitalpurch i.directexp##c.foreignown c.emplgrowth c.wcbanks
c.foreigncurr i.subsidies i.ind
> ustry i.country1 i.country2 i.country3 i.country4 i.country5 i.country6 topmanagerexp
i.firmsize c.firmage i.newproduct3y
> ears i.politicalinstability, robust
Note: 1.country6 omitted because of collinearity

Linear regression                                      Number of obs =     955
                                                       F( 23,    931) =    7.76
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.1743
                                                       Root MSE      =  .29672

-------------------------------------------------------------------------------------------
                          |               Robust
              salesgrowth |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------------------+----------------------------------------------------------------
             capitalpurch |  -.0039863   .0046092    -0.86   0.387    -.0130318    .0050593
        1.directexp |    .0225364   .0340292    0.66   0.508    -.0442465    .0893193
               foreignown |   .0602978    .033875     1.78   0.075    -.0061824    .1267781
                          |
directexpdum#c.foreignow  |
                        1  |  -.0248653   .0573906    -0.43   0.665    -.1374952    .0877647
                          |
               emplgrowth |   .1521593   .0259534     5.86   0.000     .1012253    .2030933
                  wcbanks |   -.065366   .0262094    -2.49   0.013    -.1168023   -.0139297
```

```
         foreigncurr |  -.1363997   .0356232    -3.83   0.000    -.2063108   -.0664887
         1.subsidies |    .067229   .0294126    -2.29   0.022     .1249517    .0095064
                     |
            industry |
                  2  |  -.0094953   .0239042    -0.40   0.691    -.0564076     .037417
                  3  |  -.0623888   .0443859    -1.41   0.160    -.1494968    .0247191
                  4  |  -.0210109   .0289332    -0.73   0.468    -.0777929     .035771
                     |
          1.country1 |  -.0171258   .0390912    -0.44   0.661    -.0938429    .0595912
          1.country2 |   .0923516   .0365079     2.53   0.012     .0207042    .1639989
          1.country3 |   .1577685   .0387271     4.07   0.000     .0817659    .2337711
          1.country4 |  -.0050315   .0323458    -0.16   0.876    -.0685106    .0584476
          1.country5 |  -.0566758   .0347805    -1.63   0.104    -.1249331    .0115816
          1.country6 |          0  (omitted)
      topmanagerexp |   .0026888   .0010902     2.47   0.014     .0005493    .0048283
                     |
            firmsize |
                  1  |  -.0358831   .0413745    -0.87   0.386    -.1170811    .0453149
                  2  |  -.0262107   .0427235    -0.61   0.540    -.1100562    .0576347
                  3  |   .0230363   .0450475     0.51   0.609    -.0653702    .1114427
             firmage |  -.0013542   .0009295    -1.46   0.145    -.0031783      .00047
   1.newproduct3years |    .048224   .0208043     2.32   0.021     .0890528    .0073952
 1.politicalinstability |  -.0553177   .0213711    -2.59   0.010    -.0972589   -.0133765
               _cons |  -.0377747   .0620723    -0.61   0.543    -.1595926    .0840431
------------------------------------------------------------------------------------------
```

A5.23 – Model 5.8 – diagnostic tests

Check for multocollinearity - model 5.8

```
. vif

    Variable |       VIF       1/VIF
-------------+----------------------
capitalpurch |      1.28    0.780905
1.directex~m |      1.72    0.582106
  foreignown |      1.84    0.543859
directexpd~m#|
c.foreignown |
          1  |      2.32    0.430887
  emplgrowth |      1.06    0.944964
     wcbanks |      1.31    0.765538
 foreigncurr |      1.14    0.878141
 2.subsidies |      1.06    0.947703
    industry |
          2  |      1.48    0.677122
          3  |      1.19    0.839454
          4  |      1.43    0.697719
  1.country1 |      1.47    0.679703
  1.country2 |      1.87    0.534473
  1.country3 |      2.01    0.496709
  1.country4 |      1.67    0.599339
  1.country5 |      1.73    0.577574
topmanager~p |      1.13    0.882916
    firmsize |
          1  |      7.58    0.131862
          2  |      7.69    0.129992
          3  |      7.65    0.130802
     firmage |      1.13    0.881348
2.newprodu~s |      1.11    0.897701
1.politica~y |      1.09    0.914233
-------------+----------------------
    Mean VIF |      2.26
```

Test for homoscedasticity - model 5.8

