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Single Market Transmission Mechanisms Before, During and After the 2008-09 Crisis

A Quantitative Assessment

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Research assistance: Alexandros Charos (WIFO)

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Austrian Institute of Economic Research, National Institute of Economic and Social Research, London

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Abstract

This study analyses the main transmission mechanisms relevant for the absorption and propagation of asymmetries within the EU and EMU, putting a specific focus on Europe's real economy. In particular, the report aims to assess how the economic shock that triggered the financial and economic crisis has been transmitted and at least partially absorbed in the EU's real economy and the EMU member countries, from both a macro- and a microeconomic perspective. From a policy point of view, the results of the current study imply that, on account of the substantial heterogeneity among EU countries found in all parts of the study, "one size fit all" policies are likely to be very ineffective at increasing the resilience of the EU's single market.

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Final Report on:

Single Market Transmission Mechanisms Before, During and After the 2008/2009 Crisis: A Quantitative Assessment

Vienna, July 2016

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Executive Summary

The European Union (EU) has been harshly hit by the financial market and economic crisis of 2008/09 and the consecutive European governmental debt crisis. The EU's real economy experienced a substantial slowdown in economic growth (measured in terms of real GDP), also translating into sharp reductions in manufacturing (and services) output and noticeable drops in intra- and extra-EU trade volumes. EU28-wide real GDP declined by 4.4 percent in 2009, while at the same time total extra-EU trade (by all 28 EU-member states) experienced a loss of approximately 23.7 percent and the EU wide unemployment rate, which amounted to 7.0 percent in 2008, increased to 9.0 percent in 2009 and reached 10.2 percent by the end of 2014. A closer look at the EU economies and specifically at the participants in the European Monetary Union (EMU), however, also indicates that individual countries have been asymmetrically affected by the crisis. Some economies such as Germany are already back on their growth path, reporting (relatively) high growth rates and low unemployment. Other countries still suffer severely from the consequences of the crisis. For instance, using Greece as the most visible example, the unemployment rate amounted to 26.5 percent in 2014.

Against this background, this study analyzes the main transmission mechanisms relevant for the absorption and propagation of asymmetries (both in terms of asymmetric shocks and asymmetric consequences of initially symmetric shocks) within the EU and EMU, putting a specific focus on Europe's real economy. In particular, the report aims to assess how the economic shock that triggered the financial and economic crisis has been transmitted and at least partially absorbed in the EU's real economy and the EMU member states, from both a macro- and a micro-economic perspective. It therefore analyses several aspects of crisis transmission and coping mechanisms. A macro-economic analysis asks if and how shocks unfolded asymmetrically, thereby setting the stage for the subsequent microeconomic analysis of transmission dynamics. The subsequent chapters focus on the role of three different adjustment mechanisms (i) intra- and extra EU-trade developments in direct and indirect trade relationships, (ii) capital flows and corporate finance, and (iii) cross-border migration flows. These chapters also compare the cross-country performance of the member states with different degrees of integration and different labour market and banking system regulations for the time periods just before, during and after the Great Recession.

Results of the macro-economic analysis

The simulations of the macro-economic analysis using a Dynamic Stochastic General Equilibrium (DSGE) model substantiate the hypothesis that members of the European Union experience asymmetric adjustment paths in response to global shocks. The shocks considered are a productivity shock and a financial market shock, and the assumption is made that both shocks originate outside of the EU.

The simulations highlight distinct adjustment paths between three groups of countries analysed: (i) Greece, Italy, Cyprus, Ireland, Portugal and Spain, which are all facing structural economic problems and difficulties in refinancing sovereign debt, (ii) the central and eastern European countries, and (iii) the core, which comprises the remaining countries. This applies to output as well as to other key macroeconomic variables. They show that adjustment paths changed in parallel with important structural parameters such as private and public indebtedness as well as investment ratios in the aftermath of the global financial crisis. The ongoing process of deleveraging in the corporate sector of the first group of countries (Greece, Italy, Cyprus, Ireland, Portugal and Spain) has increased the resilience of their

economies to external economic and financial shocks. Furthermore, the resilience of the central and eastern European countries has been bolstered by the exchange rate acting as a shock absorber and the low levels of private debt. In the core countries, transmission mechanisms and resilience has not changed, despite subdued economic growth and significantly higher public debt.

Estimates of a Bayesian Panel VAR model, based on quarterly data covering key macroeconomic, labour market and macro-financial variables focusing on the effects of a US and a UK house price shock, suggest that the strongest transmission of the collateral shock is via bond markets (as measured by collateral spreads) in the relatively market-based economies (i.e. the UK, US and Ireland). In contrast, transmission to the more bank-based economies such as Italy and France mainly occurs through investments. Furthermore, global shocks have little impact on the unemployment rate in countries with more flexible labour markets, whereas in countries with more highly regulated labour markets and presumably more rigid wages, unemployment rates respond more strongly to a global financial shock.

Results on intra-EU and extra-EU trade developments

Against this background, the chapter on intra-EU and extra-EU trade developments empirically analyses the role of direct and indirect trade relationships for transmitting and absorbing (or promoting) economic shocks that might be induced either externally or internally. According to the results, intra-EU exports dominate their extra-EU counterparts in both manufacturing goods and services. In relative terms, exports from the manufacturing sectors still dominate, but service exports tend to develop more dynamically. A drawback of the strong concentration on intra-EU trade relationships is that negative demand shocks translate into large within-EU export losses and a harsh export downturn for virtually all industries located in all member states participating in the single market. In addition, disaggregated analyses at the country and industry levels, respectively, reveal substantial heterogeneities in intra- and extra-EU trade performance across the EU member states in general and Eurozone economies in particular. Idiosyncratic factors that are not easy to assess by applying a quantitative approach seem to be crucial in shaping these differences.

The results on labour market effects induced by direct and indirect trade relationships reveal that the EU has fallen behind in terms of relative net job creation when compared to the 13 other major economies included in the empirical analysis. Accordingly, the dynamics in the creation of new jobs are (much) faster outside the EU. Within the EU, the EMU member states provide 2/3 of all available jobs. Since the outbreak of the crisis, the non-Eurozone economies, however, have been more successful in creating new jobs. The relatively poor performance of the Eurozone economies can be partially linked to non-trivial adjustment costs prevailing in this group of EU member states. An analysis based on dynamic labour demand equations highlights the crucial importance of adjustment costs in shaping persistence in the employment dynamics within the Eurozone. These adjustment costs are likely driven by labour market institutions that reduce flexibility in employment adjustment over time, with likely additional negative employment effects in times of economic downturns. Furthermore, labour demand in the non-Eurozone economies is systematically affected by fluctuations in domestic demand induced by both final consumption and intermediary demand. For Eurozone participants, fluctuations in foreign intermediary demand seem to be more relevant, while foreign final consumption exhibits virtually no impact on employment, both in the EU in general and the EMU in particular.

Results on capital flows and corporate finance

According to the results that concern the relationship between financial flows and investment activities in the pre-, during- and post-crisis periods, investment - although trending in the last two years - remains well below pre-crisis levels for many EU Member States, and capacity utilization is still weak. This weakness is partially related to the weakness of expected demand and partially related to pre-crisis over-investment in buildings and structures (housing) in certain countries. In many countries, banks have tightened lending standards and economic uncertainty remains high compared to the pre-crisis period. The European banking market is an important element supporting the efficient allocation of financial resources. The results suggest that a diversified domestic banking system with the presence of foreign banks is important to reducing financing constraints in Europe. In this context, foreign banks may help alleviate domestic banking shocks and excessive deleveraging of the domestic banking system, but may also have negative impacts, as they may also import foreign deleveraging shocks. Here, the evidence presented in the study suggests that well-balanced banking systems with the presence of foreign banks are better at allocating financial resources to competing uses than are unbalanced banking systems consisting mainly of domestic or of foreign banks.

The evidence shows that capital flows changed dramatically after the crisis. Capital flows, especially capital flows associated with cross-border banking activities saw a sudden stop during and after the crisis. Capital mobility declined and financial integration slowed down. The results, however, show that when accounting for cross-border banking activities, there is not much evidence to support the claim that they impacted the allocation of financial resources across industries before or after the crisis. Domestic lending remains crucial for investment finance in most bank-based economies in Europe.

While it is often argued that imposing stricter regulations may lead to a credit crunch, the present study finds there is only a weak impact of an improved quality of the banking system on lending towards more financially dependent industries. This suggests that, while the (necessary) repair of bank balance sheets may have led to heightened financing constraints in some European countries, firms affected by these constraints are not primarily found in those industries that need the most financing for investment.

Finally, the chapter also shows that the situation in the EU banking system has improved. Capital buffers have increased and regulation has reduced leverage. However, there is still a need for some further measures to strengthen the integration of European Financial markets.

Results on labour market adjustments

The chapter on labour market adjustments asked, by contrast, to what extent migration within and across countries was an important adjustment mechanism to asymmetric shocks, whether cross-border migration contributed to regional convergence in labour market conditions and to what degree cross-border migration led to a redeployment of labour on the sectoral or regional level, respectively.

Somewhat in contrast to the findings of the pre-crisis literature, this analysis finds that migration was rather effective in accommodating asymmetric shocks to regional labour markets in the 2004 to 2014 period. In addition, migration from abroad also contributed to the reduction of regional labour market disparities in the EU as well as the facilitation of the reallocation of labour to more productive (competitive) sectors. Yet the result also points to a substantial heterogeneity across demographic groups, time periods and countries. Thus, the

contribution of migration to regional labour market adjustment, convergence and structural change still seems to hinge strongly on high-skilled workers and cross-border migrants, while low-skilled and natives contributed less to regional labour market adjustment. The contribution of migration to regional labour market adjustment was also substantially higher in the pre-crisis period (2004 to 2008) than either the crisis (2008 to 2011) or post-crisis period (2011 to 2014), with the results indicating that in particular the accession of the 3 countries that joined the EU after 2007 and the successive liberalization of immigration from countries that joined after 2004 improved the adjustment capability of regional labour markets in this time period. Furthermore, the positive effects of immigration from abroad on convergence and sector reallocation hinge very strongly on third country immigration.

The contribution of migration to regional labour market adjustment also varied substantially among different countries. Formal labour market institutions, however, do not seem to have a simple connection to the flexibility of regional labour markets in the EU. Our measure of labour market flexibility at the country level is significantly negatively, correlated with only two of six institutional variables considered in this study: minimum wages (as a percent of the median) and the effective marginal tax rate for unemployed moving to employment.

Central policy recommendations

From a policy perspective, the results of the current study therefore imply that, on account of the substantial heterogeneity among EU countries found in all parts of the study, "one size fit all" policies are likely be very ineffective at increasing the resilience of the EU's single market. This rationalizes the increased emphasis on European macro-economic and structural policies that are based on tailor-made, country-specific analyses and recommendations, such as is, for instance, the case in the framework of the European Semester. The evidence in the current study indicates that such recommendations and analyses should be broad in scope and – inter alia – should focus on policy measures related to product market regulation and adjustment costs in labour markets. Furthermore, the assessment process related to these recommendations should also take explicit account of a country's industrial structure and the competiveness of its industries.

The success of such country-specific recommendations will, however, crucially depend on the willingness to implement reforms in the member states. For this purpose, a close and constructive cooperation between EU authorities (i.e., the European Commission) and the individual member states is needed. One option for increasing transparency and willingness to reform in these relationships could be provided by the implementation of evaluation processes concerning the suggested measures and the economic outcomes targeted by the measures proposed. In the long-run, this could potentially reduce the idiosyncrasies in the economic performance across different EU/EMU member states and further contribute to a successful achievement of the goals laid out in the European Semester.

Furthermore, from a macro-economic perspective high public and private debt levels continue to impede economic recovery, as they weaken the resilience of the economies of EU countries to adverse global economic shocks. Several countries have achieved progress in fostering macroeconomic stability, not least by implementing structural reforms in labour and product markets. Nevertheless, the corporate sector remains highly leveraged. In this context, the policy challenge lies in removing the impediments to balance sheet repair and reinforcing the need to strengthen balance sheets by implementing sustainable new business models. Ensuring that nonviable firms (both financial as well as non-financial) exit markets in

an orderly way would help relieve pressures in a market environment that is in some sectors marked by excess capacity, as well as allow viable firms to set up sustainable business models. To create fiscal space for macroeconomic stabilization policy it is essential to reduce excessive public debt levels in line with the European fiscal framework.

Furthermore, specifically with respect to direct and indirect trade effects, the idiosyncrasies in the performance of different countries and industries seem to be closely related to product market and labour market regulations. Persistence in labour demand which is closely related to (extensive) adjustment costs seems to be one main factor that reduces the flexibility of EMU industries with adverse effects for the overall competitiveness of the industries under consideration. Furthermore, exporting economies that are characterised by a lower level of product market regulation and thus intensified competition, seem to be more successful in international markets in the long run.

Further steps for the regulation of systematically important banks are also needed, as it is clear that the single supervisory mechanism (SRM) is still complex and entrusted to national authorities and the single resolution fund may have limited capacity for the resolution of a truly system-relevant financial institution. In this respect, the establishment of a single, centralized deposit insurance mechanism would reduce the risks associated with cross-country deposit flows. Capital market integration should, however, not exclusively focus on reducing fragmentation, but also on increasing liquidity for smaller and growth-oriented enterprises. In this context, reducing initial public offering (IPO) costs and the costs of subsequent offerings of new growth-oriented firms is especially relevant in modern industry environments, where intangible assets and investments in intangible assets are gaining importance. Particularly for investment in intangible capital, security markets and stock exchanges could play an important role and encourage the development of a financial "ecosystem" that complements and supports the entrepreneurial "ecosystem". The non-bank financing of firms complements bank financing and will be of increased importance as investments turn intangible. A true capital market union that is geared towards investment thus needs to include mechanisms that reduce the fragmentation in European stock and bond markets, as well as regulatory costs for enterprises, without increasing risks for investors.

With respect to labour market migration, by contrast, efforts to reduce (administrative) barriers to mobility within the EU (e.g. by improving systems of mutual skill recognition and reducing the administrative costs of transferring social security entitlements) should be continued. In addition, policy should also focus on concerted efforts to improve the integration of both within-EU as well as third-country immigrants into national labour markets, so as to ensure a maximum contribution of immigration to EU-wide productivity growth and labour market convergence. Ensuring incentives for mobility through the reform of national labour market governance institutions should also be continued. These reforms will, however, have to be based on more detailed national-level evidence than is available in the current study and will also have to consider the interaction of various institutions on national labour markets.

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1. Introduction and Motivation

The European Union (EU) has been harshly hit by the financial and economic crisis of 2008-09 and the consecutive European governmental debt crisis. The EU's real economy experienced a substantial slowdown in economic growth (as measured in terms of real GDP), which also translated into sharp reductions in manufacturing (and services) output and a noticeable drop in intra- and extra-EU trade volumes. EU-28-wide real GDP declined by 4.4 percent in 2009 according to official Eurostat statistics.[1] At the same time, total extra-EU trade (by all 28 EU-member states) experienced a loss of approximately 23.7 percent. The world-wide recession induced by the financial and economic crisis has also been accompanied by a substantial increase in EU-wide unemployment. Again based on Eurostat figures, in 2008 the EU-28 average unemployment rate amounted to 7.0 percent, while in 2009 it almost immediately increased to 9.0 percent and continued to rise until 2013, reaching a maximum of 10.9 percent. By the end of 2014, this trend had slightly reversed and the EU-28's average unemployment rate amounted to 10.2 percent. While other highly industrialized economies had already regained the ground lost during the crisis, the EU still seemed to be struggling to recover. The USA, for example, experienced annual real GDP growth rates above 2 percent in all years since 2009, with 2011 as the only exception. The EU-28 economy, by contrast, reached 2.1 percent in 2010 but has grown at a much slower pace ever since. Furthermore, the EU experienced a second year of real GDP decline in 2012 with the corresponding growth rate amounting to -0.5 percent.

A closer look at the EU economies and specifically at the participants in the European Monetary Union (EMU), however, indicates that individual countries have been asymmetrically affected by the crisis. Some economies such as Germany are already back on their growth path, reporting (relatively) high (real) economic growth rates and low levels of unemployment. For example, Germany's GDP growth amounted to 1.6 percent in 2014, thereby exceeding the EU-28 average by 0.2 percentage points. For the same year, Germany reported an unemployment rate of 5 percent. This is only half the EU-28 average, which amounted to 10.2 percent. Other countries, including Greece as the most visible example, by contrast, are still severely suffering from the consequences of the crisis. The unemployment rate in Greece amounted to 26.5 percent in 2014. In a similar vein and for the same year, Italy, as one of the largest EU-economies and one of its founding members, reported a real GDP growth rate of -0.4 percent, which was accompanied by an increase in the unemployment rate from 12.1 percent in 2013 to 12.7 percent in 2014.

During the course of the financial and economic crisis the question of potential contagion effects of the financial markets received substantial attention in the policy debate. In this debate, a lot of question marks arose regarding the viability of the institutional set-up of the EU in general and the EMU in particular. As a result of this, a large number of institutional reforms have already been implemented in the EU and a number of others are still under discussion. In the academic world, this policy debate has been reflected in a renewed interest of economists in understanding the impact of asymmetries (both in terms of the potential asymmetry of shocks as well as the potential asymmetric transmission of initially symmetric shocks) on the EU economy as well as the economies of its member states. The reason for this is that any policy measures and institutional transformations of the EU that aim to facilitate the absorption of negative asymmetries within the common currency area need

[1] Eurostat provides data capturing all EU-28 member states, also prior to the accession of Romania, Bulgaria (in 2007) and Croatia (2013). Real GDP growth rates for the EU-28 are, for example, available at http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tec00115&plugin=1.

to take into account the spill-over and absorption effects induced by such policy measures within the boundaries of the EU's single market.

1.1. Theoretical background

Against this background, the current study analyzes the main transmission and adjustment mechanisms relevant to the absorption and transmission of asymmetries (in terms of both asymmetric shocks and the potential asymmetric transmission of initially symmetric shocks) within the EU and EMU, respectively. The emphasis, in this respect, lies on Europe's real economy and on the time period just before, during and after the crisis. In particular, based on theoretical considerations and a screening of the literature and empirical results, the study aims to highlight the main shock absorption and transmission mechanisms relevant for the European single market and the European Monetary Union within this time period.

The theoretical framework guiding this analysis is on the one hand OCA-theory, as this addresses both the likelihood of shock asymmetry within an economic region and its ability to return to a symmetric equilibrium. This theory studies both the costs and benefits of adopting a common currency and has been one of the – continuously extended – "workhorse" theories used by international economists to study the EMU and European integration in the last decades (De Grauwe 2014). In particular, it argues that the benefits associated with the formation of a common currency area are mainly a reduction in transaction costs, an increase in price comparability, a reduction in exchange rate risk and an increase in intra-currency area trade, as well as in some cases a potential increase in the quality of the monetary policies conducted (Baldwin and Wyplosz 2015).[2] Thus, prior to the establishment of the Euro as a common currency, cross-border trade required exchanges of national currencies. This caused high transaction costs and at the same time made price comparisons (more) difficult. Whenever exchange rates varied, relative prices also changed which decreased price transparency. As a consequence, prior to the establishment of the EMU, firms and customers had to bear an exchange rate risk. The reduction in transaction costs and the full elimination of the exchange rate risk (within the Eurozone), together with the ability to directly compare prices across countries, was thus expected to also increase intra-EMU trade flows.

Since the potential benefits of a common currency area are generally undisputed, OCA theory is much more concerned with the potential costs associated with having (only) one common monetary policy. Dating back at least to the seminal contribution by Mundell (1961), economic scholars have tried to identify so-called OCA criteria, which serve as guidelines for evaluating the potential costs involved in establishing a common currency area. These criteria mainly concentrate on a) how an economic region would be able to cope with asymmetries in terms of shocks and or the transmission mechanisms of initially symmetric shocks and b) how likely it is that such shocks will occur.

The very early contributions already suggest a strong link between trade relationships and the asymmetry of economic developments, as well as the important role of labour market adjustment in absorbing asymmetries. For instance, the seminal contribution of Mundell (1961) primarily focused on the need of labour market flexibility (either in the form of wage flexibility or labour mobility) as a prerequisite for different economic regions to constitute an OCA. As a consequence, prior to the formation of the EMU, a number of scholars argue that labour

[2] The last of these potential benefits clearly depends on the (previous) history and experience of the individual national central banks.

market mobility in the EMU countries was insufficient to allow for the absorption of potentially asymmetric shocks. Thus, one study conducted on behalf of the European Commission (2008), for example, concluded that *"[...] geographic mobility rates are still relatively low in the European Union, both within and between countries. For instance, on average between 2000 and 2005, workers' mobility within EU Member States (regional mobility) amounted to only one per cent each year. This is much lower than mobility rates across Australian territories and US states, which exceed two and three per cent, respectively."*

Similarly, with respect to the likelihood of the occurrence of asymmetries Kenen (1969) states early on that economic regions which produce and export diversified products and are characterized by a similar production structure are more likely to constitute an OCA than regions with a very specialized export and production structure. This is because such economic areas are less likely to be strongly affected if demand for one specific product drops, and that, when production structures are similar across countries, one may expect greater symmetry of external negative demand shocks. Closely related to this, McKinnon (1962) argues that countries which are very open to trade and trade heavily with each other form an OCA. The basic idea here is that if economies trade goods which are homogenous, "manipulating" exchange rates will have little effect on their competitiveness.[3]

On the other hand, the current study is also related to empirical observations and a screening of the recent literature on the transmission of international business cycles. This is because much of the OCA theory was designed at a time when the integration of international financial markets was very low. As a consequence, the potential transmission mechanisms of international financial markets were not considered an important element in the transmission and absorption of asymmetries. This transmission channel has, however, received substantial attention ever since the financial and economic crisis (see Rey 2016 for a recent survey). The literature has suggested various causes for the occurrence of an asymmetric shock transmission in a common currency environment characterized by persistent external imbalances. These theories can be summarized into two different views on the causes of such asymmetries, which are not mutually exclusive, but rather likely to reinforce each other (Johnston and Regan 2014).

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[3] The literature on OCA has also pointed towards additional criteria capturing other potential costs involved when establishing a common currency area. These are, however, not directly related to the structure and homogeneity of the real economies of the participant countries and will therefore only be mentioned for the sake of completeness. A very important question on the institutional design of the EMU in the aftermath of the Eurozone crisis centres on the issue of providing (explicit and implicit) financial transfers within the Eurozone. The basic idea of any fiscal transfer system is to provide some type of automatic stabilizers which should help support a more rapid recovery in negatively affected regions. Finally, OCAs are expected to provide larger net benefits when all participating economies share homogeneous preferences on how they want to politically deal with economic shocks (Baldwin and Wyplosz 2015). Differences in the policy measures applied in the aftermath of a shock can further amplify its initial asymmetric nature while coordinated policies might help to absorb it more successfully.

In addition, another brand within the OCA theory not surveyed here addresses the potential endogeneity of optimum currency area criteria effects. By studying the effects of several currency unions that occurred in the past, Rose and Frankel showed that monetary integration leads to a very significant deepening of reciprocal trade. The implication is that a common currency area may turn into an optimum currency area (OCA) after the launch of monetary integration, even if it wasn't an OCA before, or "countries which join EMU, no matter what their motivation may be, may satisfy OCA properties ex-post even if they do not ex-ante!" (Frankel and Rose 1997). Consequently, the borders of new currency unions could be extended in expectation that trade integration and income correlation will increase once a currency union is created.

The first strand of literature argues that structural imbalances between export-led countries and domestic demand-led countries result in divergent (nominal) wages, inflation rates and, eventually, competitiveness (see, for instance, Hall 2012; Shambaugh 2012; Johnston et al. 2014), as the nominal exchange rate is no longer available as an equilibrating mechanism in a common currency area. Thus, according to this institutional view, export-led countries typically produce significant wage moderation relative to the demand-led counterparts. This exerts downward pressure on inflation and promotes persistent current account surpluses in the export-led countries, as well as a corresponding loss of competitiveness in the remaining countries. Against this background, trade and financial imbalances are therefore caused by a loss in competitiveness in demand-led countries (i.e. via the current account); financial imbalances follow as a consequence via the financial account.

The second view, on the contrary, argues that imbalances are likely to start in the financial account, and that the loss of competitiveness is merely a consequence rather than the cause of financial imbalances (Johnston and Regan 2014): With the convergence in nominal exchange rates and interest rates, demand-led countries experience significant reductions in borrowing costs (Hellwig 2011; Lane 2012, 2013). Access to cheap credit is likely to fuel consumption, which in turn exerts upward pressure on wages and inflation. The appreciation of real exchange rates, which can therefore be seen as a consequence of financial inflows rather than their cause, eventually brings about real imbalances.

While the two different perspectives basically constitute a chicken-and-egg problem, it seems likely that nominal wages and cross-country capital flows constitute important elements concerning the sustainability of an OCA in the case of global shocks.

1.2. Objectives of the report

Against this theoretical background, the first central aim of this report is to assess how the economic shock that triggered the financial and economic crisis has been transmitted and at least partially absorbed in the EU's real economy and the EMU member states. Here we add to existing knowledge by emphasising both the macro- and the micro-economic aspects of the transmission and adjustment to such asymmetries. These have been only little studied in the previous economic literature and are also generally not yet well understood. In particular, the more structural (microeconomic) analysis aims to identify a set of policy-relevant stylised facts with respect to the role of intra- and extra-EU trade, the supply and demand of financial resources and intra- and extra-EU migration as the main channels of the transmission and absorption of asymmetries.

The EU, however, aside from consisting of economies that share the same currency also consists of nine more countries which still dispose of national currencies. These economies also differ in how closely their individual monetary policy actions mimic the behaviour of the European Central Bank (ECB) as well as with respect to various institutional aspects (e.g. relating to their banking system and labour market regulations). Thus, for example, countries such as the Czech Republic, Hungary, Poland, Romania, Sweden and the United Kingdom apply free floating exchange rate regimes relative to the Euro, while others, such as Bulgaria and Denmark use the Euro as an exchange rate anchor. In addition, some of the EU countries, e.g. France and Italy, have a more bank based financial system, while others (e.g., the United Kingdom) rely more on financial markets. Furthermore, the share of foreign owned banks operating on the territories of the individual countries of the EU differs markedly between, for instance, the Central and Eastern European (CEE) economies and the other EU member states. Similarly, the strictness of labour and product market regulation differs

substantially between countries following a more liberal Anglo-Saxon tradition and countries following the Continental European or Scandinavian welfare state model.

A second objective of the current report is therefore to also compare the cross-country performance of the member states with different degrees of integration, different banking systems and different labour market regulations over the entire study period considered, as well as for relevant sub-periods (i.e., the time periods just before, during and after the Great Recession). This allows us to assess whether the adoption of the Euro or other exchange rate policies has had an impact on economic performance during the financial crisis. Furthermore, this approach enables us to analyse how institutional differences in the banking system and in labour market governance have differentially affected the adjustment behaviour of individual countries before, during and after the crisis.

Finally, by considering the main transmission mechanisms for the pre-crisis, crisis and post-crisis periods for the EU and the EMU economies, the study also tests for "structural breaks" in these transmission and adjustment mechanisms. This allows discussing to what degree these different periods are comparable. Furthermore, in some parts of the analysis this also allows us to provide evidence on how major integration projects other than the formation of the EMU (e.g., the accession of 13 countries after 2004 and the successive application of freedom of movement to these countries) have impacted the absorption capacity of the EU's economy, in particular with respect to labour market adjustments.

1.3. Structure of the report

To achieve these objectives, the next chapter of the report starts with a macroeconomic analysis. This analysis aims to motivate the subsequent micro- and meso-economic investigations by comparing the shock transmissions within the EU, the US and the rest of the world, respectively. Based on both a calibrated Dynamic Stochastic General Equilibrium (DSGE) model and estimations of an empirical Vector Auto-Regression (VAR) model, this chapter studies the main structural breaks in the transmission of economic shocks induced by the "Great Recession". The analyses also explicitly account for varying degrees in the depth of integration observed within the EU. This is achieved by analysing countries that are part of the EMU (and thus share a common monetary policy) as well as countries that are not (yet) EMU member states (which in principle could also apply autonomous monetary policies to cope with negative, perhaps external, demand shocks).

Because we utilize the most recently available macro-level data and employ state-of-the-art time series techniques, the results from this analysis are informative about the differences in adjustment to different shocks within the EU. At the same time, they suggest that trade, differences in financial systems and labour market regulations have been among the most important factors impacting both the asymmetries in shock transmission and the adjustment to economic fluctuations before, during and after the crisis. As a consequence, the remaining three analytic chapters of the report analyse:

- changes in intra- and extra-EU trade and the transmission of asymmetries through international value chains (chapter 3),
- the impact of financial flows, institutional differences in banking systems and financial integration on investment activities in the EU countries before, during and after the financial and economic crisis of 2009 (chapter 4), and
- the efficacy of regional migration patterns in adjusting asymmetries and contributing to regional convergence in unemployment rates as well as in facilitating structural

adjustment at the sector level before, during and after the financial and economic crisis (chapter 5).

Chapter 3, in a first step, estimates standard gravity models of bilateral trade which are augmented by country and industry characteristics to assess the degree of asymmetry of the trade shock induced by the Great Recession. Furthermore, and due to the increasing fragmentation of production via global value chains, in a second step this chapter extends this analysis to account for the structure of the production networks by explicitly considering value-added chains. The chapter finds that intra-EU trade has been particularly pivotal in transmitting the negative (external) demand shock within the single market, although the responsiveness of different industries and countries to this shock differs substantially. In a similar vein, it shows that labour demand in European industries is characterized by varying degrees of path dependence (via adjustment costs) and heterogeneously responds to fluctuations in final versus intermediary and domestic versus foreign demand.

Chapter 4 then shifts the focus to the relationship between financial flows and investment activities in the period before, during and after the crisis. In particular, this chapter asks how cross-border financial flows, institutional differences in banking systems and financial integration affected investment activities in the EU countries. The results of this analysis indicate that further steps for the regulation of systematically important banks are required, as it is clear that the single supervisory mechanism (SRM) is still complex and entrusted to national authorities and the single resolution fund may have a limited capacity for the resolution of a truly system-relevant financial institution. In this respect, the establishment of a single centralized deposit insurance mechanism would reduce the risks associated with cross-country deposit flows.

Subsequently, Chapter 5, motivated by Mundell's criteria for OCAs as well as the literature preceding the crisis, which often found that the EMU may be unviable due to low mobility within the EU, investigates the extent to which internal and cross-border migration in the EU has been an important mechanism of adjustment to asymmetric shocks before, during and after the Great Recession, whether cross-border migration contributed to regional convergence in labour market conditions in the period between 2004 and 2014, and the degree to which migration led to a redeployment of labour at the sectoral and regional level. The findings of this part suggest that migration was rather responsive to regional economic conditions in the time period considered. Furthermore, migration from abroad (both from other EU countries and from third countries) has also contributed to the reduction of regional labour market disparities in the EU as well as to facilitating the reallocation of labour to more productive sectors

Finally, chapter 6 summarizes the main findings of the study and draws policy conclusions, by arguing that the heterogeneity of the responses to the Great Recession among EU countries suggests that "one size fit all" policies might be very ineffective in increasing the resilience of EU's single market and by calling for an increasing emphasis of European macro-economic and structural policies based on tailor-made country specific analyses and recommendations, such as is for instance the case in the framework of the European Semester.

2. Transmission of Economic Shocks: A Macroeconomic Perspective

The political integration process of the European Union (EU) member states was widely expected to become a catalyst for steady economic convergence. The global financial and economic crisis that started in 2007/08 put a significant strain on all economies of the EU. The ensuing sovereign debt crisis and high unemployment rates continue to pose the main challenge to EU economic policy. Notwithstanding the differences in the economic performance of the EU member states prior to the crisis, it was the marked differences in economic performance following the crisis that led some economists to argue that the integration process, and, in particular, the adoption of the Euro may have been a cause of divergence rather than convergence.

The milestone of economic integration was the adoption of the Euro in 1995 as a common currency and the subsequent expansion of the Euro area to currently 19 of 28 members of the EU. A recent report by the European Central Bank (2015) notes that those countries which retained their national currencies and those which adopted the euro after 2002 performed better over the 1999 to 2014 period than the remaining twelve countries that adopted the euro before 2002. The progress has been the greatest among the Eastern European countries such as Estonia, Latvia, Lithuania, Romania and Slovakia. Early adopters of the common currency have shown little convergence, despite initial expectations that the single currency would accelerate economic integration. The evidence of divergence among the early adopters is manifest in the dynamics income gaps relative to the average per capital incomes in the Euro area. Between 1999 and 2014, income gaps persisted in countries such as Spain and Portugal and widened in Greece. This runs contrary to the convergence hypothesis, which predicts higher growth of below-average income economies. Whereas the lack of convergence among the early adopters can partly be attributed to the differential impact of the global financial and economic crisis, fundamental factors such as weak institutions, structural rigidities, weak productivity growth and insufficient policies to address asset price booms are likely to have played a substantial role (ECB, 2015).

The high degree of heterogeneity among EU countries and the recently initiated process of divergence pose a severe risk for macroeconomic stability. According to standard open economy models, the macroeconomic effects and transmission mechanism of international structural shocks do not need to be identical for different economies. Structural characteristics, such as trade openness, degree of indebtedness of public and private entities, price and wage rigidities, and financial architectures significantly influence the sensitivity of economies towards global shocks.

Whether common shocks induce country-specific asymmetries comprises a vivid strand in the contemporary macroeconomic literature, a major part of which has been motivated by the creation of the monetary union and a common monetary policy. The academic literature mainly focuses on the extent to which an exchange rate can act as a shock absorber. Following Bayoumi and Eichengreeen (1993), numerous empirical studies investigate whether shocks in the EMU member countries are symmetric or not. This reasoning rests on the implicit assumption that the goals and structure of the underlying model are symmetric (see, Kashyap and Stein, 1997; Dornbusch et al., 1998; De Bondt, 2000; Chatelain et al., 2001, 2003; Sander and Kleimeier, 2004 for further empirical results). If the structure of the underlying economies is asymmetric, then common shocks may leave a role for the exchange rate as a shock

absorber. For example, a rise in oil prices would have a different impact on the United Kingdom than on the majority of the countries in the EMU, as the UK is a net oil exporter.

The structural characteristics of an economy matter for the degree of asymmetry of the transmission of structural disturbances, and, moreover, significant differences in the structural characteristics of the EU economies continue to exist. Prior to the outbreak of the financial and economic crisis in 2007/08, the EU member states embarked on different development paths that were characterized by different growth patterns on the demand and supply side. These patterns led to large current account surpluses and deficits across member states. They led to substantial changes, not only in flows (e.g. current accounts), but also in stocks and stock prices (e.g. private sector debt and housing prices), as well as to structural changes on the production side of the economy (tradable sector versus non-tradable sector's share in total production).

The above structural characteristics have shifted rapidly and significantly in the aftermath of the financial and economic crisis and the European debt crisis. The differential performance of EU countries before and after the financial crisis is likely to be characterized by, among other factors, different transmission mechanisms and effects of international shocks at the country level. In this context, Faia (2007), for instance, points out the role of the financial structure in the transmission of international shocks, which helps to explain why certain countries co-move more than others. In what follows, we analyze this degree of asymmetry by taking a macroeconomic perspective. The focus will be on country/region-specific characteristics that explain the heterogeneity in the economic performance of the EU member states in the wake of common shocks. For this, we consider the following questions:

- Can differences in economic fundamentals explain the asymmetry in the transmission of common external economic shocks (Section 2.1)?
- What is the empirical evidence on the asymmetric shock transmission in EU countries (Section 2.2)?

Section 2.1 comprises a theoretical analysis and is carried out using the IMF's Global Integrated Monetary and Fiscal (GIMF) Model (Kumhof et al., 2010; Anderson et al., 2013). This is a multi-country DSGE model that has been repeatedly used for cross-country analysis. The model offers a rich framework that includes different sectors and frictions. This makes the model particularly suitable for analysis in the context of this project.

Section 2.2 deals with empirical evidence concerning the asymmetry of the transmission of economic shocks. The aim is to investigate the extent to which key macroeconomic variables respond differently across countries to a global shock. In the empirical part we consider two candidates for the structural shock: a shock to the US economy and a shock to the UK economy, in each case captured by shocks to the UK and the US housing price shock. Note that both shocks are external to the Euro area, despite the fact that a UK shock occurs within the European Union. By taking two potential sources of shocks, we thus hope to cover several plausible scenarios.

Despite their apparent methodological differences, we see the two modelling approaches as complementary. Each methodology allows indentifying and quantifying the extent to which global shocks trigger asymmetric adjustment paths in the EU countries. The shocks considered in the two models are, however, not directly comparable. On the one hand, the sources of the shocks differ (productivity and borrower riskiness shock in the theoretical model, as opposed to a housing shock in the empirical approach). The other difference between the shocks is related to their identification. A structural theoretical model implies a structural

shock, whereas the generalized impulse response functions of the empirical model are based on reduced from errors.

2.1. Theoretical analysis: A DSGE model for shock transmission

To gain a broad view on the interplay of structural characteristic and the asymmetries in the transmission of economic shocks, we divide the EU member states into three groups that have experienced relatively similar economic performance in recent years. These groups include core countries, GICIPS countries and CEE countries.[4] The first group of core economies includes Germany, France, the UK, the former Benelux countries and Scandinavian countries (Denmark, Sweden and Finland). The second group, called GICIPS, comprises the economies of Greece, Italy, Cyprus, Ireland, Portugal and Spain. The economies of these six member states were severely hit by the global financial and economic crisis; their governments faced difficulties in refinancing their sovereign debt and bailing out private banks during the debt crisis. The final group comprises the Central and Eastern European (CEE) countries, whose economies are still undergoing a catching-up process. In the following, we refer to the above groups of member states as regions.

The idea behind the selection of these groups is to highlight the extent to which different fundamentals characterize the asymmetric transmission paths in response to external shocks. We have therefore opted for three groups of countries that have experienced vastly different economic dynamics. We are well aware that the chosen groups of countries contain significant heterogeneity within the groups' members. In the theoretical part, the computational burden of solving an expectations-augmented, large-scale macroeconomic model requires keeping the number of simulated economies small. In the empirical part, however, the choice of country groups and microeconomic shocks is dictated by computational issues as well as limited data availability. The theoretical and empirical analyses thus adopt different but complementary vantage points on the problem.

The shocks considered are a productivity shock and a financial market shock. The motivation of the choice of a productivity shock is threefold. The productivity shocks represent an important source of business cycle fluctuations in macroeconomic theory. Second, productivity shocks are commonly studied in the literature, and are thus easily compared and interpreted. Finally, productivity shocks can be readily implemented and identified in an empirical analysis. Studying the consequences of shocks emanating from the financial sector requires a more differentiated approach that accounts for the nature of the shock. In the theoretical analysis, we choose to represent the financial shock by a shift in the risk perception on the part of lenders (borrower-riskiness).

We use the GIMF model to trace out the adjustment path of the three EU regions in response to common external shocks. We focus on the degree of heterogeneity of the transmission mechanism in the different regions and their adjustment paths. This is accomplished by using impulse response functions for a set of key macroeconomic variables derived from the GIMF model. In addition, we consider three different scenarios. These scenarios are motivated by significant structural changes in the EU economies in the following three dimensions: public debt to GDP ratio, private debt to GDP ratio and investment to GDP ratio. A detailed description of the GIMF model can be found in Appendix A. Further details concerning the calibration of the model can be found in Kumhof et al. (2010) and Anderson (2013).

[4] The CORE country group consists of AT, BE, DE, LU, NL, FR, UK, DK, SE, FI, MT; the GICIPS country group consists of EL, IE, CY, IT, PT, ES; while the EAST country group consists of PL, EE, LT, LV, CZ, SK, SI, HR, HU, BG, RO.

2.1.1.Description of structural asymmetries

Structural heterogeneities among EU member states can be identified along various dimensions. In our discussion of model simulation results we focus on the ratio of investment, the private and public debt relative to nominal GDP. Table 2.1 shows the indicators for the three regions. The table yields several important insights. The investment ratios were significantly above 20 percent in all regions and higher in the GICIPS and CEE countries than in the core economies before 2009. The investment ratios in all regions declined sharply and settled at historically low levels following the crisis. The biggest decline occurred in the GICIPS countries and the CEE economies, whereas the decline in the core economies was only moderate.

The evolution of private debt ratios is comparable in size and dynamics to the core and GICIPS economies. The countries in both regions experienced an increase in private debt ratio prior to the outbreak of the global financial crisis, followed by a decline. The decline in the GICIPS region was more pronounced than in the core economies. In the CEE region, private indebtedness increased steadily until 2009, but has remained fairly constant since then. Turning to the public debt ratios, all regions have experienced increases in debt relative to the GDP over the time horizon. The largest increases occurred in the GICIPS countries, whereas the increases in the core and CEE countries were relatively small (see Table 2.1).

Taken together, public and private indebtedness was, on average, highest in the GICIPS countries, followed by the core economies. In the following we will analyze the extent to which these level differences affect the transmission path of global economic shocks. The three scenarios are motivated by structural differences related to private and public indebtedness as well as investment activity. These structural parameters have traditionally been used to explain structural differences between countries. They have changed significantly following the onset of the global financial crisis, and have been at the focus of policy debate ever since.

Table 2.1: Structural indicators for the three regions

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
					Gross fixed capital formation - % of GDP					
CORE	20.1	20.6	21.1	21.2	19.7	19.6	20.1	20.0	19.6	19.9
GICIPS	24.7	25.5	25.6	24.5	21.7	20.8	19.8	18.4	17.5	17.3
CEE	23.2	24.2	26.9	27.4	23.4	22.2	22.6	22.0	21.2	21.1
					Private sector debt, consolidated - % of GDP					
CORE	137.1	138.6	141.4	146.9	152.8	147.4	146.5	148.1	145.4	144.4
GICIPS	125.3	138.0	147.8	154.9	162.1	162.9	162.2	161.0	154.6	149.3
CEE	52.1	58.7	68.4	78.2	82.3	83.4	83.5	81.8	81.4	80.6
					General government sector debt - % of GDP					
CORE	59.1	57.7	56.3	60.6	69.9	76.0	77.5	80.1	80.5	81.3
GICIPS		74.1	71.5	75.6	87.9	95.1	102.7	112.1	119.1	122.2
CEE	36.1	35.5	34.0	35.7	41.8	46.1	48.0	49.8	51.5	50.2

Q: Eurostat (Macroeconomic imbalances procedure - Statistical annex indicators)

The calibration of monetary rule parameters uses own estimates based on annual data for the corresponding regions. For fiscal rule parameters the calibration assumes target deficit-to-GDP ratios consistent with recent average observed government-debt-to-GDP ratios. We use OECD estimates of output gap coefficients. With respect to the parameters of the financial accelerator, the ratio of corporate debt to corporate equity has been calibrated to match the average of the values in Table 2.1.

2.1.2.Simulation results

The simulations show the results of a productivity shock, and a financial market shock. The shock is external to the three European regions under consideration and is assumed to originate in the Rest of the World aggregate. The impulse response functions depicted in the figures show the spill-over effects of this structural disturbance on the core, GICIPS and CEE countries. We trace out the adjustment paths for the following macroeconomic variables: GDP, public and private debt ratios, investment to GDP ratio, current account to GDP and net foreign asset to GDP ratio. These variables are chosen to illustrate the differences in the transmission mechanism of a global structural disturbance. The impulse response functions should be read as percent deviations (in case of GDP) and percentage point deviations (in case of the other variables) from a steady state. The steady state corresponds to the model calibration for the pre-crisis period.

2.1.3.Productivity shock

Figures Figure 2.1 to Figure 2.3 show the impulse response functions of the core, GICIPS and CEE countries in response to an exogenous productivity shock. The shock itself comprises a temporary decline in productivity in the Rest of the World, as well as in both the tradable and non-tradable sector, based on a definition in Kumhof et al. (2010). The shock is modelled using an autoregressive process, which gradually phases out over time. Figure 2.4 shows the corresponding impulse response functions for the EU as a whole. The aggregation uses a PPP-weighted sum of the three EU regions. In all graphs, the solid line describes the impulse response functions based on a calibration using empirical values for the years prior to the global financial crisis. The dashed lines depict the impulse response functions corresponding to the alternative scenarios. In each scenario, we consider the change in a single structural parameter only, with all remaining parameters fixed at their baseline values.

For each scenario we consider a negative productivity shock that contracts the output in the Rest of the World. The negative output effects from the Rest of the World rapidly spill over to the EU countries. The initial decline is rather strong in the GICIPS countries and slightly weaker in the core economies. The initial impact is rather small in CEE economies. However, the contractionary effect lasts longer in CEE countries than in the core and GICIPS countries. This is due to the fact that the global shock primarily affects the CEE countries via the core and GICIPS countries. The CEE economies are tightly linked to other European economies via trade, whereas the degree of interconnectedness of the CEE countries with the Rest of the World is rather modest. The indirect effect of output decline in the Rest of the World on the CEE economies that is propagated via the core and GICIPS countries is larger than the direct effect. The shock exhibits the largest negative output effects in the CEE countries, followed by the GICIPS economies. The contractionary effect on the core economies is moderate and relatively short-lived, so that significant output effects can only be observed for the first one and a half years.