```
. estat imtest

Cameron & Trivedi's decomposition of IM-test

---------------------------------------------------
              Source |       chi2     df      p
---------------------+-----------------------------
  Heteroskedasticity |     302.03    263    0.0492
            Skewness |      24.34     23    0.3853
            Kurtosis |      14.63      1    0.0001
---------------------+-----------------------------
               Total |     341.01    287    0.0156
---------------------------------------------------
```

Test for functional form - model 5.8

```
. estat ovtest

Ramsey RESET test using powers of the fitted values of salesgrowth
       Ho:  model has no omitted variables
                 F(3, 928) =      1.57
                  Prob > F =      0.1943
```

A5.24 Predicitve margins - model 5.8

```
. margins directexp, at ( foreignown = ( 0 (0.1)  1))

Predictive margins                                Number of obs    =        955
Model VCE    : Robust

Expression   : Linear prediction, predict()

1._at        : foreignown      =           0
2._at        : foreignown      =          .1
3._at        : foreignown      =          .2
4._at        : foreignown      =          .3
5._at        : foreignown      =          .4
6._at        : foreignown      =          .5
7._at        : foreignown      =          .6
8._at        : foreignown      =          .7
9._at        : foreignown      =          .8
10._at       : foreignown      =          .9
11._at       : foreignown      =           1

------------------------------------------------------------------------------------
                  |            Delta-method
                  |     Margin   Std. Err.      t     P>|t|      [95% Conf. Interval]
------------------+-----------------------------------------------------------------
_at#directexp |
             1 0  |  -.2100983     .011482   -18.30   0.000    -.2326318   -.1875648
             1 1  |  -.1875619    .0312377    -6.00   0.000    -.2488663   -.1262575
             2 0  |  -.2040685    .0106081   -19.24   0.000     -.224887     -.18325
             2 1  |  -.1840186    .0287991    -6.39   0.000    -.2405373   -.1274999
             3 0  |  -.1980387    .0107786   -18.37   0.000    -.2191918   -.1768856
             3 1  |  -.1804754    .0269621    -6.69   0.000    -.2333888   -.1275619
             4 0  |  -.1920089    .0119488   -16.07   0.000    -.2154587   -.1685591
             4 1  |  -.1769321     .025855    -6.84   0.000    -.2276729   -.1261913
             5 0  |  -.1859791     .013868   -13.41   0.000    -.2131953   -.1587629
             5 1  |  -.1733888    .0255729    -6.78   0.000     -.223576   -.1232017
             6 0  |  -.1799493    .0162733   -11.06   0.000    -.2118859   -.1480128
             6 1  |  -.1698456    .0261424    -6.50   0.000    -.2211505   -.1185407
             7 0  |  -.1739196    .0189807    -9.16   0.000    -.2111695   -.1366696
             7 1  |  -.1663023    .0275108    -6.04   0.000    -.2202928   -.1123119
             8 0  |  -.1678898    .0218784    -7.67   0.000    -.2108265    -.124953
             8 1  |  -.1627591    .0295674    -5.50   0.000    -.2207855   -.1047326
             9 0  |    -.16186    .0249001    -6.50   0.000    -.2107268   -.1129932
             9 1  |  -.1592158    .0321804    -4.95   0.000    -.2223703   -.0960613
```

```
            10 0  |  -.1558302   .0280056    -5.56   0.000    -.2107916   -.1008688
            10 1  |  -.1556726   .0352263    -4.42   0.000    -.2248046   -.0865405
            11 0  |  -.1498004   .0311699    -4.81   0.000    -.2109718    -.088629
            11 1  |  -.1521293   .0386027    -3.94   0.000    -.2278876    -.076371
------------------------------------------------------------------------------------
```

A5.25 Margins of interaction term between directexp and foreignown

```
. margins r.directexp, at ( foreignown = ( 0 (0.1)  1)) contrast (nowald effects)

Contrasts of predictive margins
Model VCE     : Robust

Expression    : Linear prediction, predict()

1._at         : foreignown      =           0
2._at         : foreignown      =          .1
3._at         : foreignown      =          .2
4._at         : foreignown      =          .3
5._at         : foreignown      =          .4
6._at         : foreignown      =          .5
7._at         : foreignown      =          .6
8._at         : foreignown      =          .7
9._at         : foreignown      =          .8
10._at        : foreignown      =          .9
11._at        : foreignown      =           1

------------------------------------------------------------------------------------
                  |            Delta-method
                  |   Contrast   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------------+-----------------------------------------------------------------
directexp@_at |
     (1 vs 0)  1  |   .0105051   .0340638     0.31   0.758    -.0563441    .0773542
     (1 vs 0)  2  |   .0094017   .0312967     0.30   0.764    -.0520171    .0708205
     (1 vs 0)  3  |   .0082983   .0293638     0.28   0.778    -.0493272    .0659239
     (1 vs 0)  4  |    .007195   .0284357     0.25   0.800    -.0486091    .0629991
     (1 vs 0)  5  |   .0060916   .0286103     0.21   0.831    -.0500552    .0622384
     (1 vs 0)  6  |   .0049882   .0298683     0.17   0.867    -.0536275    .0636039
     (1 vs 0)  7  |   .0038849   .0320826     0.12   0.904    -.0590763     .066846
     (1 vs 0)  8  |   .0027815   .0350725     0.08   0.937    -.0660471    .0716101
     (1 vs 0)  9  |   .0016781   .0386583     0.04   0.965    -.0741877    .0775439
     (1 vs 0) 10  |   .0005747   .0426903     0.01   0.989    -.0832037    .0843532
     (1 vs 0) 11  |  -.0005286   .0470539    -0.01   0.991    -.0928704    .0918131
------------------------------------------------------------------------------------
```

A5.26 Model 5.9 - estimated results

```
. regress c.salesgrowth c.capitalpurch c.foreignown i.directexp##c.wcbanks c.emplgrowth
c.foreigncurr i.su
> bsidies i.industry i.country1 i.country2 i.country3 i.country4 i.country5 i.country6
topmanagerexp i.firmsiz
> e c.firmage i.newproduct3years i.politicalinstability, robust
Note: 1.country6 omitted because of collinearity

Linear regression                                      Number of obs =     955
                                                       F( 23,    931) =    7.81
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.1743
                                                       Root MSE      =  .29673

------------------------------------------------------------------------------------------
                        |               Robust
            salesgrowth |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------------------+-----------------------------------------------------------------
           capitalpurch |  -.0039254   .0046109    -0.85   0.395    -.0129744    .0051236
             foreignown |   .0513374   .0277484     1.85   0.065    -.0031193    .1057941
        1.directexp |   .0102679   .0376976     0.27   0.785    -.0637142      .08425
```

```
                 wcbanks |     -.06776   .0280731    -2.41   0.016    -.1228538   -.0126662
                         |
directexp#c.wcbanks |
                       1 |    .0198737    .056374     0.35   0.725    -.0907611    .1305084
                         |
              emplgrowth |    .1522892   .0259683     5.86   0.000      .101326    .2032523
             foreigncurr |   -.1361089   .0356187    -3.82   0.000    -.2060111   -.0662067
             1.subsidies |    .0669206   .0296065     2.26   0.024     .1250237    .0088175
                         |
                industry |
                       2 |   -.0091082   .0238962    -0.38   0.703    -.0560048    .0377884
                       3 |   -.0604922   .0442334    -1.37   0.172    -.1473009    .0263166
                       4 |   -.0204592   .0289237    -0.71   0.480    -.0772224    .0363041
                         |
              1.country1 |   -.0170772   .0390533    -0.44   0.662    -.0937199    .0595656
              1.country2 |    .0908646   .0363885     2.50   0.013     .0194516    .1622776
              1.country3 |    .1569983   .0386722     4.06   0.000     .0811034    .2328931
              1.country4 |    -.005039   .0323063    -0.16   0.876    -.0684405    .0583626
              1.country5 |   -.0566828   .0347984    -1.63   0.104    -.1249752    .0116095
              1.country6 |           0  (omitted)
           topmanagerexp |    .0026827   .0010906     2.46   0.014     .0005424     .004823
                         |
                firmsize |
                       1 |   -.0356657   .0414942    -0.86   0.390    -.1170986    .0457672
                       2 |   -.0258879   .0428271    -0.60   0.546    -.1099367    .0581608
                       3 |    .0231684   .0451346     0.51   0.608    -.0654089    .1117457
                         |
                 firmage |   -.0013459   .0009284    -1.45   0.147     -.003168    .0004762
      1.newproduct3years |    .0482378   .0208072     2.32   0.021     .0890723    .0074033
  1.politicalinstability |   -.0555947   .0213272    -2.61   0.009    -.0974496   -.0137397
                   _cons |   -.0367569   .0620936    -0.59   0.554    -.1586166    .0851028
------------------------------------------------------------------------------------------
```

A5.27 Model 5.9 – diagnostis tests

Check for multicollinearity - model 5.9