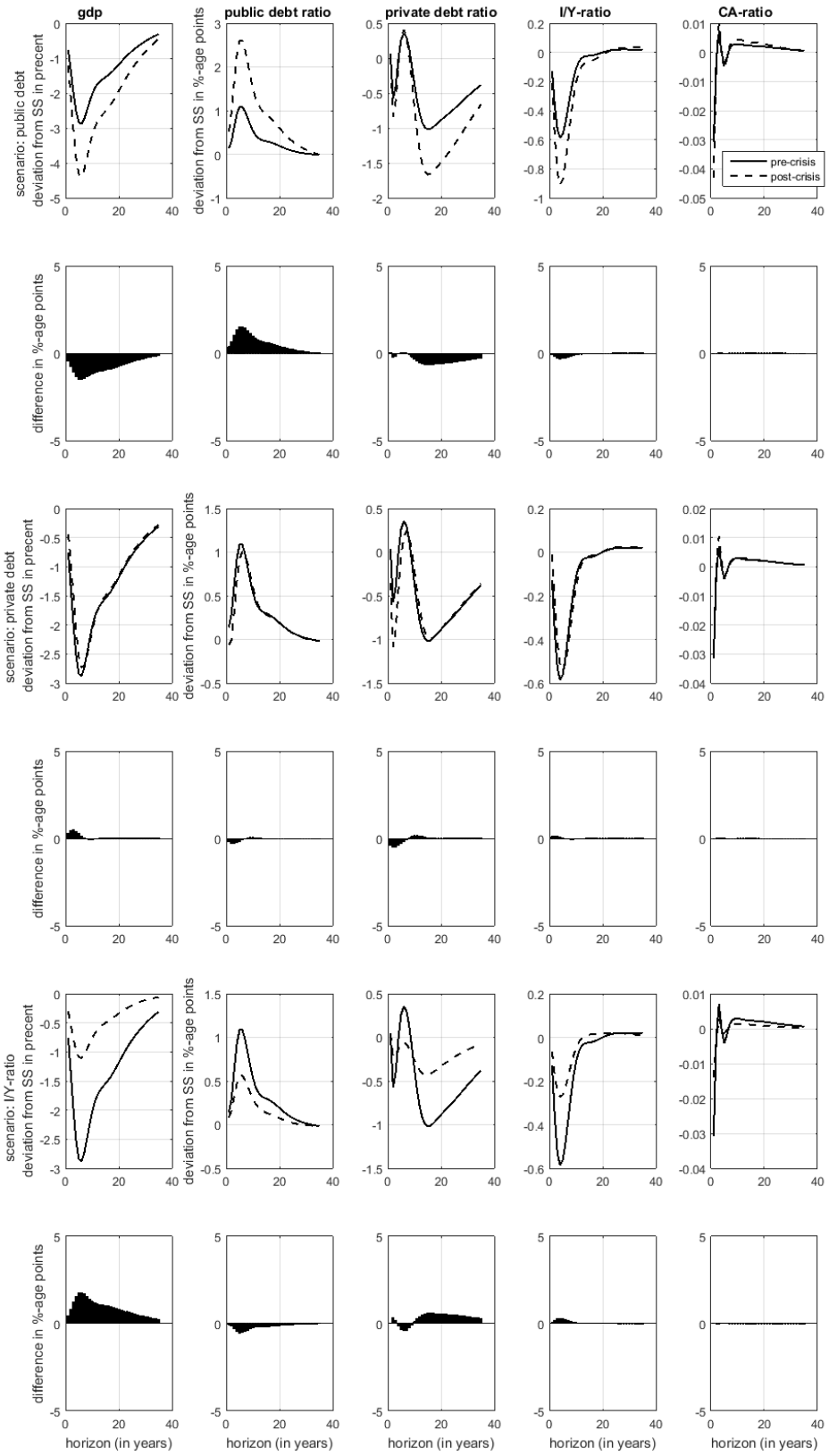
The contractionary output shock triggers an increase in private and public indebtedness, as is evident in rising private and public debt to GDP ratios, and a decline in the investment ratio. Firms react to the sharp decline in exports by reducing investment. The decline in investment outlays is stronger than the decline in GDP. This ultimately causes the investment-to-GDP ratio to decline. Finally, the negative foreign output shock leads to a deterioration in the current account-to-GDP ratio and the net foreign asset position. The changes therein are moderate and the negative income effects are partly compensated by improvements in the terms of trade.

The effect on the public debt ratio in the base scenario is moderate; a one percentage point increase in the CEE countries compares to an increase of four and five percentage points in the core and GICIPS countries, respectively. However, the impact on the public debt ratio changes significantly once the post crisis ratios are considered. This is incorporated into the model by adjusting the corresponding steady state values for public indebtedness.

In the pre-crisis scenario, the impulse response functions show the extent to which the reaction to the productivity shock originating in the Rest of the World changes the adjustment path of the countries in the EU. There is a strong increase in asymmetry in the impulse response functions. The CEE countries tend to experience larger cumulative output contractions. The differences are especially pronounced in the GICIPS countries. For the core countries, the only noteworthy change pertains to adjustment of public debt, whereas all other variables' adjustment paths remain similar. The strong increase in the sensitivity of the GICIPS and CEE countries to the foreign productivity shock result in higher public-debt-to-GDP ratios, as outlined in Table 2.1. The higher degree of indebtedness increases the overall country risk premium, which augments the negative output effects. This stands in contrast with the core economies. Despite the fact that the degree of indebtedness in the core economies also increased, the negative output effects in response to the negative foreign productivity shock remained fairly unchanged. Considering the EU as a whole in Figure 2.4 , the difference in the impulse response functions between the two scenarios is small and determined by the pattern of the core economies.

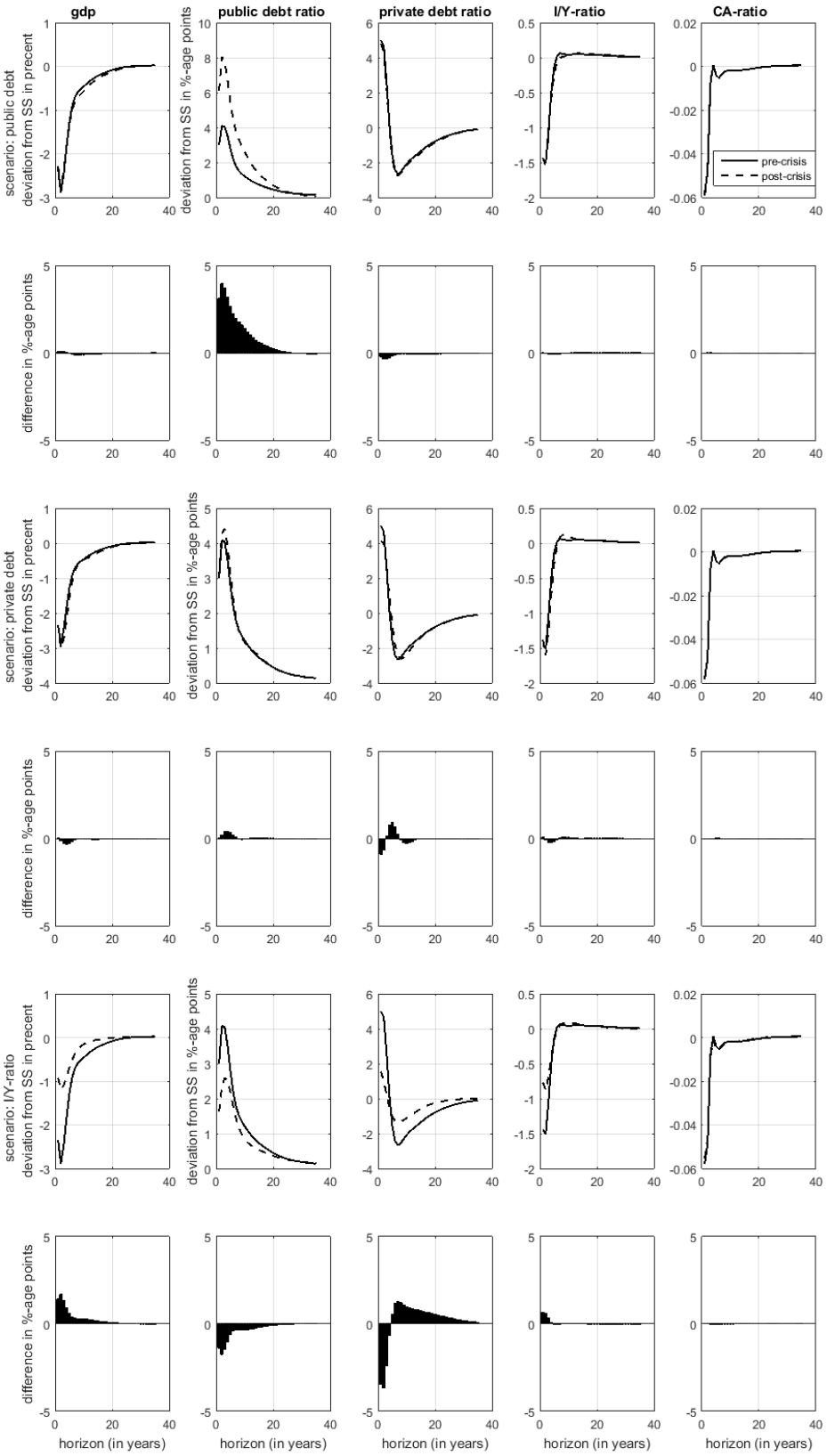
A similar picture emerges for the post-crisis scenario considered: lower private debt ratios in the core and GICIPS countries, and fairly unchanged private debt ratios in the CEE countries. Theoretically, different degrees of private indebtedness have a noteworthy effect on the impulse response functions to any shock. Since entrepreneurs must pay their interest obligations on debt to avoid bankruptcy, less leverage decreases the cutoff rate for profitability that the entrepreneur has to achieve to avoid bankruptcy. Consequently, the lower the leverage in the steady state is, the more likely it is that the entrepreneur will not default for a given decrease in risk. This decreased probability of default arising from different steady-state leverage ratios manifests itself in a decrease of the external finance premium, which is lower with lower steady-state leverage. Lower leverage ratios thus make the user cost of capital less sensitive and business investment less volatile to the economy in the presence of shocks. The real interest rate is also slightly more volatile under higher steady-state leverage. In these simulations the foreign productivity shock does not cause a noteworthy change in the impulse response functions of output for the core as well as the CEE countries in the two scenarios. As for the CEE countries, the similarity in the adjustment path is due to the fact that the degrees of private indebtedness before and after crises are fairly similar. In the core economies, the degree of private indebtedness indeed declines, though the effect on the impulse response functions is fairly small. This primarily occurs due to the fact that the elasticity of the external finance premium to the leverage is relatively small. The GICIPS countries experienced a decline in the degree of private indebtedness of a similar size to the core economies. Still, the effect of this on the impulse response functions is significantly higher. The negative output effects in the GICIPS countries, based on the new, depressed private indebtedness, is significantly lower than in the base scenario. This implies that the decline in private indebtedness indeed fostered the resilience of these economies to structural disturbances. Considering the EU as a whole, the difference in the impulse response functions across the two scenarios is negligibly small and is once more dominated by the pattern of the core economies.

Figure 2.1: Productivity shock (CEE)



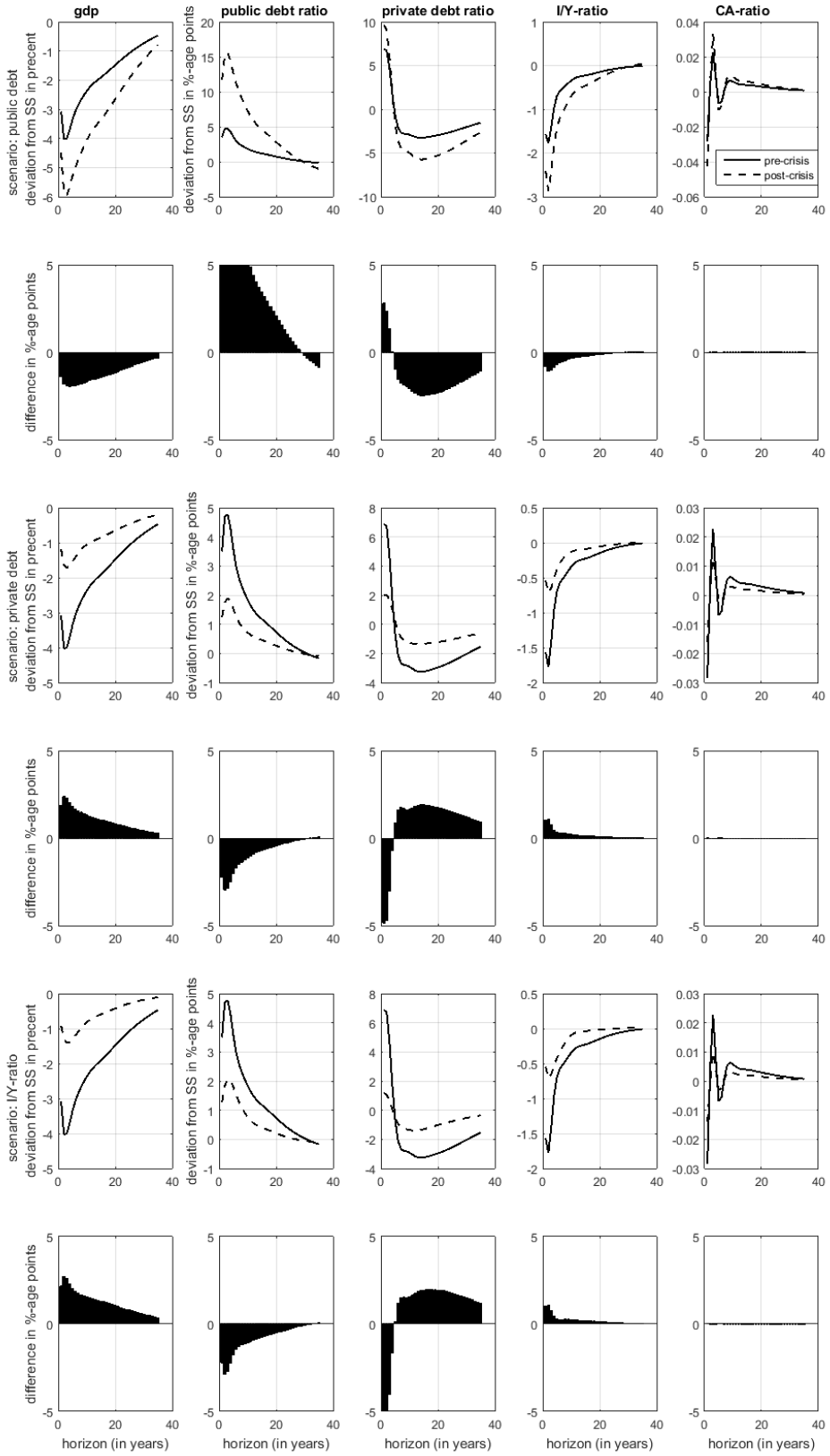
Source: WIFO calculations.

Figure 2.2: Productivity shock (core)



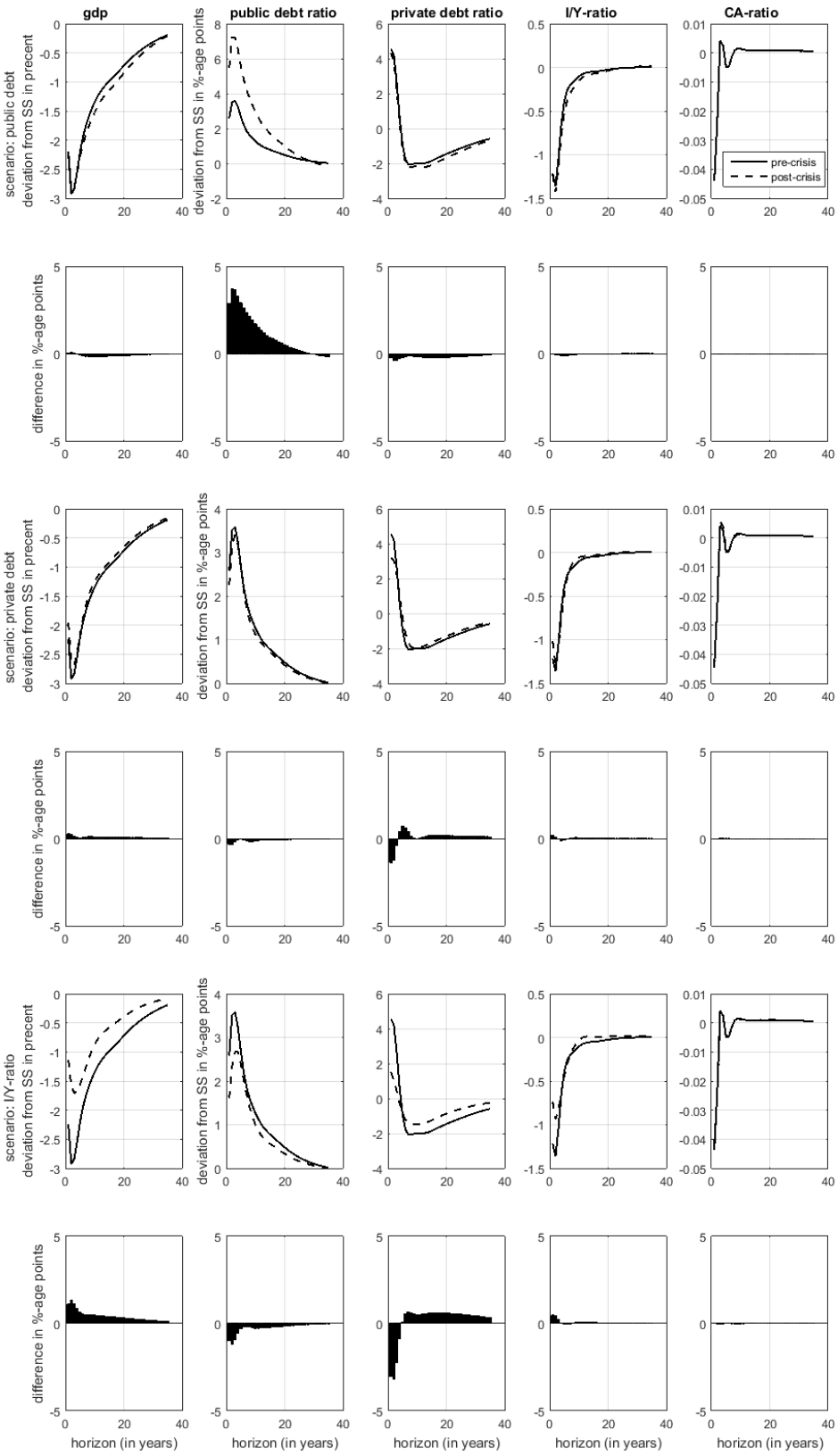
Source: WIFO calculations.

Figure 2.3: Productivity shock (GICIPS)



Source: WIFO calculations.

Figure 2.4: Productivity shock (EU)



Source: WIFO calculations.

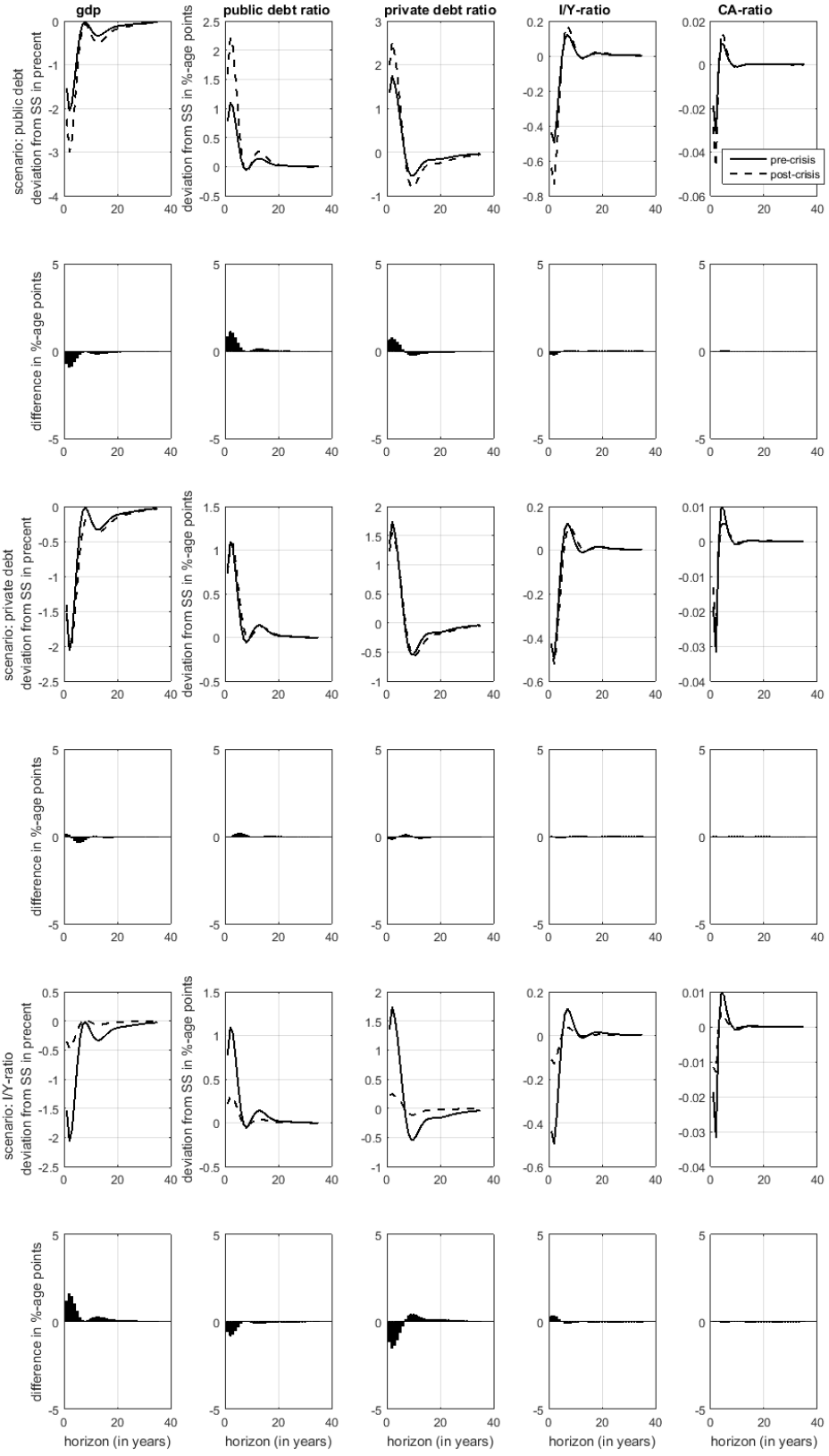
Finally, as concerns the investment to GDP ratios, we observe a similar pattern across the three regions. As indicated in Table 2.1, all regions are characterized by a severe decline in the investment ratio. The drop was strongest in the GICIPS countries followed by the CEE and core economies. The effect of lower investment ratios on the impulse response functions can be seen in the subplots of the last two rows of Figure 2.1 to Figure 2.4. In all cases a decline in the steady state investment ratio leads to a less negative reaction in output as a response to the contractionary global supply shock. This is due to the fact that the lower investment share is compensated by a higher government consumption share in output. A larger government is the consequence of that. Since public consumption is less volatile than investment, the decreased investment share hence implies less volatile output. This is the reason why the drop in output as a reaction to the contractionary productivity shock only leads to a moderate decline in output relative to the base scenario. This is in line with Galí (1994) who finds that the government spending share appears to be inversely related to the standard deviation of output. In other words, government spending behaves as an automatic stabilizer.

2.1.1.Financial shock

Figure 2.5 to Figure 2.7 show the impulse response functions of the three regions of the EU to a financial market shock. The financial market shock originates in the Rest of the World. The impulse response functions shown characterize the spill-over effects in the EU economies to the global shock. The structural shock as such emerges from the financial accelerator. The shock itself comprises a temporary increase in the idiosyncratic project risk of corporate borrowers in the Rest of the World, in both the tradables and nontradables sectors. The shock gradually phases out over time. We again consider the impulse response functions of the three EU regions for three different scenarios.

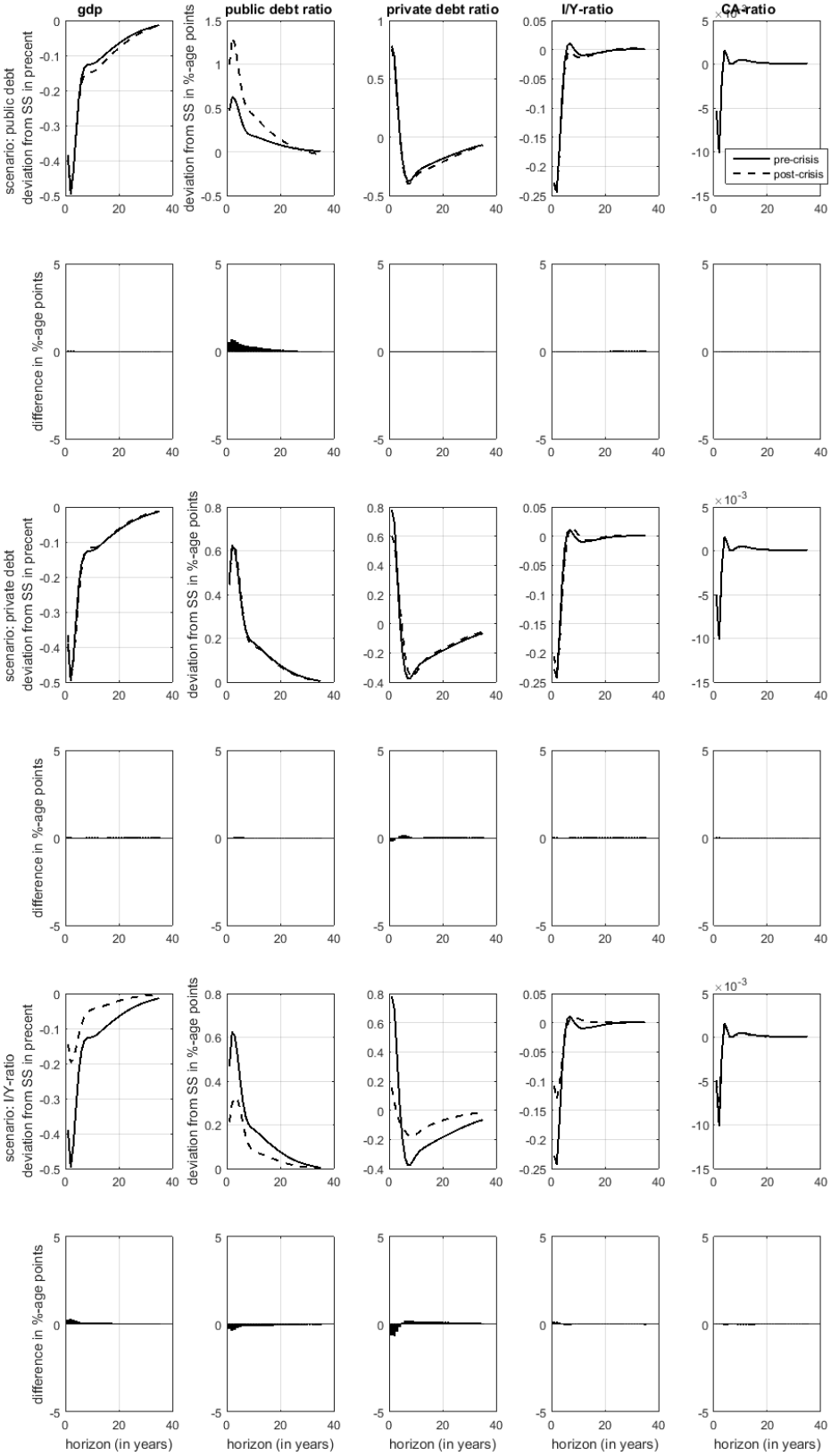
The results show that, on average, the implications drawn from the insights of the productivity shock also hold in the present context. The reason for this is primarily due to the model structure. As in any other DSGE model, the main linkages between the countries are given via trade in goods rather than financial asset flows. As public and private debt in each country is held only by domestic residents, the home-bias in the holding of financial asset limits the spill-over effects of financial market shocks. Hence, the impulse response functions in the three EU regions are characterized by perturbations in goods market flows that occur as a consequence of the financial market disturbance.

Figure 2.5: Financial shock (CEE)



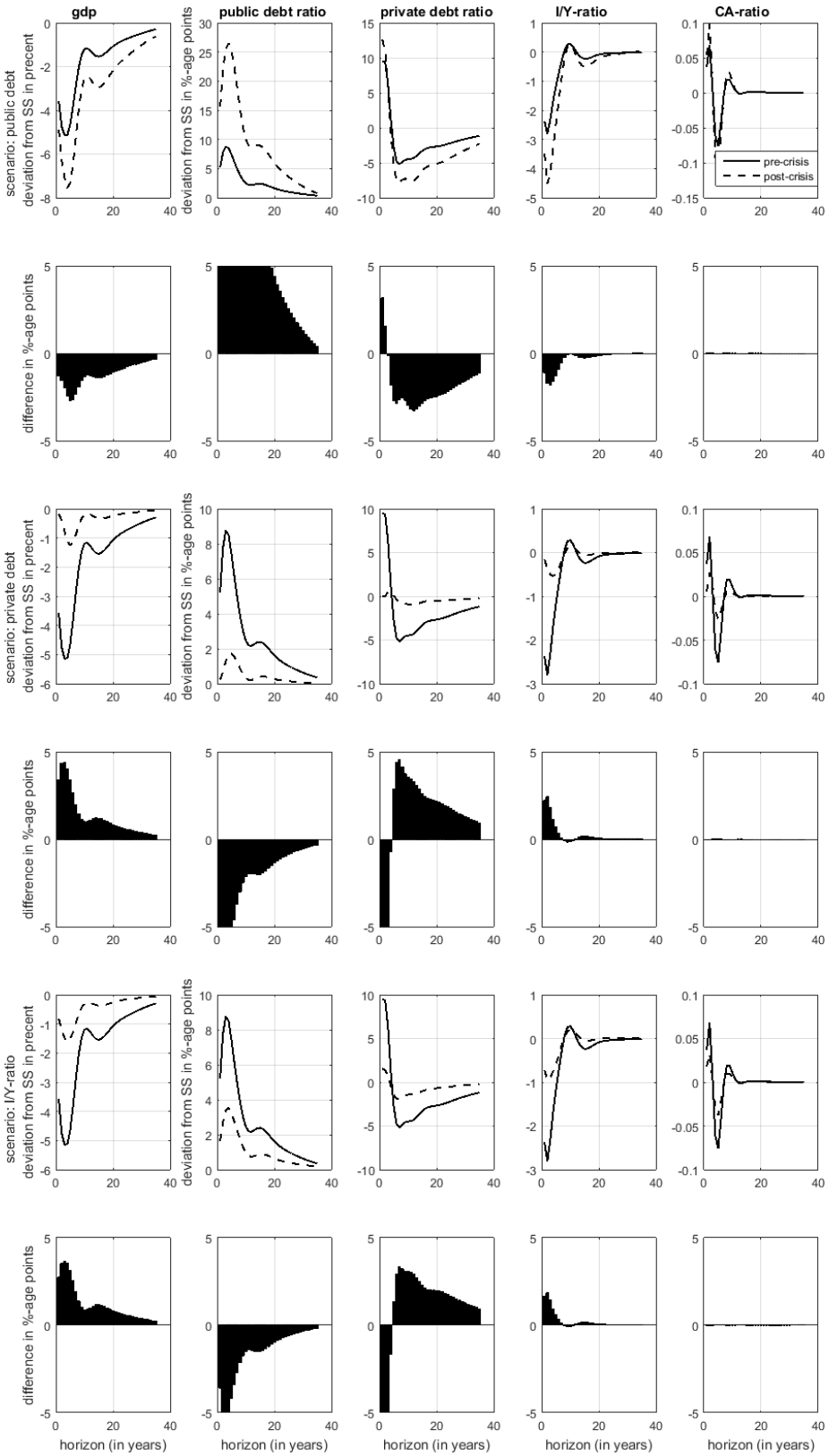
Source: WIFO calculations.

Figure 2.6: Financial shock (core)



Source: WIFO calculations.

Figure 2.7: Financial shock (GICIPS)



Source: WIFO calculations.

2.2. Empirical analysis: A panel vector autoregression model for shock transmission

The second part of the macroeconomic section of the study deals with empirical evidence concerning the asymmetry of the transmission of economic shocks. The aim is to investigate the extent to which key macroeconomic variables respond differently across countries to a global shock.

The role of Eurozone membership is a key focus, as the exchange rate regime is one of the key drivers of asymmetric transmission of shocks. Exchange rates can be an important means of adjustment for non-Eurozone countries; the sharp devaluation in the UK pound in response to the recent crisis provides an example of this. The greater the shock-absorbing capacity of the exchange rate, the less emphasis might be placed on other adjustment mechanisms. In the Eurozone, the exchange rates between Eurozone members cannot adjust, and as a consequence there might be more emphasis on other transmission mechanisms in the Eurozone countries. Our analysis will draw out differences in the transmission of the global shock between Eurozone and non-Eurozone countries.

Another key driver of asymmetric adjustment to shocks might be membership in the single market of the European Union. Members of the single market may have a greater ability to adjust to shocks via trade, investment and migration flows than non-members.

In addition, the transmission of the global shock can be expected to depend on whether an economy's financial system is primarily bank-based or market-based. Similarly, the rigidity of a country's labour and product markets might also account for varying means of adjustment, with more adjustment occurring via unemployment when wages are, for example, more rigid.

Finally, adjustment to global shocks may have changed over time in response to the crisis. This will allow us to examine whether the transmission mechanisms changed before and during the crisis.

2.2.1. Data and methodology

In order to evade the curse of dimensionality, which is inherent in the panel VAR estimation, it is necessary to restrict the number of countries and to ensure that the time series element of the data is as long as possible.[5] This limits the set of countries we can include in our sample in two ways: First, to obtain a sufficiently long time series, we focus on countries with reliable quarterly data extending back to 1980. Second, we still need to limit the number of countries, whilst ensuring a range of crisis and non-crisis, Eurozone and non-Eurozone, EU and non-EU countries.

Our core results are based on a sample of 10 major economies within and outside of the EU. This includes 5 Eurozone economies (Germany, France, Italy, the Netherlands and Ireland), 2 EU economies outside of the Eurozone (UK and Sweden), and the 3 non-EU members of the G7 (Canada, Japan and the United States). We also attempted to present some results for Spain, but the unavailability of quarterly labour market data for Spain in the 1980s led us to exclude Spain in order to also be able to examine the transmission of shocks to labour markets. That is, we include 5 core members, 2 3 GICIPS and 3 non-EU countries.

[5]The restrictions on the number of countries and the necessity of having a long time series holds even when using the shrinkage methods developed in Canova and Ciccarelli (2009).

We were unable to include any of the CEE countries, because the data did not allow for the construction of loan-deposit ratios, and other macroeconomic data was only available from 1995. This would have made it necessary to disregard data for all countries before 1995, which would have greatly restricted the number of variables we would have been able to consider for each country.

Ciccarelli, et. al. (2012) report that data for many of the variables of interest in our study, including GDP, consumption, investment and the loan-deposit ratio, is available quarterly on a consistent basis going back to 1980 for the 10 countries they consider. We extend this data to include the Netherlands. As we are less tightly focused on understanding macro-financial linkages, we reduce the set of financial variables included, in order to be able to include a broader range of real variables including measures of employment, trade and exchange rates. However, extending the data to include quarterly measures of employment for a sufficiently long time span for Spain was not possible.

We use a panel VAR methodology, which will allow us to capture interdependencies between economies, which might amplify or dampen the global shock. This is important, as these interdependencies can be expected to play an enhanced role within the single market.

Panel VARs suffer from a curse of dimensionality: It is generally not possible to identify all the parameters, as the cross-sectional dimension (the number of variables multiplied by the number of countries) is large compared to the time series dimension. This makes it necessary to use some method to 'shrink' the number of parameters to be estimated.

We use the shrinkage method developed in Canova and Ciccarelli (2009) and applied in Ciccarelli, et. al. (2012). The Canova and Ciccarelli (2009) shrinkage method uses factor methods to reduce the number of parameters to be estimated. Rather than taking each of the NG variables (N countries, G variables) as a function of P lags of the NG variables, each variable is estimated to be a function of three factors: a global factor, a country-specific factor and a variable-specific factor. We describe this method more formally in the annex.

We focus our analysis on the transmission of a 'global' shock. We considered three candidates for the 'global' shock: a house price shock to the US and UK economies, a shock to the loan-deposit ratio (a bank-based measure of credit supply) and a corporate bond spread (a market-based measure of credit supply). House price shocks can be thought of as collateral shocks, as housing is the main source of collateral for secured lending in most economies. When house prices decline, the amount of collateral in the economy declines, and borrowing constraints and credit conditions more generally might tighten. We focus on the results from the house price shocks to the US and UK economies, as these provided the strongest evidence of transmission to the rest of the world, and hence seemed most likely to have constituted a global shock. This is in line with the narrative that the origins of the global crisis were shocks to US house prices. It would also seem to indicate that the amount of collateral in the economy might be a good proxy for credit conditions.

One advantage of looking at collateral shocks is that they might be more likely to display transmission to both bank-based and market-based financial systems, as both depend on collateral.

We also experimented with shocks to the UK and US loan-to-deposit ratio, and a corporate bond spread. We did not find as much evidence for the transmission of the loan-to-deposit ratio. Although the loan-to-deposit ratio should capture the impact of deleveraging, we suspect that this measure lacked power because of banks' increasing reliance on funding in

wholesale markets. In the crisis, the 'run' was not so much on deposits (with some exceptions, such as Northern Rock in the UK), and more in wholesale markets. As a result, we next looked at a spread capturing the premium that corporate lenders pay over sovereigns. This measure turned out to have somewhat better transmission to the rest of the world. While market-based measures of credit supply did perform better than bank-based measures, their explanatory power was still somewhat limited, perhaps because sovereigns also came under pressure in the crisis.

We consider financial shocks both to the UK and the US, as these are the two major financial centres upon which most of the remaining economies in the sample rely. We consider impulse responses for two time periods, covering the immediate pre-crisis and crisis periods:

Pre-crisis: 2006:Q1 to 2008:Q2
Crisis: 2008:Q3 to 2010:Q4

We examine whether there is evidence of transmission mechanisms for financial shocks across countries by computing the generalised impulse response functions (GIRFs) for: House Prices, a Corporate Bond Spread, GDP, Investment, Unemployment, the Real Effective Exchange Rate (REER) and Net Trade to shocks in US and UK house prices. When computing generalised impulse-response functions (GIRFs), the shock is defined as the difference between the forecast path (based on historical information) and the actual path of the US or UK LDR over the GIRF time periods. The GIRFs for each variable are calculated as the difference between the forecast path of this variable, using only information up to the beginning date of the GIRF, and the actual path for the variable hit by the shock.

By using this particular definition for the shock, we do not calibrate the magnitude of the shock. Instead, this is obtained ex post by calculating the US or UK house price GIRFs to the US or UK house price shock. Furthermore, the magnitude of the shock may differ from time period to time period.

We focus on assessing the spillovers across different group of countries such as EU/non-EU members, Eurozone/non-Eurozone members and countries with low regulation, such as US, UK, Ireland and Canada, versus countries with higher regulation of product and labour markets.

2.2.2.Results

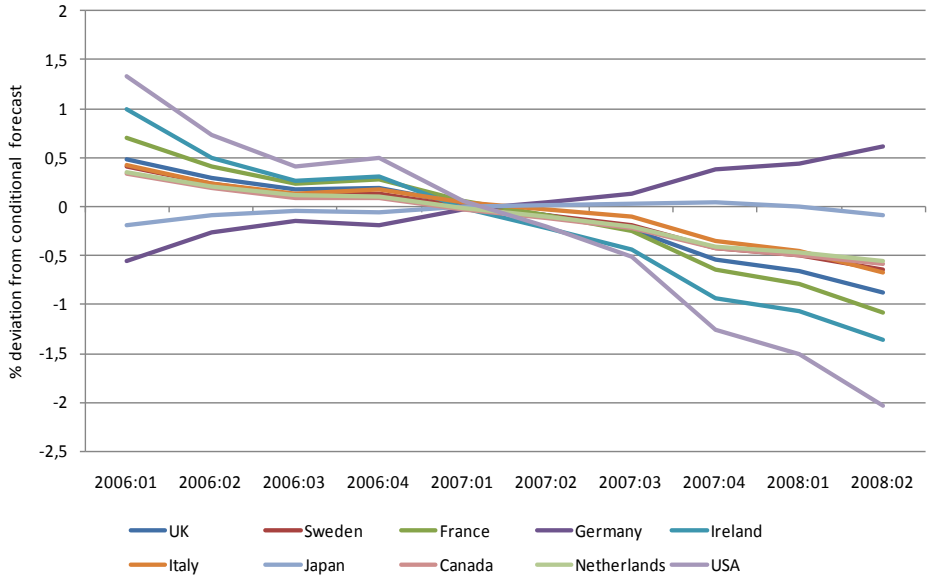
We report the impulse-responses of the key macroeconomic variables for each country to the US and UK house price shocks, and draw out similarities and differences during the pre-crisis and crisis periods. We would expect house price shocks to have an impact on own credit market conditions, which we might expect to be transmitted to countries with tight financial linkages. Tighter credit market conditions would tend to lead to reductions in investment, especially to countries which rely on the financial centres experiencing tighter credit supply. We would expect any reductions in investment to be transmitted on to GDP and unemployment. We would also expect the ability of the real exchange rate (REER) to adjust – either by depreciation of the currency or by internal devaluation – to impact on the transmission, with greater REER adjustment going hand-in-hand with responsiveness of trade flows.

Pre-crisis

US financial shock

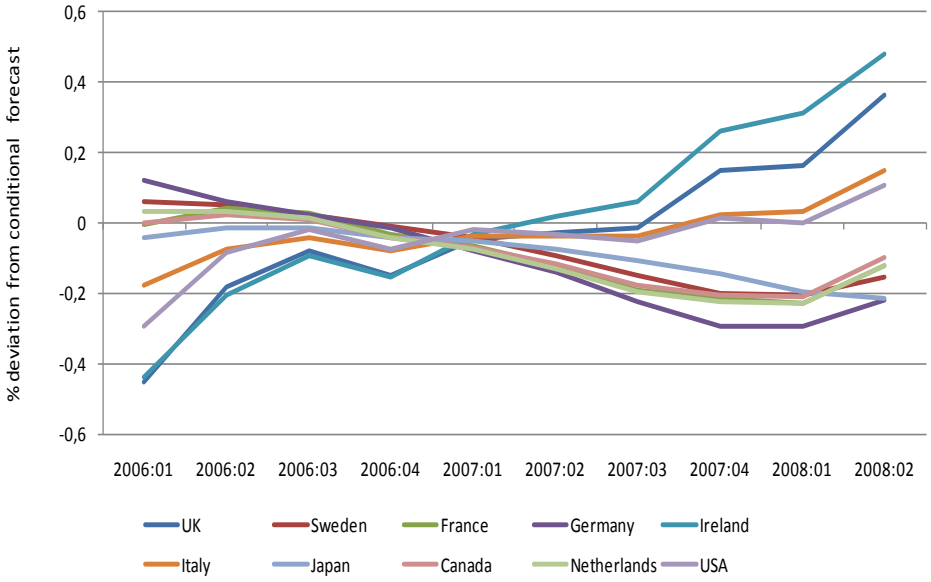
We begin by focusing on the impact of the US house price shock before the crisis. The US house price shock is initially high and positive, but declining and reversing sign by the 2nd quarter of 2007.

Figure 2.8: Responses of house prices to US house price shock - pre-crisis



Source: NIESR calculations.

Figure 2.9: Response of credit spreads to US house price shock - pre-crisis



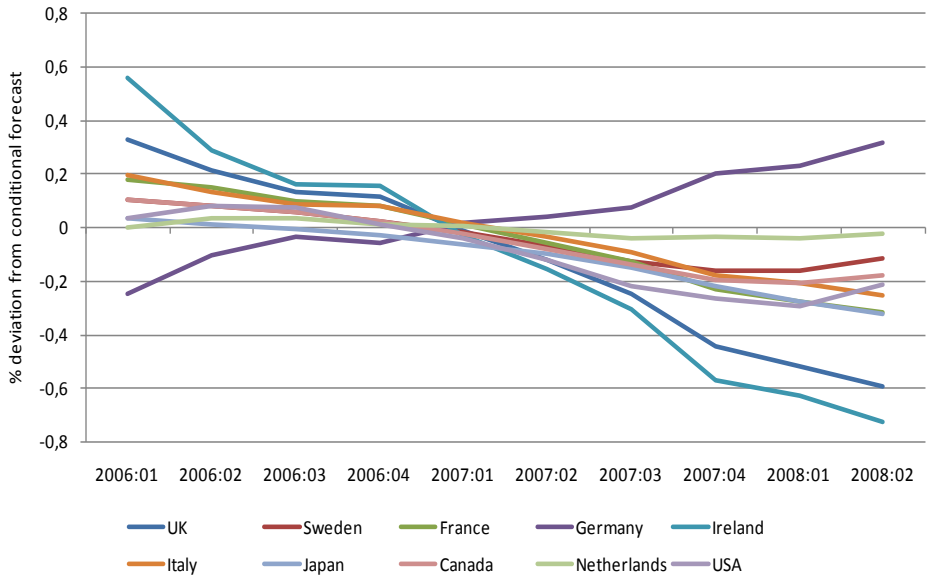
Source: NIESR calculations.

We observe that the US house price shock represents a significant and rather large expansion of house prices in the US economy, which seems to be transmitted to all of the other economies in our sample except for Germany and Japan. (Figure 2.8). Interestingly,

however, the US house price shock seems to lead to the biggest credit market loosening as measured by the credit spread measure of credit conditions in Ireland and the UK, while causing no significant reaction in US credit spreads (Figure 2.9). This might indicate that securitised US mortgage-backed assets were being used as collateral in the UK and Ireland, but it might also be a result of the coincident strong expansion in UK and Irish house prices.

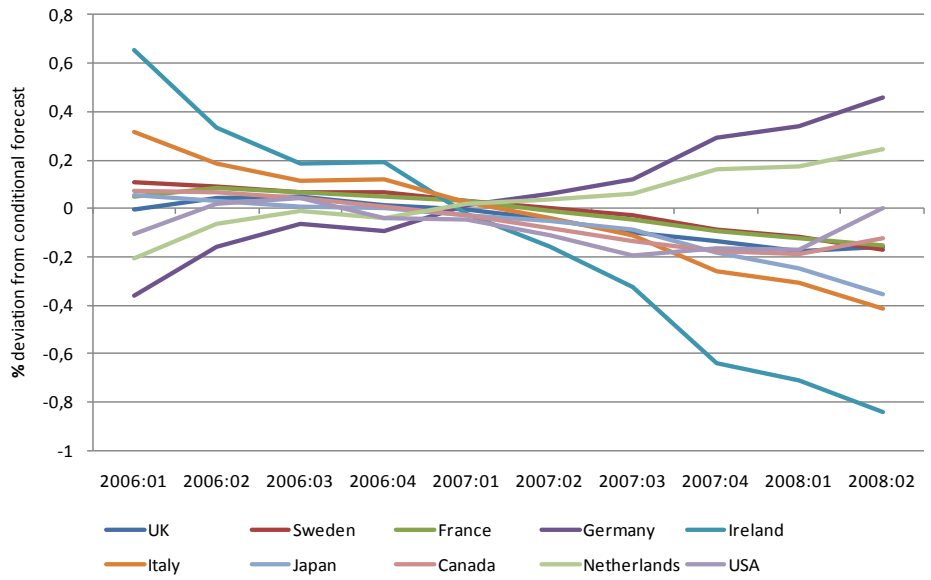
This strong international transmission to the UK and Ireland is also reflected in the responses of investment and GDP. Figure 2.10 shows the generalized impulse-response function of GDP to the US house price shock. The US house price expansion seems to have been transmitted even more strongly to Irish, UK and Italian GDP than to US GDP. We also note that transmission seems somewhat asymmetric, with the relatively moderate contraction of collateral from 2007:Q1 leading to relatively larger downward reactions in GDP.

Figure 2.10: Responses of GDP to the US house price shock - pre-crisis



Source: NIESR calculations.

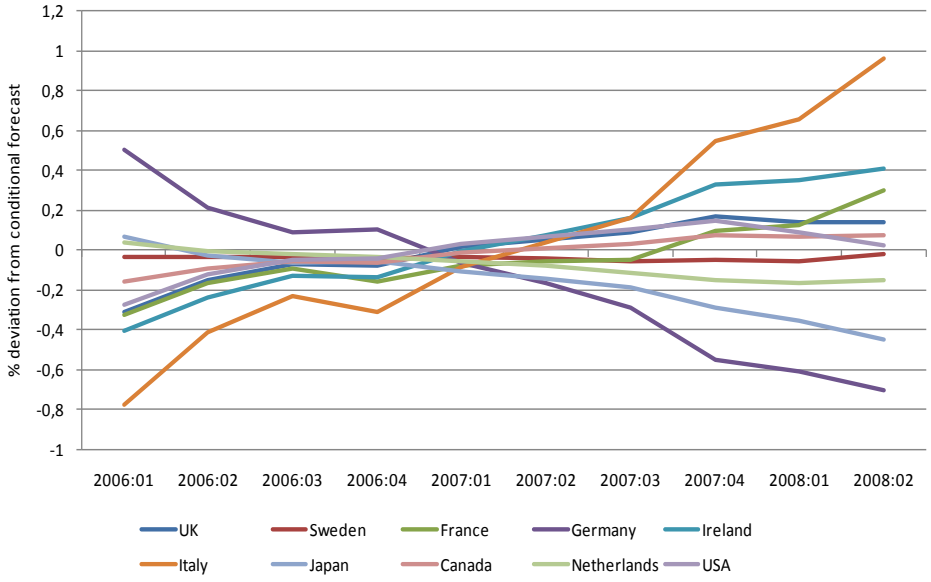
Figure 2.11: Responses of investment to the US house price shock - pre-crisis



Source: NIESR calculations.

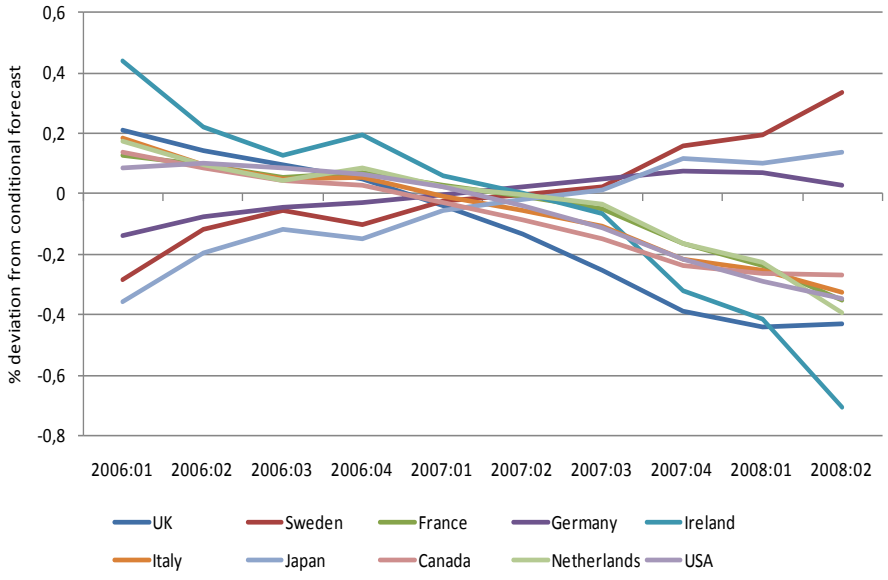
Figure 2.11 shows the generalized impulse-response function of investment to the US house price shock. Again, it is Ireland and Italy to which the expansion of credit seems to be transmitted most strongly, generating the biggest surge in investment, albeit a short-lived one. In the case of Ireland, it may be that the availability of credit-spurred US investment in an EU country which share a similar regulatory regime (i.e. low regulation of both labour and product markets) and a language. It may also be that returns to investment in Ireland and Italy were high, and that the buoyant US credit conditions led to capital flows into these countries. Again we note a degree of asymmetry, as the downward reaction in investment to the negative US house price shock from 2007:Q2 seems to be larger for Ireland and Italy than the corresponding upside reaction.

Figure 2.12: Responses of unemployment to the US house price shock - pre-crisis



Source: NIESR calculations.

Figure 2.13: Responses of the real effective exchange rate to the US house price shock - pre-crisis

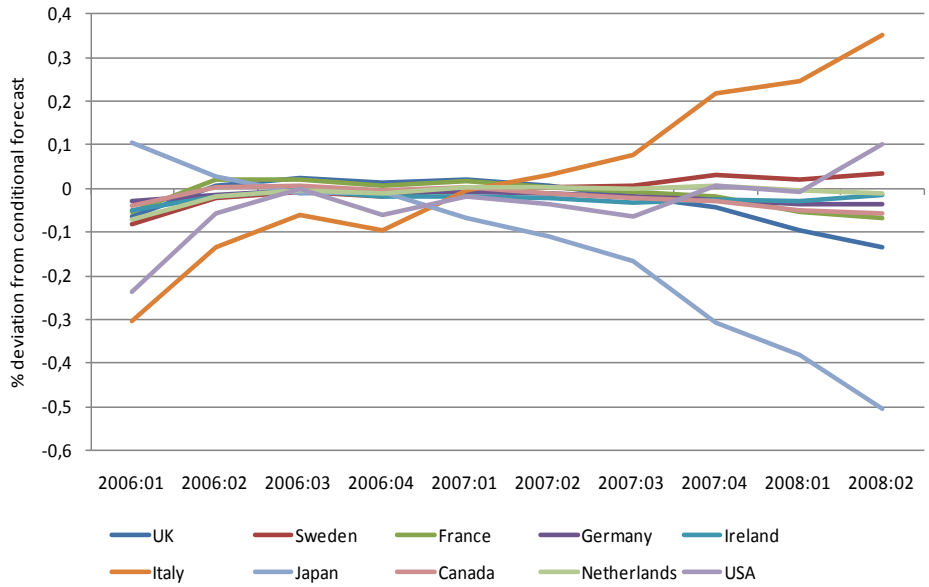


Source: NIESR calculations.

The responses of unemployment to the US house price shock in Figure 2.12 show a clear pattern between the more flexible and inflexible labour markets. Italy displays a larger reduction in unemployment to the positive house price shocks than do the flexible labour market economies Ireland and UK, although the GDP and investment shocks are transmitted more strongly to the Irish economy. Similarly, the French decline in unemployment is larger than that of the US. This larger reaction via unemployment (and presumably less reaction via wages) for Italy and France also remains true once the house price shock goes negative in 2007.

Figure 2.13 and Figure 2.14 show the generalized impulse-response function of the real effective exchange rate and net trade to the US financial shock. Again, the same pattern between countries with more flexible markets versus those with less flexible markets emerges. In Ireland and the UK with their flexible markets, transmission seems to mainly occur via prices, i.e. an increase in the real exchange rate. In Italy, however, transmission and adjustment again seem to occur via quantities, as net trade declines most sharply, perhaps indicating some rigidities in prices.

Figure 2.14: Responses of net trade to the US house price shock - pre-crisis



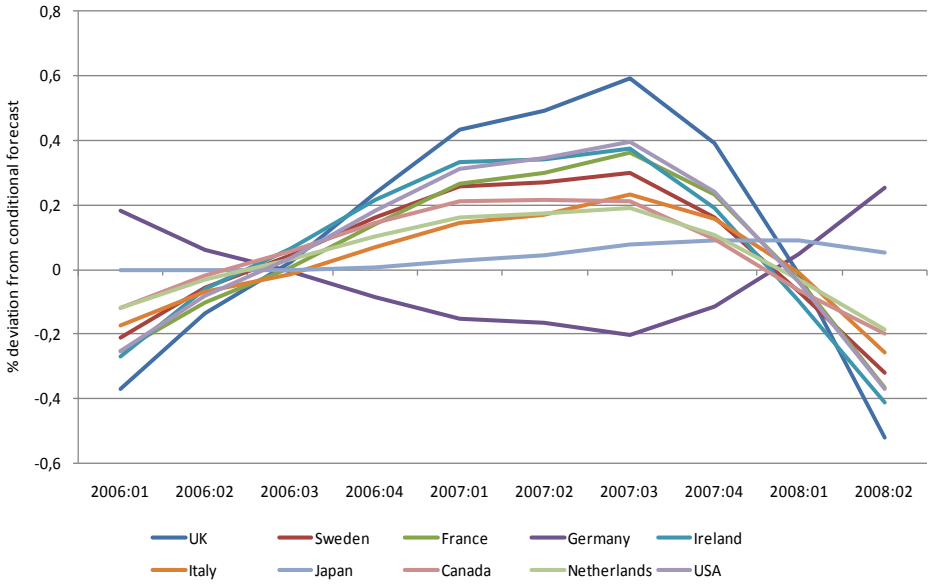
Source: NIESR calculations.

UK financial shock

Next, we examine the impact of the UK house price shock before the crisis. Figure 2.15 shows the generalized impulse-response function of house prices to the UK house price shock. Transmission of the UK house price shock seems to be greatest to house prices in the UK, while the responses of house prices in the US, Ireland and the rest of Europe was more muted, in line with the responses of GDP (Figure 2.16). This is also broadly consistent with the behaviour of the credit spread (Figure 2.17). Only the UK and Irish credit spreads fell, indicating that direct transmission of the increase in collateral in the economy on lending rates to businesses was primarily domestic, with little or no transmission via this route to the rest of Europe or Canada. The impact on Ireland might be explained by relatively tight financial links to the UK. However, transmission to French house prices was also quite strong, despite the absence of evidence of any transmission of the increase of UK collateral to French credit spreads. This might be indicative of the bank-based nature of the French financial system, so that it might be difficult

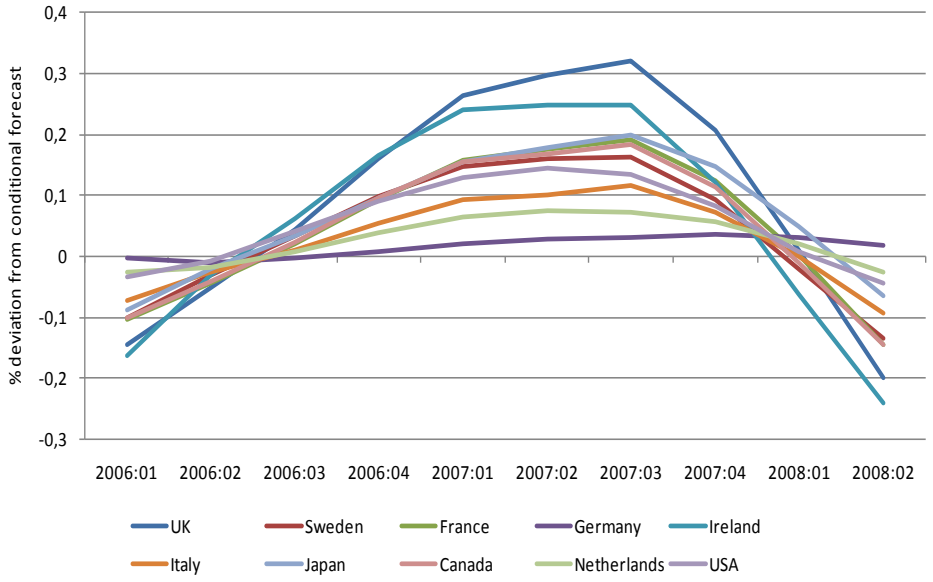
to pick up any indication of credit market loosening in French credit spreads, if French corporate bond markets are relatively thin. This might apply more generally to the other bank-based system with relatively thin corporate bond markets.

Figure 2.15: Responses of house prices to UK house price shock - pre-crisis



Source: NIESR calculations.

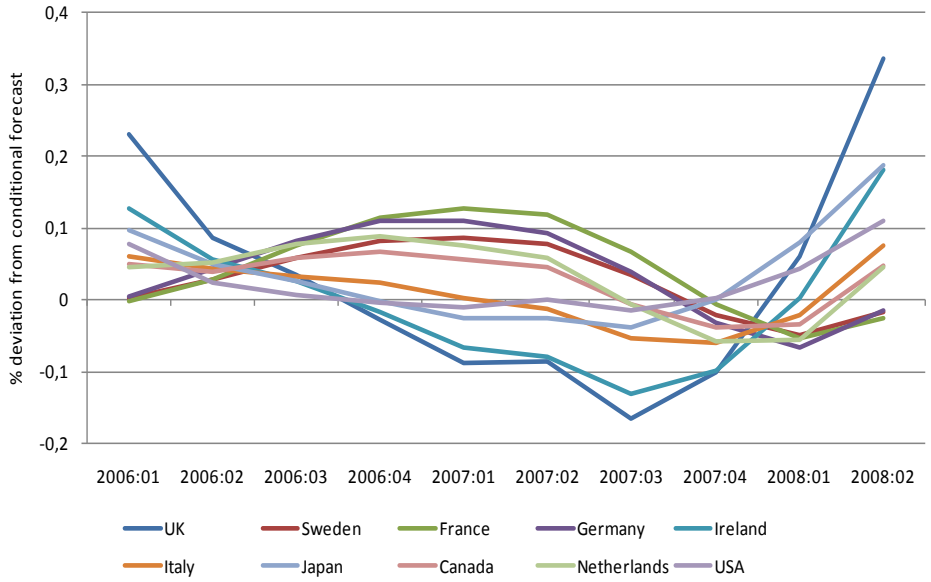
Figure 2.16: GDP responses to UK house prices - pre-crisis



Source: NIESR calculations.

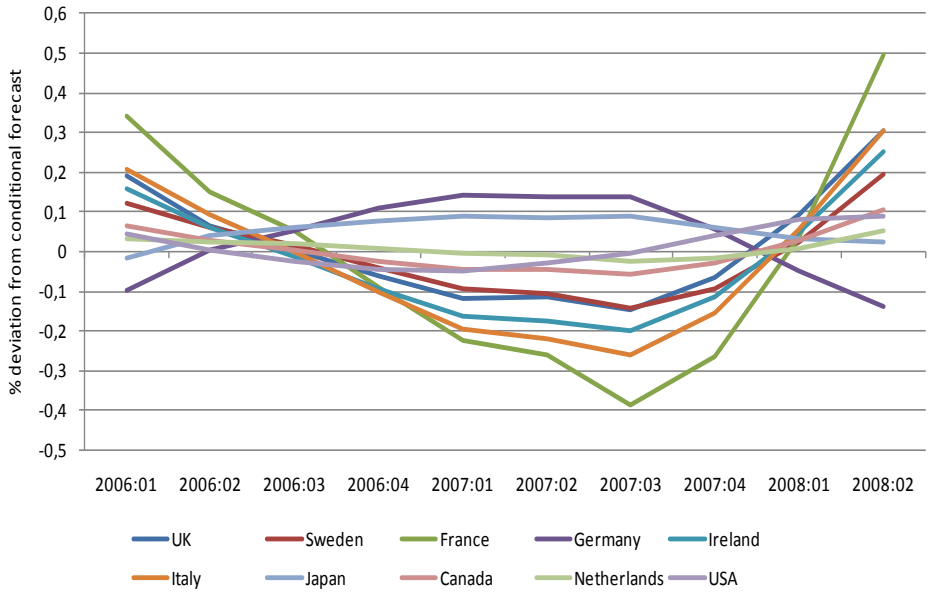
The bank-based and relatively rigid labour market economies Italy and France show substantial decreases in unemployment in response to the UK collateral shock (Figure 2.18), while Italy also shows a particularly strong surge in investment (Figure 2.19). In terms of the rise in investment, this might again be an indicator that collateral is especially important for bank-based economies. The strong reductions in unemployment for Italy and France might either be related to the rises in investment (in the case of Italy), or an indication that the relatively rigid French and Italian labour markets tend to adjust by quantities rather than by wages.

Figure 2.17: Credit spread responses to UK house prices - pre-crisis



Source: NIESR calculations.

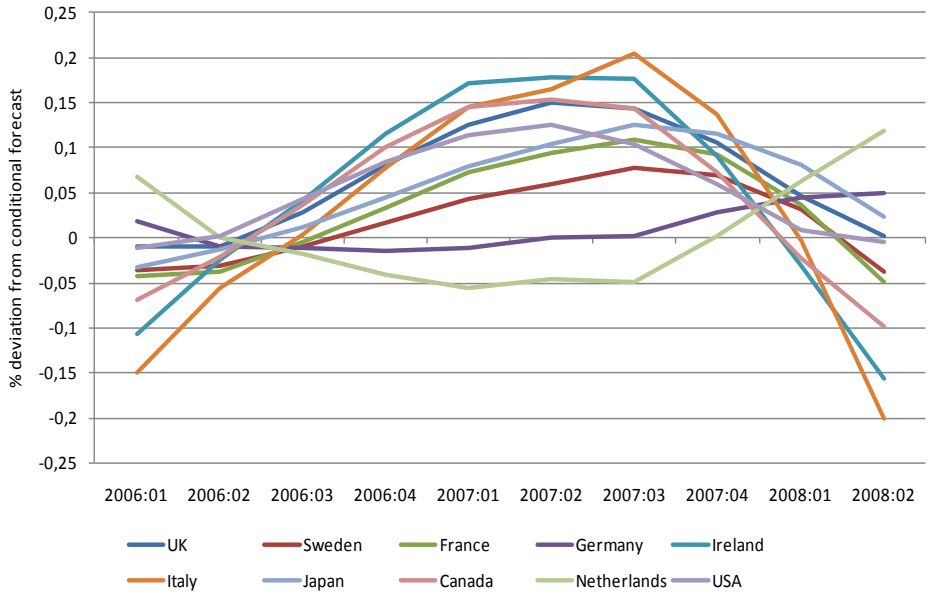
Figure 2.18: Unemployment responses to UK house prices - pre-crisis



Source: NIESR calculations.

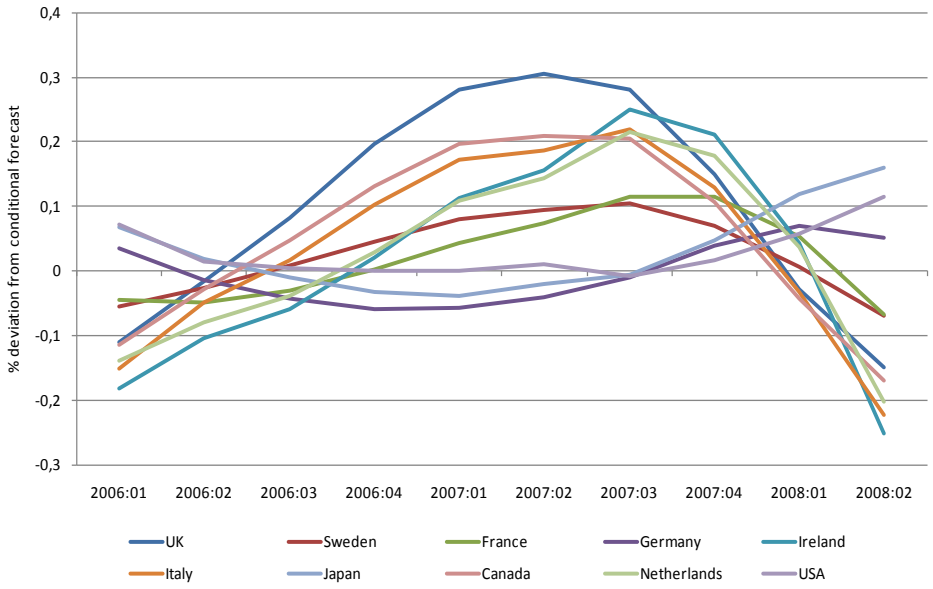
We observe relatively strong transmission of the UK collateral shock to the real exchange rates of the Eurozone economies (Figure 2.20), with somewhat weaker transmission to the non-Eurozone Sweden. Germany's REER is not affected in a statistically significant way, perhaps already a sign of widening imbalances within the Eurozone. In contrast, we see little impact of the UK collateral shock on net trade (Figure 2.21), with the UK being the only European economy to display an increase, despite the single market.

Figure 2.19: Investment responses to UK house prices - pre-crisis



Source: NIESR calculations.

Figure 2.20: REER responses to UK house price shock - pre-crisis



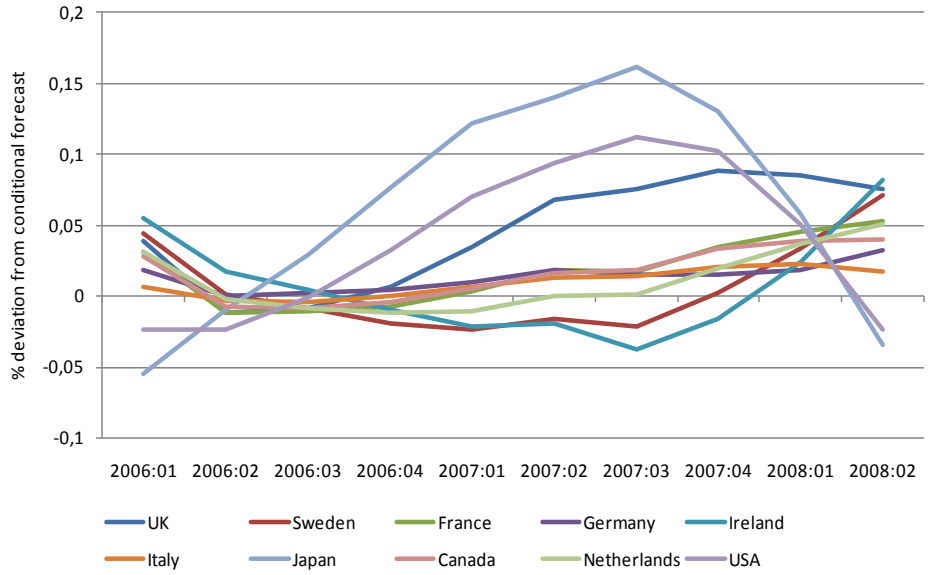
Source: NIESR calculations.

Crisis

During the crisis we see a large and negative US and UK house price shock (Figure 2.22 and Figure 2.23). The strongest reactions to the US house price shock can be found in house prices in Ireland France and the UK, with most other EU countries also responding with more muted house price falls. In the case of the UK house price shock, which is of similar magnitude, the strongest responses are in US and Irish house prices, but with somewhat stronger responses in most other EU countries. German and Japanese house prices do not react (significantly) negatively to either the UK or US house price shocks. In the case of Germany, the more prudent 'Pfandbriefe' mortgage lending securitization system may have contributed to more

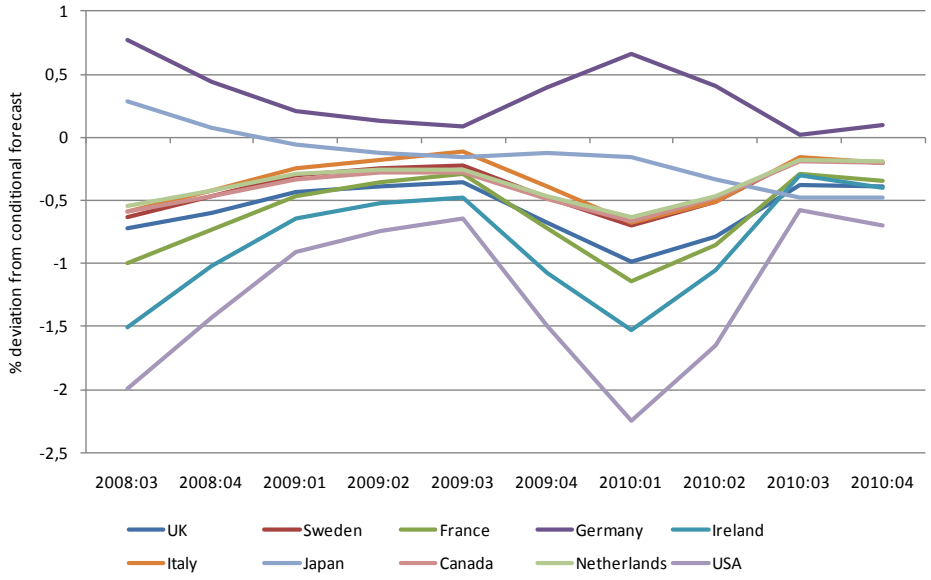
moderate German house prices before the crisis, leaving German mortgage-lending and hence house prices relatively immune to the sub-prime crisis.[6]

Figure 2.21: Net trade responses to UK house prices - pre-crisis



Source: NIESR calculations.

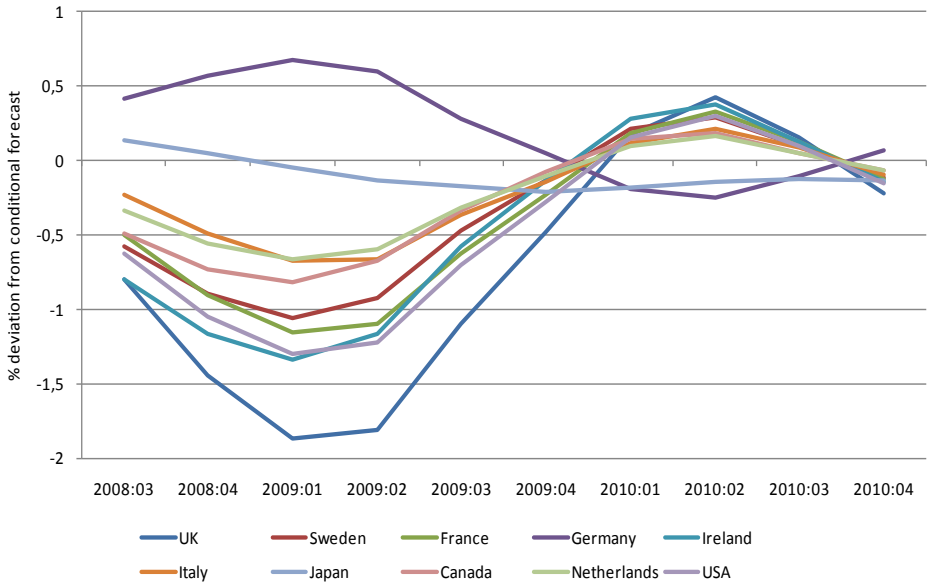
Figure 2.22: Response of house prices to US house price shock - crisis



Source: NIESR calculations.

[6] This is not to say that German banks did not hold foreign sub-prime assets in their portfolios, and we will see that there was some transmission of the US and UK house price shocks to German credit market conditions.

Figure 2.23: Response of house prices to UK house price shock

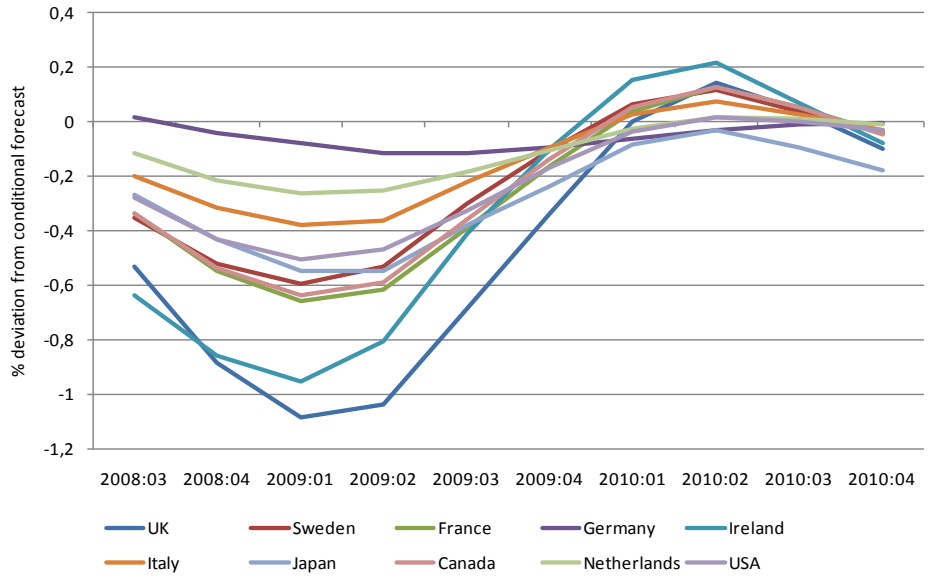


Source: NIESR calculations.

UK house price shock

Figure 2.24 illustrates the response of GDP to the UK house price shock. It is the UK's own GDP which contracts most, followed by Ireland and the US, in line with the transmission of the house price shock to house prices. In general, the transmission of the UK house price shock to GDP seems to be in line with the transmission of the UK house price shock to house prices in other countries. Also, German GDP seems well-insulated from the UK house price shock, which may again reflect Germany's relatively prudent mortgage lending system.

Figure 2.24: Responses of GDP to UK house price shock - crisis

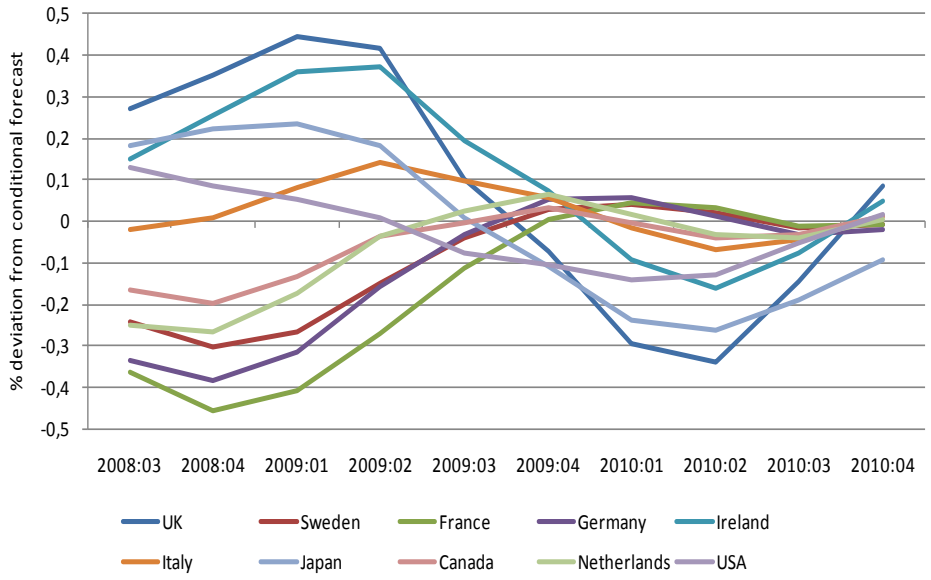


Source: NIESR calculations.

For Ireland and the UK, the transmission of the UK house price shock seems to work through the corporate bond spread (Figure 2.25). We see a surge in the premium in borrowing rates

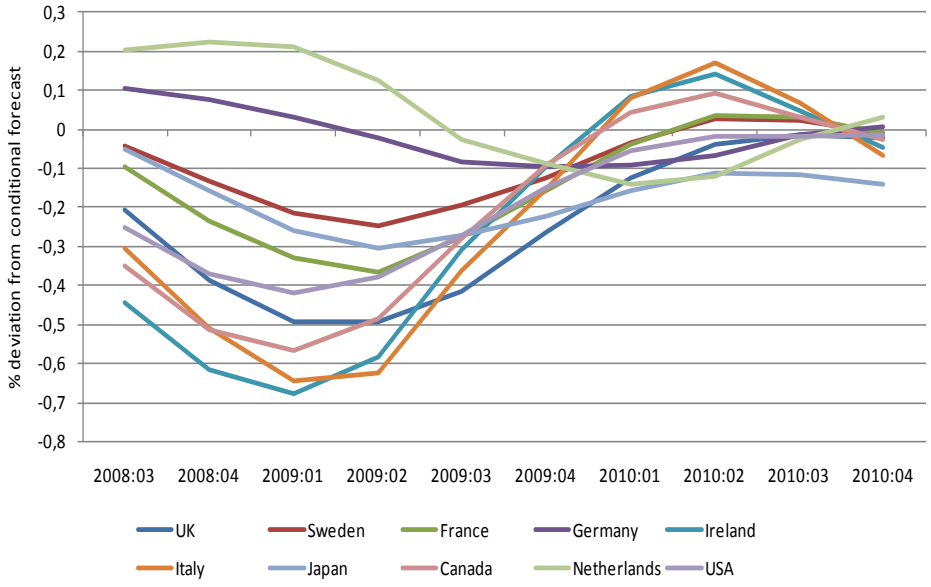
over the sovereign, indicating a tightening of this market-based credit supply measure. However, the tightening in credit supply in the remaining EU countries is delayed and very small, not taking place until 2009. There is no statistically significant transmission of the UK house price shock to US credit market conditions, in line with US credit markets not being reliant on funding from the UK.

Figure 2.25: Response of credit spreads to UK house price shock - crisis



Source: NIESR calculations.

Figure 2.26: Responses of investment to UK house price shock - crisis



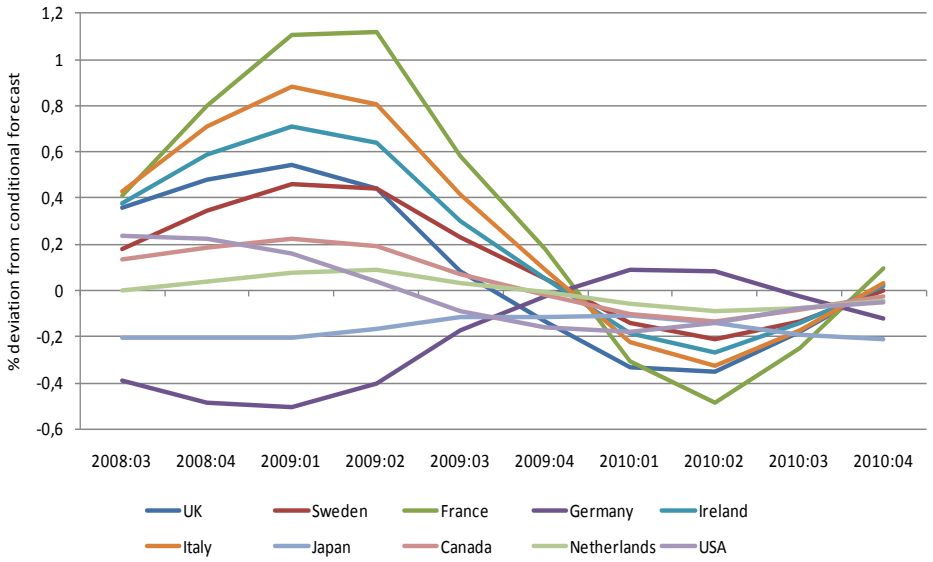
Source: NIESR calculations.

The transmission of the UK financial shock seems to also work through investment, with investment in the UK, Ireland and Italy reacting most strongly to the UK house price shock (Figure 2.26). This would indicate that Italian banks have been quite reliant on UK financial markets in funding investment, which could be an indication of the EU single market at work

in financial services. The remaining EU countries also display some downward movement in investment, with the exception of Germany and the Netherlands. This would be in line with Germany and the Netherlands being least reliant on the UK markets to fund investment.

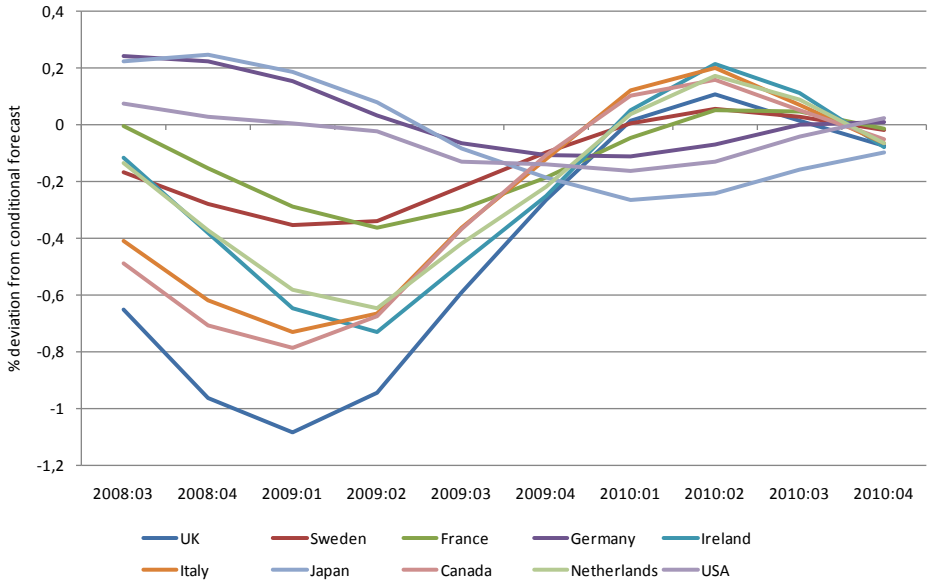
Interestingly, UK and Irish unemployment rates react relatively weakly to the UK house price shock, despite the large responses of investment (Figure 2.27). Instead, it is Italy and France whose unemployment rates surge most in response to the UK house price shock. This is in line with the greater degree of regulation of these countries' labour markets, making it difficult for wages to adjust, so that labour market adjustments take place to a greater extent along the unemployment/employment margin.

Figure 2.27: Responses of unemployment to UK house price shock - crisis



Source: NIESR calculations.

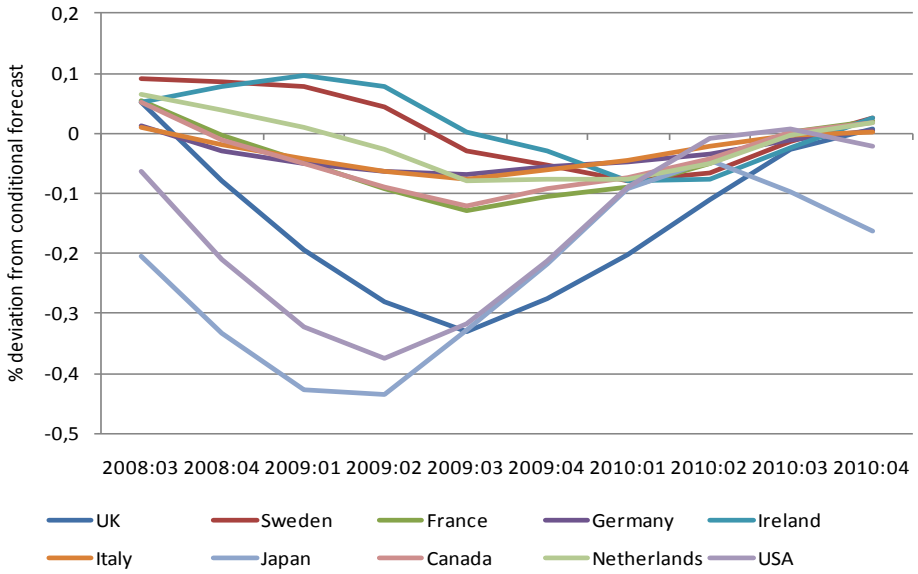
Figure 2.28: Response of the REER to the UK house price shock - crisis



Source: NIESR calculations.

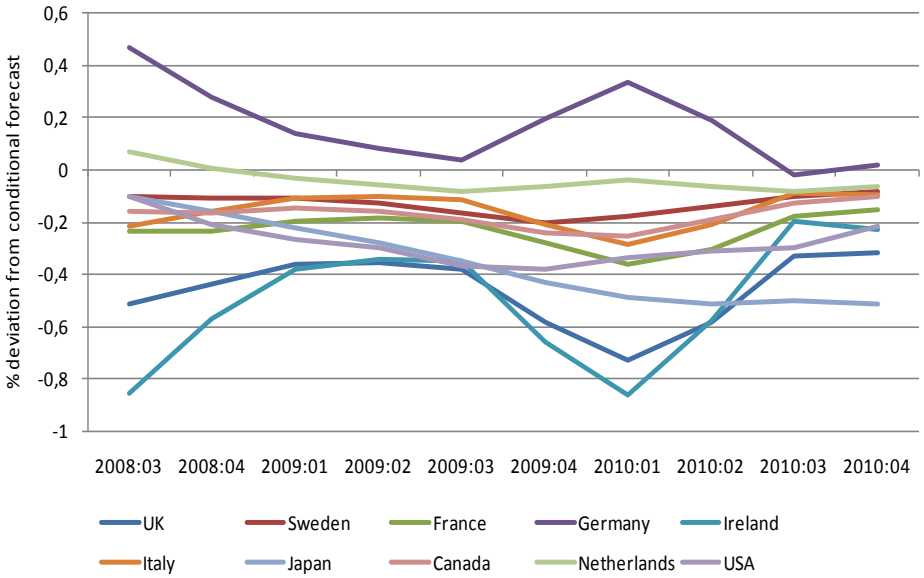
Interestingly, in the early stages of the crisis, the responses of Eurozone real effective exchange rates (REER) are quite similar, both in direction (depreciation) and magnitude to those of the non-Eurozone EU countries (UK and Sweden) and by Canada (Figure 2.28). This would tend to run counter to the narrative of the currency union impeding exchange rate adjustment. Also, the UK shows the greatest responsiveness of net trade to the UK house price shock, while none of the Eurozone economies adjust via net trade in a statistically significant way (Figure 2.29).

Figure 2.29: Responses of net trade to UK house price shock - crisis



Source: NIESR calculations.

Figure 2.30: Responses of GDP to the US house price shock

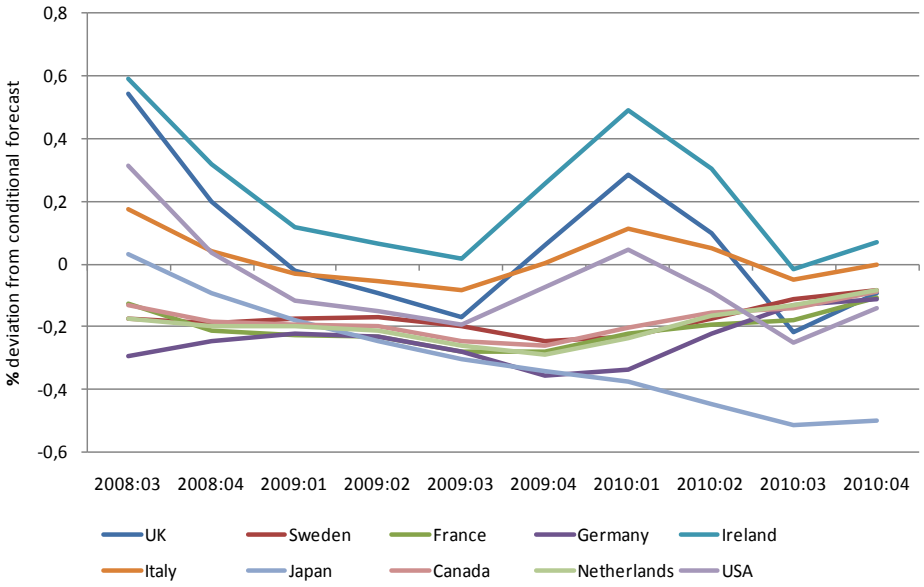


Source: NIESR calculations.

US house price shock

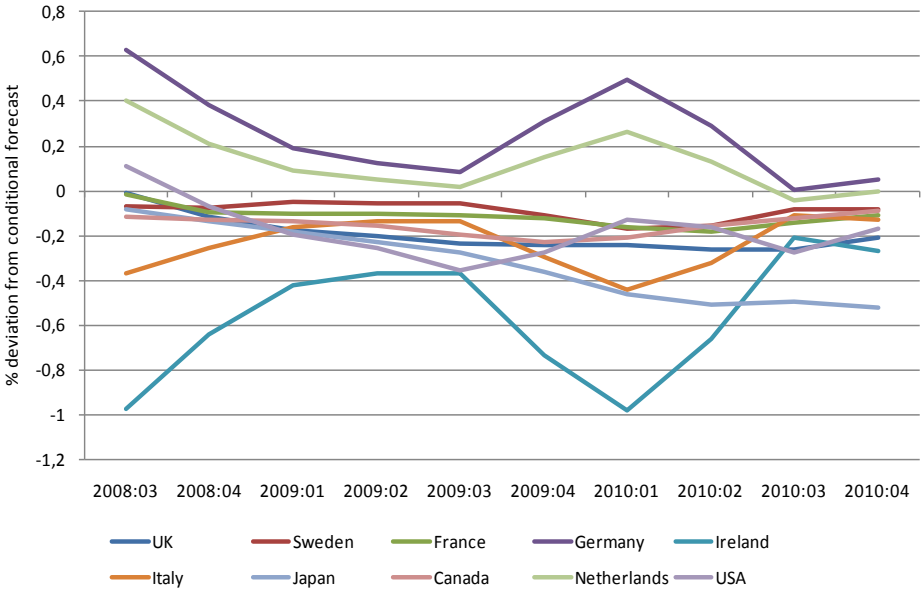
Figure 2.30 shows the response of GDP to the US house price shock. Interestingly, there is more transmission to UK and Irish GDP than to US GDP itself. Also, German and Dutch GDP seem to be immune to the US house price shock, which might indicate that their financial systems were relatively insulated from the US house price shock. Indeed, it is only the UK and Irish credit spreads which seem to increase significantly in response to the US house price shock, while German and Dutch credit conditions actually loosen in response (Figure 2.31). This provides evidence for the credit market transmission of the shock to the UK and Ireland, in line with the strong transatlantic links among these financial markets.

Figure 2.31: Response of credit spreads to US house price shock - crisis



Source: NIESR calculations.