```
. vif

    Variable |       VIF       1/VIF
-------------+----------------------
capitalpurch |      1.28    0.780671
  foreignown |      1.17    0.857311
1.directex~m |      1.98    0.504027
     wcbanks |      1.46    0.687141
directexpd~m#|
   c.wcbanks |
          1  |      1.90    0.527388
  emplgrowth |      1.06    0.944612
 foreigncurr |      1.14    0.879192
 2.subsidies |      1.06    0.944754
    industry |
          2  |      1.47    0.678495
          3  |      1.18    0.850325
          4  |      1.43    0.697814
  1.country1 |      1.47    0.679696
  1.country2 |      1.89    0.529174
  1.country3 |      2.01    0.496979
  1.country4 |      1.67    0.599296
  1.country5 |      1.73    0.577523
topmanager~p |      1.13    0.882380
    firmsize |
          1  |      7.58    0.131841
          2  |      7.69    0.130018
          3  |      7.64    0.130820
     firmage |      1.13    0.883181
2.newprodu~s |      1.11    0.896947
1.politica~y |      1.10    0.912674
```

```
-------------+----------------------
    Mean VIF |      2.23
```

Test for homoscedasticity - model 5.9

```
. estat imtest

Cameron & Trivedi's decomposition of IM-test

---------------------------------------------------
              Source |       chi2     df      p
---------------------+-----------------------------
  Heteroskedasticity |     302.77    264    0.0505
            Skewness |      24.34     23    0.3853
            Kurtosis |      14.50      1    0.0001
---------------------+-----------------------------
               Total |     341.61    288    0.0163

---------------------------------------------------
```

Test for functional form - model 5.9

```
. estat ovtest

Ramsey RESET test using powers of the fitted values of salesgrowth
       Ho:  model has no omitted variables
                F(3, 928) =      1.65
              Prob > F =      0.1765
```

A5.28 Predictive margins - model 5.9

```
. margins directexp, at (wcbanks = ( 0 (0.1)  1))

Predictive margins                                Number of obs   =        955
Model VCE     : Robust

Expression    : Linear prediction, predict()

1._at         : wcbanks         =           0
2._at         : wcbanks         =          .1
3._at         : wcbanks         =          .2
4._at         : wcbanks         =          .3
5._at         : wcbanks         =          .4
6._at         : wcbanks         =          .5
7._at         : wcbanks         =          .6
8._at         : wcbanks         =          .7
9._at         : wcbanks         =          .8
10._at        : wcbanks         =          .9
11._at        : wcbanks         =           1

------------------------------------------------------------------------------------
                  |            Delta-method
                  |     Margin   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------------+-----------------------------------------------------------------
_at#directexp |
             1 0  |  -.1784528   .0139911   -12.75   0.000    -.2059106   -.1509951
             1 1  |  -.1681849   .0345579    -4.87   0.000    -.2360054   -.1003645
             2 0  |  -.1852288   .0123285   -15.02   0.000    -.2094238   -.1610339
             2 1  |  -.1729736   .0312384    -5.54   0.000    -.2342794   -.1116678
             3 0  |  -.1920048   .0111354   -17.24   0.000    -.2138582   -.1701515
             3 1  |  -.1777622    .028514    -6.23   0.000    -.2337214    -.121803
             4 0  |  -.1987808   .0105717   -18.80   0.000    -.2195281   -.1780336
             4 1  |  -.1825509   .0265685    -6.87   0.000    -.2346919   -.1304098
             5 0  |  -.2055568   .0107373   -19.14   0.000    -.2266289   -.1844848
```