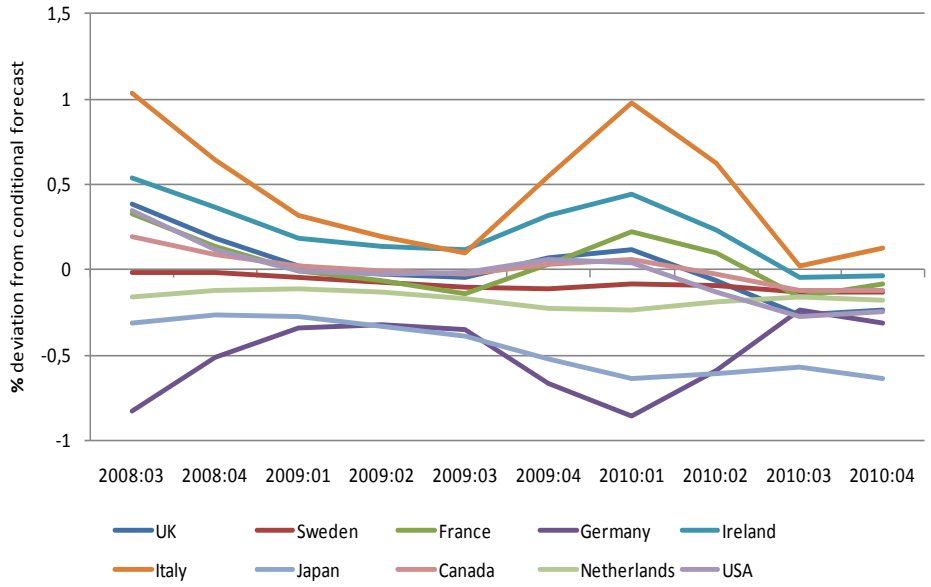
Figure 2.32: Responses of investment to the US house price shock - crisis



Source: NIESR calculations.

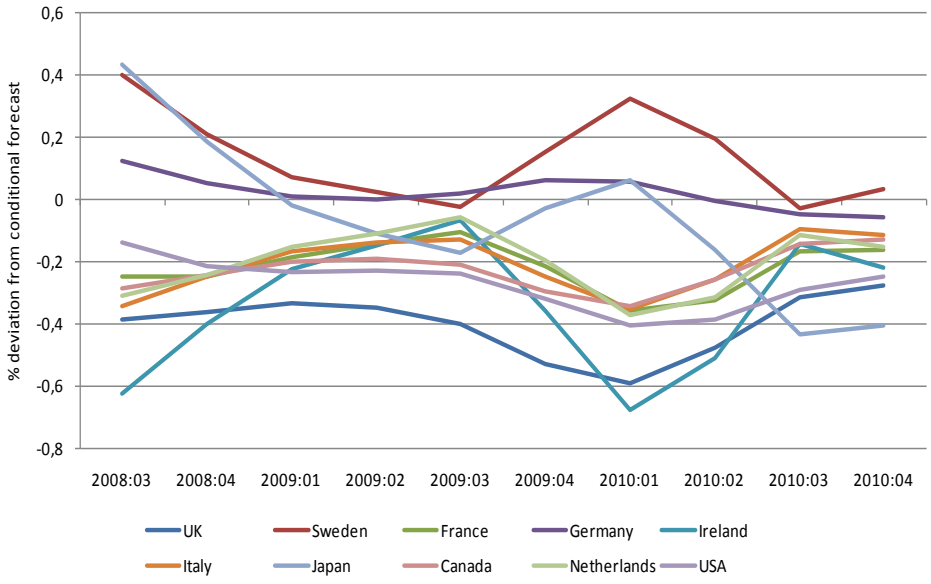
In terms of investment, it is again Ireland whose investment declines most strongly in response to the US house price shock, followed by Italy (Figure 2.32). Again, investment in Germany and the Netherlands seems immune, even increasing in response.

Figure 2.33: Responses of unemployment to the US house price shock - crisis



Source: NIESR calculations.

Figure 2.34: Responses of the REER to the US house price shock - crisis



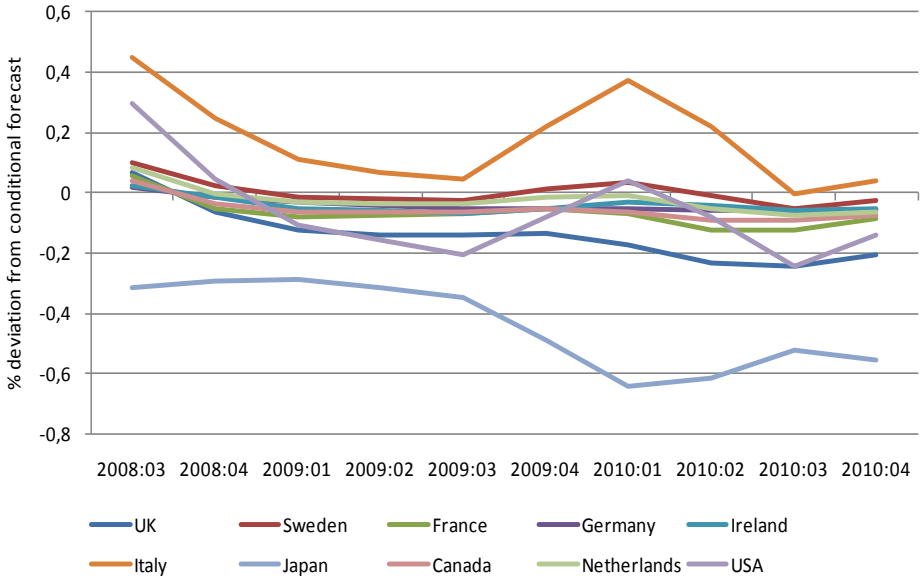
Source: NIESR calculations.

Similarly to the UK house price shock, it is the unemployment rate in the relatively high labour-market regulation country Italy which increases most in response to the US house price shock (Figure 2.33). The response is greater in magnitude to the responses of Irish unemployment, which experienced the sharper fall in investment.

We also find little evidence that Eurozone membership impeded real effective exchange rate adjustment in the early stages of the crisis, as the degree of depreciation in response to the

US house price shock was quite similar across Eurozone and non-Eurozone members (Figure 2.34). There is also no clear pattern of transmission via net trade between Eurozone and non-Eurozone economies (Figure 2.35).

Figure 2.35: Responses of net trade to the US house price shock - crisis



Source: NIESR calculations.

2.3. Conclusions

Our theoretical analysis using the GIMF model and the empirical analysis using a panel VAR model uncover significant differences in the way different countries of the European Union react to common global shocks. The simulations performed using the GIMF highlight distinct adjustment paths between the core, GICIPS and CEE countries. This applies to output, as well as to other key macroeconomic variables. Furthermore, the analysis shows that adjustment paths have changed since important structural parameters such as private and public indebtedness and investment ratios have changed in the aftermath of the global financial crisis. In the case of UK and US housing price shocks, we observe the strongest transmission of the collateral shock via bond markets (as measured by collateral spreads) in the relatively market-based economies: the UK, US and Ireland. In contrast, transmission to the more bank-based economies such as Italy and France seems to mainly occur by investment. We observe little transmission of the global financial shock to unemployment in those countries with more flexible labour markets. In contrast, countries with more highly regulated labour markets, and presumably more rigid wages, have unemployment rates which respond more strongly to the global financial shock. The above macroeconomic analysis sets the scene for a more detailed investigation of trade flows, capital formation and labour markets in the following chapters.

3. The Role of Intra-EU Trade Flows for Transmitting and Absorbing Asymmetric Shocks in the EMU Before, During and After the 2008/2009 Crisis

According to the OCA framework discussed in Chapter 1, the structure and extent of trade flows between the economies participating in a currency area are among the crucial criteria to reduce the likelihood of asymmetric shocks. Accordingly, economies which share similar production and trade structures are expected to be more symmetrically affected by (external) negative demand shocks, which would make it easier to react with common monetary policy measures.

This part of the report is devoted to analyzing the extent to which intra-EU trade flows are structured in so as to qualify for the OCA criteria on homogenous trade patterns. In order to do so, the analysis will compare trade patterns from the pre-crisis, crisis and post-crisis period. This approach allows to assess whether the financial crisis induced systematic changes in the intra- and extra-EU trade relationships.

International trade patterns are nowadays strongly shaped by global value chains. This phenomenon is a consequence of an increased division of economic activities across borders, which took place over the last couple of decades and is often referred to as the second wave of globalization (Mateus 2014). To draw a complete picture of the role of (intra-EU) trade relationships in shock absorption, an empirical analysis on the transmission of economic shocks within the EU and the EMU needs to take these "new" trade patterns into account. For this reason, we focus on both the direct and indirect trade channels.

The analysis on changes in direct trade relationships induced by the financial crisis will mainly be explorative in nature and aims at establishing stylized facts. A comprehensive treatment of this subject is available in a companion study provided by Stehrer et al. (2016). The empirical analysis regarding the (indirect) transmission channel via trade in intermediate goods mainly focuses on the role of (exogenous) demand shocks (in final and intermediate goods) for employment in European industry-country-specific observations. Accordingly, we analyze the extent to which variation in domestic and foreign final consumption vis-à-vis intermediate demand triggers employment fluctuations in (European) industries over the course of the financial crisis.

3.1. Analyzing the direct trade effects of the financial crisis

Within common currency areas, the traditional OCA theory highlights openness to trade and the structure of cross-country trade flows as crucial determinants for the likelihood of asymmetric shocks occurring. The main argument here is that economies which share a diversified production portfolio (in terms of the number of different goods and services), but similar production and export structures, are less likely to be adversely affected by negative external (demand) shocks (`Keen criterion'). Furthermore, integrated goods and services markets within the common currency area (or more generally within the single market) are also expected to contribute to improvements in production efficiency at the firm level by ensuring the need for the application of pricing to market strategies (`McKinnon criterion'). As a consequence, in the long-run only the most efficient firms will be able to survive and these firms can be expected to most successfully cope with negative external demand shocks.

In the context of the EMU and the European single market, the empirical assessment of the Keen and MacKinnon criteria is so far mainly based on macroeconomic indices summarizing openness to trade, trade intensity and the trade structure of the participating economies. Openness to trade is typically measured as the aggregated share of a country's exports and imports relative to its total production (GDP), while trade intensity combines a country's relative exports to and imports from the economic centre of the common currency area/the single market (such as e.g., Germany), and the (bilateral) trade structure is captured with a trade dissimilarity index. This index measures how a country's trade structure differs from that of the economic centre by decomposing trade into the three main types of goods: agricultural, minerals and manufacturing.[7]

The available evidence based on the previously discussed macroeconomic indices can be summarized as follows (Horváth 2005a, 2007, Baldwin and Wyplosz 2015):

- Most EMU and EU-member economies are generally very open, and more so the smaller they are.
- Based on the trade intensity indicator, the EMU members are well integrated with each other, while some new member states are still relatively loosely integrated with the other EMU economies.
- Trade dissimilarities: The export structure of Latvia, Denmark and the Netherlands is most different from that of Germany, while countries such as Slovenia, Italy, Austria and the Czech Republic export rather similar types of goods (Horváth 2007).

This study builds on this evidence from the country level and adds to it by providing a more disaggregated view on the trade patterns across industries (including both manufacturing and services sectors) and all EU-member states. In particular, we descriptively analyze whether some industries and/or countries are asymmetrically affected in their direct trade performance and separately study the developments of intra- and extra-EU trade flows over time, including pre-crisis, during-crisis and post-crisis periods.

3.1.1. Data sources and descriptive results

The empirical analysis presented in this section rests upon two different data sources for manufacturing and services exports, respectively. Data on trade in manufacturing goods are well-established and nowadays capture almost all industries and countries around the world. Service export data, by contrast, are limited in their country and time coverage as well as their level of disaggregation. However, for the purpose of studying the impact of the Great Recession on the export performance of EU member states, sufficient data are available to provide important stylized facts on the main developments induced by the last financial market crisis.

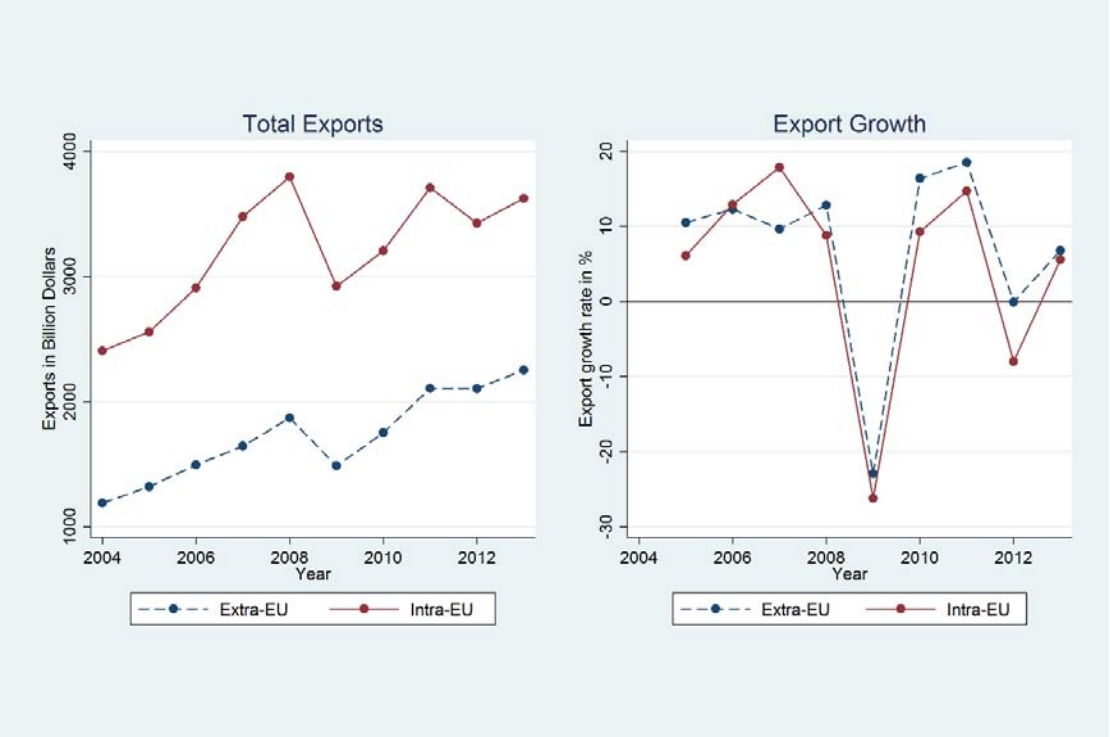
Bilateral (nominal) export flow data for goods are compiled from the Commodity Trade Statistics Database (Comtrade) provided by the United Nations. The available sample covers bilateral export flows in goods collected at the SITC (rev. 3) two-digit level of disaggregation for the time period from 2000 to 2013 and for 186 source and destination countries.[8] Export flow data for services are available in Eurostat's Balance of Payments (BOP) Statistics for a limited number of source countries (mainly the EU-28 economies) and for (only) up to 67 destination countries. The level of disaggregation is restricted to the main BOP categories as

[7] For more details on the construction of the respective indices see e.g., Horváth (2005b).
[8] A classification of SITC (rev 3) 2-digit industries is available at http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=14.

defined in the Balance of Payments Manual number 5.[9] These data are available for a time period from 2004 to 2012. For this reason we restrict the subsequent analysis to the years from 2004 onwards in order to provide comparable results for both data sources. We, however, do not restrict the number of destination economies to be the same across both available samples. This is important to remember when comparing the extra-EU export developments between goods and services exports. In the econometric analysis (to be discussed in more detail below), both data sets will, however, be restricted to the same number of destination economies to allow for a direct discussion on differences in the estimated parameters (and marginal effects) of greatest interest.

The general trends in the overall export developments in manufacturing goods and service are displayed in Figure 3.1 and Figure 3.2, respectively. The left panels compare the evolutions in aggregated intra- versus extra-EU exports over time while the right panels plot the (corresponding) export growth rates. These are approximated by calculating first differences in the logs of the export levels.[10]

Figure 3.1: Development of extra- and intra-EU trade in manufacturing goods, 2004-2013



Source: Comtrade database, WIFO calculations.

Nevertheless, both figures allow to derive some interesting stylized facts: For both types of exports, intra-EU transactions dominate the picture. In other words, firms within the EU tend to mainly export to other EU member states. The gaps in intra- and extra-EU trade in goods and services in the left panels of both figures also do not seem to substantially narrow over time. In total, the EU member states seem to be strongly integrated and tend to continue to mainly concentrate their foreign export activities in other EU member economies. In terms of OCA theory these findings might come with benefits and costs: Whenever an exogenous shock takes place outside the boundaries of the EU, the negative trade effect for the member

[9] The fifth Balance of Payments manual can be retrieved at https://www.imf.org/external/np/sta/bop/BOPman.pdf.
[10] Note again, with the differing number of potential destination countries included in Comtrade and the BOP database the levels of total exports between manufacturing and services industries are not directly comparable.

states seem to be smaller due to the predominant role of intra-EU trade. By contrast, when a negative demand shock is induced and/or reinforced within the boundaries of the single market by e.g., either EMU or non-EMU EU-member states, the negative import demand effect can easily become non-negligible in terms of propagating the initial shock.

Furthermore, with only a few exceptions, the general evolutions of intra- and extra-EU trade flows over time are rather similar, both for manufacturing and services exports, respectively. The bivariate correlation for the two growth rate time series for services exports, for example, confirms this impression by taking on a value of 0.85. Turning briefly to the most visible exceptions, in 2007 the increase in intra-EU export growth in manufacturing and services exports clearly outperformed the corresponding developments in extra-EU trade. Most notably, the extra-EU export growth rate for manufacturing goods slightly declined relative to the growth rate observed in 2006, while in 2007 intra-EU exports recorded the largest annual growth rate over the whole sample period. In a similar vein, intra-EU exports in services experienced a growth rate of almost 25% in 2007 while extra-EU exports only grew by approximately 13% (see Figure 3.2)

When comparing the evolution of exports between manufacturing and services industries, the share of services exports still seems to be relatively small, but these exports develop more dynamically then the ones in manufacturing industries. Over almost the whole sample period, intra- and extra-EU services exports grew by more than 10 percent annually, while, on average, the manufacturing industries only exceeded this threshold in three out of nine years considered. This finding is well in line with the observed shift in demand from manufacturing goods to services (typically referred to as structural change) taking place especially in industrialized economies, which constitute the most important trade partners for the EU and its member states (Peneder et al. 2003). With regard to the main focus of this study, it is worth noting that services industries seem to be less affected by the negative demand shock induced by the financial crisis. For both sectors, intra-EU exports reacted more sensitively than extra-EU exports, but struggled more in relative magnitude manufacturing. Accordingly, in 2009 intra-EU (extra-EU) exports in manufacturing goods declined by 26.24% (22.95%), while for services the corresponding numbers (only amount) to 13.63% and 10.30%, respectively. In a similar vein, the relative decline in manufacturing intra-EU exports in 2012 has been more pronounced than for services. The corresponding growth rates amount to -8.00% and -5.31%, respectively.

The main descriptive results from Figure 3.1 and Figure 3.2 can be summarized as follows:

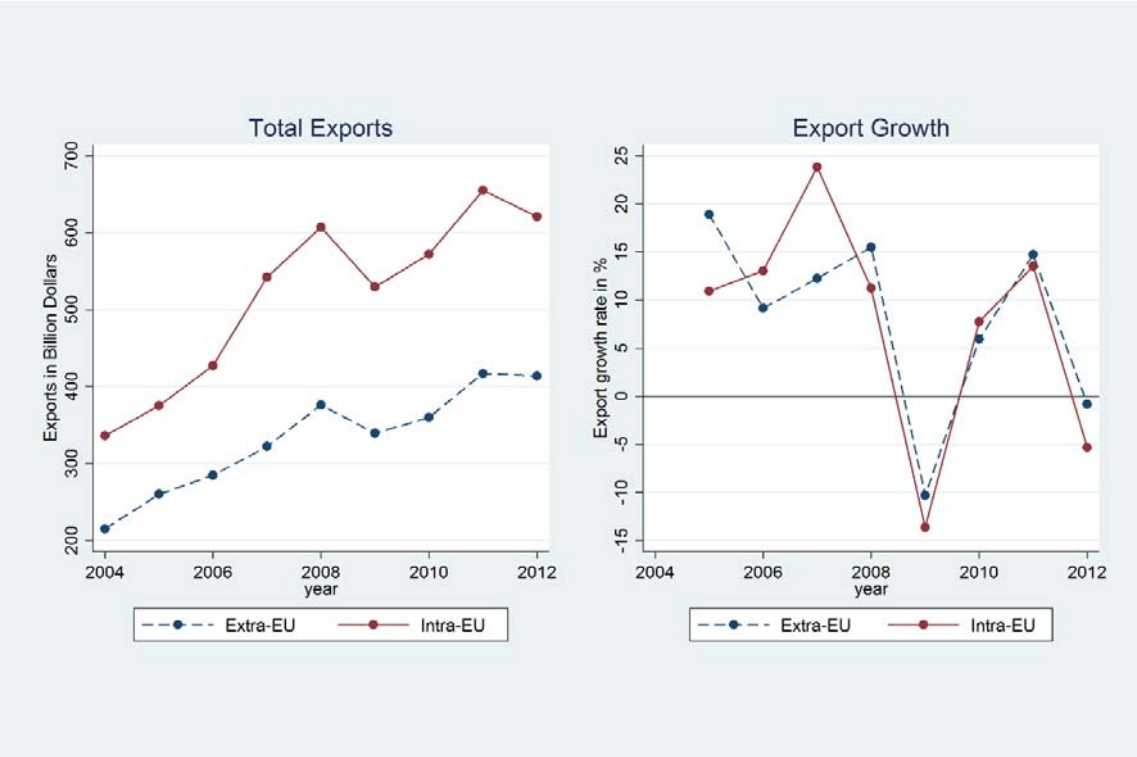
- Intra-EU exports dominate their extra-EU counterparts in both types of economic activity, including manufacturing goods and services.
- Manufacturing still dominates European trade relationships.
- Services exports are less important in total but develop more dynamically over the last decade and outperform manufacturing exports throughout.

Due to aggregation of the data at the EU-level, Figure 3.1 and Figure 3.2 do not allow to uncover whether certain industries or EMU and EU-member economies have been especially and asymmetrically affected by the overall downturn observed in 2009 (and to some extent also in 2012). For this reason, Table 3.1 reports annual growth rates for one-digit manufacturing industries based on the SITC (rev 3) classification and the main service categories, as defined in the BOP manuals. Further, for each year and industry this table differentiates between intra-EU and extra-EU export growth. Table 3.2 collects similar information for country-specific intra-

EU and extra-EU export growth rates in the manufacturing and services industries, respectively. [11]

Table 3.1 documents a relative diverse picture regarding the export performance across the main EU-industries observed from 2005 to 2012. In each of the eight years considered, at least one European industry documented a decline in either extra-EU or intra-EU exports. However, the year 2007 seems to have been the most successful one for the exports of European industries and only extra-EU exports of governmental services experienced a decline. With regard to the latter it is important to mention that in 2013 governmental services exports which consist of activities related to embassies and consultants, military units and agencies and other government services only account for about 1 percent of all services exports from the EU.[12] All other intra-EU and extra-EU exports grew reasonably with a large number of two-digit growth rates reported.

Figure 3.2: Development of extra- and intra-EU trade in services, 2004-2012



Source: BOP statistics, WIFO calculations.

The extent of the impact of the Great Recession on exports becomes visible in Table 3.1. In 2009 the largest drops in both intra-EU and extra-EU exports took place for mineral fuels, lubricants and related materials with their growth rates amounting to -50.01% and -42.92%, respectively. Furthermore, in 2009 (in terms of export growth/decline) for 15 out of 20 industries, extra-EU exports performed better than their intra-EU counterparts. Among the exceptions from this general trend are exports in the food and live animals, beverages and tobacco and the miscellaneous manufactured articles industries and exports of insurance

[11] The separate treatment is motivated by the differences in the number of destination economies accounted for in the alternative data sets available for the different export activities and the maybe differing dynamics in their respective developments over time.

[12] Most recent data on services exports can be obtained online at Eurostat's homepage using http://ec.europa.eu/eurostat/statistics-explained/index.php/International_trade_in_services.

and governmental services. This picture gets additional support from the export growth figures reported for 2010. Again, in 15 out of 20 main industries, the (mostly) positive and large export growth rates for extra-EU exports exceed the ones for their intra-EU counterparts. Finally, the year 2012 shows a tendency towards another decline in industry-specific exports, with this effect being again most pounced for intra-EU exports.

Table 3.1: Annual export growth rates in % by industries

		Year							
Industry		2005	2006	2007	2008	2009	2010	2011	2012
Manufacturing Industries									
Food and live animals	Extra-EU	7.19	10.46	10.96	21.23	-14.79	16.49	20.29	2.00
	Intra-EU	7.70	8.37	19.92	15.20	-10.28	3.24	15.81	-3.29
Beverages and tobacco	Extra-EU	7.38	14.75	12.98	6.82	-13.99	12.78	22.63	3.70
	Intra-EU	4.50	6.54	19.25	9.53	-10.14	0.22	14.05	-4.95
Crude materials, inedible	Extra-EU	12.37	22.68	9.33	13.06	-20.72	27.85	20.56	-3.77
except fuels	Intra-EU	4.03	20.19	22.66	5.24	-37.49	29.26	23.07	-10.22
Mineral fuels, lubricants	Extra-EU	33.77	23.84	10.22	32.94	-42.94	25.77	28.55	15.02
and related materials	Intra-EU	28.28	18.63	6.69	33.70	-50.01	25.22	32.21	1.05
Animal and vegetable oils,	Extra-EU	1.58	5.17	4.72	29.67	-23.02	11.42	28.46	10.98
fats and waxes	Intra-EU	7.43	15.13	19.03	39.12	-32.79	5.89	33.70	-4.20
Chemicals and related products,	Extra-EU	9.57	12.51	11.64	9.11	-7.60	12.72	12.58	0.01
n.e.s.	Intra-EU	9.91	10.24	18.91	10.50	-16.58	8.06	12.32	-5.98
Manufactured goods	Extra-EU	9.88	12.38	7.65	9.37	-31.53	16.15	18.59	-2.91
classified chiefly by material	Intra-EU	5.59	15.64	22.12	5.60	-38.37	14.38	19.47	-12.89
Machinery and	Extra-EU	10.40	12.25	10.12	12.01	-28.25	18.24	17.74	0.23
transport equipment	Intra-EU	5.23	13.29	12.98	4.28	-30.41	9.43	14.14	-10.57
Miscellaneous manufactured	Extra-EU	6.42	10.64	2.18	9.51	-19.74	12.05	16.93	3.83
articles	Intra-EU	6.17	8.30	17.99	9.28	-16.17	5.35	13.85	-9.17
Commodities and transactions not	Extra-EU	15.51	-4.45	28.40	29.82	0.94	10.46	33.89	-25.78
classified elsewhere in the SITC	Intra-EU	-25.52	18.02	49.02	8.55	-9.73	-8.62	-29.31	5.15
Services Indusries									
Transportation	Extra-EU	25.08	9.97	6.86	15.97	-21.85	9.90	10.30	-1.42
	Intra-EU	12.25	13.97	22.27	12.30	-23.37	9.76	9.79	-4.87
Communications services	Extra-EU	22.67	23.02	2.00	27.23	-6.47	9.65	13.78	19.55
	Intra-EU	14.84	16.62	11.48	7.76	-20.58	19.01	7.63	-1.10
Construction services	Extra-EU	24.12	8.69	1.02	12.24	-4.13	-15.77	11.61	-14.27
	Intra-EU	15.41	12.59	12.19	12.75	-11.51	-2.93	3.82	-8.54
Insurance services	Extra-EU	-24.57	47.22	36.10	-7.46	-6.25	6.53	1.02	-7.89
	Intra-EU	-6.91	11.38	12.28	13.30	1.91	-2.81	8.57	0.93
Financial services	Extra-EU	13.77	15.05	24.37	-4.31	-12.83	11.95	13.83	2.05
	Intra-EU	16.01	31.10	30.12	2.29	-19.29	3.22	16.98	-6.02
Computer and information services	Extra-EU	8.34	20.03	22.73	24.97	-0.35	-2.50	17.58	13.54
	Intra-EU	6.51	13.56	28.67	18.59	-3.71	3.88	5.48	16.54
Royalties and license fees	Extra-EU	26.41	-3.85	22.85	15.29	1.37	6.34	27.01	-19.58
	Intra-EU	-1.26	12.61	23.94	42.48	-0.75	-14.36	48.03	-60.59
Other business services	Extra-EU	19.82	6.16	14.18	18.95	-3.51	3.75	17.72	0.31
	Intra-EU	12.45	8.21	26.62	9.00	-9.41	11.36	14.84	-5.04
Personal, cultural and	Extra-EU	-23.04	-8.92	9.51	-5.35	12.04	28.88	4.14	-2.82
recreational services	Intra-EU	7.74	-2.91	12.85	-12.76	1.15	25.23	14.58	-3.76
Government services, n.i.e.	Extra-EU	-32.46	4.49	-5.31	0.40	-13.83	-6.79	2.92	-1.97
	Intra-EU	-1.17	0.23	10.10	-46.69	13.64	2.94	-3.59	-3.12

Source: Comtrade database, BOP statistics, WIFO calculations.

To summarize, the following stylized facts can be highlighted:

- Annual export growth suggests that European economies have been harshly hit by the economic crisis induced by the financial crisis.
- Given the dominance of intra-EU exports within virtually all European industries, the negative shock of 2009 also translated into larger within-EU export losses.
- These findings give some first indication of the potentially negative long-run effects associated with a strong concentration of all the European exports in the single

market which evolved naturally as a consequence of the political steps that boosted economic integration within the boundaries of the EU.

Table 3.2 allows to descriptively assessing whether intra- and extra-EU export growth performances in the pre-, during- and post-crisis periods differed across EU-member states and for the main economic activities aggregated at the total manufacturing- and services-level, respectively. With some exceptions, Table 3.2 indicates that both intra-EU and extra-EU exports developed rather successfully in the years from 2005 to 2007. Finland's export performance in extra-EU services most notably deviates from this general trend by already reporting large negative growth rates in 2005 and 2006. In line with Figure 3.2, the country-specific export growth rates confirm the more dynamic developments in services exports. For most countries and years, both intra-EU and extra-EU export growth rates attached to services exceed the corresponding numbers for the manufacturing industries.

Focusing on the year 2009, virtually all economies and export activities have been negatively affected by the economic crisis. From a total of 108 (country-industry-export type) cells observed in 2009, 103 export growth rates were negative. Furthermore, the positive export developments observed in this year are all related to export activities in the services industries and four out of the five instances occurred for extra-EU relationships. The sole positive intra-EU export growth rate in 2009 is associated with services exports provided from French services suppliers. For most negative export growth observations, the export decline was substantial, amounting to a maximum of -46.30% in extra-EU manufacturing exports from Lithuania. This number is closely followed by Slovakia's intra- and extra-EU exports in services and Finland's manufacturing exports, both to other EU-member states and to the Rest of the World (RoW).

Concerning the export performance of non-EMU EU-member economies, Table 3.2 points to considerable heterogeneity across countries, which is comparable to that observed for EMU participants. For the United Kingdom, intra- and extra-EU exports declined rather symmetrically in 2009 for both services and manufacturing industries, with export growth rates amounting to values ranging from -23.54% to -29.94%. In Sweden, manufacturing exports more severely suffered and extra-EU exports also reacted more strongly to the Great Recession. A qualitatively similar picture can be observed for Bulgaria and Poland, while in Hungary and Romania extra-EU manufacturing and intra-EU services exports reacted most sensitively. For Denmark, which pegged its krone to the Euro, the most negative crisis effects are observed for both extra- and intra-EU services exports. Contrasting this with two EMU member states, Austria's intra-EU exports reacted more strongly to the crisis, while for Germany intra-EU manufacturing and extra-EU services exports exhibited the most negative (relative) rates of decline in 2009.

Furthermore, Table 3.2 points to a relatively fast recovery in the export growth in the aftermath of the Great Recession. When counting negative growth rates for the 108 export activities associated with the EU-27 member states in the year 2010, we observe a (further) decline in only 15 cells, while 93 intra- and extra-EU export cells reported positive relative changes. The largest relative gain in exports in 2010 is documented for intra-EU exports conducted by Greek service providers. Here, however, it's worth emphasizing that Greek's tourism had to deal with a large decline in demand in 2009, due to the risks associated with the states near collapse. Putting this into perspective, the recovery in 2010 is fine but at least partially reflects the low starting point based on the previous year's sharp decline in services exports. The average export growth rate across all activities amounted to 9.67% in 2010. This trend continued in 2011 where the average exports grew by approximately 17%. Thereby, the largest relative gains occurred in the extra-EU service exports from Finland amounting to an

impressive export growth rate of 88.68%. Finally, in line with the aggregate picture from Figure 3.1and Figure 3.2, in 2012 the developments had been reversed once more and again more negative export growth rates are reported in Table 3.2. This last finding is in line with the general view on recent difficulties of the European economy in quickly and permanently recovering from the last crisis induced by the turmoil in the financial markets.

Table 3.2: Annual export growth rates by countries

			Year							
Country	**Industrie**		2005	2006	2007	2008	2009	2010	2011	2012
Austria	Manufacturing	Extra-EU	6.87	15.49	8.23	11.20	-23.26	10.91	18.75	-1.92
		Intra-EU	4.78	11.69	15.97	10.26	-28.42	9.04	14.96	-8.14
	Services	Extra-EU	13.34	16.60	2.99	19.49	-16.22	8.25	13.92	-0.91
		Intra-EU	14.41	4.12	25.29	15.62	-19.51	0.97	16.51	0.81
Belgium	Manufacturing	Extra-EU	10.86	8.31	15.41	5.09	-18.12	18.95	19.12	0.43
		Intra-EU	7.82	8.85	16.44	9.74	-25.62	5.88	14.12	-9.14
	Services	Extra-EU	5.39	-0.84	36.76	30.17	-2.46	7.63	4.28	5.43
		Intra-EU	4.33	-3.37	17.44	26.60	-6.35	9.58	5.21	3.93
Bulgaria	Manufacturing	Extra-EU	13.70	29.99	-74.68	21.42	-43.48	25.77	25.29	6.17
		Intra-EU	-	-	-	19.49	-23.87	16.77	33.86	-12.24
	Services	Extra-EU	8.89	26.63	-118.64	18.71	-23.58	27.00	-1.61	2.86
		Intra-EU	-	-	-	22.83	-13.01	-15.94	21.87	4.79
Cyprus	Manufacturing	Extra-EU	2.86	5.82	-3.63	23.58	-11.78	11.42	14.23	14.71
		Intra-EU	25.84	-21.54	14.42	2.02	-19.30	9.66	24.68	-21.64
	Services	Extra-EU	-0.62	19.23	7.46	24.56	1.24	9.16	-16.19	3.28
		Intra-EU	16.76	32.67	40.55	-10.39	-27.46	-6.11	-0.73	-20.60
Czech Republic	Manufacturing	Extra-EU	27.87	19.50	18.20	16.35	-21.36	21.25	26.08	7.70
		Intra-EU	15.50	17.56	27.06	16.39	-25.90	14.19	22.40	-6.28
	Services	Extra-EU	30.26	-21.55	37.51	28.03	-9.62	23.36	23.37	2.47
		Intra-EU	21.17	32.62	29.99	39.59	-22.70	14.96	9.50	-7.51
Germany	Manufacturing	Extra-EU	8.15	17.30	9.60	12.60	-21.30	19.12	18.74	0.36
		Intra-EU	6.25	11.61	21.30	8.13	-25.72	7.56	12.47	-8.59
	Services	Extra-EU	12.76	10.10	18.33	15.58	-8.40	9.46	10.62	1.99
		Intra-EU	10.73	16.69	17.75	14.28	-2.02	-0.24	10.66	-4.33
Denmark	Manufacturing	Extra-EU	4.43	12.91	11.86	15.13	-17.76	9.38	16.96	-3.33
		Intra-EU	4.30	10.76	12.38	11.44	-25.78	3.08	15.66	-7.95
	Services	Extra-EU	30.83	21.97	18.22	17.53	-28.99	14.32	10.66	4.54
		Intra-EU	32.42	17.87	16.38	16.46	-26.50	7.13	4.20	-7.50
Spain	Manufacturing	Extra-EU	12.30	13.00	15.02	13.92	-21.19	14.68	23.58	5.71
		Intra-EU	1.99	8.61	17.96	6.67	-21.97	7.64	16.39	-10.37
	Services	Extra-EU	20.21	24.81	31.05	37.24	-22.39	13.80	22.85	1.92
		Intra-EU	7.86	9.87	38.08	16.91	-22.61	3.57	13.72	-1.78
Estonia	Manufacturing	Extra-EU	19.41	41.75	21.69	21.58	-18.13	16.05	38.97	4.10
		Intra-EU	23.05	5.34	19.97	12.00	-32.65	21.89	32.17	-2.99
	Services	Extra-EU	20.10	-9.52	38.01	24.29	-30.95	0.35	22.61	11.77
		Intra-EU	19.50	22.56	27.27	13.01	-20.07	4.41	22.33	-6.60
Finland	Manufacturing	Extra-EU	11.18	14.83	15.13	8.80	-41.87	11.24	7.63	-0.71
		Intra-EU	6.56	15.02	14.71	6.43	-44.40	9.80	13.02	-11.55
	Services	Extra-EU	-14.37	-23.30	80.82	-6.18	-14.33	-50.57	88.68	-7.13
		Intra-EU	-3.73	7.86	15.86	9.73	-11.04	-7.74	22.24	5.81
France	Manufacturing	Extra-EU	8.58	10.59	9.58	14.81	-20.81	12.52	13.45	0.32
		Intra-EU	2.91	9.26	13.20	6.71	-27.30	8.33	12.42	-7.45
	Services	Extra-EU	12.90	8.82	9.59	12.63	14.52	-1.32	21.77	-15.20
		Intra-EU	10.03	2.51	23.39	3.88	18.71	23.26	20.37	-12.47
Greece	Manufacturing	Extra-EU	16.73	18.03	-24.01	44.14	-19.22	18.18	21.82	18.59
		Intra-EU	9.27	19.21	30.86	19.45	-29.13	7.19	12.69	-11.15
	Services	Extra-EU	126.34	6.76	-102.93	13.78	76.98	-80.09	1.40	-2.76
		Intra-EU	68.34	8.94	-12.65	13.19	-34.94	61.28	7.62	-9.71

Table 3.2 (continued): Annual export growth rates by countries

Hungary	Manufacturing	Extra-EU	25.80	24.39	2.63	18.74	-29.81	21.60	21.34	-6.88
		Intra-EU	3.43	12.11	28.88	12.05	-24.18	12.51	15.46	-8.74
	Services	Extra-EU	24.57	-12.34	15.03	11.68	-6.49	18.64	5.67	-0.59
		Intra-EU	28.09	16.34	35.74	13.09	-13.84	5.80	19.39	-7.11
Ireland	Manufacturing	Extra-EU	3.59	-0.74	10.96	7.33	-4.37	8.80	7.74	-11.62
		Intra-EU	6.52	-1.22	12.09	2.03	-10.69	-3.92	6.75	-5.30
	Services	Extra-EU	22.29	10.36	36.21	-1.31	-10.53	17.10	15.92	0.27
		Intra-EU	13.02	9.86	36.11	8.43	-13.88	6.74	-4.89	17.95
Italy	Manufacturing	Extra-EU	6.79	11.56	13.73	12.55	-25.54	9.95	18.33	0.90
		Intra-EU	4.17	10.81	21.35	4.34	-30.81	9.01	13.28	-8.42
	Services	Extra-EU	18.64	13.51	-0.87	33.00	-24.46	1.72	21.63	9.05
		Intra-EU	5.46	11.74	18.32	-15.17	-28.95	12.07	2.72	-7.32
Lithuania	Manufacturing	Extra-EU	34.92	17.45	15.03	43.90	-46.30	31.66	28.91	6.44
		Intra-EU	21.22	14.97	21.69	25.64	-30.26	18.29	27.91	6.37
	Services	Extra-EU	25.03	17.23	-3.50	22.21	-44.87	20.46	34.41	21.80
		Intra-EU	22.83	13.40	23.17	14.74	-14.16	7.56	16.29	14.49
Luxembourg	Manufacturing	Extra-EU	21.32	15.86	4.00	2.00	-14.07	16.55	23.55	-12.05
		Intra-EU	1.72	9.70	15.20	7.92	-35.89	9.57	13.90	-18.32
	Services	Extra-EU	19.30	16.17	23.73	-1.11	-18.19	15.38	5.88	5.62
		Intra-EU	20.25	28.97	29.37	6.30	-23.60	6.91	15.03	-3.04
Latvia	Manufacturing	Extra-EU	23.47	6.26	24.03	26.53	-18.76	22.55	26.66	15.80
		Intra-EU	20.42	12.02	30.76	12.11	-27.74	20.78	30.98	1.34
	Services	Extra-EU	8.97	15.15	33.46	17.73	-18.56	-6.55	35.55	-8.39
		Intra-EU	25.27	16.53	32.68	21.86	-16.45	-1.28	16.35	10.10
Malta	Manufacturing	Extra-EU	-9.87	16.84	15.19	1.35	-25.96	20.79	46.65	21.86
		Intra-EU	-2.08	15.70	4.68	-12.99	-29.88	40.08	16.19	-8.09
	Services	Extra-EU	-90.37	112.50	-0.56	37.83	-4.67	11.51	5.17	-2.30
		Intra-EU	11.30	44.35	40.78	-7.49	-11.20	-13.06	2.14	-0.71
Netherlands	Manufacturing	Extra-EU	16.11	16.87	19.45	9.24	-16.00	15.86	9.43	4.88
		Intra-EU	7.66	13.71	18.09	13.62	-25.10	12.44	15.70	-6.51
	Services	Extra-EU	21.72	-2.17	10.08	7.03	-25.48	8.22	24.39	-6.48
		Intra-EU	-0.78	19.25	14.24	11.32	-32.77	3.00	39.49	-38.56
Poland	Manufacturing	Extra-EU	27.89	20.17	16.74	25.61	-30.94	16.97	23.64	5.82
		Intra-EU	14.04	21.74	25.52	19.61	-20.69	15.14	16.48	-7.88
	Services	Extra-EU	24.55	19.86	38.66	30.96	-20.00	21.15	9.91	-3.22
		Intra-EU	27.73	31.20	29.59	24.66	-16.77	11.90	17.47	0.74
Portugal	Manufacturing	Extra-EU	4.28	25.40	16.02	18.09	-30.83	13.81	24.14	10.21
		Intra-EU	-3.15	10.46	15.51	3.41	-19.00	11.92	19.89	-7.29
	Services	Extra-EU	-0.70	16.23	48.96	14.22	-8.30	3.07	2.85	-3.45
		Intra-EU	5.92	27.26	24.57	12.83	-19.30	-1.10	14.45	-18.68
Romania	Manufacturing	Extra-EU	16.98	15.45	-106.60	26.40	-34.70	28.99	27.04	-4.31
		Intra-EU	-	-	-	18.55	-14.31	16.47	22.30	-9.29
	Services	Extra-EU	-	34.33	-133.01	11.44	5.80	15.49	-3.62	-2.85
		Intra-EU	-	-	-	35.12	-27.88	-20.76	18.78	10.92
Slovakia	Manufacturing	Extra-EU	13.09	29.17	20.72	29.97	-26.93	24.15	18.35	7.28
		Intra-EU	13.43	26.54	35.07	17.32	-22.80	12.40	20.80	0.70
	Services	Extra-EU	11.02	9.36	1.20	30.30	-43.10	6.43	8.88	-18.48
		Intra-EU	17.17	25.27	33.94	10.17	-44.15	-6.35	20.57	25.24
Slovenia	Manufacturing	Extra-EU	7.54	13.82	16.36	15.33	-28.50	4.32	17.33	0.66
		Intra-EU	14.05	16.83	26.67	7.18	-25.77	10.52	16.90	-10.02
	Services	Extra-EU	14.88	-0.20	28.08	56.40	-27.61	-6.05	12.41	11.50
		Intra-EU	17.80	18.98	27.69	20.40	-27.17	4.43	15.02	0.14
Sweden	Manufacturing	Extra-EU	5.92	9.32	9.93	11.03	-30.01	17.54	17.17	-9.92
		Intra-EU	4.96	14.46	16.27	6.54	-36.30	14.23	14.63	-6.33
	Services	Extra-EU	1.23	15.35	13.71	27.05	-22.78	6.99	8.07	5.37
		Intra-EU	10.04	10.18	22.79	7.89	-15.93	15.85	15.79	-2.38
United Kingdom	Manufacturing	Extra-EU	15.54	-0.87	10.72	11.58	-28.71	21.18	25.54	-5.66
		Intra-EU	5.96	26.76	-8.84	1.46	-29.94	11.53	15.11	-9.51
	Services	Extra-EU	10.76	0.84	7.44	9.63	-26.58	6.45	14.25	-0.57
		Intra-EU	-2.41	4.44	20.79	8.13	-23.54	0.02	6.07	-6.71

Source: Comtrade database, BOP statistics, WIFO calculations.

The disaggregated descriptive statistics thus point to some key findings which are in line with general observations already highlighted in Chapter 1:

- The European industries have been asymmetrically affected by the financial crisis, but service industries have been more successful in coping with it.
- In general, intra-EU exports suffered more strongly in comparison to the extra-EU trade flows. This again highlights that a negative demand shock induced within the boundaries of the EU and/or EMU might induce substantial spillover effects to other participating economies as well as other industries.
- The country-specific export performance during the crisis has also been heterogeneous. This finding also holds for economies with differing degrees of integration within the EU.

3.1.2. Gravity model evidence for crisis-effects

The empirical investigation of the crisis-induced intra- and extra-EU export effects discussed in Section 3.1.1 relied on descriptive statistics. Table 3.1 and Table 3.2 point to non-negligible heterogeneity in the export performance across industries and EU member states observed over the time period considered. Such a finding tends to indicate that the annual growth rate figures might be contaminated by other (idiosyncratic) factors which we have not yet controlled for. For this reason, we now present and discuss some additional evidence based on a more structural approach for identifying the (direct) export effects induced by the financial crisis.

Accordingly, we suggest an econometric analysis of intra- and extra-EU trade flows making use of the gravity model for bilateral trade, the workhorse model in International Economics. Conceptually, this model is orientated on *Newton's Law of Universal Gravitation* and its economic formulation is in line with most economic theories on international trade (see, e.g., Allen et al. 2014). In the early economic literature, the gravity model was used for estimating bilateral trade flows due to its high explanatory power, but in economic terms has only been justified by applying ad-hoc assumptions (see Tinbergen 1962 for the first application of gravity models for international trade). Starting with the seminal contribution of Anderson and van Wincoop (2003), the gravity model has now been based on a sound theoretical foundation, which is able to capture alternative explanations for the variation in observed bilateral trade flows including love-of-variety preferences (Krugman 1980), the presence of heterogeneous firms (Helpman et al. 2008) or differences in the available production technology (Eaton and Kortum 2002).