```
          5 1  |  -.1873395   .0255802    -7.32   0.000     -.237541    -.137138
          6 0  |  -.2123328   .0116008   -18.30   0.000    -.2350996   -.1895661
          6 1  |  -.1921281   .0256599    -7.49   0.000    -.2424861   -.1417701
          7 0  |  -.2191089   .0130242   -16.82   0.000    -.2446691   -.1935486
          7 1  |  -.1969168   .0267982    -7.35   0.000    -.2495086   -.1443249
          8 0  |  -.2258849   .0148473   -15.21   0.000     -.255023   -.1967467
          8 1  |  -.2017054     .02887    -6.99   0.000    -.2583632   -.1450475
          9 0  |  -.2326609   .0169416   -13.73   0.000     -.265909   -.1994127
          9 1  |   -.206494   .0316929    -6.52   0.000    -.2686918   -.1442963
         10 0  |  -.2394369   .0192186   -12.46   0.000    -.2771537     -.20172
         10 1  |  -.2112827   .0350859    -6.02   0.000    -.2801393    -.142426
         11 0  |  -.2462129   .0216207   -11.39   0.000    -.2886438   -.2037819
         11 1  |  -.2160713   .0389003    -5.55   0.000    -.2924137   -.1397289
------------------------------------------------------------------------------
```

A5.29 Model 5.10 - estimated results

```
. regress c.salesgrowth c.capitalpurch c.foreignown i.directexp##i.currdep c.emplgrowth c.wcban
> ks c.foreigncurr i.subsidies i.industry  topmanagerexp i.firmsize c.firmage i.newproduct3years
i.
> politicalinstability, robust

Linear regression                                      Number of obs =     972
                                                       F( 19,   952) =    7.93
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.1473
                                                       Root MSE      =  .30135

-----------------------------------------------------------------------------------

                       |               Robust

           salesgrowth |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]

-----------------------+-----------------------------------------------------------
          capitalpurch |  -.0050224   .0046333    -1.08   0.279    -.0141149    .0040702
            foreignown |   .0607811   .0274819     2.21   0.027      .006849    .1147133
     1.directexp |   .0417837   .0335941     1.24   0.214    -.0241433    .1077107
             1.currdep |   .1138799   .0230122     4.95   0.000     .0687194    .1590404
                       |
 directexp#currdep |
                  1 1  |  -.1152724   .0542334    -2.13   0.034    -.2217033   -.0088414
                       |
            emplgrowth |   .1330162   .0252287     5.27   0.000      .083506    .1825264
               wcbanks |  -.0326326   .0237992    -1.37   0.171    -.0793376    .0140725
           foreigncurr |  -.1695198   .0344748    -4.92   0.000    -.2371753   -.1018643
           2.subsidies |  -.0547278   .0281932    -1.94   0.053    -.1100558    .0006003
                       |
              industry |
                    2  |  -.0094258    .023792    -0.40   0.692    -.0561166    .0372649
                    3  |  -.0623808   .0442772    -1.41   0.159    -.1492729    .0245113
                    4  |  -.0361624   .0287096    -1.26   0.208    -.0925038     .020179
                       |
         topmanagerexp |   .0028864   .0010822     2.67   0.008     .0007626    .0050102
                       |
              firmsize |
                    1  |  -.0469063   .0387442    -1.21   0.226    -.1229402    .0291276
                    2  |   -.021989   .0397773    -0.55   0.581    -.1000503    .0560722
                    3  |   .0418536   .0426451     0.98   0.327    -.0418357    .1255429
                       |
               firmage |  -.0018555    .000982    -1.89   0.059    -.0037826    .0000715
    2.newproduct3years |  -.0480434   .0206118    -2.33   0.020    -.0884931   -.0075936
1.politicalinstability |  -.0685419   .0209023    -3.28   0.001    -.1095618    -.027522
                 _cons |  -.0726648   .0548628    -1.32   0.186    -.1803308    .0350012
-----------------------------------------------------------------------------------
```

A5.30 Predictive margins - model 5.10

```
. margins directexpdum, at ( currdep = (0  1))

Predictive margins                                Number of obs    =        972
Model VCE     : Robust

Expression    : Linear prediction, predict()

1._at         : currdep         =           0

2._at         : currdep         =           1

------------------------------------------------------------------------------------
                  |            Delta-method
                  |     Margin   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------------+-----------------------------------------------------------------
_at#directexp |
             1 0  |  -.2615397    .015032   -17.40   0.000    -.2910394   -.2320401
             1 1  |   -.219756   .0292098    -7.52   0.000    -.2770792   -.1624329
             2 0  |  -.1476598   .0164529    -8.97   0.000    -.1799479   -.1153718
             2 1  |  -.2211485   .0435707    -5.08   0.000    -.3066541   -.1356429
------------------------------------------------------------------------------------

. margins r.directexpdum, at ( currdep = (0, 1)) contrast (nowald effects)

Contrasts of predictive margins
Model VCE     : Robust

Expression    : Linear prediction, predict()

1._at         : currdep         =           0

2._at         : currdep         =           1

------------------------------------------------------------------------------------
                  |            Delta-method
                  |   Contrast   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------------+-----------------------------------------------------------------
directexp@_at |
      (1 vs 0) 1  |   .0417837   .0335941     1.24   0.214    -.0241433    .1077107
      (1 vs 0) 2  |  -.0734886   .0466959    -1.57   0.116    -.1651273      .01815
------------------------------------------------------------------------------------
```

A5.31 Model 5.11 – estimated results

```
. regress c.salesgrowth c.capitalpurch c.foreignown i.directexp c.emplgrowth c.wcbanks c.foreig
> ncurr##i.currdep i.subsidies i.industry  topmanagerexp i.firmsize c.firmage i.newproduct3years
i.
> politicalinstability, robust

Linear regression                                      Number of obs =     972
                                                       F( 19,    952) =    7.84
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.1524
                                                       Root MSE      =  .30045

-----------------------------------------------------------------------------------------
                       |               Robust
           salesgrowth |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-----------------------+-----------------------------------------------------------------
          capitalpurch |   -.004843   .0046304    -1.05   0.296      -.01393     .004244
            foreignown |   .0560996   .0266605     2.10   0.036     .0037795    .1084197
       1.directexp |  -.0069599   .0289549    -0.24   0.810    -.0637827    .0498629
            emplgrowth |    .136109   .0254355     5.35   0.000     .0861928    .1860251
               wcbanks |  -.0409122   .0235562    -1.74   0.083    -.0871404     .005316
           foreigncurr |  -.0747667   .0379746    -1.97   0.049    -.1492904   -.0002431
             1.currdep |   .1248714   .0226701     5.51   0.000     .0803823    .1693605
                       |
 currdep#c.foreigncurr |
                     1  |  -.2355602   .0757979    -3.11   0.002    -.3843104     -.08681
                       |
```

```
         2.subsidies |  -.0503977   .0283037    -1.78   0.075    -.1059426    .0051472
                     |
            industry |
                  2  |  -.0092563   .0237212    -0.39   0.696    -.0558082    .0372956
                  3  |  -.0557798    .044686    -1.25   0.212    -.1434743    .0319147
                  4  |  -.0351359   .0285071    -1.23   0.218    -.0910799     .020808
                     |
      topmanagerexp  |   .0028904   .0010748     2.69   0.007     .0007811    .0049997
                     |
            firmsize |
                  1  |  -.0521443   .0397585    -1.31   0.190    -.1301687    .0258801
                  2  |  -.0273189   .0404228    -0.68   0.499    -.1066469    .0520091
                  3  |   .0324703    .043467     0.75   0.455    -.0528319    .1177724
                     |
             firmage |  -.0019632   .0009582    -2.05   0.041    -.0038436   -.0000829
   2.newproduct3years |  -.0471344   .0205404    -2.29   0.022     -.087444   -.0068247
1.politicalinstability |   -.070163   .0208762    -3.36   0.001    -.1111317   -.0291943
               _cons |  -.0710323   .0551443    -1.29   0.198    -.1792507     .037186
--------------------------------------------------------------------------------------
```

A5.32 Predictive margins - model 5.11