A standard empirical formulation of a bilateral gravity model can be stated as:

(Eq. 3-1) $$X_{ijkt} = exp(x_{ijkt}\,\beta)\,\mu_{ijkt}\,,$$

where X_{ijkt} denotes exports from country *i* to country *j* in industry *k* at time *t*. x_{ijkt} represents a vector which collects all explanatory variables, including source- and destination-country specific (nominal) GDPs and a large number of fixed effects where the latter aim at capturing unobserved destination-, exporter- and time-period effects, respectively. For the purpose of this analysis, time is split into pre-, during- and post-crisis periods, respectively. The pre-crisis period is defined for the years from 2005 to 2008. Based on the descriptive findings from above, the crisis episode lasts from 2009 to 2010 while the years from 2011 onwards (until 2013) are defined as belonging to the post-crisis time period.

For the purpose of studying the trade effects of the financial crisis, the empirical specification of the applied gravity model will be augmented with further indicators. First, we introduce a dummy variable taking on a value of one for all bilateral intra-EU export relationships and zero otherwise. This indicator thus captures the conditional average difference in export

developments between intra-EU and extra-EU export flows over the whole sample period. In order to assess potential heterogeneity in intra-EU versus extra-EU export effects induced by the crisis and in the recovery dynamics observed in its aftermath, the intra-EU dummy variable is further interacted with the crisis and post-crisis period indicators, respectively. In two alternative specifications we introduce additional interaction terms for crisis-intra-EU-industry and crisis-intra-EU-country effects in order to further assess the heterogeneity in the export performance across (European) industries and countries over the crisis time period. The results obtained from this analysis will provide insights on whether EU economies with differing depths of integration have been symmetrically or asymmetrically affected by the Great Recession. This in turn, allows to draw some first policy conclusions on how European integration could contribute to the absorption of asymmetric shocks within the EU in general and the EMU in particular.

For estimation purposes, we apply state-of-the-art econometric methods for identifying unbiased parameter estimates from trade flow data. In particular, when analyzing bilateral trade one needs to account for the existence of zero-trade flows (in many bilateral trade combinations zero exports are observed), the integer nature of the trade flow data to be observed and the heteroscedasticity in the error terms resulting from bilateral gravity model estimations. The latter follows from an increase in the conditional variance in export flows for larger countries. All the mentioned issues are most effectively tackled by applying quasi-maximum-likelihood (QML) methods in the spirit of the seminal contribution by Santos Silva and Tenreyro (2006).[13] Accordingly, Poisson-regression models satisfy the properties required for estimating unbiased parameters from bilateral export flow data. The Poisson distribution is defined for integer values, including zero-trade flows, and further allows for heteroscedasticity in the observed export data. For estimation purposes, the trade flow data do not need to be transformed in any way and the obtained estimation results can be directly interpreted when taking the exponential value formulation of the conditional mean in Poisson-regression models into account (Cameron and Trivedi 2005).

As mentioned above, in this analysis we restrict the manufacturing data from Comtrade to the time period and destination economies also available in the BOP data. This renders a direct comparison across industries and countries possible, but at the same time does not make it possible to provide a comprehensive analysis for total trade in European manufacturing industries.[14] The resulting estimates are based on 1,776,000 and 114,168 export-destination observations for the manufacturing and services industries samples, respectively. Tables 3.3 and 3.4 display these estimation results.

Before turning our attention to the parameter estimates, it is worth emphasizing that according to Pseudo-R^2 values the industry- and country-specifications provide virtually identical model fits. For the manufacturing industries the alternative specifications generate exactly the same Pseudo-R^2 values which amount to 0.645. For the services industries the goodness-of-fits are given by 0.783 and 0.784, respectively. In general, for both alternative specifications and the different samples the explanatory power of the specifications seem to be reasonable again pointing to the usefulness of gravity models for explaining (bilateral) export relationships.

[13] For a detailed survey on the econometric issues involved when estimating gravity models of bilateral trade see e.g., Baltagi et al. (2015).
[14] For a more detailed analysis on the subject, we again refer the reader to Stehrer et al. (2016).

Table 3.3: Estimation results for industry regressions

	Manufacturing		Services	
	Parameters	Standard Errors	Parameters	Standard Errors
GDP-exporter	0.721 ***	0.066	0.783 ***	0.130
GPD-destination	0.735 ***	0.048	0.645 ***	0.079
Intra-EU trade	0.050	0.043	-0.044	0.065
Intra-EU trade*crisis period	-0.081 *	0.043	-0.031	0.063
Intra-EU trade*post-crisis period	0.013	0.034	0.127 **	0.053
Crisis	-0.130 ***	0.030	0.024	0.047
Post-crisis	-0.068 **	0.034	0.023	0.049
Intra-EU trade*crisis period*				
Food and live animals	0.348 ***	0.046		
Beverages and tobacco	0.014	0.092		
Crude materials	0.050	0.058		
Mineral fuels	0.115	0.114		
Animal and vegetable oils	0.328 ***	0.115		
Chemicals and related products	0.065	0.056		
Goods classified chiefly by material	0.146 ***	0.043		
Miscellaneous manufactured articles	0.085 *	0.047		
Commodities not elsewhere classified	0.349 **	0.136		
Communications services			0.136 **	0.072
Construction services			0.069	0.096
Insurance services			0.211	0.166
Financial services			0.267 *	0.160
Computer and information services			0.245 **	0.131
Royalties and license fees			-0.058	0.196
Other business services			0.020	0.062
Personal, cultural, recreational services			-0.156	0.108
Government services			-0.670 ***	0.180
Industry-fixed effects	Yes		Yes	
Exporter-fixed effects	Yes		Yes	
Importer-fixed effects	Yes		Yes	
Pseudo-R2	0.645		0.783	
Observations	1,776,000		114,168	

Source: Comtrade database, BOP Statistics. WIFO calculations.
Notes: ***, **, * denote statistical significance at the 1%, 5% and 10% level, respectively.

Continuing with the control variables, the corresponding estimates are also robust against different model specifications (i.e., industry- versus country-effects) and across the manufacturing and services industries samples. Exporter- and destination specific (nominal) GPDs positively and highly significantly affect exports from all EU-economies. Accordingly, larger exporting countries tend to export larger quantities and, on average, all industries in the member states export more goods and services to larger destination economies. This finding is well in line with almost all the available evidence in the literature on bilateral trade relationships. Furthermore, the significantly negative effects attached to the crisis and post-crisis indicators for the manufacturing industry-specifications indicate that these industries have struggled during the crisis but also still find it difficult to recover in its aftermath. Note, however this finding is true for exports both into intra-EU and extra-EU destinations, respectively. By contrast, services exports are not in general specifically affected by the crisis and post-crisis periods. We are not able to identify significant structural breaks in all services exports induced by the crisis as indicated by insignificant parameter estimates. In a similar vein, the intra-EU export indicator turns out insignificant throughout the two different specifications and the two different data samples considered. Since the model also includes interaction effects of the intra-EU indicator with the crisis and post-crisis periods, respectively, this finding implies that intra-EU exports have not systematically performed differently to extra-

EU exports in the pre-crisis period lasting from 2005 to 2008. Focusing on the estimated interaction effects between intra-EU exports and the post-crisis period, the findings from both specifications point to a more dynamic evolution of intra-EU services exports in the aftermath of the Great recession. Comparing the results across manufacturing and services industries, we are able to identify some industries in which conditional intra-EU exports during the Great Recession still developed more dynamically as the average extra-EU exports in the same industries. Among these resilient industries are food and live animals, animals and vegetable oils and commodities producers which are not elsewhere classified together with computer and information services providers, the communication services and firms engaged in transport service provision. The export effects observed in the former two manufacturing industries might reflect the crucial role of the common agricultural policy (CAP) for stabilizing trade relationships in times of economic downturns. The other industries are likely to be profiting from a shift in overall demand for their products (especially within the EU) induced by underlying structural change dynamics.

Turning the attention to the impact of the crisis for intra- versus extra-EU trade developments, we need to simultaneously assess the main effects reported in the upper parts of Table 3.4 and the reported industry- and country-specific effects, respectively. In a model specification with interaction effects, the main effects are associated with the omitted reference groups while the interaction terms capture the average differences to these reference groups, respectively (see e.g., Angrist and Pischke 2009, pp. 48-51 on saturated model specifications). In Table 3.3 the machinery and transport equipment and the transport services industries serve as reference groups in the manufacturing and services industry-specifications, respectively and trade effects for those are captured by the *intra-EU trade*crisis period* interaction terms. In the regression specifications with country-crisis interaction terms reported in Table 3.4 Germany is omitted and thus serves as reference group for both the manufacturing and services samples, respectively.

Starting with the EU-wide industry effects of the crisis, the left panel of Table 3.3 indicates that the intra-EU trade in the machinery and transport equipment declined more strongly in comparison to the general developments in extra-EU trade. This can be seen from the significant and negative parameter estimate associated with main effect reported in in the first column. The four other industries with non-significant parameter estimates are affected in a similar vein and therefore intra-EU exports have suffered most significantly for the machinery and transport equipment, beverages and tobacco and crude materials industries. The five manufacturing industries which report positive and significant parameter estimates outperformed the reference group and in some cases also (conditionally) did better than the overall development in extra-EU trade. Among the manufacturing industries, the food and live animals sector together with the animals and vegetable oils industry and the other commodities not elsewhere classified (in the SITC rev. 3 classification) exhibited the most positive intra-EU export performance during the crisis. For calculating quantitative differences from a Poisson regression framework, where the differences are modelled with a dummy variable design, one needs to take the exponential value of the parameter estimate and subtract a value of one (see e.g. Anderson et al 2015). Accordingly, the machinery and transport equipment industry exhibited an export growth performance which has been approximately 7.78%-points (given by exp(-0.081)-1) lower than the one of the reference group capturing the average of all extra-EU exports from all industries.

In terms of intra-EU exports the EU services industries have been more symmetrically affected by the financial crisis. Five industries including construction, insurance, personal, cultural, recreational and other business services as well as royalties and license fees have not

performed statistically significantly differently from the reference group consisting of intra-EU exports in the transport services industry. Only computer and information services and communication services clearly outperformed the above mentioned group of industries while the effect for the financial services sector is only marginally statistically significant. In quantitative terms, the largest and statistically most convincing relative effect is identified for computer and information services. This exceeds the reference group by 27.7%-points. The only statistically significant and economically relevant relative decline in services exports during the financial crisis is observed for governmental services with a parameter value of -0.670 resulting in a 48.9%-points lower export growth relative to the transport service sector. This result is certainly driven by budgetary constraints during the financial crisis which forced virtually all EU-member states to reduce their services related expenditures including also imported ones.

Turning to Table 3.4 and the analysis of the export performance across the 27 EU-economies, we also identify some heterogeneity in the developments during the financial crisis. Starting with Germany as the reference group, the estimates do not point to outstanding positive or negative export performance of this economy during the financial crisis. Across both samples the estimated main effects turn out to be statistically insignificant. Continuing with the results for the manufacturing industries, the left panel of Table 3.4 identifies five economies which outperformed Germany including Belgium, the Czech Republic, Luxembourg, Poland and Slovakia. Among this group of top-performing economies, the Czech Republic and Poland have not been members of the EMU and used floating exchange rate regimes while Slovakia has adopted the Euro as official currency in January 2009, only just before the culmination of the international financial crisis and the Great recession in Europe. Seven countries performed statistically and economically worse than Germany in intra-EU manufacturing exports. These include Bulgaria, Estonia, Finland, the United Kingdom, Italy, Lithuania and Malta. Accordingly, the group of poorly performing manufacturing goods exporters consists of very different economies both in terms of size and their depth of integration with the EU. Malta and the Baltic states are small and Estonia and Lithuania only adopted the Euro in the aftermath of the crisis. Finland and Italy had been among the group of founding members of the EMU. Bulgaria still has not joined the EMU but rather rely on their respective national currencies and monetary policies. In terms of their economic fundamentals these two economies differ quite substantially. In terms of the estimated parameters, the United Kingdom is of specific interest since the associated (highly significant) parameter estimate of -0.256 is the second largest negative one, only exceeded by Malta. Accordingly, United Kingdom's relative manufacturing export performance during the crisis period had been 22.5%-points worse relative to the one of Germany although, in principle, the United Kingdom would have had the possibility to additionally use monetary policy measures to support manufacturing exports from domestic producers.

The estimation results for services exports reveal that Germany was outperformed in intra-EU exports during the crisis by many more EU-member states in this sector. We estimate positive and statistically significant relative effects for eleven countries including Austria, Belgium, Bulgaria, Hungary, Ireland, Malta, Poland, Portugal, Romania, Slovakia and Sweden. This group is again rather heterogeneous both in terms of their underlying economic development and their depths of integration with the EU in general and the EMU in particular. For the service sector one might thus conclude that participating in the EMU was neither a boon nor a burden for coping with negative demand shocks. To conclude this discussion, the right panel of Table 3.4 provides negative relative performance estimates in intra-EU exports for Denmark and most pronouncedly for Greece. Taking all the evidence for Greece together, the drop in services exports therefore more strongly contributed to the long-lasting

downturn, which has been initiated by the financial crisis and enhanced by the subsequent governmental debt crisis.

Table 3.4: Estimation results for country-effects during the crisis

	Manufacturing		Services	
	Parameters	Standard Errors	Parameters	Standard Errors
GDP-exporter	0.659 ***	0.068	0.738 ***	0.133
GPD-destination	0.757 ***	0.049	0.664 ***	0.079
Intra-EU trade	0.064	0.043	-0.082	0.067
Intra-EU trade*crisis period	0.019	0.052	-0.051	0.066
Intra-EU trade*post-crisis period	0.019	0.034	0.133 **	0.053
Crisis	-0.123 ***	0.030	0.029	0.047
Post-crisis	-0.067 **	0.034	0.024	0.048
Intra-EU trade*crisis period*				
Austria	0.033	0.077	0.348 **	0.160
Belgium	0.135 *	0.077	0.211 **	0.092
Bulgaria	-0.176 *	0.092	0.299 **	0.121
Cyprus	-0.092	0.160	0.175	0.189
Czech Republic	0.169 **	0.085	0.481	0.154
Denmark	-0.004	0.081	-0.165 ***	0.134
Estonia	-0.244 ***	0.093	0.276	0.192
Finland	-0.202 **	0.084	-0.026	0.145
France	-0.017	0.062	-0.174	0.113
Greece	-0.131	0.086	-0.520 ***	0.179
Hungary	0.111	0.089	0.233 ***	0.086
Ireland	-0.155	0.149	0.354 **	0.146
Italy	-0.121 **	0.061	0.012	0.104
Latvia	-0.116	0.087	0.079	0.162
Lithuania	-0.221 **	0.098	0.006	0.197
Luxembourg	0.261 ***	0.099	0.284	0.237
Malta	-0.681 ***	0.195	0.390 **	0.156
Netherlands	0.093	0.078	-0.005	0.112
Poland	0.137 *	0.073	0.334 ***	0.107
Portugal	0.079	0.087	0.279 **	0.126
Romania	-0.033	0.090	0.562 ***	0.090
Slovakia	0.222 **	0.089	0.266 *	0.157
Slovenia	0.001	0.088	0.292 *	0.152
Spain	0.014	0.095	0.233	0.159
Sweden	-0.114	0.071	-0.017	0.097
United Kingdom	-0.256 ***	0.083	-0.227	0.161
Industry-fixed effects	Yes		Yes	
Exporter-fixed effects	Yes		Yes	
Importer-fixed effects	Yes		Yes	
Pseudo-R2	0.645		0.784	
Observations	1,776,000		114,168	

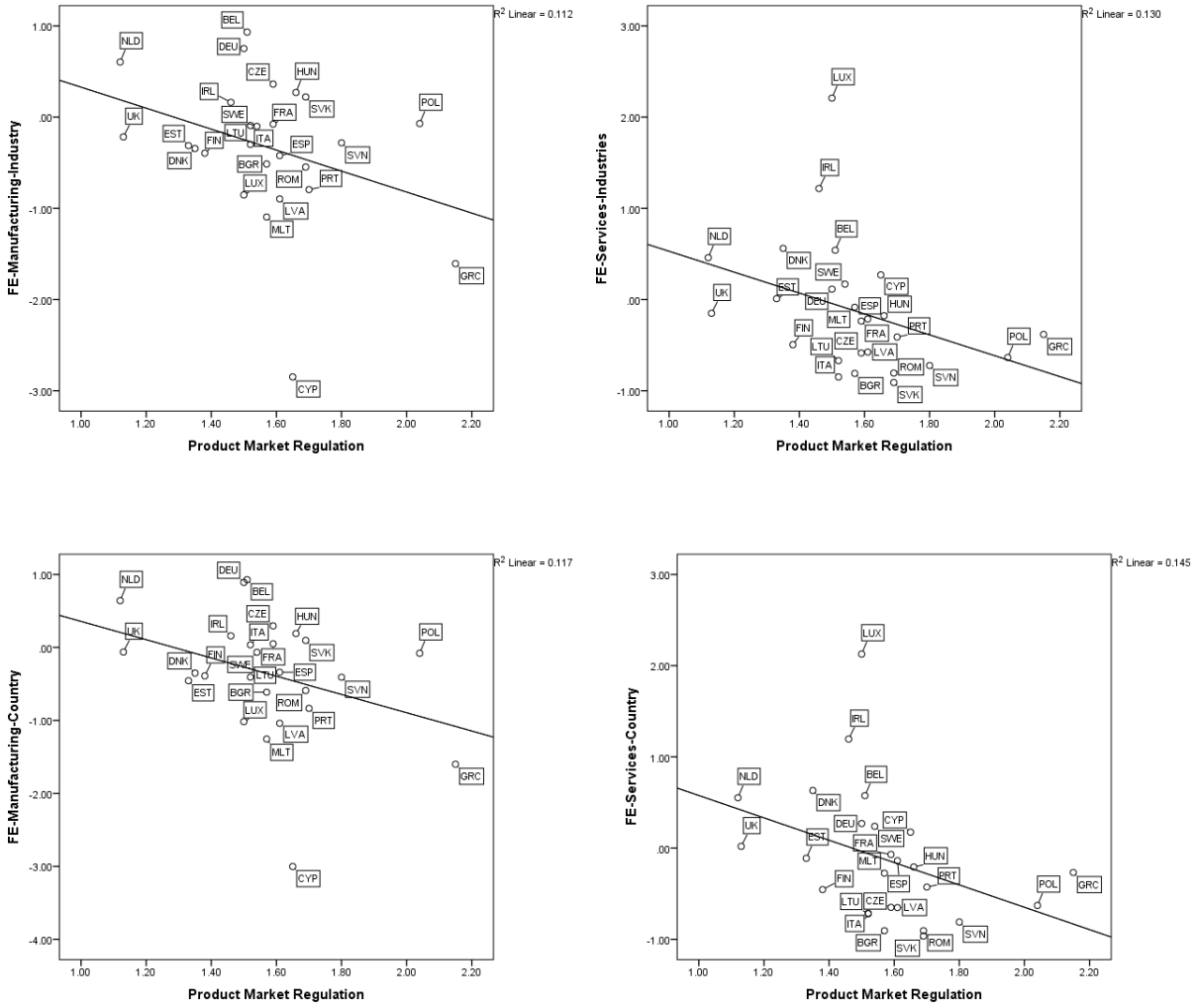
Source: Comtrade database, BOP Statistics, WIFO calculations.
Notes: ***, **, * denote statistical significance at the 1%, 5% and 10% level, respectively.

Briefly summarizing the main results obtained from the more structural gravity model analysis provided in this section:

- Our findings clearly point to heterogeneity in the intra-EU export performance of different industries and EU-member states during the financial crisis.
- Given the similarity in the results especially observed in the country-analysis across economies which exhibit varying degrees in the depth of their integration into the European single market, our evidence points to the importance of idiosyncratic effects in shaping the resilience of these economies.
- This implies that for direct trade relationships differences in integration intensities were not as important as suggested by proponents of the OCA theory.

In order to analyze the last issue further we conclude the investigation of direct bilateral exports by relating the long-run performance in exports to variation in the exporter's economies market regulation. For this, we rely on indicators for product market regulation collected by the OECD (Koske et al. 2015). These indicators are also used (and discussed in more detail) in Section 5, which addresses labour market related transmission mechanism for external shocks. Unfortunately, these indicators are only collected very infrequently and are available for 1998, 2003, 2008 and 2013 only. For our observation period, only one country-specific product regulation observation would be available. This makes it impossible to directly include these indicators into our gravity framework (which relies on time variation). In order to provide some indicative evidence on the impact of product market regulation for the long-run export performance of the EU-member states, we correlate the fixed country effects from all specification reported in Table 3.3 and Table 3.4 with the averages of the product market regulation indicators over the three available time periods.

Figure 3.3: Correlation between product market regulation and the estimated country-fixed effects for the different estimation results provided in Table 3.3 and Table 3.4.



Source: Comtrade database, BOP Statistics, WIFO calculations.

Figure 3.3 displays the four resulting scatter plots for the bivariate relationships between product market regulation and the fixed effects, which capture long-run deviations from the average export performance. Accordingly, larger values of these fixed effects are associated with generally larger conditional (ceteris paribus) long-run exports both into other EU member states and to the Rest of the World included in the sample. In terms of product market

regulation larger values indicates more extensive regulation (and maybe a lower intensity of competition). All four graphs representing the different country-fixed effects across all different specifications and across manufacturing and services industries clearly point to a negative association between product market regulation and the long-run export performance of the EU economies considered. Furthermore, running a bivariate regression for these four scatter plots indicates that product market regulation is able to explain some non-negligible variation in the country-fixed effects. The simple R^2 measure for these bivariate regressions amounts to approximately 0.13. From this, one may conclude that differences in the long-run export performance across the EU-member states are to some extent associated with differences in product market regulation. This is also reinforced by the estimated slope parameters identified from the bivariate regressions. Accordingly, the linear relationships based on the simple bivariate regressions result in slope coefficients ranging from -1.14 to -1.25 and are statistically significant at the 10-percent level. However, given the small number of only 27 observations utilized for studying this relationship we are already able to conclude that product market regulations and export performance seem to be positively related (at least) in the long run.

Furthermore, the four scatter plots in Figure in Figure 3.3 allow to assess which countries performed better or worse than predicted by the simple bivariate regression function. Observations which are above the estimated regression function correspond to economies which did better in their long-run export performance, while observations below the line indicate that the countries did worse than average in terms of long-run exports given their average realization of product market regulation. Some countries including Belgium, Germany and the Netherlands tend to outperform their conditional expectations based on all four graphs. Accordingly, these countries tend to be characterized by additional institutional and non-institutional factors which allow them to be more competitive in their export markets.

For the country-fixed effects that are based on the industry specifications (left panels) a couple of new member states are identified as also being located above the regression line. Among these are e.g., the Czech Republic, Hungary, Poland, Slovakia and Slovenia. Most of them, however, perform below their conditional expectation given product market regulation when turning to the country-effects specification (right panels). Accordingly, for this group of EU-member states it is difficult to reach unambiguous conclusions. A similar result with the reversed ordering is observable for Greece (which constitutes the economy with the highest degree of average product market regulation in our sample). Greece outperforms its conditional expectation when the country-effects specification is applied while it underperforms it in the industry-effects specifications. Finally, the United Kingdom is characterized by a very low level of average product market regulation which is similar to that of the Netherlands but clearly did much worse in their long-run export performance as measured by the model-inferred fixed-effect realisations. This finding together with the gravity model specification indicates that neither differences in product market regulation nor in all the other characteristics included in the gravity model are able to explain the difference in the long-run export performance across these two economies. This remaining heterogeneity in export performance is an important issue that could be addressed by economic policy (see below).

Summing up the overall findings, this again suggests that even for the most developed EU member economies idiosyncratic factors seem to be crucial in shaping their individual and relative performance in competitiveness in their international market activities.

From a policy point of view, the European Commission's practice of providing detailed and individual country reports for each and every member state analyzing its economic and social policies seems to be an important tool for better documenting and understanding the idiosyncrasies that shape each member's individual performance in many different economic and social areas.[15] These reports typically include suggestions for potential policy measures to be implemented by the respective member states. With respect to strengthening the impact of this policy measure the results provided here give rise to two important issues:

- Implementing a careful evaluation process concerning the suggested measures and the economic outcomes could help reduce the idiosyncrasies in the economic performance across different EU and EMU member states and could further contribute to a successful achievement of the goals laid down in the European Semester.
- This process should further explicitly take account of the industrial structure and the countries' competiveness in these industries when formulating policy suggestions. To give an example, an acceleration of the dynamics underlying the structural change from manufacturing to services industries could be helpful for some of the EU and EMU member states.

3.2. Indirect trade labour demand effects via global value chains

In this subsection we set up a (micro-econometric) framework for studying how trade relationships in intermediate goods transmit shocks within the EU's real economy. In particular we are interested in studying how global (and European) value chains contribute to the absorption and transmission of (negative) shocks within the European labour markets. From a policy point of view and given the relative poor average but heterogeneous performance of European labour markets (see Section 1) a proper understanding of how European employment responds to negative (external) shocks seems to be crucial to formulating policy recommendations on how to adjust the European single market to make it more resilient to cyclical fluctuations in worldwide demand. With the increasing dependence of jobs all over the world on global value (supply) chains, the (international) division of production activities becomes a more and more import transmission channel for economic shocks:

- According to estimates from the International Labour Organization, in 2013 around 453 million jobs in the 40 countries captured in the WIOD database were related to global value chain activities (Kizu et al. 2016).
- For the same economies, in 1995 this number only amounted to about 296 million jobs, which implies a 53% increase in global value chain related jobs over this 18-year period.
- Furthermore, in 2013 the share of global value chain related jobs to total employment in developed economies reached its historical high and amounted to approximately 25% (see Figure 1 in Kizu et al. 2016). Splitting this overall number into different parts, for 2009 Jang (2015) identifies that trade in intermediate goods accounted for 14% of all available jobs while the import content of exports added another 7% to this number.

An overall assessment of labour demand effects induced by external shocks thus needs to account for the sensitivity of employment to changes in both final demand (i.e., direct purchases by customers) and indirect demand (i.e., intermediate demand within domestic and global value chains). This subsection tries to disentangle these distinct channels for the transmission of an (overall) external demand shock. For this purpose, we set up a generalized

[15] These reports are available online at http://ec.europa.eu/europe2020/making-it-happen/country-specific-recommendations/index_en.htm.

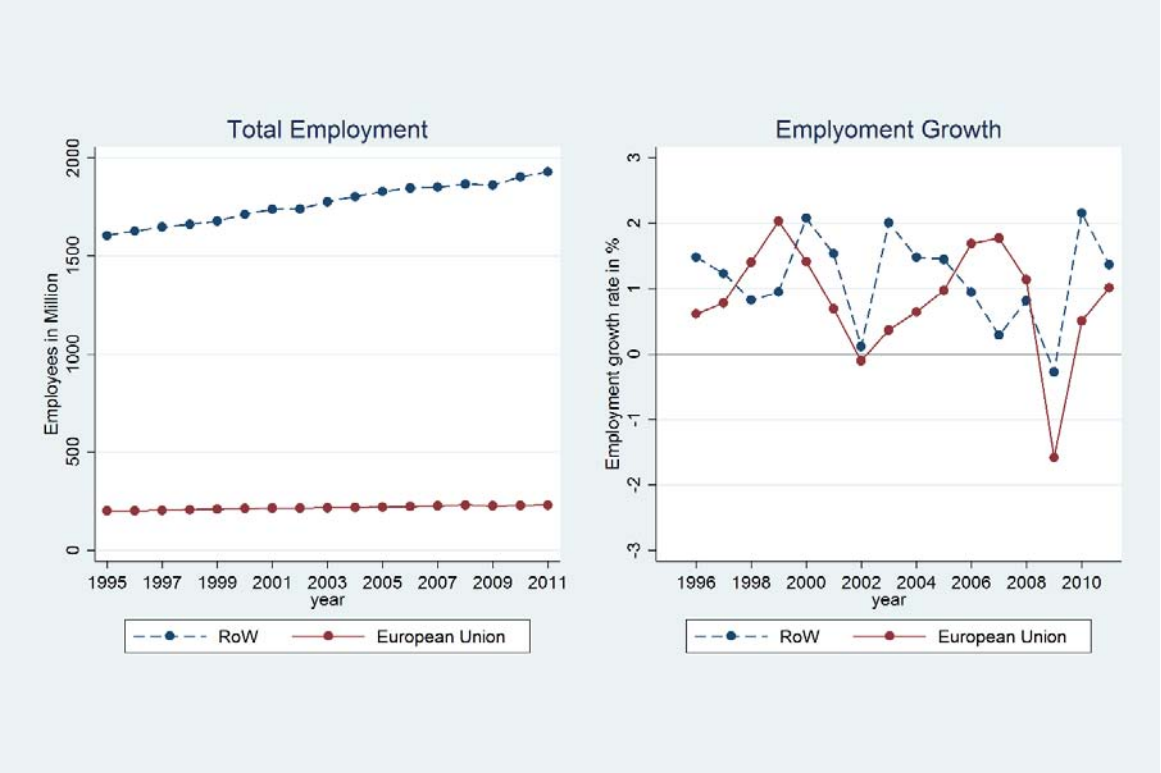
labour demand framework at the industry-country level, which allows to separately investigating the employment effects of shocks in final versus intermediate demand. This framework thus permits an analysis for the relative contribution of different types of external shocks to overall job losses or gains induced by business cycle fluctuations. Regarding the latter, the analysis concentrates on differences in the responsiveness of labour demand in different economic areas and industries over a time-span capturing 14 years and putting a specific focus on differences in the depth of integration relevant for different European economies. Most prominently, we compare the EU-27 economies with a subsample of EMU members as of January 1st, 2009. This approach allows investigating the likely impact of having a common currency for labour demand when goods and services can be demanded both in terms of final consumption and in intermediate goods. By further distinguishing between domestic and foreign demand in final and intermediate goods and services we are also able to assess the impact of (asymmetric) external shocks on employment within the European single market.

3.2.1. Data and descriptive evidence

The analysis of labour demand effects induced by indirect trade within global value chains is conducted at the industry-country level of aggregation. The role of intra-EU trade and global value chains is considered by means of input-output relations available from the World Input-Output Database (WIOD)[16] for the years from 1995 to 2009.[17] In general, WIOD-data are currently available until 2011. Unfortunately, the capital stock data necessary for estimating labour demand equations are missing for the years 2010 and 2011 in the WIODs Socio-Economic Accounts.[18] Therefore the analysis is restricted to the 14-year time span for which all necessary data are available. The descriptive analysis provided in this section will, however, utilize the whole time period from 1995 to 2011. Industry-country-specific employment and further control variables including relative wages necessary for specifying dynamic labour demand equations (at this level of aggregation) are also taken from the Socio-Economic Accounts of the WIOD database. The combined dataset containing information on input-output relationships and other industry characteristics has, for example, been used for studying the impact of fragmentation in global production chains on employment patterns (also across skill groups) observed in Europe and the World (Timmer et al. 2013, Timmer et al. 2014). The available data contain 35 industries mostly aggregated at the two-digit ISIC (rev. 3) level observed for (up to) 40 countries including all EU-27 economies as of January 1st, 2007 (Timmer et al. 2015).[19] For analytical reasons related to the construction of worldwide input-output tables, the analysis needs to also include all non-EU member economies. Otherwise the world input-output figures would not sum up to their theoretical underlying concepts and the weights provided therein would be misleading. Furthermore, the residuals related to the input-output relationships with all other non-included economies from the rest of the world would not be consistent. However, after obtaining consistent labour demand estimates from the full WIOD input-output system the empirical analysis concentrates on the crisis-induced labour demand effect for the economies participating in the single market and the EMU countries as of January 1st, 2009.

[16] http://www.wiod.org.
[17] For an illustrative study with data obtained from the WIOD database see (Timmer et al. 2015).
[18] http://www.wiod.org/new_site/database/seas.htm.
[19] The appendix in Timmer et al. (2015) provides a detailed description of the industry and country coverage of the WIOD database and its Socio-Economic Accounts.

Figure 3.4: Evolution of labour demand: European Union and Rest of the World (RoW), 1995-2011



Source: WIODS Socio-Economic Accounts, WIFO calculations.

FiguresFigure 3.4 andFigure 3.5 provide a descriptive overview of the development in employment as reflected in WIOD's Socio-Economic Accounts. Figure 3.4 compares the evolution in total employment in the EU-27 economies relative to the Rest of the World as included in the WIOD data for the time period from 1995 to 2011.[20] The left panel displays the number of employed while for the right panel we calculate net employment growth rates. The left panel shows that, relative to the other included (large) economies, the European Union provides about 10 percent of all jobs reported in WIOD. Accordingly, approximately 200 million employed are recorded for 2011 which, based on official Eurostat data constitutes all jobs within the Union. For 2014 (which is not captured in the WIOD yet) Eurostat reports a total employment of 217.3 million persons.[21] The corresponding number of employed from the Socio-Economic Accounts amounts to 229.4 million in 2011. The data used in this chapter thus capture the universe of jobs within the boundaries of the EU and, therefore, these data seem to be perfectly suitable for studying the labour market effects induced by the financial crisis.

Comparing the EU (red line) to the Rest of the World (blue line), it becomes obvious that, in aggregate, the labour markets related to the Rest of the World have developed much more dynamically over the 16 years considered. The total number of employed in the Rest of the World increased by approximately 324.9 million from 1,603.5 in 1995 to 1,928.5 million in 2011 while EU employment rose by (only) 28.7 million from 200.7 million in 1995 to above mentioned 229.4 million. In terms of relative new net job creation, the Rest of the World has provided about 20.3% new jobs. The corresponding number of the EU amounts to 14.3%.

[20] The RoW in the Socio-Economic Accounts is composed of Australia, Brazil, Canada, China, India, Indonesia, Japan, South Korea, Mexico, Russia, Taiwan, Turkey and the USA.
[21] See http://ec.europa.eu/eurostat/statistics-explained/index.php/Labour_market_and_Labour_force_survey_%28LFS%29_statistics#Employees for further details.

The right panel in addition allows assessing to year-to-year volatility in the net job creation process observed within and outside the EU. For both groups of countries the annual changes in employment are concentrated within a -2 to 2 interval for most of the years. In general, when comparing the volatility in employment to the annual fluctuations observed for e.g., intra- and extra-EU exports (see Figure 3.1and Figure 3.2), employment remains relatively stable. This points to additional (institutional) factors which also help stabilize employment during times of sharp economic recession. In relative growth terms, the EU member states did better in job creation in a couple of years including 1998, 1999 and from 2006 to 2008. In the remaining 11 years the EU's job growth rate was lower than in the other major economies included in the WIOD-data. Turning briefly to the impact of the financial crisis, in 2009 1.58% of all EU jobs were destroyed, while for the Rest of the World economies one observes a negative net job creation rate that amounts to -0.27%. Furthermore, during the post-crisis period spanning the years from 2010 and 2011, the European labour market developed much less dynamically in comparison to the other large economies under investigation. In 2010, for example, the net job creation rate in the Rest of the World amounted to 2.15%, while the European single market growth rate was only 0.5%. The gap between the Rest of the World and the EU in job creation, however, lessened in 2011 with observed net employment growth rates of 1.37% for the Rest of the World and 1.01% for the overall EU economy. The differences for the post-crisis time period are in line with the general observations discussed in Section 1 and point to structural recovery problems, which the EU is facing in the aftermath of the Great Recession.

In Figure 3.5 we assess the potential heterogeneity of labour market performance within the EU by comparing overall trends for economies with different degrees of economic integration. In particular, we compare the labour market dynamics in the EMU economies as of 1st of January of 2009 (red line) with the one of non-EMU economies (blue line). The choice of the EMU group reflects the peak of the crisis during 2009 and should allow to investigate whether labour markets in the EMU economies were differently affected by the crisis.

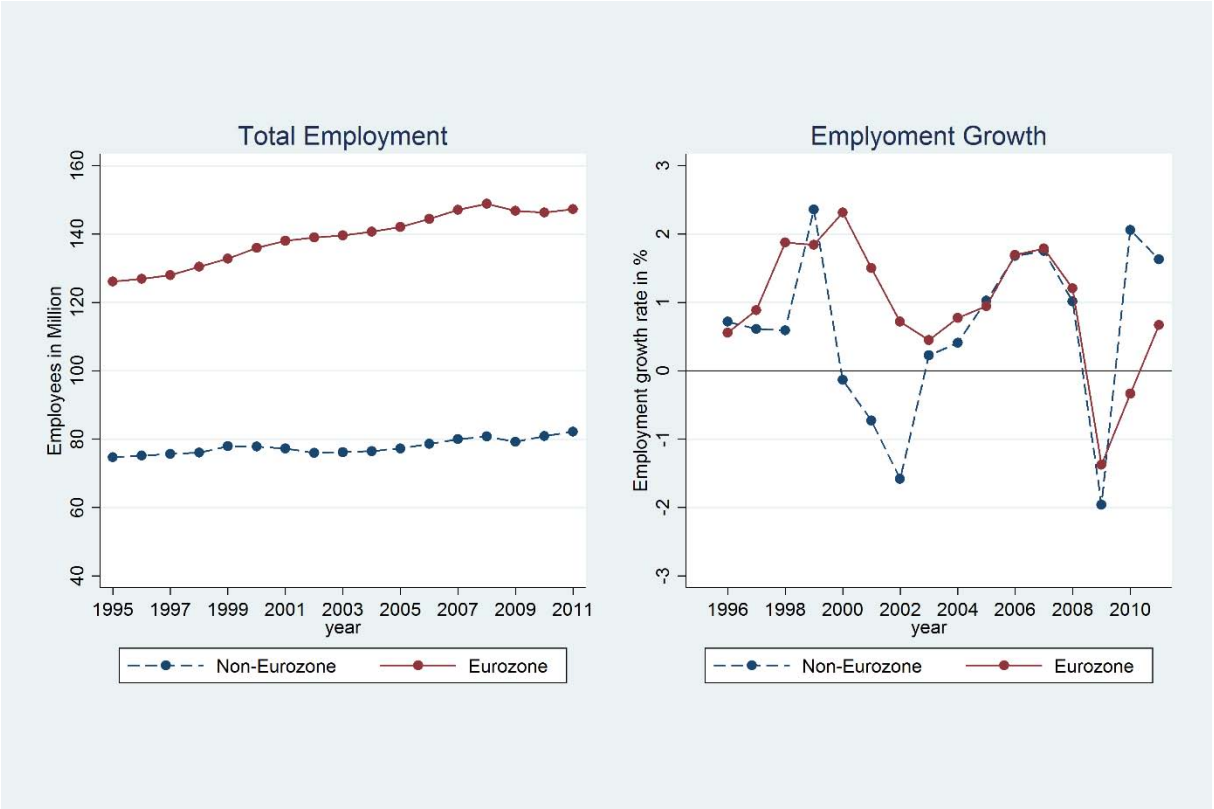
The left panel of Figure 3.5 highlights that the bulk of jobs within the EU is provided by the EMU members. This finding does not come as a surprise, given that these economies also account for a large share of the EU's GDP. In 1995, 126.1 million people were employed in countries that later constituted the EMU, while non-EMU economies provided 74.6 Million jobs. In relative terms, for the year 1995 this implies that about 62.8% of all employed within the boundaries of the EU worked in the EMU economies while 37.2% worked in the non-EMU economies. Until the year 2011 the importance of the EMU economies as providers of jobs further increased and in relative terms amounted to 64.2%. Accordingly, the share of persons employed in the non-EMU economies declined to 35.8%. In absolute terms, the EMU employed 147.3 Million persons while the remaining EU-member states reported an employment 82.2 Million. It is worth emphasizing that the development in employment displayed here is not related to the enlargement of the EMU. The EMU economies are defined based on adoption of the Euro until the 1st of January 2009 and this is held constant over the whole sample period considered.[22]

This widening in the gap of jobs provided by economies with differing degrees of economic integration within the single market also becomes visible from annual (aggregate) net job creation rates reported in the right panel of Figure 3.5. The red (blue) line indicates the year-

[22] The EA-16 economies which adopted the Euro as official currency until the 1st of January 2009 includes Austria, Belgium, Cyprus, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, Netherlands, Portugal, Slovakia, Slovenia and Spain.

to-year net job creation rates in the EMU (non-EMU economies). To start with, the left panel of Figure 3.5 suggests that the volatility in net job creation rates is larger for the group of non-EMU economies. The standard deviation in annual net job creation rates amounts to 1.23% percent for non-EMU economies, while for EMU members it is only 0.92% although the average annual net job creation rate amounts to just 0.60% for the former but to 0.97% for the latter group, respectively. Accordingly, relative to the labour markets in the non-EMU countries, employment within the EMU tends to be more stable over time.

Figure 3.5: Evolution of labour demand: EMU and Non-EMU EU members (as of 1st of January 2009), 1995-2011



Source: WIODS Socio-Economic Accounts, WIFO calculations.

When comparing the evolution of year-to-year net job creation rates over time and across EMU economies and the remaining EU-member states it turns out that in 11 out of 16 years, the EMU economies outperformed the non-EMU in terms of relative net job creation. Only in the years 1996, 1999, 2006 and from 2010 onwards the non-EMU members have been more successful in this regard. The largest gap in favour of the EMU is observable for the time period from 2000 to 2002. While net job creation rates associated to these years amounted to 2.31%, 1.50% and 0.72% in the EMU, respectively, the non-EMU total average amounted to -0.14, %, -0.73% and -1.58% for the same years. For all these years, the annual difference in net job creation rates across the two types of economies exceeded 2.2%-points. Given the relatively stable overall development of European labour markets (see Figure 3.4), these differences are non-negligible.

With the outbreak of the financial crisis this picture, however, has reversed and during the last two years available in WIOD's Socio-Economic Accounts the EMU labour market has been outperformed by the non-EMU economies. Both groups of countries experienced a relatively severe drop in the overall employment numbers in 2009 with corresponding net job creation rates of -1.37% for the EMU and -1.96% percent for the other EU-members but the labour

markets in the latter group have recovered much faster. In 2010, for example, the net job creation rate associated with the non-EMU EU-member states amounted to 2.06% percent while, at the same, within the EMU more jobs were destroyed than created. The resulting net job creation rate amounted to -0.34%.

Summing up on the descriptive evidence provided here, the following main findings can be identified:

- Over the time span from 1995 to 2011, the Row has been more successful in creating both new absolute net jobs but also in terms of net employment growth.
- Within the EU, the EMU participants are responsible for the largest bulk of total jobs provided. The difference in relative jobs available inside and outside the EMU (as of January 1st, 2009) has further widened.
- With the outbreak of the financial crisis, the dynamics in net job creation within the EMU also slowed down relative to the dynamics observed in the other EU-economies and remained at generally lower growth rates at least until 2011. In terms of net employment effects, the EMU has struggled most since the Great Recession.

The remainder of this subsection aims at identifying the structural determinants of the labour market performance, both within the EU and relative to the Rest of the World, by putting a specific focus on the role of global value chains and trade in intermediate goods. For this purpose a more systematic approach based on dynamic labour demand equations is warranted. This approach will be discussed in detail below.

3.2.2.Dynamic labour market equations for global value chains

Our structural analysis builds on contributions which combine input-output relations from WIOD with its Socioeconomic Accounts and extend this strand of literature by using WIOD data for modelling the transmission mechanisms within the EU's single market. In particular, we are interested in studying how an asymmetric shock, which reduces production and demand within the European value chain, spreads over the EU in general and the EMU in particular.

For this purpose, we formulate a generalized dynamic labour demand equation which differentiates an industry's total production by different uses including e.g., total production, production for domestic and foreign final consumption and intermediate production for domestic and foreign industries. This decomposition into different demand categories is based on input-output coefficients from the WIOD data and induced demand is calculated by applying the Leontief inverse to the system of inter- and intra-industry relationships (Leontief 1936). In particular, for each country-industry-year observation from 1995 to 2009 we separate intermediates production (as collected from the World Input-Output Tables, WIOTs) from production for final consumption. Summing up the aggregates of these two components we obtain each industry's total production in each year. More formally and based on standard input-output definitions, total output of industry j, denoted by X_j equals the sum of production for final consumption Y_j plus total intermediates production which is given by the matrix product AY, where A denotes the input-output technical coefficient matrix with typical element a_{ij} (see e.g., Jang 2013). This technical coefficient matrix denotes how many units of all other goods from all source economies are necessary for assembling an industry's good, which then can be further used for final consumption or intermediate demand. From the data available in WIOD we calculated all elements a_{ij} by relating the intermediates production in each row of a given column to the column total which measures an industry's

total production. Equipped with all input-output coefficients for a given year we are able to calculate the Leontief inverse which, in the general case, is given by

(Eq. 3-2) $$X = [I - A]^{-1}Y.$$

Equation (Eq. 3-2) allows to construct total production induced both by direct as well as indirect demand for goods produced by each industry *j.* Equation (Eq. 3-2) can be further used and additionally multiplied with other vectors capturing sub-dimensions of final demand for calculating further output measures. For our purpose, we multiply (Eq. 3-2) either with total consumption induced by domestic or foreign demand. This allows us to obtain a measure for induced production separated by domestic versus foreign final and intermediate demand. Regarding final versus intermediate demand the structure of input-output relationships allow to distinguish between these two types both for domestically and foreign induced production. In particular, the totals on the main diagonals capture direct (within industry) demand while the off-diagonal elements are associated with intermediate demand. To calculate domestic intermediate demand we only need to subtract the total main diagonal from the country-specific input-output matrix from total production. In order to obtain foreign intermediate demand we proceed similarly but only include bilateral trade based on the main and off-diagonal elements (and ignore the domestic input-output relationships).

In assessing the employment effects of demand fluctuations, both in final consumption and intermediates in domestic and foreign markets, we rely on standard labour demand equations form the industrial organization literature. We use an empirical specification for labour demand which is based on standard economic theory elaborated by e.g. Bresson et al. (1996). In this setting firms (in our case aggregated to industries) are assumed to be output constrained and face adjustment costs when they intend to change their levels of production. These adjustment costs are assumed to be continuous and quadratic. Output is produced by means of a simple Cobb-Douglas production function. Given these assumptions firms (industries) determine their path of future employment by minimizing the expected discounted value of their production costs subject to their output constraints. From this optimization problem, first order conditions for input choices (i.e., labour and capital) can be derived. Solving this model around the long-run equilibrium and log-linearizing the resulting equations delivers an approximation to the optimal path of employment which can thus be used for estimation purposes. [23]

For the formulation of the studied labour demand equation we follow Bresson et al. (1996) and assume that the exogenous factors consisting of production and the relative real wages follow an AR(2) process. Formally, the resulting formulation of the labour demand equation to be estimated reads as (see Gugler and Yurtoglu 2004):

(Eq. 3-3) $$l_{jct} = \alpha l_{jct-1} + \beta_1 q_{jct} + \beta_2 q_{jct-1} + \gamma_1 (w/u)_{jct} + \gamma_2 (w/u)_{jct-1} + f_{ic} + g_t + \epsilon_{jt}.$$

where l_{jct} denotes the log of employment, q_{jct} is total industry production and $(w/u)_{jct}$ capture the (real) average wages relative to the user cost of capital (*u*) at in industry *j* in country *c* at time *t.* f_{ic} is the country-industry specific but time-constant effect. Average wages are calculated by dividing total employment compensation by the number of workers employed in each country-industry observation *jc.* The user costs of capital are approximated by relative capital compensation calculated as total capital compensation divided by the

[23] Technical details on the derivation of the labour demand equation can be obtained from e.g., Appendix A in Gugler and Yurtoglu (2004). Nickell (1984) and Bresson et al. (1996) provide a full exposition on this production and labour demand framework.

real capital stock (see, e.g. Bruno et al. 2005). $\alpha, \beta_1 - \beta_2$ and $\gamma_1 - \gamma_2$ are the parameters to be estimated. g_t denotes a full set of time-dummy variables which capture common time-specific effects for all observations and ϵ_{jt} collects the residuals from the regression.

In econometric terms, equation (Eq. 3-3) describes a (reduced-form) dynamic panel data model with fixed-effects. As documented in the literature, simple fixed-effects estimators based on the routinely applied within-transformation provide inconsistent estimates (termed the Nickell-Bias) in case of a large number of cross-sectional units *j* and a small number of time-periods *t* available (Nickell 1981). The underlying conceptual reason is related to the so-called incidental parameters problem. Accordingly, as *t* is fixed and *j* goes to infinity more and more separate parameters are to be estimated (or equivalently within-transformations are to be carried out). For the identification of these parameters no additional information can be provided in the fixed *t* case and thus the parameters cannot be identified. In the within-transformed equation this results in a non-vanishing correlation between the within transformed error terms and the lagged outcomes per definition. In our case, the number of available time periods amounts to 14, since we cannot identify effects for observations from 1995 due to the inclusion of lagged terms in equation (Eq. 3-3). However, this relatively long time period should make the Nickell-Bias an issue of only minor concern. Nevertheless, in our empirical analysis we investigate this issue further by also applying a bias-corrected estimation procedure for baseline comparisons. Bias correction will be carried out based on the approach suggested by Bruno (2005a).[24]

As an alternative estimation procedure, equation (Eq. 3-3) will also be estimated by fixed effects methods. The fixed-effects will thus be wiped out from (Eq. 3-3) by applying the so-called within transformation. Accordingly, the estimator calculates industry-country specific averages of all covariates included and subtract the resulting between-equation from (Eq. 3-3). As a result, only time-varying within country-industry variation will be exploited for the identification of the parameters of interest and, thus, unobserved but time-constant effects are controlled for. The choice for this rather simple estimation procedure is based on two considerations:

- First, as mentioned above the time-series available is relatively long and the Nickell-Bias should not be too severe.
- Second, we are also interested in studying differences in labour adjustment across different groups of countries including the EU, the EMU and the RoW as captured in the Socio-Economic Accounts. For this purpose, some specifications of equation (Eq. 3-3) will additionally include interaction terms between lagged employment l_{jct-1} and EU and EMU country-group indicators, respectively. The parameters associated with this interaction terms allow to identify differences in the persistence of employment in these country groups. As documented by Nickel (1981, p.1422) the estimated αs are biased towards zero when simple fixed-effects estimators for equation (Eq. 3-3) are applied and α can reasonably be assumed to be positive. As a consequence, whenever the Nickell bias is important, both estimates for the persistence in labour demand in the control group and the EU or the EMU will be biased in the same direction. Taking the difference between those two estimates (as it is the case when introducing the interaction term) will therefore still provide unbiased estimates for the

[24] In Stata the bias-corrected estimator can be implemented by applying the xtlsdvc package available as an ado-file. Based on an available formula for the analytical expression of the Nickell bias, the bias-corrected estimator accounts for all different components of the bias which are induced by the incidental parameters problem and the correlation between the lagged outcome and the within-transformed error terms. Further details on the syntax and an empirical application are discussed in Bruno (2005b).

relative difference in adjustment dynamics across different economic regions in the world and Europe. Accounting for parameter heterogeneity in the lagged dependent variable would be much more difficult to do when applying more sophisticated bias-correction procedures.

3.2.3. Estimation results

Table 3.5 reports our baseline estimates using all industry-country observations available in WIOD's socioeconomic accounts and pooling over all industries. By pooling over the different industries, we assume an aggregate production function for the whole economy in the spirit of the macroeconomic growth literature (see e.g., Solow 1956). In Table 3.6 and Table 3.7 this assumption is relaxed and separate labour demand equations are estimated for different industries captured in the data.[25] The first two columns of Table 3.5 compare the estimates for equation (Eq. 3-3) based on the bias-corrected fixed-effects estimator (Bruno 2005a) and the simple within estimator. The bias-corrected estimator is initialized by the dynamic estimator proposed by Arellano and Bond (1991).[26]

Comparing the estimation results from the first two-columns the bias-corrected estimator, as expected, indicates an underestimation of absolute labour demand persistence in the whole sample including all 40 available economies. Applying the Bruno (2005a) methodology the estimate for α amounts to 0.938 while from the fixed-effects estimator we obtain a value of 0.853. From this we can conclude that in absolute terms persistence in industry employment levels is somehow larger as identified by our preferred estimation strategy. Both estimates, however, clearly point to the fact that employment adjustment over time occurs in a relative moderate way. This can be traced back to non-trivial adjustment costs involved for the decision to either hire new workers or the lay them off. This evidence is also well in line with, the descriptive results provided in Figure 3.5. Thus, total employment is much less volatile relative to more output orientated economic indicators including extra- and intra-EU exports (see Section 3.1).

Turning the attention to the other exogenous variables included in the baseline-specification, the different specifications provided very similar estimates regarding the impact of changes in production and in relative wages for labour demand. This is important, as it indicates the usefulness of the simple fixed-effects methodology for obtaining reliable parameter estimates for the variables of interest. In economic terms, the results suggest a positive (negative) impact of changes in total output (relative wages) for labour demand. The lagged effects further show a decrease (in absolute terms) in these two identified effects. Both of these findings are well in line with previous findings (see e.g., Gugler and Yurtoglu 2004) and highlight the usefulness of the theoretical framework applied for specifying an empirical labour demand equation. The within-R^2 measure reported in column (2) of Table 3.5 which amounts to 0.735 gives further support to this model specification by highlighting its ability to predict variation in labour demand in WIOD's Socio-Economic Accounts.

Columns (3) to (5) of Table 3.5 further assess the role of adjustment costs for shaping labour-demand in different economic areas of the world. Column (3) and (4) include an additional interaction term between lagged employment and indicators for EU-membership and EMU-participation, respectively. In line with the group definitions applied in Section 3.2.1, the group

[25] After estimating all different specifications reported in Tables 4.5 to 4.7 we test for a random walk in our lagged dependent variable which would be the case whenever $\alpha = 1$. Due to the very precise estimation of the lagged effects we reject the null hypothesis of α being equal to in all cases. Thus we can safely assume that our autoregressive processes are not characterizes by random walks.

[26] The bias correction is based on O(1/NT) asymptotic results.

of EU economies includes all 27 members available from WIOD sources and we again hold this group constant for the whole sample period. In a similar vein, countries are classified as EMU members based on the Euro adoption as of 1st of January 2009. This EMU definition is also held constant for all years from 1995 to 2011. Column (5) simultaneously includes both group indicators interacted with lagged employment and thus allows to assess potential differences in labour adjustment across the EMU and the other EU members.

The results from Column (4) indicate that, in aggregate, adjustments costs are lower in the EU relative to the 14 countries constituting the Rest of the World. The parameter estimate associated with the interaction between past employment and the EU indicator turns out statistically significant, negative and amounts to -0.061. Industries in the EU economies are thus able to adjust employment more easily relative to their counterparts from the non-EU economies. The next column, however, emphasizes that this finding is not true for the EMU economies. In this specification the non-EMU member states also constitute a part of the control group and the resulting parameter estimate for the interaction term (i.e., lagged employment with the EMU dummy variable) becomes positive and statistically significant. The parameter estimate amounts to 0.067 which is comparable in magnitude to the negative effect identified in Column (3). The results from Column (5) provide further evidence on the heterogeneous adjustment patterns identified for EMU members versus non-EMU participants. Accordingly, the EU economies which are also members of the EMU do not seem to differ from the Rest of the World in terms of labour adjustment costs. For these economies, the deviation to the Rest of the World is given by the sum of the two effects identified for EU-membership and EMU participation. In quantitative terms this results in a deviation in the adjustment costs parameter from the overall one by 0.009 (i.e., 0.116+ (-0.107)) which is not statistically different from zero. For the non-EMU EU-economies the deviation from the overall parameter is given by -0.107 clearly documenting lower adjustment costs for the 11 remaining mostly Eastern-European economies. The evidence provided on heterogeneous adjustment costs clearly suggests that employment in industries located in the non-EMU EU-member states is much less persistent relative to the EMU and the RoW. This points to differences in labour market related institutions which seem to allow the non-EMU economies to more flexibly adjust employment both in good and bad times. Regarding the included exogenous variables, the assessment of heterogeneity in adjustment costs exhibits virtually no impact on their respective parameter estimates. Conditional on different degrees of employment persistence, an increase in production (relative wages) again increases (decreases) overall employment.

The remaining columns (4) to (10) reported in Table 3.5 assess the impact of changes in different demand sources for labour demand. Most importantly, we are interested in disentangling the effects of changes in direct from those of indirect demand where the latter is based on the integration of the respective countries and industries to domestic and global value chains. To this end, Column (6) differentiates total (industry-country) output into production for domestic and foreign demand, respectively. In line with equation (Eq. 3-3) the one-year lagged values from these variables also enter into the specification. In Column (7) domestic and foreign demand are further separated into demand for final consumption and intermediate demand. Accordingly, in this specification each year's total output is differentiated into four components. Accounting also for the AR(2) process this specification includes eight indicators for an industry's overall demand. In order to assess whether the effects from different demand sources differ by degree of European integration, Columns (8) to (10) finally provide estimates for restricted subsamples only including EU-economies the EMU and Denmark and United Kingdom, respectively. The latter choice is based on their

specific reliance on external markets and the not (yet) adoption of the Euro as national currencies.

The results provided in Column (6) suggest that labour demand is mainly related to fluctuations in domestic demand. This can be seen from the statistically significant effects associated with this years and one-year lagged production for the local market. Furthermore, the effects for foreign production are small in magnitude and only the parameter associated with lagged foreign demand turns out to be on the verge of statistical significance. In terms of labour demand, the industries located in the 40 countries captured by WIOD data thus seem to react most sensitively to fluctuations in domestic demand. Taking this result at face value, domestic policies aimed at stabilizing domestic demand might be most successful in securing high employment-levels in the countries included in the available dataset. However, the small positive estimate associated with lagged foreign demand also suggests that international markets might exhibit some impact on domestic employment as well. As a consequence, fluctuations in foreign demand seem to induce some spillover effects for domestic labour demand.

Table 3.5: Estimation results for pooled labour demand equations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Employment (t-1)	0.938 ***	0.853 ***	0.895 ***	0.835 ***	0.896 ***	0.853 ***	0.851 ***	0.833 ***	0.903 ***	0.951 ***
	(0.006)	(0.004)	(0.007)	(0.005)	(0.007)	(0.004)	(0.004)	(0.006)	(0.006)	(0.012)
Employment (t-1)*EU			-0.061 ***		-0.107 ***					
			(0.008)		(0.009)					
Employment (t-1)*EMU				0.067 ***	0.116 ***					
				(0.009)	(0.010)					
Relative wages (t)	-0.07 ***	-0.071 ***	-0.07 ***	-0.071 ***	-0.069 ***	-0.071 ***	-0.072 ***	-0.071 ***	-0.019 ***	-0.005
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.006)
Relative wages (t-1)	0.051 ***	0.044 ***	0.045 ***	0.043 ***	0.043 ***	0.045 ***	0.047 ***	0.048 ***	0.009 ***	-0.024 ***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.006)
Total production (t)	0.046 ***	0.046 ***	0.046 ***	0.046 ***	0.045 ***					
	(0.005)	(0.005)		(0.005)	(0.005)					
Total production (t-1)	-0.031 ***	-0.026 ***	-0.026 ***	-0.025 ***	-0.026 ***					
	(0.005)	(0.005)		(0.005)	(0.005)					
Production: Domestic market (t)						0.047 ***				
						(0.005)				
Production: Domestic market (t-1)						-0.037 ***				
						(0.005)				
Production: Foreign market (t)						0.003				
						(0.004)				
Production: Foreign market (t-1)						0.008 *				
						(0.004)				
Final domestic consumption (t)							0.006 ***	0.001	-0.001	0.004
							(0.002)	(0.003)	(0.002)	(0.005)
Final domestic consumption (t-1)							-0.004 *	0.000	0.003	-0.002
							(0.002)	(0.003)	(0.003)	(0.005)
Final foreign consumption (t)							0.001	0.000	-0.003	0.006 *
							(0.002)	(0.002)	(0.002)	(0.003)
Final foreign consumption (t-1)							-0.001	0.001	0.003	-0.005
							(0.002)	(0.002)	(0.002)	(0.003)
Intermediate domestic consumption (t)							0.033 ***	0.027 **	0.007	0.015
							(0.007)	(0.011)	(0.009)	(0.026)
Intermediate domestic consumption (t-1)							-0.037 ***	-0.019 *	-0.01	-0.004
							(0.007)	(0.011)	(0.009)	(0.027)
Intermediate foriegn consumption (t)							-0.003	-0.001	-0.001	-0.020
							(0.007)	(0.010)	(0.009)	(0.025)
Intermediate foreign consumption (t-1)							0.025 ***	0.015	0.018 **	0.016
							(0.007)	(0.010)	(0.009)	(0.025)
Within-R2	-	0.735	0.736	0.736	0.738	0.737	0.733	0.679	0.786	0.921
Observations	17147	17147	17147	17147	17147	17147	16476	10691	6300	783

Source: WIOD database, WIFO calculations.
Notes: ***, **, * denote statistical significance at the 1%, 5% and 10% level, respectively.

Further disentangling different sources for domestic and foreign demand in Column (7) reveals that industry-country employment is statistically and positively related to both domestic demand for final goods as well as to domestic intermediate demand. This provides an important additional insight as a proper understanding of domestic value chains seems to

be crucial for assessing the likely effects of economic fluctuations and policy that reacts to that. According to our findings, fluctuations induced by changes in intermediate demand by upstream produces more strongly affect labour demand as compared to changes in final demand. Furthermore, in quantitative terms the effects induced by intermediate demand (both current and one-year lagged) seem to dominate the employment adjustment induced by changes in final demand. This effect is further reinforced by the parameter estimate associated with impact of lagged foreign demand in intermediate goods. The corresponding parameter estimate amounts to 0.025 and is highly statistically significant, while neither contemporaneous nor lagged foreign demand for final goods seems to be of specific relevance. Given the observed time pattern induced by foreign intermediate demand, industries and countries thus seem to adjust employment to fluctuations in the international markets with some delay. This provides further important insight into the dynamics in employment induced by the global integration of industries and countries over the last decades.

Finally, when assessing the potential heterogeneous impact of different demand sources for employment adjustment within the EU (Column 8) the EMU (Column 9) and the EEA economies UK and Denmark (Column 10), for the EU27 the fluctuations in domestic intermediate demand dominate all other effects. Comparing this to the EMU, the effect induced by foreign demand in intermediates becomes most important for the latter group of economies. Consequently, non-EMU members seem to be more systematically affected by changes in domestic intermediate demand while employment in the EMU depends more strongly on global value chains and the induced foreign demand for intermediate goods. This deviating finding clearly points to the relevance of trade-offs EU policy makers are confronted with and to the policy relevance of the exchange rate instrument for the EMU area (see the macroeconomic analysis from above). Changes in employment in the EMU and the other EU-member states are therefore shaped by different sources for which different policy tools are most likely to be needed. The EMU economies are more sensitive to changes in the international competiveness of this economic area while non-EMU members' employment at the industry-country level is crucially affected by fluctuations in their domestic value chains. For Denmark and the United Kingdom we identify the largest overall persistence in employment parameter throughout Table 3.5 amounting to 0.951. Accordingly, adjustment costs seem to be an important issue for these two economies. Furthermore and as expected, due to the extensive reliance of these two economies to foreign markets we are able to identify small but significant positive effects of changes in final foreign demand for employment in these respective economies.

In Table 3.6 and Table 3.7 we investigate the heterogeneity in Europe's single market further by providing separate estimates for the main industries included in WIOD. To this end and based on the SITC (rev. 3) two-digit level of disaggregation, we define eight distinct industries including manufacturing (1), sales and trade (2), transport (3), telecommunication and postal, real estate and renting services (4), agriculture and mining (5), electricity and construction (6), hotel and bank services as well as public administration (7) and education and health care services (8). The empirical specifications applied in Table 3.6 and Table 3.7 are based on the last three columns of Table 3.5 but extent them in two regards. We include interaction terms for different degrees of persistence across different economic regions (see also Columns 3-5 in Table 3.5) and additionally interact all different demand sources with indicators for the specific economic region to be considered. In Table 3.6 the economic area of interest is the EU. The empirical specifications include an EU times lagged employment interaction as well as additional EU interaction terms with final domestic consumption, final foreign consumption, intermediate domestic consumption and intermediate foreign

consumption all measured at t and t-1. In Table 3.7 the focus is restricted to the members of EMU as of January 1st, 2009. A comparison of the results from both columns allows to assess differences across EU member states with deviating degrees of integration into the single market.

The estimated interaction effects between EU-membership and lagged labour demand indicate that in six out of the eight industries employment is statistically less persistent as compared to the 13 other large economies included in the WIOD data. The noticeable exceptions are the electricity and construction sectors. In these, employment is less flexibly adjusted within the EU as compared to other economies considered. Given the strong cyclical fluctuations observed, especially in the construction sector, this finding might point to an international disadvantage within the EU that may be related to specific labour market institutions and regulations.

Table 3.6: Estimation results for labour demand at the industry level. Effects for the whole EU

	Manufacturing	Sale &Trade	Transport	Telecom	Agriculture	Elec. & Const	Hotels & Banks	Educ. & Health
Employment (t-1)	0.882 ***	0.865 ***	0.888 ***	0.896 ***	0.878 ***	0.531 ***	0.842 ***	0.875 ***
	(0.013)	(0.029)	(0.033)	(0.015)	(0.031)	(0.053)	(0.019)	(0.026)
Relative wages (t)	-0.076 ***	-0.038 ***	-0.126 ***	-0.089 ***	-0.046 ***	-0.131***	-0.031 ***	-0.021 ***
	(0.004)	(0.007)	(0.010)	(0.009)	(0.008)	(0.015)	(0.005)	(0.004)
Relative wages (t-1)	0.042 ***	0.021 ***	0.092 ***	0.072 ***	0.017 **	0.089***	0.009 *	0.019 ***
	(0.004)	(0.007)	(0.010)	(0.009)	(0.008)	(0.016)	(0.005)	(0.004)
Final domestic consumption (t)	0.020 ***	0.000	0.043	0.011	0.013	-0.055	0.049 ***	-0.067 ***
	(0.006)	(0.011)	(0.064)	(0.019)	(0.028)	(0.052)	(0.017)	(0.023)
Final domestic consumption (t-1)	-0.017 ***	0.008	-0.045	-0.026	0.017	0.082 *	-0.051 ***	0.047 **
	(0.006)	(0.013)	(0.061)	(0.020)	(0.027)	(0.048)	(0.016)	(0.022)
Final foreign consumption (t)	0.002	0.003	0.005	0.007	-0.003	-0.024	0.004	0.002
	(0.009)	(0.007)	(0.007)	(0.005)	(0.007)	(0.016)	(0.003)	(0.005)
Final foreign consumption (t-1)	-0.013	-0.002	-0.002	0.002	-0.003	0.049 ***	-0.003	-0.000
	(0.009)	(0.006)	(0.006)	(0.005)	(0.006)	(0.017)	(0.003)	(0.004)
Intermediate domestic consumption (t)	0.017	0.061 **	-0.037	0.050 *	-0.019	0.174 **	0.020	0.085 ***
	(0.020)	(0.028)	(0.072)	(0.030)	(0.044)	(0.071)	(0.027)	(0.026)
Intermediate domestic consumption (t-1)	-0.057 ***	-0.073 **	0.009	-0.083 ***	0.013	-0.180 **	0.005	-0.047 *
	(0.020)	(0.029)	(0.067)	(0.030)	(0.042)	(0.070)	(0.026)	(0.025)
Intermediate foreign consumption (t)	0.029	-0.063 **	-0.014	-0.014	0.042	-0.078	-0.013	-0.028
	(0.022)	(0.028)	(0.055)	(0.037)	(0.043)	(0.069)	(0.025)	(0.021)
Intermediate foreign consumption (t-1)	0.037 *	0.066 **	0.057	0.055	-0.034	0.040	0.011	0.015
	(0.022)	(0.028)	(0.052)	(0.037)	(0.041)	(0.069)	(0.025)	(0.021)
Employment (t-1)*EU	-0.069 ***	-0.081 **	-0.095 **	-0.030	-0.077 **	0.266 ***	-0.060 **	-0.060 *
	(0.015)	(0.034)	(0.037)	(0.022)	(0.038)	(0.070)	(0.026)	(0.031)
Final domestic consumption (t)*EU	-0.020 ***	0.038 ***	-0.016	-0.017	-0.016	0.016	-0.019	0.098 ***
	(0.007)	(0.013)	(0.076)	(0.020)	(0.029)	(0.065)	(0.021)	(0.030)
Final domestic consumption (t-1)*EU	0.022 ***	-0.030 **	0.053	0.024	-0.029	-0.106 *	0.034 *	-0.071 **
	(0.007)	(0.015)	(0.073)	(0.021)	(0.028)	(0.062)	(0.021)	(0.030)
Final foreign consumption (t)*EU	-0.004	-0.005	0.002	-0.013	0.006	-0.004	-0.001	-0.005
	(0.011)	(0.008)	(0.010)	(0.008)	(0.015)	(0.025)	(0.005)	(0.006)
Final foreign consumption (t-1)*EU	0.015	0.000	0.002	-0.001	0.003	-0.040	0.002	0.000
	(0.010)	(0.008)	(0.009)	(0.008)	(0.015)	(0.026)	(0.005)	(0.005)
Intermediate domestic consumption (t)*EU	0.003	-0.006	0.072	-0.034	0.005	-0.150	0.045	-0.077 ***
	(0.026)	(0.037)	(0.097)	(0.039)	(0.061)	(0.103)	(0.033)	(0.029)
Intermediate domestic consumption (t-1)*EU	0.009	0.095 **	-0.078	0.057	0.025	0.272 ***	0.010	0.035
	(0.025)	(0.038)	(0.093)	(0.039)	(0.060)	(0.101)	(0.031)	(0.028)
Intermediate foreign consumption (t)*EU	-0.031	0.027	0.015	0.043	-0.048	0.105	0.006	0.035
	(0.026)	(0.036)	(0.078)	(0.042)	(0.055)	(0.089)	(0.030)	(0.024)
Intermediate foreign consumption (t-1)*EU	0.005	-0.061 *	-0.031	-0.043	0.015	-0.169 *	-0.052 *	-0.011
	(0.026)	(0.035)	(0.075)	(0.042)	(0.054)	(0.088)	(0.030)	(0.024)
Within-R2	0.710	0.833	0.657	0.891	0.743	0.620	0.805	0.813
Observations	6825	1020	1834	1568	887	526	1940	1432

Source: WIOD database, WIFO calculations.
Notes: ***, **, * denote statistical significance at the 1%, 5% and 10% level, respectively.

Turning to the impacts of different demand sources, labour demand in some industries in general depends extensively on fluctuations in domestic final demand (both current and lagged). Among this group are the manufacturing industries, hotel, bank and public administration services and education and healthcare services. Regarding the latter, however, the time pattern is reversed. Domestic final demand in education and healthcare services exhibit a negative contemporaneous but a positive lagged effect on labour demand in these two respective industries. In addition, for most industries fluctuations in intermediate domestic production (especially one-year lagged) have had a significant

impact on labour demand, while changes in both foreign final consumption and foreign intermediate demand are of minor relevance for industry-employment observed for the 13 additional non-EU countries included in this analysis.

The parameter estimates associated with the interaction terms between EU membership and the different demand components allow to assess whether labour demand differs systematically within EU-wide industries from the one observed in the Rest of the World. With regard to the impact of domestic final demand for industries operating within the boundaries of the EU, the picture from the 13 Rest of the World economies seems to be reversed for manufacturing, sales and trade and education and health services. The respective parameter estimates are statistically significant, in their signs the opposite and quantitatively similar to the main effects (i.e., the effects associated to the rows without EU interaction terms). These results point to a decreasing relevance of domestic final demand for employment in single market participating economies. For the remaining demand components we are not able to identify very strong results. Changes in lagged intermediate domestic consumption are able to explain some variation in European employment in the sales and trade industries as well as in electricity and construction. Statistically moderate countercyclical employment effects are identified for foreign intermediate demand in sales and trade industries, the construction and electricity sector and for hotel, banks and public administration services. It is also worth emphasizing that for three industries, including agriculture, transport and telecommunication (together with postal, real estate and renting services) none of the interaction terms are statistically significant. Accordingly, labour demand within the EU and these industries behaves very similarly to that in the other 13 economies which do not share a common market.

Table 3.7 additionally allows to assess whether the results from above can also be identified for the EMU economies. Again in line with our pooled estimation results from Table 3.5, the interaction effects of lagged employment with EMU-membership document very persistent employment dynamics within the EMU economies. For five of eight industries, including manufacturing, sales and trade, transport, hotel and bank services and education and health care related activities, the respective parameter estimates are significant and positive. An interesting result is obtained for the construction and electricity services. The interaction effect of lagged employment with EMU membership now turns out insignificant while the overall parameter estimate associated with the control group (now also including non-EMU EU-member states) is substantially larger as compared to Table 3.6. From this we can infer that the result from the above table is driven by the employment adjustment behaviour observed in non-EMU member states, while the EMU does not systematically differ from the Rest of the World in labour demand persistence in the respective industries.

With regard to systematic and structural differences in labour demand between the EMU and the Rest of the World (including the non-EMU economies), the main differences are observed in manufacturing industries. Within the EMU, manufacturing industries are differently affected by contemporaneous and lagged final domestic consumption, from foreign final demand, and from domestic intermediate demand. Similarly to the discussion on the results from Table 3.6, the relative final demand effects observed for EMU manufacturing industries indicate that these are not sensitive to fluctuations in domestic final demand, while employment in the control group is (for the EMU effects one needs to sum up the respective overall effects with the ones from the interaction terms). For foreign final consumption, the time patterns in the estimated parameters indicate some asymmetric employment adjustment in the manufacturing industries within the EMU. Changes in lagged final demand positively affect labour demand while the contemporaneous effect turns out negative. Similar adjustment

dynamics are also identified for fluctuations in domestic intermediate demand. Lagged intermediate foreign demand is also important, but this is true for all manufacturing industries as indicated by the significant and positive main effect reported in Column (1) of Table 3.7. For the other seven industries, the results (especially on systematic differences between the EMU and the Rest of the World) are much weaker and thus do not point to substantial systematic differences in labour demand across different economic regions of the World.

Table 3.7: Estimation results for labour demand at the industry-level. Effects for the EMU as of 1st of January 2009

	Manufacturing	Sale &Trade	Transport	Telecom	Agriculture	Elec. & Const	Hotels & Banks	Educ. & Health
Employment (t-1)	0.812 ***	0.795 ***	0.788 ***	0.874 ***	0.824 ***	0.771 ***	0.802 ***	0.799 ***
	(0.008)	(0.020)	(0.016)	(0.013)	(0.023)	(0.036)	(0.015)	(0.020)
Relative wages (t)	-0.076 ***	-0.036 ***	-0.128 ***	-0.091 ***	-0.045 ***	-0.126 ***	-0.031 ***	-0.023 ***
	(0.004)	(0.007)	(0.010)	(0.009)	(0.008)	(0.016)	(0.005)	(0.004)
Relative wages (t-1)	0.041 ***	0.024 ***	0.090 ***	0.070 ***	0.016 *	0.113 ***	0.009 *	0.019 ***
	(0.004)	(0.008)	(0.010)	(0.009)	(0.008)	(0.016)	(0.005)	(0.004)
Final domestic consumption (t)	0.013 ***	0.030 ***	0.031	-0.004	0.007	-0.040	0.044 ***	-0.017
	(0.004)	(0.008)	(0.045)	(0.007)	(0.010)	(0.042)	(0.013)	(0.017)
Final domestic consumption (t-1)	-0.007 *	-0.025 ***	-0.013	-0.009	-0.014	0.080**	-0.041 ***	0.018
	(0.004)	(0.009)	(0.042)	(0.007)	(0.010)	(0.040)	(0.013)	(0.017)
Final foreign consumption (t)	0.005	0.003	0.010	0.001	-0.001	-0.015	0.003	-0.001
	(0.005)	(0.006)	(0.006)	(0.004)	(0.006)	(0.014)	(0.003)	(0.003)
Final foreign consumption (t-1)	-0.009 *	-0.001	-0.003	0.001	-0.003	0.033**	-0.003	0.001
	(0.005)	(0.005)	(0.005)	(0.004)	(0.006)	(0.015)	(0.003)	(0.003)
Intermediate domestic consumption (t)	0.039 ***	0.034	0.024	0.032	-0.019	0.171 ***	0.053 **	0.032 *
	(0.015)	(0.022)	(0.056)	(0.023)	(0.035)	(0.059)	(0.022)	(0.017)
Intermediate domestic consumption (t-1)	-0.079 ***	0.005	-0.056	-0.052 **	0.032	-0.222 ***	0.000	-0.020
	(0.015)	(0.022)	(0.054)	(0.023)	(0.034)	(0.058)	(0.021)	(0.017)
Intermediate foriegn consumption (t)	0.004	-0.024	-0.030	0.017	0.029	-0.062	0.004	0.000
	(0.015)	(0.022)	(0.045)	(0.025)	(0.035)	(0.057)	(0.019)	(0.015)
Intermediate foreign consumption (t-1)	0.056 ***	0.022	0.064	0.035	-0.041	0.043	-0.029	-0.001
	(0.015)	(0.022)	(0.044)	(0.025)	(0.034)	(0.057)	(0.019)	(0.015)
Employment (t-1)*EMU	0.082 ***	0.110 ***	0.100 ***	0.029	0.065	-0.010	0.089 ***	0.103 ***
	(0.015)	(0.037)	(0.035)	(0.024)	(0.042)	(0.080)	(0.031)	(0.034)
Final domestic consumption (t)*EMU	-0.015 **	-0.018	-0.080	-0.004	-0.011	-0.016	-0.050 **	-0.004
	(0.006)	(0.013)	(0.074)	(0.012)	(0.014)	(0.067)	(0.021)	(0.029)
Final domestic consumption (t-1)*EMU	0.012 *	0.017	0.057	0.015	0.012	-0.112 *	0.049 **	0.001
	(0.006)	(0.014)	(0.074)	(0.011)	(0.013)	(0.067)	(0.022)	(0.029)
Final foreign consumption (t)*EMU	-0.025 ***	-0.005	-0.010	-0.010	0.004	0.015	-0.002	0.000
	(0.009)	(0.007)	(0.010)	(0.010)	(0.017)	(0.034)	(0.006)	(0.005)
Final foreign consumption (t-1)*EMU	0.021 **	0.002	0.005	0.001	0.006	-0.018	0.002	-0.002
	(0.009)	(0.007)	(0.010)	(0.010)	(0.017)	(0.033)	(0.005)	(0.005)
Intermediate domestic consumption (t)*EMU	-0.065 **	0.018	-0.110	0.014	0.026	-0.143	-0.036	-0.016
	(0.027)	(0.045)	(0.102)	(0.041)	(0.061)	(0.120)	(0.030)	(0.024)
Intermediate domestic consumption (t-1)*EMU	0.066 **	-0.035	0.076	-0.009	-0.007	0.363 ***	0.010	0.003
	(0.026)	(0.043)	(0.099)	(0.040)	(0.063)	(0.124)	(0.029)	(0.023)
Intermediate foreign consumption (t)*EMU	0.018	-0.032	0.141	-0.018	-0.050	0.053	-0.019	0.000
	(0.025)	(0.039)	(0.091)	(0.036)	(0.054)	(0.100)	(0.028)	(0.021)
Intermediate foreign consumption (t-1)*EMU	-0.022	0.031	-0.082	-0.012	0.034	-0.144	0.026	0.013
	(0.025)	(0.038)	(0.089)	(0.036)	(0.056)	(0.100)	(0.028)	(0.021)
Within-R2	0.711	0.828	0.658	0.891	0.741	0.583	0.805	0.812
Observations	6825	1020	1834	1568	887	526	1940	1432

Source: WIOD database, WIFO calculations.
Notes: ***, **, * denote statistical significance at the 1%, 5% and 10% level, respectively.

The main insights provided by the systematic analysis based on dynamic labour demand equations can be summarized as follows:

- Employment related adjustment costs seem to be crucial in shaping the observed employment dynamics within the EU in general and the EMU in particular. Adjustment costs are identified to be especially large within the EMU, while employment can be more easily adjusted in the non-EMU member states. Regarding the latter, the electricity and construction sector seem to form a notable exception where employment is more persistent in the non-EMU economies.
- Fluctuations in domestic demand, both for final and intermediate goods are of specific relevance in explaining employment variation in the Rest of the World and also for the non-EMU economies. On the contrary, domestic demand for final and intermediate goods is not a good predictor for employment adjustment within EMU countries.

- For EMU economies, variation in intermediate foreign demand has some explanatory power while changes in foreign final demand are hardly relevant in any specification applied.
- In terms of industry-specific effects we again obtain some heterogeneous effects, especially for the manufacturing industries but a large group of industries located within the EU and/or EMU behave very similarly in employment adjustment to the Rest of the World.

3.3. Summary of main findings and policy recommendations

This chapter empirically addressed two issues closely related to transmission mechanisms put forward in the OCA theory. In particular, we studied the role of direct and indirect trade relationships for transmitting and absorbing (or promoting) economic shocks that might be either externally or internally induced. In studying direct trade relationships the chapter utilized two different data source capturing both intra- and extra-EU trade export flows in manufacturing and services industries. By making use of data available at more disaggregated industry levels, an analysis for both country and industry heterogeneities in the direct export performance over the course of the financial crisis was conducted. The main empirical findings based on this analysis can be summarized as follows:

- Intra-EU exports dominate their extra-EU counterparts in both types of economic activity including the exports of manufacturing goods and services. In relative terms, exports from the manufacturing sectors still dominate but services exports tend to develop more dynamically.
- A drawback of the strong concentration on intra-EU bilateral trade relationships (which came as result of the successful deepening of the European integration) became visible during and in the aftermath of the financial crisis. The negative demand shock induced overseas, which was propagated and intensified in some EU-economies, translated into large within-EU export losses and a harsh export downturn for virtually all industries located in all member states participating in the single market.
- Focusing on the more disaggregated picture, the EU-wide industries have been asymmetrically affected by the financial crisis but services industries, in general, have been more successful in coping with the global downturn. This evidence is also in line with the observation that intra-EU exports declined more dramatically relative to exports to extra-EU territories.
- The country-specific export performance during the crisis has also been heterogeneous where some EMU members performed fairly well while others did not. In a similar vein, some EU economies which do not participate in the EMU outperformed the EMU members, while others including e.g., the United Kingdom performed systematically worse.
- Given the similarity in the estimation based results for economies with varying degrees of depth of integration (especially with regard to the adoption of Euro as the national currencies), our evidence points to the importance of idiosyncratic effects in shaping the resilience of the export performance of virtually all EU member states. As a consequence, for direct trade relationships differences in integration intensities might not be as important as suggested by proponents of the OCA theory.

The second part of this chapter has been devoted to studying the impact of different demand components, including domestic and foreign final consumption and intermediate demand for labour demand adjustment by (European) industries. Accordingly, the approach taken here aimed at identifying the distinct roles of direct versus indirect demand for goods

and services as transmission and absorption mechanisms in the context of the OCA theory and, in empirical terms, for the European single market and the EMU. The main results inferred from this analysis can be stated as follows:

- Over the time span from 1995 to 2011, the EU has fallen behind in terms of net job creation relative to 13 other major economies available in the WIOD dataset. This finding holds for both total jobs created as well as for average year-to-year net job creation rates. Within the EU, the EMU member states are most important in providing jobs. Around 2/3 of all jobs available in the single market are provided by industries located in the EMU as defined by their adoption state on January 1st, 2009. Over the time period considered this share has further increased.
- However, with the outbreak of the financial crisis, the dynamics in net job creation within the EMU also slowed down relative to the dynamics observed in the other EU-economies. Further, this reversal in the relative importance of different country groups within the EU for generating new net jobs has not only been transitory, but is observed at least until 2011(which forms the end of the considered time period). As a consequence, in terms of net employment creation, the EMU has struggled most since the Great Recession.
- A systematic analysis based on dynamic labour demand equations reveals the crucial importance of adjustment costs for shaping employment dynamics within the EMU. Accordingly, employment is much more persistent within the EMU, with likely adverse effects in times of negative shocks. Accordingly, adjusting employment to changes in demand might be more costly or not feasible which can have negative effects on the competitiveness of European firms.
- In terms of different demand components, labour demand in the non-EMU EU economies is systematically affected by fluctuations in domestic demand induced both by final consumption and intermediate demand. For EMU participants fluctuations in foreign intermediate demand seem to be more relevant, while interestingly foreign final consumption has virtually no impact on employment, both in the EU in general and the EMU in particular.
- Focusing on differences across industries, the results again point to some heterogeneous effects, especially for the manufacturing industries, but a large group of other industries located within the EU and/or EMU is very similar in their employment adjustments compared to the other main Rest of the World economies considered.

The evidence provided in both sections of this chapter gives rise to some specific policy recommendations which are briefly summarized below:

- Most of the evidence put forward for both direct and indirect trade as mechanisms for transmitting and absorbing economic shocks point to substantial heterogeneity in performance, both across industries and countries. From a policy point of view, this suggests that one-size-fits-all policies might be very ineffective in this context. This is also true for the most integrated countries which e.g., take part in the EMU. Therefore, providing tailor-made country reports, as proposed within the framework of the European Semester, might be most effective in supporting the member states in their efforts to increase their competiveness and resilience to economic downturns. Given our evidence, these reports should be broad in scope and – inter alia – should focus on policy measures related to product market regulation and adjustment costs in the labour market.
- This assessment process should further take explicitly into account the industrial structure and the countries' competiveness in these industries when formulating policy

suggestions. The evidence provided here gives rise to policy measures that aim at accelerating the dynamics underlying the structural change from manufacturing to services industries. Given the more dynamic development of the international markets in these sectors, changing the structural composition could be helpful for some of the EU and the EMU member states. On the other hand, other economies which are among the market leaders in more traditional manufacturing sectors might benefit more from a strengthening of these industries, for example by providing research- and innovation-friendly market environments. Regarding the latter, competition and regulation polices might be of specific importance.

- Finally, the success of country-specific recommendations may crucially depend on the willingness to implement reforms in the member states. For this purpose, a close and constructive cooperation between EU authorities (e.g., the European Commission) and the individual members seems warranted. One option for increasing transparency in these relationships and the reform processes could be provided by the implementation of a careful evaluation process concerning the suggested measures and the economic outcomes targeted by the measures proposed. In the long run, this could help reduce the idiosyncrasies in economic performance across the different EU/EMU member states and further contribute to a successful achievement of the goals laid down in the European Semester.

4. Investment, Capital Flows and Banking Integration over the Course of the Current Economic Crisis

4.1. Introduction

The financial sector, especially banking, has been identified as a key element inducing and propagating the economic crisis from 2008-09 onwards. The crisis originated from troubles within the US sub-prime mortgage market, and spread over to the global banking systems leading to massive policy interventions to assure the stability of the financial and banking in Europe and in other parts of the world. The so-called EU sovereign debt crisis was partially triggered by unsustainable imbalances within Europe but also by fragile banking systems in many European countries.

The analysis of the transmission of shocks within the financial market and within the economy as a whole received attention. Capital flows, the stability of banking systems and the increased financial integration within Europe are central aspects. Financial integration was facilitated by the Single Market but also by the introduction of the Single Currency, which eliminated within-Euro area currency risks for economic and financial agents within the Euro area. The time up to the crisis saw an increase in the scale of gross capital flows, but at the same time also the building up of persistent real and financial imbalances across the EU Member States. The crisis led to sudden stop of financial flows and to rebalancing dynamics. The gross capital flow returned to values well below their pre-crisis levels, and real and financial imbalances have since contracted with painful adjustment processes in some EU Member States. Banking systems in many European countries were hit by the crisis, and many are still weak, which has a negative impact on credit dynamics. The banking sector also played an important role in the sovereign debt crisis. Most European economies are heavily bank-based financial system. Thus, bank finance and the health of the banking system is crucial for investment, even if many firms finance their investment with retained earnings.

It is important to note that the overall approach towards financial stability prior to the global financial crisis was based on a too-narrowly defined conceptual framework of regulations that largely neglected the system-wide characteristics of risks. Banking regulation, which is largely driven by the Basel Committee for banking supervision, was mainly microprudential. Regulators looked at the banking sector on a bank-by-bank basis and at bank safety in loan-by-loan terms. The 1988 Capital Accord, or Basel I, adopted the approach of a minimum, risk-weighted capital ratio. After a lengthy search for a new basis for assigning risk and eventually a new compromise, Basel II was presented in 2004. Basel II was based on three pillars: minimum capital requirements, supervisory review, and market discipline. However, it was immediately noted that the pillars were unevenly developed. The bulk of the Accord was devoted to the first pillar and some riskier assets were moved to off-balance-sheet entities. The reaction of banks to the new regulatory requirements was to reduce capital by reducing their higher risk assets. This, however, did not foster the macroeconomic resilience of the banking sector and hence shows how banks' reactions to the regulatory requirements undermined the regulation's effectiveness. The widespread view that the Credit Crunch of 2007-9 was, in part, a result of insufficient reach of regulation and that a solution is to take existing regulation and spread it more comprehensively across more institutions and jurisdictions is likely to be an incorrect diagnosis (Brunnermeier et al. 2009). The crisis was based on regulatory failures as much as anything else. At the heart of the crisis were highly regulated institutions in regulated jurisdictions.

However, a general phenomenon that characterized crisis countries was the failure of the regulatory authorities to enforce their powers within the implementation of existing financial regulatory requirements. Those who view the recent global financial crisis as an American affair, spread by contagion to a group of bystanders, often argue that it was the repeal of the Glass-Steagall-Act that caused the crisis. This view has difficulty explaining why some countries – in addition to the US - saw a serious financial crisis (Iceland, Ireland and the UK), while others did not (Caprio, 2013). If the channel primarily consisted of portfolio links, it does not appear to have been the case that the three hardest hit crisis countries in Europe were particularly large purchasers of CDOs. Instead, these countries had their own domestic lending bubbles that were set to explode, which were fed by incentive systems that favoured risk, and they were largely unrestrained by regulation and supervision. The latest variant of the banking regulations, outlined in Basel III, was agreed to in 2010 and subsequently revised. It features a redefined and higher capital requirement, a liquidity requirement, likely a leverage requirement and much greater complexity compared to Basel I and II. However, beyond complexity, the Basel Committee has once more neglected the endogeneity of risk.

In Europe banking regulation is made more complex by financial integration, especially in the banking sector. The large European banks are multinational and are potentially subject to a multitude of regulations and different regulators that leads to regulatory competition and adds some complexity to the goal of building stable banking systems that can very unlikely be solved by national regulators alone.Even if much of the international evidence does not find any consistent effect on banks' lending behaviour due to tighter capital regulation or increased supervisory powers (Barth, Caprio, and Levine 2006), financial integration requires similar institutional environments, at least for multinational banks, as there is no reason to think that harmonized policies will work in the same way across different institutional environments.

The crisis itself showed that gross capital flows experienced a sudden halt during the financial crisis. The adjustment process affected different kinds of financial flows in different ways. However, from a policy perspective it is important to know whether the large financial inflows before the crisis went to those industries which are generally believed to be in need of finance, or whether those capital flows increased the imbalances by flowing into industries that are generally less dependent on finance, as well as how this relationship changed after the crisis.

It is well known that the weakness of European Economies after the crisis is characterized by weak investment dynamics. Investment as percent of GDP remains below its pre-crisis level average values for many EU countries, also leading to discussions on restoring competitiveness in many member states. It is also well known that the competitiveness of firms and sectors within counties depends crucially on productivity efforts by the firms and their investment. Creating an environment that fosters investment becomes crucial in order to sustain needed structural adjustments. The recent European Commission's *Investment Plan* focuses on investment and intends to a) provide investments of at least €315 billion in three years, b) support investment in the real economy and c) create an investment-friendly environment (European Commission 2016). For this reason, the focus of this part of the study lies on the interaction between capital flows, banking quality and financial integration with real activity, especially investment. The main empirical research questions are:

- How did the sudden stop in financial flows affect investment across European countries?
- Do sound banking systems foster or hinder investment dynamics in sectors that need more external finance?

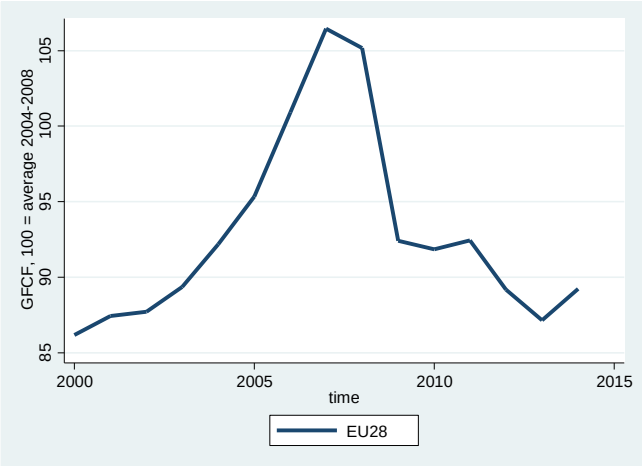
- Is the increased financial fragmentation of the European banking system observed after the crisis a help or a hindrance to investment dynamics in the private sector?

Answering those empirical research questions allows to draw policy conclusions with regard to central factors that affect the transmission of financial shocks to the real economy and the broad measures needed to support a more resilient system of investment finance in Europe, especially regarding financial flows and the European banking systems.