```
 margins currdep, at ( foreigncurr = (0 (0.1) 1))

Predictive margins                                Number of obs    =        972
Model VCE     : Robust

Expression    : Linear prediction, predict()

1._at         : foreigncurr     =           0

2._at         : foreigncurr     =          .1

3._at         : foreigncurr     =          .2

4._at         : foreigncurr     =          .3

5._at         : foreigncurr     =          .4

6._at         : foreigncurr     =          .5

7._at         : foreigncurr     =          .6

8._at         : foreigncurr     =          .7

9._at         : foreigncurr     =          .8

10._at        : foreigncurr     =          .9

11._at        : foreigncurr     =           1

------------------------------------------------------------------------------
             |            Delta-method
             |     Margin   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 _at#currdep |
        1 0  |  -.2461149   .0147452   -16.69   0.000    -.2750518    -.217178
        1 1  |  -.1212435   .0162337    -7.47   0.000    -.1531015   -.0893855
        2 0  |  -.2535916   .0133574   -18.99   0.000    -.2798049   -.2273782
        2 1  |  -.1522762   .0153672    -9.91   0.000    -.1824337   -.1221187
        3 0  |  -.2610683   .0129715   -20.13   0.000    -.2865243   -.2356122
        3 1  |  -.1833089   .0172787   -10.61   0.000    -.2172176   -.1494001
        4 0  |  -.2685449   .0136727   -19.64   0.000     -.295377   -.2417129
        4 1  |  -.2143416   .0212307   -10.10   0.000    -.2560059   -.1726772
        5 0  |  -.2760216   .0153122   -18.03   0.000    -.3060712    -.245972
        5 1  |  -.2453743   .0263195    -9.32   0.000    -.2970252   -.1937233
        6 0  |  -.2834983   .0176303   -16.08   0.000    -.3180971   -.2488994
        6 1  |   -.276407   .0320074    -8.64   0.000    -.3392202   -.2135937
        7 0  |  -.2909749   .0203969   -14.27   0.000    -.3310031   -.2509468
        7 1  |  -.3074397   .0380266    -8.08   0.000    -.3820652   -.2328141
        8 0  |  -.2984516   .0234538   -12.73   0.000    -.3444788   -.2524244
        8 1  |  -.3384723    .044242    -7.65   0.000    -.4252954   -.2516493
        9 0  |  -.3059283   .0267015   -11.46   0.000    -.3583289   -.2535277
        9 1  |   -.369505   .0505813    -7.31   0.000    -.4687688   -.2702413
```

```
       10 0  |   -.313405   .0300782   -10.42   0.000    -.3724323   -.2543776
       10 1  |  -.4005377   .0570032    -7.03   0.000    -.5124042   -.2886712
       11 0  |  -.3208816   .0335451    -9.57   0.000    -.3867125   -.2550508
       11 1  |  -.4315704   .0634827    -6.80   0.000    -.5561527   -.3069882
------------------------------------------------------------------------------


margins r.currdep, at ( foreigncurr = (0, 0.3, 0.7, 1)) contrast (nowald effects)

Contrasts of predictive margins
Model VCE    : Robust

Expression   : Linear prediction, predict()

1._at        : foreigncurr     =           0

2._at        : foreigncurr     =          .3

3._at        : foreigncurr     =          .7

4._at        : foreigncurr     =           1

------------------------------------------------------------------------------
             |            Delta-method
             |   Contrast   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 currdep@_at |
 (1 vs 0) 1  |   .1248714   .0226701     5.51   0.000     .0803823    .1693605
 (1 vs 0) 2  |   .0542033   .0257602     2.10   0.036       .00365    .1047567
 (1 vs 0) 3  |  -.0400207   .0497174    -0.80   0.421    -.1375891    .0575476
 (1 vs 0) 4  |  -.1106888   .0709543    -1.56   0.119    -.2499337    .0285561
```