4.2. Investment and its composition before and after the crisis

Economic recessions go hand in hand with a decline in gross fixed capital formation. It is well known that investment is the most volatile economic aggregate over the business cycle. During the Great Recession in 2008 and 2009, some European countries saw declines in Investment by 20 percent, and the EU28 saw a deep reduction in gross fixed capital formation during the crisis (see Figure 4.1). The steep decline in investment in the EU28 stabilized after the crisis (2009 to 2011), however, investment in the EU started to fall again after 2011. The decline continued until 2013. The aggregate level of investment in the EU28 countries is still around 10% below the average investment during 2004 and 2008.

Figure 4.1: Investment dynamics in the EU-28 countries 2000 to 2014



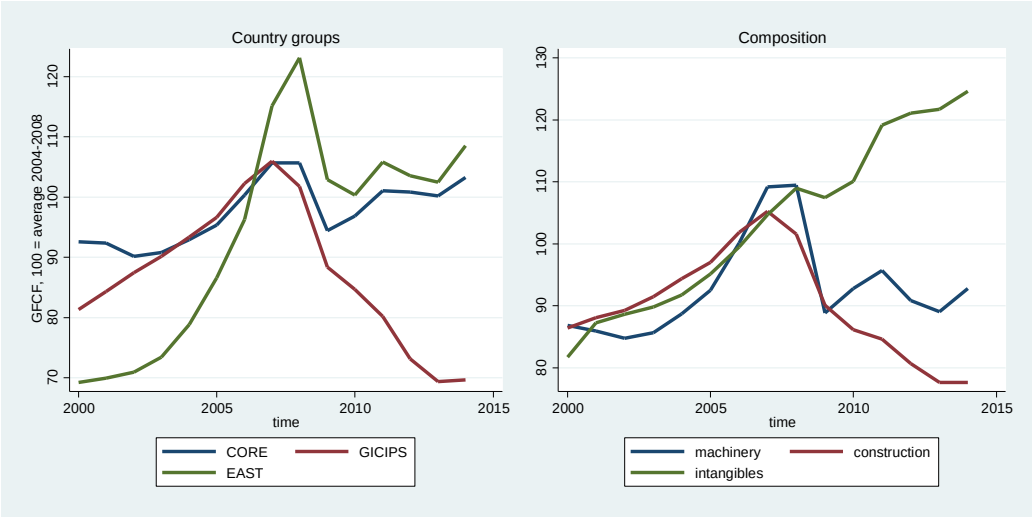
Source: Eurostat National Accounts, WIFO calculations.
Notes: Volume Index, the average investment in 2004 to 2008 equals to 100. Data for IE, HR and CY is not included because of missing data.

Performance within the EU has not been uniform across countries and asset classes, as Figure 4.2 shows. The left panel in Figure 4.2 presents aggregate investment dynamics for three different country groups.[27] In the core EU countries, investment fell less during the crisis than in the vulnerable countries (GICIPS – Greece, Ireland, Cyprus, Italy, Portugal and Spain) and than in the eastern European countries. Behaviour after the crisis is also remarkably different across country groups. The core countries saw a moderate slump in investment after the crisis, but since 2011 the level of investment has been close to the average value during 2004 and 2008. The eastern European countries saw a sharp increase in investment before the crisis and a sharp decline afterwards. However, gross capital formation in these countries remained above the average pre-crisis value (measured as the average between 2004 and 2008 (100 in the figure)), also after the crisis. The countries that were most hit by the crisis (GICIPS

[27] The CORE country group consists of AT, BE, DE, LU, NL, FR, UK, DK, SE, FI, MT the GICIPS country group consists of EL, IE, CY, IT, PT, ES, while the EAST country group consists of PL, EE, LT, LV, CZ, SK, SI, HR, HU, BG, RO.

countries) show a continued decline of gross fixed capital formation from 2008 to 2013. The level in 2014 was around 70% of the average during the time period 2004 and 2008. The largest drop in investment in 2014 compared to the values in 2008 was recorded for Greece, with investment down to 37% of the investment volume in 2014, Cyprus (40 %), Slovenia (61%) and Romania (62%), while Investment in Poland (114%), Sweden (105%), Luxembourg (103%) and Germany (103%) was above the real value of 2008 in 2014. This thus underscores the unbalanced impact across countries.

Figure 4.2: Investment dynamics in the EU 2000 to 2014: Country groups and composition of investment



Source: Eurostat National Accounts, WIFO calculations.
Notes: Volume Index , the average investment in 2004 to 2008 equals to 100. Country group CORE consists of BE DK DE FR LU MT NL AT FI SE and UK, Country group GICIPS consists of EL CY IE ES IT PT, country group EAST consists of BG CZ EE LV LT HU PL RO SI SK. HR is not included due to missing data.

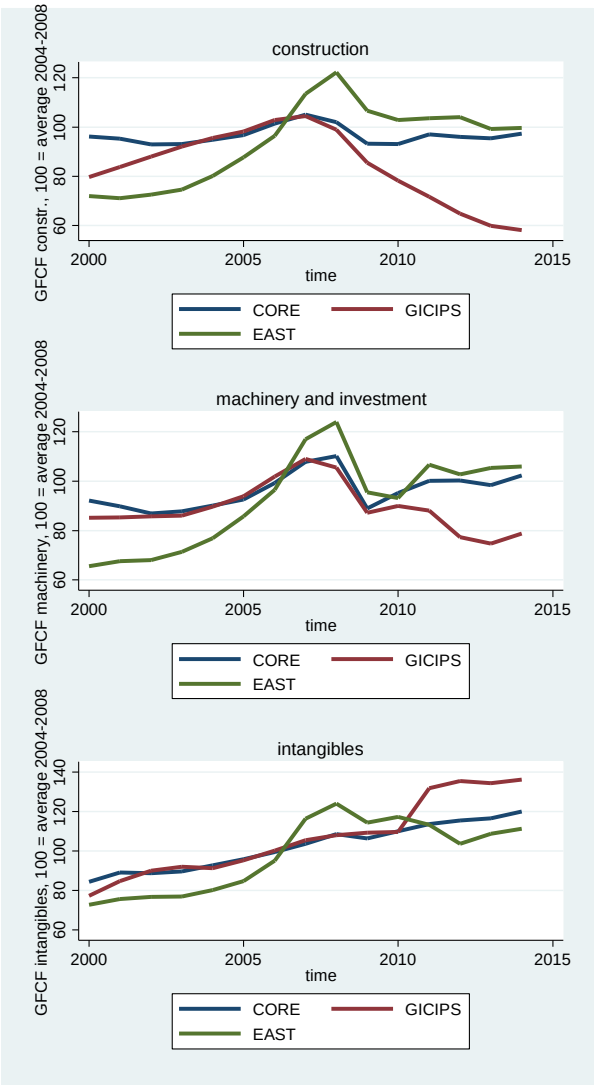
However, the crisis did not just impact countries in a heterogeneous way; the composition of investment was also affected by the crisis. The right panel of Figure 4.2 shows the composition of investment across broad asset classes for the 2000 to 2014 time period. The data clearly indicate that the decline is most pronounced in buildings and structures. Investment in buildings and structures (construction investment) in the EU-28 countries shows a steady decline from 2008 up to the year 2013. While total investment declined to 89% of the average investment volume in the years before the crisis (2004 to 2008), by the year 2014 investment in buildings and structures declined to 77%. Investment in machinery and equipment shows slightly more dynamic development after the crisis. It experienced a sharp decline during the crisis years, rebounded in 2011, and declined afterwards in the years 2012 and 2013. In 2014 investment in machinery and investment was at 93 % of the average real investment during the 2004-2008 pre-crisis period. In contrast to investment in buildings and structures and equipment and machinery, gross capital formation in intangible assets shows a remarkably different trend. Investment in intangibles grew very quickly before the crisis, experienced stagnation during the crisis, and has returned to high growth since 2010. In 2014 intangible investment accounted for 125% of the average investment in intangibles before the crisis.

This result on the composition of investment highlights that investment in intangibles[28] is less prone to reactions to economic downturns than the more traditional components of gross

[28] According to the 2008 SNA/ESA 2010 definitions, intangible assets are R&D, mineral exploration, computer software and databases, entertainment, and literary and artistic originals.

fixed capital formation investment in buildings and structures and investment in machinery and equipment. The results also show that the share of intangibles in total investment increased over the past period and accounts for close to 4% of GDP and 19% of total annual fixed investment in the EU28. As intangible investment is less prone to boom and bust cycles than 'traditional' capital formation and has held up rather well in the crisis, its inclusion also matters for gauging the depth of the post-2008 investment shortfall and its impact on the future development of countries.

Figure 4.3: Composition of investment across country groups, 2000 to 2014



Source: Eurostat National Accounts, WIFO calculations.
Notes: Volume Index , the average investment in 2004 to 2008 equals to 100. Country group CORE consists of BE DK DE FR LU MT NL AT FI SE and UK, Country group GICIPS consists of EL CY IE ES IT PT, country group EAST consists of BG CZ EE LV LT HU PL RO SI SK. HR is not included due to missing data.

Figure 4.3 reports the development of the three groups of investment for the three country groups. Remarkable differences emerge.[29] With regard to investment in buildings and structures the data clearly show that no country group achieved values that were recorded for the year 2007 before the outbreak of the crisis and that investment in structures and buildings remained comparably weak in all country groups. However, investment in buildings

[29] Country evidence is provided in Table 8.1and Table 8.2 (Appendix C)

and structures remained slightly below the values in the pre-crisis period for the core countries during the whole post-crisis period, and in the Eastern European countries investment in buildings and structures was above the pre-crisis average volume of investment during 2004 and 2008, and in the years 2009 to 2011. Most of the decline is thus attributable to the crisis countries (GCIPS), where the real volume of investment fell steadily after 2007, from 104% of the pre-crisis average to 58% of the pre-crisis average in 2014.

At the aggregate level, investment in machinery and equipment follows broadly similar dynamics to gross capital formation in buildings and structures at the country group level. The global shock in 2008 and 2009 led to a decline in investment in all countries. In the CORE country group, investment in machinery and equipment shows a slow but steady upward trend from immediately after the crisis to 2014, and in 2014 it reached a volume of 102% of the pre-crisis average investment volume. In the Eastern European countries investment in machinery and equipment started to rise again in 2011 and was at a volume of 106% of the pre-crisis average volume in 2014. In the GICIPS countries, investment in machinery and equipment remained weak during the whole period from 2008 to 2014. In 2014 the volume of investment in this category was at 78% of the pre-crisis average.

Investment in intangibles shows a completely different pattern. For the core countries no change in the growth trend could be identified. Since 2007, investment in intangibles increased from 105% of the pre-crisis average value to 120% of the pre-crisis volume. In contrast to the other categories, the crisis countries (GICIPS) also show a positive development for investment in intangibles. Here, it increased from 105% of pre-crisis average volume to 134% of the pre-crisis average. However, for the Eastern European countries a negative development of investment in intangibles can be observed from 2008 (123% of the pre-crisis average volume) to 2014 (108% of the pre-crisis average).

The rise in intangible capital in the GICIPS countries is primarily related to the dynamics in Ireland and Spain, where the investment volume in intangible capital increased by 38% since 2008, while in Greece the investment volume decreased by 37% over the same period and remained relatively stable in Portugal.

Table 4.1: shows the pre-crisis and post-crisis composition of investment for important sectors across the three country groups. The detailed data are in line with the aggregate results. The largest drops in investment are recorded for real estate activities across all country groups, whereas with regard to the GVA-to-GDP ratio the largest declines are observed for manufacturing and construction across all country groups. With regard to the composition of investment differences across sectors and across country groups, the results show that intangible capital makes up the largest share in investment in manufacturing and in important knowledge-based service industries (information and communication and finance). However, there are clear differences across country groups, especially for manufacturing. While the intangible investment intensity is high in the core countries - 45% of

Table 4.1: Composition of investment for selected industries across country groups in the pre-crisis and the post-crisis period

	NACE	GROUP	Intangible Assets			Machinery and Equipment			other (mostly Construction)			Investment / GVA			share in GDP		
			2004 - 2008	2010 - 2014	*change in PP*	2004 - 2008	2010 - 2014	*change in PP*	2004 - 2008	2010 - 2014	*change in PP*	2004 - 2008	2010 - 2014	*change in PP*	2004 - 2008	2010 - 2014	*change in P.*
C	Manufacturing	CORE	40.0	45.6	*5.6*	47.7	42.5	*-5.2*	12.3	11.9	*-0.4*	21.8	22.7	*0.9*	15.3	13.0	*-2.3*
F	Construction	CORE	8.7	10.7	*2.0*	62.8	62.7	*-0.2*	28.5	26.6	*-1.9*	8.5	9.8	*1.3*	5.2	4.9	*-0.3*
G-I	Trade, transport and accomodatic	CORE	11.4	13.2	*1.8*	56.8	56.0	*-0.8*	31.8	30.8	*-1.0*	16.1	15.3	*-0.8*	16.9	16.7	*-0.1*
J	Information and Communication	CORE	43.2	49.5	*6.3*	44.1	39.6	*-4.6*	12.7	10.9	*-1.7*	22.4	23.7	*1.3*	4.5	4.5	*0.1*
K	Finance	CORE	44.0	47.0	*3.0*	29.6	27.1	*-2.5*	26.4	25.9	*-0.5*	11.8	10.7	*-1.1*	6.8	7.0	*0.2*
L	Real estate activities	CORE	1.8	1.3	*-0.5*	1.4	1.7	*0.3*	96.8	97.0	*0.2*	85.3	72.1	*-13.2*	8.3	8.2	*-0.1*
O-Q	Public adm. & services	CORE	17.9	21.0	*3.1*	24.6	23.4	*-1.2*	57.5	55.6	*-1.9*	19.9	18.6	*-1.3*	16.3	17.5	*1.1*
C	Manufacturing	EAST	7.8	11.8	*4.0*	65.4	65.5	*0.1*	26.9	22.7	*-4.2*	31.1	23.9	*-7.2*	17.3	16.8	*-0.5*
F	Construction	EAST	1.6	2.8	*1.2*	54.9	56.7	*1.8*	43.5	40.5	*-3.0*	23.5	13.7	*-9.8*	6.4	5.7	*-0.7*
G-I	Trade, transport and accomodatic	EAST	2.8	3.6	*0.8*	48.2	52.4	*4.3*	49.1	44.0	*-5.1*	27.5	19.5	*-7.9*	19.7	19.1	*-0.6*
J	Information and Communication	EAST	25.6	36.7	*11.1*	53.8	43.0	*-10.8*	20.6	20.3	*-0.3*	33.3	24.4	*-8.9*	3.9	4.1	*0.2*
K	Finance	EAST	30.4	37.2	*6.8*	50.3	35.3	*-15.0*	19.3	27.5	*8.2*	14.6	11.1	*-3.5*	3.9	4.0	*0.1*
L	Real estate activities	EAST	0.2	0.2	*0.0*	8.0	5.2	*-2.8*	91.8	94.5	*2.7*	63.9	46.8	*-17.1*	7.4	7.6	*0.2*
O-Q	Public adm. & services	EAST	8.8	10.5	*1.7*	31.4	22.4	*-9.0*	59.8	67.1	*7.3*	27.3	25.7	*-1.7*	13.1	13.4	*0.3*
C	Manufacturing	GICIPS	22.5	26.8	*4.3*	55.9	44.7	*-11.2*	21.6	28.5	*6.9*	17.9	18.1	*0.2*	12.6	11.7	*-1.0*
F	Construction	GICIPS	1.7	7.0	*5.3*	64.2	58.2	*-6.0*	34.1	34.8	*0.7*	14.0	7.3	*-6.8*	7.6	4.2	*-3.4*
G-I	Trade, transport and accomodatic	GICIPS	3.1	5.2	*2.0*	60.1	64.7	*4.6*	36.7	30.1	*-6.6*	20.2	16.4	*-3.8*	20.0	20.1	*0.0*
J	Information and Communication	GICIPS	39.8	51.3	*11.6*	42.2	33.4	*-8.8*	18.0	15.2	*-2.7*	26.5	25.8	*-0.7*	4.1	4.6	*0.6*
K	Finance	GICIPS	28.5	40.3	*11.8*	34.8	26.7	*-8.0*	36.8	33.0	*-3.8*	8.0	7.6	*-0.4*	5.7	5.8	*0.2*
L	Real estate activities	GICIPS	0.7	1.0	*0.2*	0.5	0.8	*0.3*	98.7	98.2	*-0.5*	115.7	41.3	*-74.3*	8.6	10.9	*2.3*
O-Q	Public adm. & services	GICIPS	14.6	20.8	*6.2*	24.1	24.7	*0.6*	61.4	54.6	*-6.8*	21.5	15.5	*-6.0*	16.2	17.3	*1.2*

Source: Eurostat National Accounts, WIFO calculations. Country group CORE consists of DE FR LU MT NL AT FI and SE, Country group GICIPS consists of CY EL ES IT PT, country group EAST consists of BG CZ EE LV HU PL SI SK. HR RO LT DK BE and UK are not included due to missing data.

investment are intangibles in the pos-crisis period, it is lower in the GICIPS countries (around 27 in the post-crisis period) and the EAST country group (around 12%). Investment in building and structures is over-proportional in the real estate sector and in public administration and services. The largest investment-to-value-added ratios are observed for the real estate sector, manufacturing and the information and communications sector.

Returning to the aggregate level, Table 4.2 displays the investment ratios and the composition of investment for three time periods for the EU28 and the average values for the three country groups. The investment-to-GDP ratio for buildings and structures and machinery and equipment declined for all country groups in the post-crisis period, while for intangible assets we observe an increase in the investment-to-GDP ratio. This indicates a structural shift towards intangible assets, but also a lower reaction to business cycle downturns of intangible assets. This is also reflected in the composition of investment, which shows a shift towards intangibles. .

Table 4.2: Composition of investment across country groups

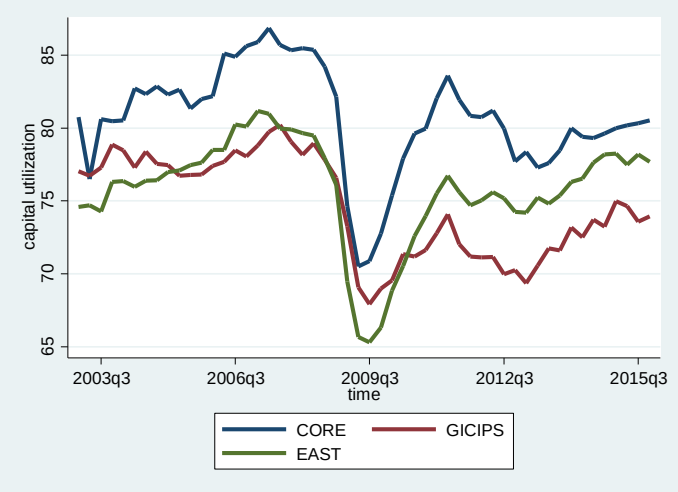
Countrygroup	Construction			Machinery and Equipment			Intangible Assets		
	1999 - 2003	2004 - 2008	2010 - 2014	1999 - 2003	2004 - 2008	2010 - 2014	1999 - 2003	2004 - 2008	2010 - 2014
						Investment in relation to GDP			
EU28	**10.9**	**11.9**	**10.2**	**6.9**	**6.7**	**5.9**	**3.4**	**3.4**	**3.7**
CORE	10.6	11.1	10.0	6.9	6.7	6.1	3.7	3.7	4.1
GICIPS	14.3	15.8	9.0	7.3	7.0	5.5	1.9	2.1	2.7
EAST	11.2	14.1	11.2	11.1	11.3	8.7	1.8	1.9	2.2
						Composition of Investment			
EU28	**51.4**	**54.0**	**51.5**	**32.4**	**30.6**	**29.7**	**15.9**	**15.2**	**18.5**
CORE	50.0	51.4	49.3	32.5	31.1	30.1	17.4	17.3	20.4
GICIPS	60.2	62.7	51.7	31.3	28.5	31.9	8.1	8.5	15.3
EAST	46.2	51.0	50.7	45.5	41.3	39.0	7.3	6.9	9.7

Source: Eurostat National Accounts, WIFO calculations.
Notes: EU28 denotes the EU28 aggregate values, while country groups are unweighted country averages. Country group CORE consists of BE DK DE FR LU MT NL AT FI SE and UK, Country group GICIPS consists of EL CY IE ES IT PT, country group EAST consists of BG CZ EE LV LT HU PL RO SI SK. HR is not included due to missing data.

However, it should not be overlooked that investment in intangibles in EU28 countries remained weak when compared to the USA, Switzerland and South Korea, where the investment-in-intangibles-to-GDP ratio is above 5% of GDP. Thus, the weakness in investment is also related to investment in intangibles, which are likely complementary to investment in physical capital. While no data are available on the utilization of intangible assets, the European Commission's business tendency surveys[30] provide an indication of the degree of capacity utilization of physical capital in the manufacturing industries. Figure 4.4 shows the average country capacity utilization rates for the three country groups. While there seem to be structural differences in the degree of capacity utilization across countries and country groups, the figure shows that in most countries, especially in the crisis countries, the post-crisis capacity utilization remained well below the pre-crisis values, indicating below-average production in manufacturing. This evidence is in line with more sophisticated analyses of the weakness of investment in Europe (e.g. Barkbou et al. 2015, Bussiere et al. 2015, European Commission 2015).

[30] See http://ec.europa.eu/economy_finance/db_indicators/surveys/index_en.htm

Figure 4.4: Rate of capacity utilization in European industry for country groups, in percent



Source: Eurostat.
Notes: Current level of capacity utilization in percent, seasonally adjusted. Country group CORE consists of BE DK DE FR LU MT NL AT FI SE and UK, Country group GICIPS consists of EL ES IT PT, country group EAST consists of BG CZ EE LV LT HU PL RO SI SK. CY, HR and IE are not included due to gaps in the data.

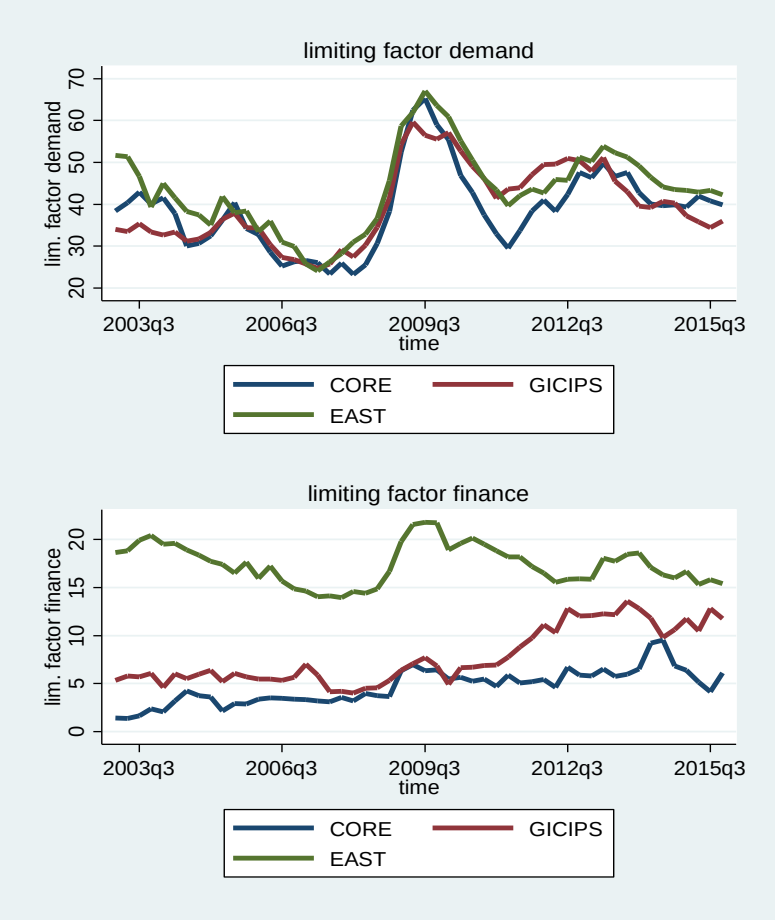
4.2.1.What explains the weakness of investment?

Available research indicates that the main factor explaining the weaknesses in investment across European countries is the ongoing weakness in aggregate demand (e.g. Barkbou et al. 2015, Bussiere et al. 2015, European Commission 2015).[31] The weakness of demand as a central factor also emerges from the answers to the question of limiting factors to production in the European business tendency survey. Most managers mention "no constraining factor" most frequently, however, "insufficient demand" is the most important factor limiting production (upper panel of Figure 4.5). The evidence shows that the assessment of "demand" as a limiting factor for production increased sharply in the crisis period, where around 65% of the firms mention “insufficient demand” as a main factor holding back production, but remaining well above pre-crisis levels for all country groups. The assessment is remarkably homogenous across the three country groups. The lower panel in Figure 4.5 displays the time series of answers regarding "financial factors constraining production". This evidence for "financial factors" is more heterogeneous. The evidence suggests that there are structural differences across countries, which are likely related to the development and sophistication of the financial systems (e.g. Levine 2005 for a survey, or Gorodnichenko and Schnitzer 2013 and Hölzl and Janger 2014 who focus on innovation). In fact, enterprises in Eastern European countries mention financing as a limiting factor to production much more often than firms in the core and the crisis country groups. The evidence for the crisis countries shows that managers assess financial constraints much more often as a limiting factor for production than they did before the crisis. At the country level, increases are especially pronounced in Greece, Spain and Italy. For these countries, the estimates by Barkbou et al. (2015) also indicate that financial constraints affect the volume of investment, while they do not find similar evidence in the core country group among the member states. Most studies also show that the cost of capital and interest rates plays a modest role in explaining the weak investment dynamics after the crisis. Only for Greece does the cost of capital seem to have played an important role in reducing investment dynamics in the post-crisis period (e.g.

[31] Bussiere et al (2015) argue on the basis of using real time data, that the over-optimistic GDP forecasts supported investment dynamics in Europe, which would have been 12 percentage points lower otherwise.

Barkbou et al. 2015). Macroeconomic uncertainty is relevant, but it does not seem to be a main factor driving the misalignment of investment with macroeconomic activity (cf. European Commission 2015), while the deleveraging of the public and private sectors after the crisis played an important role – in particular the severe corrections in housing investment in the crisis countries.

Figure 4.5: Limiting factors for production in European industry for country groups, in percent

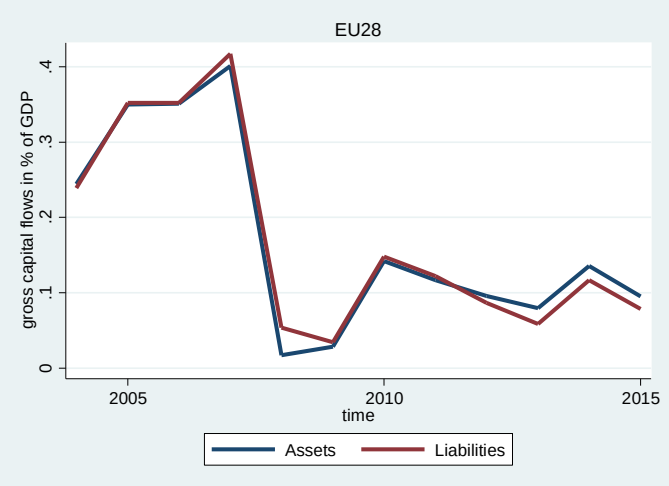


Source: Eurostat.
Notes: Current level of capacity utilization in percent, seasonally adjusted. Country group CORE consists of BE DK DE FR LU MT NL AT FI SE and UK, Country group GICIPS consists of EL ES IT PT, country group EAST consists of BG CZ EE LV LT HU PL RO SI SK. CY, HR and IE are not included due to gaps in the data.

4.3. Capital flows and investment before and after the crisis

Gross capital flows in the EU 28 countries experienced a large decline in 2008 at the outbreak of the crisis when they decreased from around 40% of GDP to well below 10% of GDP in 2008 and 2009, as Figure 4.6 shows. It is important to note that gross capital inflows and gross capital outflows far exceed the levels of net flows and are much more volatile than net flows (cf. Lane 2013, Broner et al. 2013). Gross capital flows are driven by the different behaviour of domestic and foreign investors and are generally pro-cyclical. During expansions, both the acquisition of domestic assets by foreigners and the acquisition of domestic assets tend to increase, while during downturns the foreign holdings of foreign assets decrease.

Figure 4.6: Capital outflows (assets) and capital inflows (liabilities) for the EU28 countries, 2003 to 2015



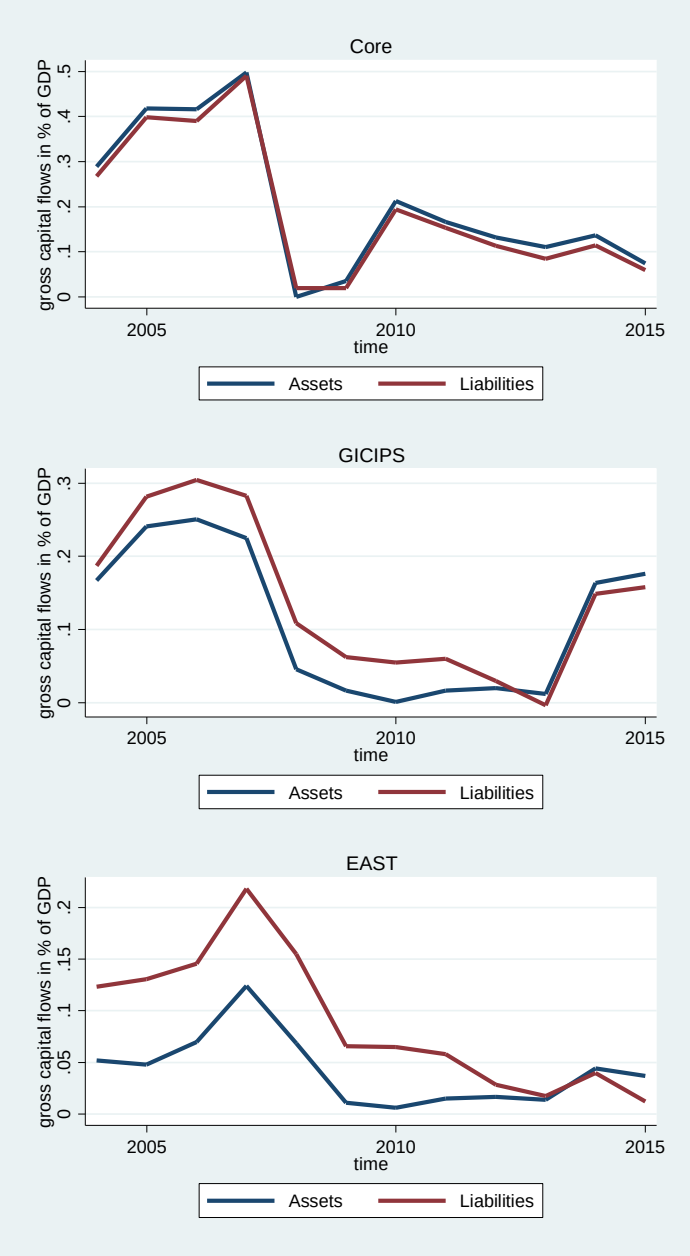
Source: Eurostat Balance of Payment statistics.
Notes: Assets = Outflows, Liabilities = Inflows. Gross flows are constructed by adding up direct investment, portfolio investment and other investment. Country group CORE consists of BE DK DE FR LU MT NL AT FI SE and UK, Country group GICIPS consists of CY IE EL ES IT PT, country group EAST consists of CZ EE LV LT HU PL RO SI SK. CY FI and BG are not included due to gaps in the data.

The recent financial crisis has revitalized research concerning the impact of liquidity on economic and financial stability, of which much has already been documented. Domestically, liquidity has been observed as having important implications for the real economy and financial system stability (for example Friedman and Schwarz, 1963). It affects both asset prices and risk-taking, with significant consequences for macrofinancial stability (Borio and Zhu, 2008). Globally, the allocation of liquidity affects macroeconomic and financial developments in ways that are not under the direct control of national policymakers (see IMF, 2011a; IMF, 2011b; IMF, 2011c; IMF, 2011d; CGFS, (2011) and Darius and Radde, 2010). In the vein of recent research on this issue, global liquidity is highly cyclical because it is driven by divergences in growth rates, monetary policies and, above all, appetite for risk.

Before the 2008/2009 financial crisis, many economies in the EU saw large capital inflows in addition to low savings. The resulting combination of low savings and lower borrowing costs spurred credit creation and economic growth, especially in the GICIPS countries. At the same time, appreciation pressures on exchange rates (in real-effective terms) increased, as did the overall risk to financial stability. In this environment, pro-cyclicality risks are particularly high when capital flows reverse sign: Rapid liquidity growth can turn into a sharp contraction. So with plenty of liquidity and low borrowing costs, individuals, banks and companies all shifted their preferences towards more risky investments.

In this context, high levels of gross capital can be stabilizing if they support international risk diversification and, more importantly to the real sector, capital flows can help improve the efficiency of financial intermediation. However, gross flows can also raise risks. For example, credit booms can be amplified by the inflow of debt into the domestic banking system (e.g. Lane and McQuade 2014, Lane 2013) or the issue of foreign liabilities. This may create risks if domestic banks take on excessive risks in foreign activities where they do not have a comparative advantage, thereby weakening the stability of the domestic banking systems (e.g. Allen et al. 2011).

Figure 4.7: Capital outflows (assets) and capital inflows (liabilities) for country groups, 2003 to 2015



Source: Eurostat Balance of Payment statistics.
Notes: Assets = Outflows, Liabilities = Inflows. Gross flows are constructed by adding up direct investment, portfolio investment and other investment. Country group CORE consists of BE DK DE FR LU MT NL AT FI SE and UK, Country group GICIPS consists of CY IE EL ES IT PT, country group EAST consists of CZ EE LV LT HU PL RO SI SK. CY FI and BG are not included due to gaps in the data.

Figure 4.7 shows that the composition of gross capital outflows (assets) and gross capital inflows (liabilities) was different for the three country groups. The core countries displayed very high levels of international financial integration before the crisis. Inflows and outflows of capital were, on average, at levels above 50% of GDP for the core countries before the crisis.

During the crisis both capital inflows and capital outflows dropped to comparatively low levels. While capital inflows and outflows were of a similar magnitude, the core countries were on average net lenders of capital over the whole period, as the capital outflows exceeded capital inflows. In contrast, the Eastern European countries and the GICIPS countries were net

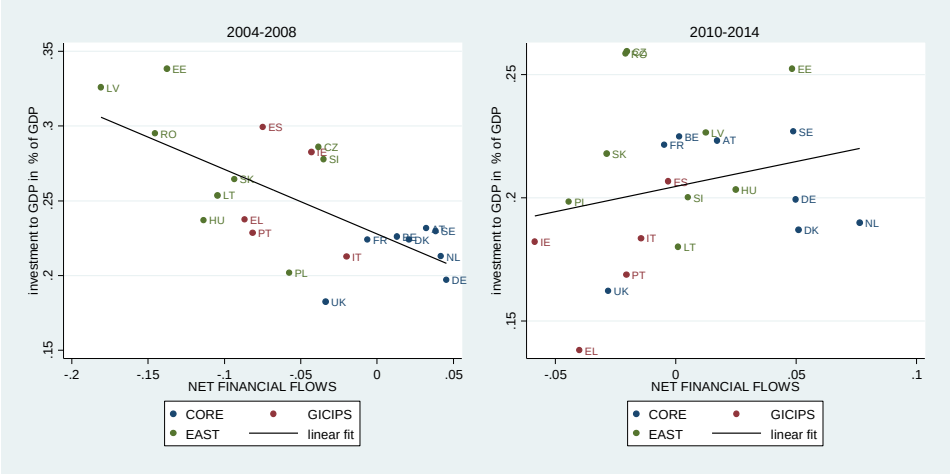
capital importers up to 2013. Since 2013, these countries also had larger outflows than inflows. In order to understand the importance of gross flows, it is useful to use the following identity (cf. IMF 2013):

Gross inflows = current account deficit + gross outflows + reserves accumulations

This balance of payment identity shows that changes in gross inflows must be absorbed by changes in the current account, gross outflows or reserves. Especially if high capital inflows are associated with increases in current account deficits this may require painful real adjustments if the inflows dry up.

As Figure 4.8 shows, the size of gross capital flows changes after the crisis, as well as the qualitative impact of net capital flows on investment ratios. Figure 4.8 shows the relationship between domestic investment and net capital inflows for European countries for the pre-crisis period (2004 to 2008) and the post-crisis period (2010 to 2014). Net capital flows can be negative (inflows) or positive (outflows). Before the crisis, net capital inflows were associated with higher investment-to-GDP ratios, while in the post-crisis period no statistically clear relationship can be identified.

Figure 4.8: Investment-to-GDP ratios and net financialflows-to-GDP ratios before and after the crisis

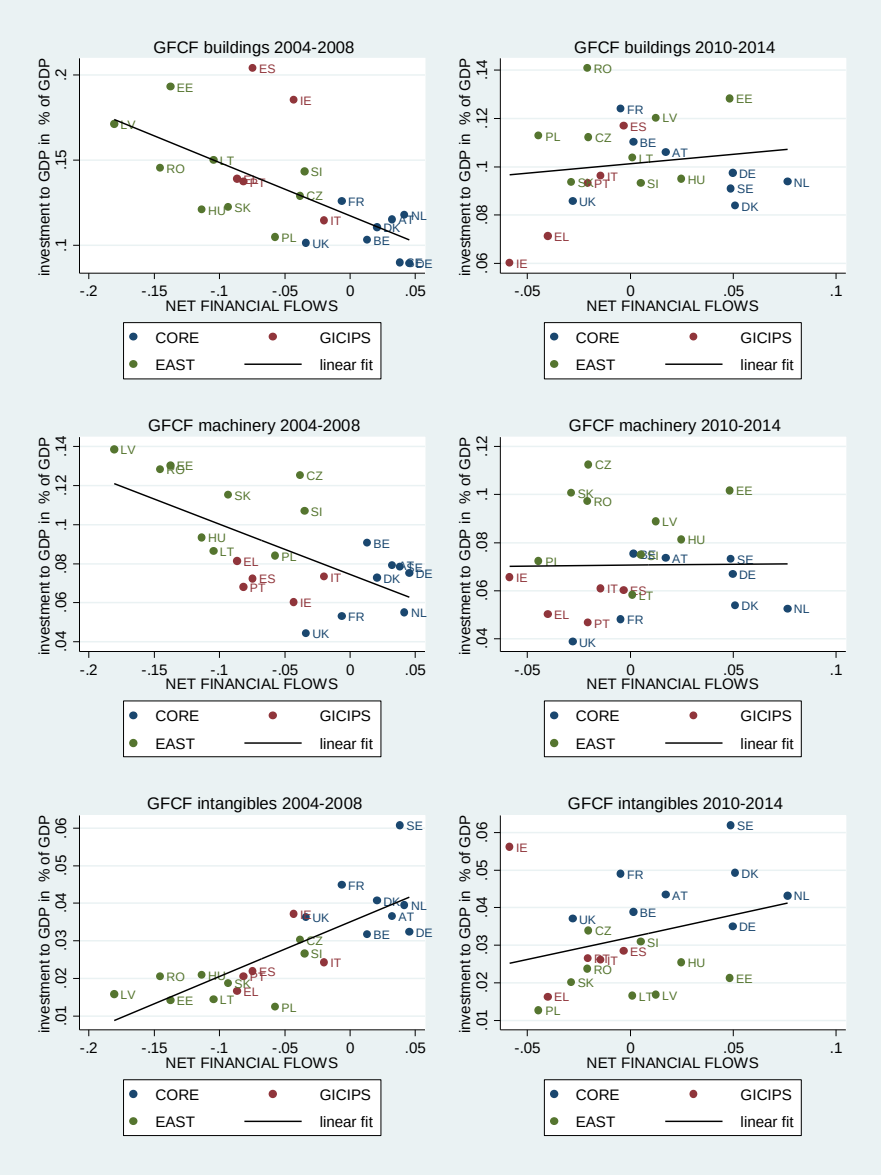


Source: Eurostat Balance of Payment statistics, national accounts, WIFO calculations.
Notes: net flows = Assets (Outflows) - Liabilities (Inflows). Net flows are constructed by adding up net flows in direct investment, portfolio investment and other investment. Country group CORE consists of BE DK DE FR NL AT FI SE and UK, Country group GICIPS consists of CY IE EL ES IT PT, country group EAST consists of CZ EE LV LT HU PL RO SI SK. CY FI and BG are not included due to gaps in the data. MT and LU are excluded because of their small country size and role as financial centres.

Figure 4.9 shows the relationship between net capital flows and the investment in buildings and structures, investment in machinery and equipment and investment in intangibles. The figure shows that for both investment in buildings and structures and investment in machinery and equipment the relationship to net capital flows is positive before the crisis, while for the post-crisis time period (2010 to 2014) no statistical significant relationship can be identified. Also for investment in intangibles, the association between investment intensity and net capital flows changes during the crisis, although in a less radical way than for the other components of investment. Before the crisis, a higher intensity in intangible investment is observed for countries that experience a capital outflow, while countries that experienced capital inflows had a low investment-in-intangibles-to-GDP ratio. After the crisis, the relationship remains weakly positive, but is no longer statistically significant. This evidence suggests that capital inflows before the crisis did not lead to higher investment in intangible

capital, but those inflows were primarily associated with investment in buildings and structures and machinery and equipment.

Figure 4.9: Investment-to-GDP ratios for buildings and structures and machinery and equipment and net financial-flows-to-GDP ratios before and after the crisis



Source: Eurostat Balance of Payment statistics, national accounts, WIFO calculations.
Notes: net flows = Assets (Outflows) - Liabilities (Inflows). Net flows are constructed by adding up net flows in direct investment, portfolio investment and other investment. Country group CORE consists of BE DK DE FR NL AT FI SE and UK, Country group GICIPS consists of CY IE EL ES IT PT, country group EAST consists of CZ EE LV LT HU PL RO SI SK. CY FI and BG are not included due to gaps in the data. MT and LU are excluded because of their small country size and role as financial centres.

Complementary evidence on the relationship between capital flows and domestic investment can be provided by testing for international capital mobility. Following Feldstein and Horioka (1980), international capital mobility can be measured by regressing the investment-to-GDP ratio on the savings-to-GDP ratio. The equation to be estimated is:

Eq. 4-1

$$\frac{I_i}{GDP_i} = a + b_1 \frac{S_i}{GDP_i} + \varepsilon_i,$$

where I_i is investment (GFCF – gross fixed capital formation) in country i, S_i is gross domestic savings and ε_i is an error term. According to Feldstein and Horioka (1980), with perfect capital mobility the coefficient on the saving-to-GDP ratio is expected to be less than 0.10.

Table 4.3 reports the estimates for two time periods (2004 to 2008 and 2010 to 2014). Our findings are in line with those by Wagenwoort and Torfs (2013), which used the same specification to estimate the impact of the crisis on the European financial market integration process, however for different sub periods, and also used GDP volume growth as a control variable to correct for short-run influences. We additionally use a factor-augmented regression model proposed by Giannone and Lenza (2009), who argue that if global shocks propagate heterogeneously across countries, the relationship between the idiosyncratic components of saving and investment rates cannot be consistently estimated by the regressions commonly used in the estimation of the degree of international capital mobility as proposed by Feldstein and Horioka (1980). Following Giannone and Lenza (2009), we use principal components of the covariance matrix of the data (investment-to-GDP and savings-to-GDP ratios). These principal components have the propensity to control for the effects of global shocks on savings and investment that might affect the consistent estimation of the coefficient b_1 across countries. Our analysis reveals that three common factors (principal components) should be included in the econometric analysis, based on the criterion that only principal components with eigenvalues larger than 1 should be considered relevant in explaining the variance of the multidimensional data.

Table 4.3: European capital mobility: The relationship between domestic investment, domestic savings and economic growth across EU countries

	(1)	(2)	(3)	(4)
	2004-2008		2010-2014	
VARIABLES	time aggregated data	factor augmented regression	time aggregated data	factor augmented regression
S/GDP	0.10	0.02	0.33**	0.38**
	(1.01)	(0.34)	(3.22)	(9.29)
GDP growth	1.38**		0.31	
	(4.63)		(1.09)	
factor 1		-0.00		0.00
		(-0.13)		(0.01)
factor 2		0.00		0.00
		(0.45)		(0.06)
factor 3		0.00		-0.00
		(0.23)		(-0.09)
Constant	0.17**	0.26*	0.13**	0.13
	(6.59)	(2.42)	(6.51)	(0.37)
Observations	26	128	26	128
R2	0.48	0.06	0.51	0.42

Source: WIFO calculations.
Notes: ** and * denote statistical significance at the 1% and the 5% level respectively. t-values are in brackets. Time-aggregated data denotes regression on time-averaged data over the respective periods. Factor-augmented regression denotes regression that controls for common factors across countries.

The regression results in Table 4.3 show that in the pre-crisis period 2004 to 2008 the coefficient b_1 is not statistically significant from zero in both specifications. During this period there is no strong relationship between domestic savings and domestic investment for the 26 EU countries included. However, the results in for the post-crisis period in columns (3) and (4) show a strong relationship between domestic savings and domestic investment for the same

set of EU countries. The coefficient b_1 is statistically significant and, more importantly, its magnitude - 0.33 when the GDP volume growth is included as control variable - is considerably higher than the 0.10 benchmark proposed by Feldstein and Horioka (1980). This result confirms that capital has been less mobile within Europe since the crisis, so that a strong positive and statistically significant relationship between domestic investment and domestic savings emerges. The decline of cross-country capital flows led to decreased capital mobility. If savings do not flow across borders to support the highest-yielding investments, this strongly implies that the domestic financial system is crucial to channelling savings to their best uses. However, before turning to the banking sector, let us investigate whether capital flows supported domestic investment in the most financially dependent industries, as this allows us to gain insights that are more precise.

4.4. Capital Flows and investment growth and gross value added growth at the industry level

4.4.1. Introduction

The question of how the magnitude of gross capital inflows and net capital flows affects investment with high needs of liquidity can be tested by using the approach proposed by Rajan and Zingales (1998). Industries are characterized by an industry-specific need for external finance to run businesses and finance capital expenditures, in addition to using internal finance such as retained earnings. If financial inflows relax financial constraints, industries that rely more on external capital should benefit more in terms of growth of investment or value added than industries that rely less on external capital. This methodology by Rajan and Zingales has recently been applied to assess the impact of financial and banking crises, to estimate the size of a possible credit crunch in the 2008-09 global recession (e.g. Bijlsma et al. 2013, Balta and Nikolov 2013, Dell' Ariccia et al. 2004), and to study the impact of banking integration on industrial growth in Europe (Schnabel and Seckinger 2015).

4.4.2. Methodology

The basic idea behind the approach (originally proposed by Rajan and Zingales 1998) is to estimate the causal impact of an independent variable (here: capital flows) on a dependent variable (here: investment growth) by exploiting the variation across industries for their expected impact, while controlling for industry, time and country-specific unobserved factors. The specification is the following:

Eq. 4-2
$$gr(I_{ijt}) = \theta_{ij} + \gamma_{it} + \delta_{jt} + b_1 FD_j \times CF_{it-1} + \varepsilon_{ijt},$$

where $\mathrm{gr}(\mathrm{I_{ijt}})$ is the growth rate of investment in country i, industry j and time t. θ_{ij} are country-industry effects, γ_{it} are country-time fixed effects, δ_{jt} are industry-time fixed effects, $\mathrm{FD_j}$ is the measure of external financial dependence of industry j, $\mathrm{CF_{it-1}}$ is the lagged indicator of capital flows (gross capital inflows or net capital flows) and ε_{ijt} is the time, country and sector-specific error term. b_1 is the coefficient of interest that measures the interaction between financial dependence and capital flows. Four types of capital flow indicators are used in the analysis. Gross capital inflows, net capital flows that were discussed in the previous section, and, in addition, gross foreign direct investment inflows as well as gross other inflows. The latter two indicators are specific components of gross capital inflows and should provide some more information on the composition of capital inflows. If capital flows lead to a relatively greater growth rate in investment of industries with high liquidity needs (financial dependence), then b_1 should be positive and economically and statistically significant.

This methodology has two advantages:

- The use of a full set of two-dimensional fixed effects allows to control for a large part of unobserved heterogeneity. Country-industry fixed effects, θ_{ij}, capture all time-invariant effects varying on the country-industry level, for example, constant tax policies that favour certain industries in a specific country. Industry-time fixed effects, δ_{jt}, capture all effects on a specific industry in a specific year across all countries. One example might be a global industry shock like the recent decline in oil prices that led to demand shocks for the oil industry but also for industries that supply equipment for oil extraction. Country-time fixed effects, γ_{it}, control for factors that affect all industries in a specific country and year in the same way, e. g., country-individual business cycle shocks that affect demand for all industries in the sample. In presence of these fixed effects, the results could only be biased by an omitted variable that varied through countries, time and industries and was correlated with the interaction of liquidity needs and capital flows.
- It helps to contain problems of reverse causality, as it is unlikely that the investment growth of specific industries affects gross or net capital flows. The presence of the fixed effects controls for much of the potential feedback from investment growth to the level of capital flows.

However, this method also has important drawbacks. Using this method it is impossible to identify the absolute effects on investment growth. Part of the effect of capital flows on investment is absorbed by the fixed effects. Causal interference can be drawn with respect to differences between the effects on investment stemming from the industry-specific dependence on external capital, but not on its absolute value. However, economic theory predicts that capital inflows should in general support industries with more need of external capital, except if capital allocation to industries is distorted by frictions that allocate financial funds to industries with lower needs for external finance.

The second drawback is that any benchmark measure of financial dependence based on a specific country is a noisy measure of true external dependence of industries. The measure of external financial dependence constitutes the link that allows to identify the impact of capital flows on investment and is assumed not to vary across countries. Rajan and Zingales (1998), as well as most subsequent studies, use a sector-specific and time-invariant measure of external financial dependence based on a benchmark country in their analyses. Time-invariance is required to control for the confounding effects of business cycles on the indicator of financial dependence. Country-invariance is used because it is difficult to disentangle demand and supply determinants of external dependency at the country level.

4.4.3.Measuring financial dependence

Rajan and Zingales (1998) use the industry gap between investment and operating cash flow for the US. The US is chosen as benchmark country on the basis of the argument that capital supply in the US is elastic and financial frictions do not distort capital allocation as in other countries. Rajan and Zingales (1998) thus argue that the internal financing gap in the US is a measure of external financial dependence which is primarily driven by technological and structural factors for other countries. While most studies using the Rajan and Zingales methodology use the financial dependence measure based on US data (e.g. Schnabel and Seckinger 2015, Bijlsma et al. 2013), this assumption has been criticised in the literature. For example, Furstenberg and Kalkreuth (2006) argue based on a comparison with different data for the US that the measure is not robust and thus question the assumption that these

measures may provide appropriate information on which industries can benefit most from a relaxing of financial frictions in different countries. Balta and Nikolov (2013) argue that this may be amplified when non-tradable or service sectors are considered. Balta and Nikolov (2013) provide sector and country-specific measures of external financial dependence of economic sectors in the pre-boom years (2000-2004) for six European Countries based on the BACH database. Their measure is calculated as the gap between operating profits and investment in tangible fixed assets, and normalized by investment in tangible fixed assets. The measures are depicted in Table 4.4 and cover 13 manufacturing industries at the 2-digit NACE Rev. 2 level, and 16 industries including services at the 1-digit, NACE Rev. 2 level. The measure of external dependence varies considerably across industries, but also across countries. Services sectors appear to have more external funding needs than the manufacturing sectors in all countries. While similarities across countries exist, as is revealed by the correlation coefficient with an average measure of financial dependence that is used in the econometric analysis, there are also important differences for some of the industries considered:

- Some industries are financially dependent across most countries, most notably for transportation, agriculture, computers and electronics or motor vehicles,
- Other industries are financially independent, e.g. pharmaceuticals, wholesale and retail trade, textiles and wearing apparel or furniture and other manufacturing.
- But there is also a set of industries that displays marked differences across countries, e.g. arts and entertainment, real estate, health services or construction.

Table 4.4: Dependence on external finance

NACE CODE	Industry	Belgium	Germany	Spain	France	Italy	Portugal	Average
A	Agriculture	81.7	52.9	73.9	22.5	85.7	95.1	68.6
B	Mining	70.6	-36.6	51.5	-8.6	-617.2	75.0	-77.6
C10-C12	Food beverages and tobacco	12.4	1.3	-73.9	-27.1	-60.1	-39.9	-31.2
C13-C15	textile and wearing apparel	-33.6	-66.5	-84.9	-122.0	-155.4	59.0	-67.2
C16-C18	wood and paper	40.6	19.4	-9.3	7.4	19.4	36.2	19.0
C19	coke and refined petroleum	-105.6		-458.1	-25.6	-115.4		-176.2
C20	chemical products	24.6	22.9	-46.7	21.1	-9.2	-38.9	-4.4
C21	pharamceutical products	-6.1	-27.4	-212.0	-163.2	-222.3	-161.6	-132.1
C22-C23	rubber and plastic products	45.9	-11.7	-23.6	-15.2	-7.6	-4.9	-2.9
C24-C25	basic metals and metal products	34.6	8.4	-37.6	2.7	12.0	0.3	3.4
C26	computer and electronics	24.9	118.0		70.1	66.2	-45.6	46.7
C27	electrical equipment	-44.6	-17.9	-152.0	-16.9	-45.0	-116.9	-65.6
C28	machinery and equipment n.e.c.	-130.9	-39.2	-320.2	-78.3	-105.6	-17.6	-115.3
C29-C30	transport equipment	26.1	76.0	67.4	47.9	190.7	-34.7	62.2
C31-C33	furniture other manufacturing repair	-19.9	-32.2	-80.9	-46.9	-103.9	-13.3	-49.5
D	electricity, gas, steam supply	-47.7	-73.3	42.1	32.6	4.4	40.7	-0.2
E	Water dupply sewerage	93.8	26.4	86.5	20.1	64.4	96.4	64.6
F	Construction	37.8	16.0	1.4	-60.8	-91.4	6.1	-15.2
G	Wholesale and retail trade	-159.9	-63.2	-184.6	-102.6	-134.5	-224.6	-144.9
H	Transport and storage	90.9	47.7	76.0	28.0	105.3	94.6	73.8
I	Accomodation and food services	71.9	44.8	32.6	24.7	-23.2	80.3	38.5
J	Information and Communication	31.0	-41.3	-26.9	-18.3	-8.9	-53.1	-19.6
L	Real estate activities	96.0	9.7	88.9	54.7	-262.1	75.8	10.5
M	Professional and techical services	91.9	-289.0	107.8	-51.8	-106.3	64.6	-30.5
N	Administrative and support services	77.7	85.3	40.4	70.7	50.5	86.1	68.5
P	Education	53.2	67.7	30.7	4.8	-178.7	57.6	5.9
Q	Health services	15.0	87.1	-10.1	-25.7	-177.0	103.5	-1.2
R	Art entertainment and recreation	-15.5	207.9	28.6	-13.4	49.5	102.5	59.9
S	Other services	57.0	99.0	-23.5	22.2	78.9	126.0	59.9
	Correlation of country financial dependence with the average value	0.73	0.58	0.82	0.75	0.60	0.68	

Source: Balta and Nikolov (2013).

In our analysis we use a measure averaged across all countries. Thus, we do not account for country-specific differences, as Balta and Nikolov (2013) do in their analysis. This may introduce some imprecision in the estimates but it allows us to use all countries. Using only

CORE countries for calculating the average value of financial dependence would not affect the results very much, as the correlation between the two averages is 0.99.

4.4.4.Dependent variable

The analysis is based on industry-level data from EU countries. We drop Malta and Luxembourg, since they do not provide a sufficient number of industry observations. Luxembourg also exhibits a feature of a financial centre, which may distort our results. Croatia is also dropped because of data limitations.

Annual industry data is obtained from the National accounts available at Eurostat, which provides investment and gross value added data on an annual basis up to 2014 for the countries in our sample. The data is available at the NACE Rev. 2 level. The sector breakdown used in the analysis follows the sector breakdown used by Balta and Nikolov (2013) and depicted in Table 4.4. Both investment and gross value added growth rates are calculated on the basis of chain linked volume (2010) data.

Table 4.5: Descriptive statistics for investment and gross value added growth rates

		Mean	Std. Dev.	Min	Max	Observation
total investment growth	original	3.4	58.2	-718.5	1633.3	N = 3454
	winsorised	0.3	20.6	-33.5	55.1	N = 3454
buldings and structures investment growth	original	148.2	6870.0	-4833.3	366900.0	N = 2864
	winsorised	1.6	40.9	-61.9	113.7	N = 2864
chinery and equipment investment gro	original	11.1	224.3	-1124.2	10726.1	N = 3152
	winsorised	1.9	30.5	-45.5	82.5	N = 3152
intangible investment growth	original	10.8	176.2	-4100.0	3838.9	N = 2669
	winsorised	3.5	24.6	-40.0	77.0	N = 2669
gross value added growth	original	0.4	18.2	-98.6	550.0	N = 3776
	winsorised	0.2	8.0	-14.2	18.9	N = 3776

Source: Eurostat National Accounts, WIFO calculations.

Due to the large outliers, investment growth rates and gross value added growth rates are winsorized[32] at the 5%–level following (Schabel and Seckinger 2015). In addition, we consider only industries that account for at least 1.5% of GDP at the country level, in order to minimize distortions arising from very small industries that are not representative and very driven by idiosyncratic and firm-specific investment dynamics. Table 4.5 provides the descriptive statistics. The coverage of investment growth rates is not uniform across countries and industries. The descriptive statistics also show that the winsorizing of the data reduces the mean of the investment growth rates considerably; this is due to very high growth rates observed in some instances.

Table 4.6 presents average growth rates at the country level. For Belgium, Denmark, Lithuania and Romania no information on buildings and structures is available, while machinery and investment growth rates are missing for Belgium and Romania, while intangible investment is not available for Belgium, Denmark, Lithuania and Romania. In contrast, gross value added growth is available for all countries, as is total investment growth.

[32] Winsorization is a transformation in statistics that limits extreme values in the data to reduce the effect of possible outliers. A 5% winsorization implies that all data below the 2.5th percentile set to the 2.5th percentile, and data above the 97.5th percentile set to the 97.5th percentile.

Table 4.6: Average investment and gross value added growth rates at the country level

	total investment growth		buldings and structures investment growth		machinery and equipment investment		intangible investment growth		gross value added growth	
Country	original	winsorised	original	winsorised	original	winsorised	original	winsorised	original	winsorised
AT	1.2	1.2	2.5	0.1	3.3	2.7	4.7	4.5	3.2	1.1
BE	-0.1	0.0	.	.	.	.	.	.	0.6	0.5
BG	15.6	4.3	69.1	9.6	18.9	8.7	.	.	1.3	1.3
CY	-12.8	-10.2	6.1	7.8	58.7	-1.7	-50.0	-14.6	0.5	-1.1
CZ	-0.6	-0.6	-1.1	-1.2	0.6	0.6	4.2	2.7	0.4	0.3
DE	-0.2	-0.1	0.1	0.1	0.6	0.6	2.8	2.8	0.6	0.9
DK	0.2	0.2	.	.	1.3	0.4	.	.	1.0	0.2
EE	2.7	2.3	21.4	7.2	11.6	2.7	16.7	9.7	0.8	1.1
EL	-5.8	-4.9	1912.4	-1.4	0.0	-3.5	-1.4	-5.0	-5.2	-3.6
ES	-1.4	-1.5	-1.4	-1.7	3.5	4.1	8.0	4.8	-0.3	-0.1
FI	-1.0	-0.2	-14.8	0.5	4.3	2.3	4.0	3.7	-0.8	-0.2
FR	0.5	0.2	1.2	-0.6	-0.1	-0.3	2.4	2.4	-0.5	-0.3
HU	1.3	1.4	0.9	0.9	2.2	2.2	8.3	5.2	1.0	1.2
IE	10.3	5.3	16.9	3.6	41.0	6.3	28.2	7.8	1.2	0.6
IT	-4.2	-4.2	-6.2	-6.2	-3.9	-3.9	1.7	1.4	-1.9	-1.6
LT	3.5	3.1	.	.	10.9	10.1	.	.	1.1	2.2
LV	15.7	2.3	95.0	7.1	15.2	7.7	27.2	9.6	0.6	1.4
NL	0.8	0.8	4.7	3.6	2.2	2.2	2.4	2.4	-0.1	-0.1
PL	3.1	3.1	4.9	4.9	1.3	1.3	1.1	2.6	3.3	3.3
PT	-0.6	-1.5	14.4	-0.6	-5.7	-3.9	28.8	6.1	-0.4	-0.7
RO	45.0	1.4	.	.	.	.	.	.	2.8	2.0
SE	5.1	2.1	67.0	2.6	5.0	3.4	12.0	2.9	0.7	0.5
SI	-6.8	-6.0	-7.2	-7.8	-2.5	-2.7	0.6	0.8	-0.1	0.0
SK	19.1	4.3	52.6	6.2	80.1	9.0	46.2	6.5	4.2	2.4
UK	1.0	1.2	13.9	11.4	2.1	2.6	1.4	1.4	-1.2	-1.0
Total	3.4	0.3	148.2	1.6	11.1	1.9	10.8	3.5	0.4	0.2

Source: Eurostat National Accounts, WIFO calculations.

4.4.5.Estimation results

The estimation results are reported in Table 4.7. They suggest that before the financial crisis larger capital inflows were not associated with an improved allocation of resources toward more financially dependent sectors for total investment. After the crisis we observe a better allocation of resources to financially dependent sectors for total investment, but not for investment in buildings and structures. Investment in intangible investment shows no statistically significant differential investment growth due to aggregate capital inflows before or after the crisis.

With regard to net capital flows, the interpretation of the coefficient in Table 4.7 is the opposite, as with gross capital flows. Capital inflows are negative and capital outflows are positive. Therefore, a negative coefficient indicates that a larger net capital inflow was associated with higher growth rates of investment in more financially dependent sectors. In contrast, a positive value indicates that the differential investment growth in financially dependent sectors was associated with capital outflows. In fact, the results show that the differential effect in the pre-crisis period was associated with a higher growth rate of total investment and growth rate of intangible investment in financially dependent sectors in countries with high net capital outflows, while the differential growth rate of investment in buildings and structures across financially dependent sectors was higher when the country had net capital inflows.

Table 4.7: Estimation results for the impact of aggregate capital flows on investment growth rates at the industry level, pre-crisis and post-crisis period

a) capital inflows and net capital flows

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
		2008-2014				before 2008				2008-2014				before 2008		
VARIABLES		growth rate				growth rate				growth rate				growth rate		
	total inv.	mach. & equip	buildings	intangible	total inv.	mach. & equip	buildings	intangible	total inv.	mach. & equip.	buildings	intangible	total inv.	mach. & equip.	buildings	intangible
capital inflows	0.052*	-0.049	-0.219**	-0.007	-0.089+	0.089	0.061	-0.001								
	(1.98)	(-1.12)	(-4.10)	(-0.26)	(-1.91)	(1.46)	(0.72)	(-0.02)								
net capital flows									0.111	0.034	0.536*	-0.045	0.757**	0.167	-1.315**	0.637**
									(1.08)	(0.20)	(2.45)	(-0.42)	(4.13)	(0.64)	(-3.56)	(3.22)
Observations	2,580	2,281	2,091	2,092	1,615	1,411	1,343	1,336	2,580	2,281	2,091	2,092	1,615	1,411	1,343	1,336
R2	0.719	0.656	0.638	0.760	0.736	0.779	0.764	0.844	0.720	0.658	0.626	0.760	0.753	0.781	0.755	0.844

b) direct investment inflows and other inflows

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
		2008-2014				before 2008				2008-2014				before 2008		
VARIABLES		growth rate				growth rate				growth rate				growth rate		
	total inv.	mach. & equip	buildings	intangible	total inv.	mach. & equip	buildings	intangible	total inv.	mach. & equip.	buildings	intangible	total inv.	mach. & equip.	buildings	intangible
direct investment	0.079	-0.050	-0.058	-0.183*	-0.239**	0.237*	-0.043	-0.008								
inflows	(1.49)	(-0.41)	(-0.38)	(-2.43)	(-3.08)	(2.28)	(-0.29)	(-0.11)								
other capital inflows									-0.013	-0.122*	-0.107+	-0.050	-0.077	-0.018	0.038	0.084
									(-0.43)	(-2.36)	(-1.72)	(-1.56)	(-1.30)	(-0.22)	(0.34)	(1.56)
Observations	2,580	2,281	2,091	2,092	1,615	1,411	1,343	1,336	2,580	2,281	2,091	2,092	1,778	1,574	1,474	1,467
R2	0.719	0.661	0.635	0.762	0.747	0.78	0.76	0.844	0.719	0.653	0.655	0.754	0.72	0.729	0.746	0.858

Source: WIFO calculations.

Notes: robust regression results (Huber estimator) **, * and + denote statistical significance at the 1%, 5% and 10% level respectively. t-values are in brackets. Observations for MT and LU are excluded because of their small country size and role as financial centres.

This result suggests that investment in intangibles is often financed by retained earnings or external equity finance, but not by external debt finance. After the crisis, a differential growth effect across financially dependent industries can only be observed for the growth rate of investment in buildings and structures. Here, countries that experienced net capital outflows experienced higher investment in buildings and structures. Panel b in Table 4.7 reports the results for two components of gross capital flows, namely capital inflow in the form of foreign direct investment and capital inflows in the form of "other investment" that also capture large parts of debt flows across countries. The evidence suggests that large inflows of foreign direct investment did not generally lead to a differential growth advantage of firms in sectors that are more financially dependent on external resources. Before the crisis, we observe a statistically negative coefficient (opposite effect) for the growth rates of total investment, but a positive differential growth effect for investment in machinery and equipment. After the crisis, the relationship seems to change and we observe negative differential growth rates of investment in intangible capital.

For gross capital inflows associated with other investment, before the crisis we observe no statistically significant growth differential for financially dependent industries. Statistically significant negative coefficients are observed for the differential growth rate of investment in machinery and equipment and investment in buildings and structures. That is, gross capital inflows associated with other investment are associated with stronger investment growth in sectors that are less financially dependent, suggesting that the pattern of capital flows did not reduce financial frictions across countries.

Table 4.8: Estimation results for the impact of aggregate capital flows on the growth rate of gross value added at the industry level, pre-crisis and post-crisis period

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	2008-2014	before 2008	2008-2014	before 2008	2008-2014	before 2008	2008-2014	before 2008
VARIABLES	growth rate gross value added							
industry size	-6.697**	-7.170**	-6.501**	-7.454**	-6.768**	-7.247**	-6.810**	-7.349**
	(-20.99)	(-13.49)	(-20.44)	(-13.74)	(-21.18)	(-13.27)	(-21.36)	(-16.08)
capital inflows	-0.009	-0.042**						
	(-0.99)	(-3.50)						
net capital flows			-0.093**	0.123*				
			(-2.66)	(2.49)				
direct investment inflows					-0.002	-0.074**		
					(-0.11)	(-3.49)		
other capital inflows							-0.006	0.025
							(-0.57)	(1.62)
Observations	2,767	1,687	2,767	1,687	2,767	1,687	2,767	1,850
R2	0.782	0.860	0.781	0.854	0.781	0.855	0.783	0.851

Source: WIFO calculations.
Notes: robust regression results (Huber estimator) **, * and + denote statistical significance at the 1%, 5% and 10% level respectively. t-values are in brackets. Observations for MT and LU are excluded because of their small country size and role as financial centres.

It is important to see that that capital flows can also support the growth of enterprises across sectors without having a strong impact on investment, especially if growth is driven by intangibles that are not accounted for in the national accounts (e.g. investment in personnel, marketing). For this purpose, we estimate the same set of regressions that we estimated for investment growth for gross value added growth rates across the sectors.

Table 4.8 presents the estimation results. Overall, the results confirm the results for investment growth. In general, we observe negative effects of gross capital flows on the differential growth rate of industries that are more dependent on external finance, both for the pre-crisis and the post-crisis period. Statistically significant results are observed for total gross capital inflows and other gross capital inflows for the post-crisis time period, and for total gross capital inflows and for foreign direct investment inflows in the pre-crisis period. This suggests that foreign direct investment did not contribute to investment in financially dependent sectors before the crisis, and that the reduction of other capital inflows after the crisis lowered credit supply in industries that depend more on external finance.

For net capital flows we observe a differential growth advantage for financially dependent industries in countries with net capital outflows in the pre-crisis period. This result suggests that the positive effect of net capital inflows on total investment in the pre-crisis period did not translate into a higher growth rate for those industries. After the crisis, no statistically significant coefficient can be observed for net capital flows, which stands somewhat in contrast with the results for investment.

Overall, the results show that there was an impact of changes in capital flows after the financial crisis, both in quantitative terms and in qualitative terms, and that the impact of capital flows on investment and gross value added growth in the domestic economy not only depends on the size of changes, but also on the composition of capital flows. The reversals of capital flows affected the differential efficiency of the allocation of finance to different sectors in the European countries and contributed (not surprisingly) to the slowdown in investment.

Before the crisis, larger capital inflows did not always support industries that were more dependent on external finance, suggesting that high gross capital flows supported a misallocation of financial resources in weak economies. This contributed to a build-up of unsustainable imbalances in the Eurozone, which in turn led to the sovereign debt crisis The results suggest that the structure of gross capital inflows matters.

4.5. Banking systems

4.5.1. Introduction

Due to the high dependence of investment on external financing, the smooth and frictionless operation of capital markets and the banking system as a whole play a crucial role in facilitating the allocation of financial resources to different investment projects. Especially in bank-based financial systems, banks play a central role in the allocation of financial resources across competing uses, even if non-financial corporations finance about half of

their investment activities from their own (internal) funds, while the remainder comes from external sources (e.g. EIB, 2013).

In this context, the availability of finance has played a significant role as a constraining factor for investment during the recent crises. While large corporations have sought to build up cash reserves, small and medium-sized enterprises - all of which highly depend on bank financing - have been hit hardest. As a result, concerns about access to credit in an adverse economic and financial environment have led firms to reduce their dependence on external financing. The inability of the banking sector to allocate resources efficiently across different geographical regions and sectors of the economy has the potential to impair the recovery of the European economy as a whole. Against this background, the following section discusses some recent developments in the European banking sector.

4.5.2.Banking systems in the EU countries

Eight years after the start of the crisis, banking systems in the EU countries are still at different stages of balance sheet repair, with some banks still requiring further significant adjustment. So far, banks in the EU countries have taken significant steps towards adjusting their balance sheets, but the progress has been uneven. In the Euro area, in particular, a number of banks are facing noteworthy cyclical headwinds as well as structural challenges in the form of deteriorating asset quality, weak profitability and elevated funding costs - all of which impair the ability of banks to contribute their share to an economic recovery. While immediate pressure is less acute for banks of non-Euro area economies, the process of balance sheet deleveraging and de-risking is not yet finished.

The macrofinancial environment in the EU was characterized by an ongoing financial fragmentation in the last few years. This resulted in adverse feedback loops between weak banks, weak non-financial sectors and sovereigns in financially distressed economies, which fostered divergence in financial and economic conditions. In this environment, weak banks exacerbated weaknesses in the non-financial sector. In particular, banks with thin buffers have been tightening credit conditions for enterprises by rationing credit and increasing lending standards. The weak performance of the non-financial enterprise sector in turn augmented the problems of weak banks: high corporate leverage interacted with weak profitability and created debt-servicing difficulties for enterprises, which in turn led to a sharp rise in non-performing loans, worsening the quality of assets in banks' balance sheets. This in turn led to tighter bank lending conditions, putting an additional drag on the corporate sector. As a result of this feedback loop, bank lending contracted and lending rates remained at elevated levels.

The efforts in bank balance sheet repair undertaken so far have made banks in the EU economies more resilient to credit and liquidity shocks, thanks to regulatory initiatives that increased the amount and quality of capital, reduced funding mismatches and raised liquidity buffers.

Table 8.3 and Table 8.4 in the Annex show key balance sheet indicators for the EU countries based on loss-absorption capacity, profitability, asset quality and reliance on wholesale

funding. These characteristics are measured by means of (1) capital adequacy ratio, (2) return on assets (RoA), (3) non-performing loan ratio (NPL) and (4) loan-to-deposit ratio. The table highlights that many EU banking systems remain relatively vulnerable, as the loss absorption capacity is low relative to the volume of impaired loans, asset quality continues to deteriorate in some countries, and profitability is weak across most EU countries.

In general, EU banks have continued to reshape their balance sheets via capital raising, liability restructuring and asset reduction, with cutbacks in high-risk assets. This is because banks have concentrated on (1) reducing capital-intensive (high-risk-weight) businesses; (2) steering loan portfolios to those with lower-risk weights; (3) holding greater liquidity buffers of cash and government bonds with zero-risk weights; and in some cases, (4) optimizing risk-weight models[33]. This has helped to strengthen the banks' financial positions. However, there is also a remarkable degree of country-specific heterogeneity. In particular, while European banks have on average substantially increased their regulatory capital ratios, core Euro area banks' leverage and reliance on wholesale funding remains relatively high. Some of the structural deficiencies of EU banks are being tackled by means of programs supported by the ECB, the European Commission, and the IMF (Greece, Ireland, and Portugal), by means of system-wide reforms assisted by the European Stability Mechanism (Spain), or by means of targeted financial sector action plans aimed at increasing loan loss provisions, strengthening capital and funding plans and improving bank efficiency where needed (Italy, Austria). While large core Euro area and U.K. banks have been progressively de-risking and deleveraging, the process of balance sheet repair is not yet complete - capital buffers against impaired loans are not yet as high as those of their peers and reliance on wholesale funding and leverage are still relatively high.

4.5.3.Economic weakness continues to impair balance sheet repair

Despite some improvements, the outlook remains subdued. Rising risks of low inflation or even deflation and low growth perspectives have recently pushed banks' equity valuations down, and weak sentiment has been reinforced by the poor earnings conditions. A further cyclical challenge to bank profitability comes as central banks continue to push policy rates into negative territory, which in turn depresses net interest margins and hence profitability.

Against this background, asset quality and profitability will be further placed under pressure by the still weak macroeconomic environment. While funding conditions have improved, concerns about asset quality and profitability have recently moved to the forefront. A prolonged period of low policy interest rates is likely to exert pressure on banks' pre-provision profits. The net interest margins (NIMs) of many advanced economies' banks have been on the decline for a number of years (IMF 2016), with pressures from low policy rates becoming more acute for banks that offer fixed-rate savings deposit products to customers.

[33] The fall in risk-weighted assets would likely have been more pronounced if risk weights on the trading book had not been raised under Basel 2.5 at the same time as banks cut back their asset positions.

Banks that face a higher exposure to economies with subdued growth perspectives are more vulnerable to a further deterioration in asset quality. Some banks (primarily from the euro area periphery) have both low levels of loss absorption buffers and significant exposures to weak economies, which makes them highly vulnerable to an economic downturn. In some cases in turn, the concerns surrounding banks' asset quality are exacerbated by the fact that banks are holding assets that are hard to value, such as for instance commercial real estate exposures. Uncertainty addressing asset valuations as well as risk weights of certain assets is reinforcing investor concerns as bank asset quality and capital adequacy tend to be scrutinized by investors, in particular when the economic prospects are weak. If these uncertainties are hard to ascertain from reported bank level data - for instance, due to differences in reporting standards - investors demand higher risk premiums, which in turn further raises bank funding costs. Two major issues are of concern in this respect:

- First, market participants and regulators are concerned that some banks might be engaging in excess lender forbearance. In general, lender forbearance can make it difficult to assess the quality of assets and to estimate the full scale of potential losses and required provisions and capital. At times, this is practiced in order to smooth the recognition of non-performing loans, especially if banks' profitability and loss absorption capacity are low, or where legal regulations render the resolution of impaired loans difficult.
- Second, there are significant uncertainties concerning the calculation of risk-weighted assets. Indeed, the Basel Committee on Banking Supervision recently highlighted that the dispersion of risk-weights cannot be explained through publicly available information (BCBS, 2013). Other studies concerning banks' risk weights on assets have reached similar conclusions.

4.5.4.Ongoing efforts to better contain liquidity risk

The falling loan-to-deposit ratios shown in Table 8.4 imply that banks are changing their funding policy and hence the liabilities side of their balance sheets in order to reduce their use of wholesale, short-term, and cross-border funding sources. This occurs in response to (1) the higher cost of wholesale funding, particularly where there is the prospect of bailing-in holders of bank debt; (2) the funding risk as experienced in form of the wholesale funding runs during the crisis; (3) Basel III liquidity requirements (which favour more stable funding sources: LCR and NSFR); and (4) the increased incidence of macroprudential fine-tuning of bank liquidity and capital on the national level[34].

In the vein of the last point, some internationally operating banks are increasingly aiming to match their assets and liabilities on a country-by-country basis. This occurs in a move to render their subsidiaries self-funded over time, which is encouraged by regulators in certain countries (e.g.: Austria: Loan-to-Local-Stable-Funding-Ratio (LLSFR)).

[34] This is partly due to the slow progress in establishing a cross-border resolution framework

In general, matching assets and liabilities on a country-by-country basis implies that banks would have to close deposit funding gaps. One way to close these gaps is to raise deposits locally; another possibility is to hold back new lending. Encouragingly, recent trends suggest that foreign subsidiaries of banks - notably those operating in eastern European countries - have been fairly successful at raising local deposits (EBA 2015) rather than cutting down on local lending.

4.5.5.Nonperforming loans remain at elevated levels

Weak bank profitability in EU countries increases the problem of low asset quality by reducing banks' capacity to build loss absorption buffers through retained earnings. For many banking systems, elevated non-performing loans (NPLs) comprise a major structural problem (see Table 4.9). As highlighted in IMF (2016), Euro area banks still have an outstanding volume of €900 billion in non-performing loans (as of end-June 2015).

Table 4.9: Non-performing loans to total loans in percent, 2007 to 2014

	2007	2008	2009	2010	2011	2012	2013	2014
Austria	2.2	1.9	2.3	2.8	2.7	2.8	2.9	3.5
Belgium	1.2	1.7	3.1	2.8	3.3	3.8	4.3	4.4
Bulgaria	2.1	2.4	6.4	11.9	15.0	16.6	16.9	16.7
Cyprus	-	3.6	4.5	5.8	10.0	18.4	38.6	44.9
Czech Republic	2.4	2.8	4.6	5.4	5.2	5.2	5.2	5.6
Germany	2.7	2.9	3.3	3.2	3.0	2.9	2.7	2.3
Denmark	0.6	1.2	3.3	4.1	3.7	6.0	4.6	4.4
Estonia	0.5	1.9	5.2	5.4	4.0	2.6	1.5	1.4
Spain	0.9	2.8	4.1	4.7	6.0	7.5	9.4	8.5
Finland	0.3	0.4	0.6	0.6	0.5	0.5	-	-
France	2.7	2.8	4.0	3.8	4.3	4.3	4.5	4.2
United Kingdom	0.9	1.6	3.5	4.0	4.0	3.6	3.1	1.8
Greece	4.6	4.7	7.0	9.1	14.4	23.3	31.9	33.8
Croatia	4.8	4.9	7.7	11.1	12.3	13.8	15.4	16.7
Hungary	2.3	3.0	8.2	10.0	13.7	16.0	16.8	15.6
Ireland	0.6	1.9	9.8	13.0	16.1	25.0	25.7	20.7
Italy	5.8	6.3	9.4	10.0	11.7	13.7	16.5	17.3
Lithuania	1.0	6.1	24.0	23.3	18.8	14.8	11.6	8.2
Luxembourg	0.4	0.6	0.7	0.2	0.4	0.1	0.2	-
Latvia	0.8	2.1	14.3	15.9	14.1	8.7	6.4	4.6
Malta	5.9	5.5	5.8	7.0	7.1	7.8	8.9	9.0
Netherlands	-	1.7	3.2	2.8	2.7	3.1	3.2	3.1
Poland	5.2	2.8	4.3	4.9	4.7	5.2	5.0	4.8
Portugal	2.8	3.6	4.8	5.2	7.5	9.8	10.6	11.9
Romania	2.6	2.7	7.9	11.9	14.3	18.2	21.9	13.9
Sweden	0.1	0.5	0.8	0.8	0.7	0.7	0.6	1.2
Slovenia	1.8	4.2	5.8	8.2	11.8	15.2	13.3	11.7
Slovakia	2.5	2.5	5.3	5.8	5.6	5.2	5.1	5.3

Source: European Central Bank.

Although banks' capital bases have improved (see Table 8.3 in the Annex), making banks safer, lending capacity remains constrained for many banks, especially in the crisis countries, and profitability expectations are still low. De-risking banks' balance sheets by means of

reducing NPLs would free up bank capital and hence encourage credit growth. Progress has been made in resolving non-performing loans, in the form of higher loan-loss-provisioning ratios. However, the pricing gap remains an important impediment to a reduction in NPLs[35].

Table 4.10: Average returns on assets for European banking systems, 2007 -2014

	2007	2008	2009	2010	2011	2012	2013	2014
Austria	-	0.1	0.2	0.5	0.1	0.3	0.0	0.1
Belgium	0.4	-1.5	-0.1	0.5	0.1	0.2	0.4	0.5
Bulgaria	1.9	2.0	1.1	0.8	0.6	0.6	0.6	0.9
Cyprus	-	0.9	0.6	0.6	-3.6	-3.6	-5.2	-0.6
Czech Republic	1.3	1.1	1.4	1.3	1.2	1.4	1.1	1.2
Germany	-	-0.3	-0.1	0.1	0.1	0.0	0.1	0.1
Denmark	-	-0.1	-0.2	0.1	0.0	0.1	0.2	0.3
Estonia	-	1.3	-3.4	0.4	3.1	2.0	1.8	1.6
Spain	-	0.7	0.6	0.5	0.0	-1.4	0.4	0.5
Finland	1.1	0.5	0.4	0.4	0.3	0.3	0.4	0.4
France	0.4	0.1	0.2	0.4	0.3	0.2	0.3	0.2
United Kingdom	-	-0.4	0.0	0.2	0.2	0.1	0.1	0.2
Greece	-	0.6	0.1	-0.3	-0.3	-0.3	-0.3	-1.0
Croatia	-	-	-	-	-	-	0.1	0.5
Hungary	-	1.0	1.7	0.0	-0.9	-0.4	0.0	-2.0
Ireland	-	0.0	-1.7	-3.1	-0.6	-0.9	-0.9	0.9
Italy	0.7	0.3	0.3	0.3	-0.9	-0.1	-0.8	-0.2
Lithuania	1.4	0.8	-3.9	-0.3	1.5	0.9	1.0	0.9
Luxembourg	-	0.0	0.4	0.5	0.2	0.5	0.5	0.5
Latvia	-	0.2	-4.0	-1.7	0.5	0.6	0.9	1.0
Malta	0.7	0.2	1.8	1.0	0.8	1.1	0.7	0.7
Netherlands	-	-0.4	0.0	0.3	0.3	0.2	0.2	0.2
Poland	1.8	1.3	0.7	1.0	1.2	1.2	1.1	1.0
Portugal	0.9	0.2	0.3	0.4	-0.2	-0.3	-0.7	-1.2
Romania	1.8	1.7	0.6	0.3	0.1	-0.6	0.1	-1.3
Sweden	-	0.5	0.2	0.5	0.4	0.5	0.5	0.6
Slovenia	0.9	0.4	0.1	-0.2	-0.8	-1.5	-8.0	-0.3
Slovakia	1.0	0.8	0.5	0.9	1.2	1.0	1.0	0.9

Source: European Central Bank.

4.5.1.Banks face tighter regulatory requirements along various dimensions

Regulatory requirements add further challenges to the already existing cyclical and structural impediments in the banking sectors. Banks face higher regulatory demand for higher capital ratios as a result of ongoing regulatory actions. However, some banks, especially in the member states most hit by the crisis, have difficulty meeting the existing requirements. Under the Basel III timetable, banks will be subject to leverage ratio requirements starting in 2018. Many European banks will also need to raise bail-in-able liabilities in order to meet the stricter regulatory requirements that force them to meet total loss-absorbing capacity. Additional regulatory challenges address the size of banks. Although large institutions continue to play a dominant role in the EU banking system, markets and regulators are putting pressure on banks

[35] The pricing gap is defined as the difference between book value of an asset in the bank balance sheet and the price an investor is willing to pay.

to become smaller, simpler and more focused on servicing their home markets by imposing stricter regulations banks with foreign affiliates.

As highlighted in Table 4.10, the (average) return on assets for European banks is structurally low at 0.25 to 0.50 percent; this compares with about 1 percent for U.S. banks. The low return on assets is, among other things, a consequence of the excess capacity in the European banking system which will have to be addressed at some point (IMF, 2016). In many countries, a consolidation and downsizing of the banking system might be required so that the remaining banks can enjoy higher pricing power and sufficient demand, in order to increase banks' capital generation capacity and thereby likely render the system as a whole more stable.

4.5.2.Summary

To summarize, a large share of European banks, especially in the crisis countries, face a combination of cyclical, structural and regulatory challenges. Deteriorating profitability and unresolved legacy challenges raise the risk that re-financing could become more expensive, and this particularly applies to weaker banks with low equity valuations and subdued profit prospects.

Addressing these issues and strengthening the banking system as a whole will have positive side effects for other policy institutions. In particular, a healthy banking system can help enhance the transmission of monetary policy, increase confidence, and mitigate any adverse side effects of negative interest rates. In the long run, a stronger and more efficient banking system is also needed in order to improve the allocation of financial resources across competing needs.

4.6. Banking systems, financial integration and investment growth at the industry level

4.6.1.Introduction

The above description of the state of the European banking systems indicates that banking systems are undergoing substantial change. In the period before the crisis, European banks increased their lending activities at home and abroad. Banks increased their leverage and were dependent on wholesale funding. The shock with the financial crisis led to an adjustment process during which banks needed to change their operations, partly in response to new capital regulations and partly in response to refinancing constraints as the interbank funding markets dried up. This process of deleveraging can affect credit availability for enterprises if banks reduce their leverage by reducing lending.

Many studies have shown that during the crisis lending was sharply reduced and that this was associated with a reduction of economic activity in more financially dependent sectors. Dell'Arica et al. (2008) provide robust evidence for significant negative growth effects of financial crises. Bijsma et al. (2013) show that industries that are more dependent on external finance experienced lower growth rates during the 2007–2009 crisis years. The negative

differential growth effect for industries that depend more on long term finance was larger for countries with more leveraged banking systems. Bijsma et al. (2013) conclude on this basis that the crisis in fact led to a credit crunch.

In this subsection we study two different aspects relevant for assessing banking systems in Europe. First, we study whether the quality of the banking system affects investment growth. Many European banking systems have to reduce the share of non-performing loans, increase regulatory capital ratios, have a need to improve profitability and are in the process of decreasing their loan to deposits ratio. Are banking systems with better banks along these lines better at allocating investment finance? This is the first question. The foreign ownership of banking operations is an inherent feature of financial integration in Europe. After the crisis, banks started to reduce their foreign presence by closing or selling foreign affiliates. As documented by Schnabel and Seckinger (2015) this process continued well into 2012, while domestic banks did not immediately reduce their balance sheets. They began with this process in late 2011. Acharaya and Steffen (2014) argue that the liquidity support of the ECB helped to avoid massive balance sheet reductions. Schnabel and Seckinger (2015) studied whether foreign bank presence can reduce the impact of domestic deleveraging. We are more generally interested in the question of whether foreign bank presence helped reduce the impact of deleveraging of the entire banking system.

4.6.2. Measuring the state of the European banking systems

Measuring the quality of banking systems is a difficult task, as many indicators are not precise enough as the previous overview on European banking systems has suggested. Most analyses of banking during the crisis look at the impact of a reduction of the supply of finance (e.g. credit volume) or at one specific indicator of banks balance sheets – namely leverage.

We focus on the four indicators usually used in discussions on the quality and stability of banking systems discussed earlier (section 4.5) and try to isolate common components that capture important dimensions of banking system quality. Table 4.11 presents the correlation coefficients between return on assets (ROA), the regulatory capital ratio (TIER), the leverage of the banking sector (LEVER) and the ratio of non-performing loans to total loans (NPL). The correlations show that the relationship between the indicators is somewhat weak. It is important to note that ROA and TIER should be high, while NPL and LEVER should be low in order to signal a high-quality banking system.

Table 4.11: Correlation of indicators of banking system quality across time and countries

	NPL	ROA	TIER	LEVER
Non performing loans (NPL)	1			
Return on Assets (ROA)	-0.43	1		
Tier 1 Capital (TIER)	0.01	0.26	1	
Leverage (LEVER)	-0.32	-0.23	-0.36	1

Source: WIFO calculations.

In order get a better grip on the notion of quality of the banking system we perform a principal component analysis in order to isolate unobservable components that signal the quality of the banking system. The four indicators are normalised in such a way that a higher value indicates a higher quality of the banking system. The principal component analysis suggests to retain two components based on the usual cut-off limit of an eigenvalue of 1. The correlation of the matrix between the principal components and the original variables is depicted in Table 4.12. The first principal component is highly correlated with the return on assets (ROA), the regulatory capital ratio (TIER) and a lower leverage (LEVER), as the correlation is negative. The association with the non-performing loan ratio (NPL) is negative but low. Nevertheless we call the indicator "quality of the banking sector" (overall). The second principal component is primarily associated with the non-performing-loan ratio and returns to assets. This suggests that the first principal component should be considered an indicator of overall banking system quality, while the second principal component (quality of the banking sector (NPL)) is primarily an indicator of the non-performing loans ratio.

Table 4.12: Correlation of summary banking sector quality indicators and single indicators of banking quality

	Quality banking sector (overall)	Quality banking sector (NPL)
Non performing loans (NPL)	-0.10	-0.92
Return on Assets (ROA)	0.69	0.53
Tier 1 Capital (TIER)	0.72	-0.13
Leverage (LEVER)	-0.71	0.51

Source: WIFO calculations.

4.6.3.Methodology

In order to investigate the impact of the quality of national banking systems on investment, the same econometric methodology as before is used. The econometric specification reads:

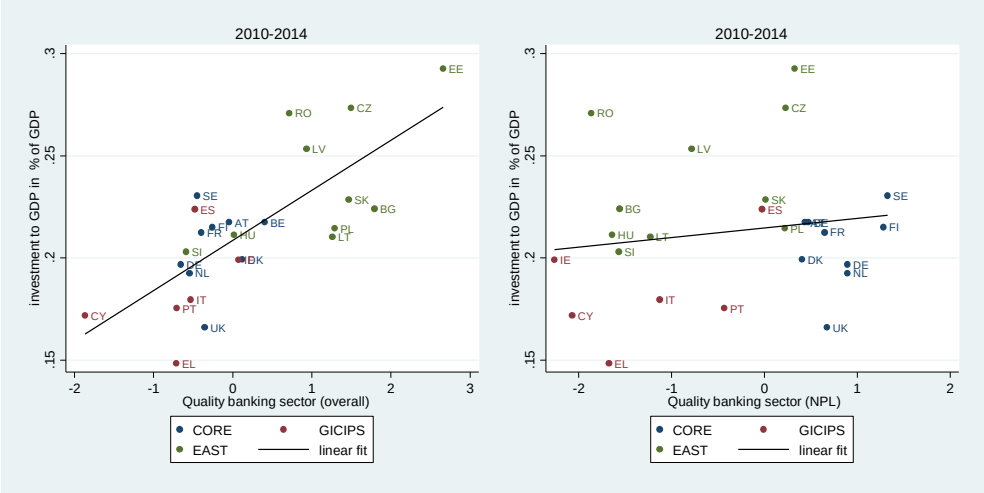
(Eq. 4-3) $$gr(I_{ijt}) = \theta_{ij} + \gamma_{it} + \delta_{jt} + b_1 FD_j \times BQ_{it-1} + \varepsilon_{ijt},$$

where $\mathrm{gr}(\mathrm{I}_{\mathrm{ijt}})$ is the growth rate of investment in country i, industry j and time t. θ_{ij} are as before country-industry effects, γ_{it} are country-time fixed effects, δ_{jt} are industry-time fixed effects, FD_j is the measure of external financial dependence of industry j based on the country specific measures of external financial dependence in Table 4.4 , $\mathrm{BQ}_{\mathrm{it}-1}$ is the lagged indicator of banking structure quality (principal components 1 and 2, as well as the single indicators) and ε_{ijt} is the time, country and sector-specific error term.

The basic idea is to identify national differences in the quality of banking systems by exploiting the variation across sectors for their expected impact, controlling for industry and country-specific unobserved factors. As before, we are only able to estimate the differential growth effect of banking quality, i. e., if banking quality does not foster the allocation of funds

towards more financially dependent sectors, then the coefficient is 0. However, nothing in the economic literature suggests that this should be the case.

Figure 4.10: Investment share in GDP and the banking structure quality indicator, 2010 - 2014



Source: WIFO calculations.
Country group CORE consists of BE DK DE FR NL AT FI SE and UK, Country group GICIPS consists of CY IE EL ES IT PT, country group EAST consists of CZ EE LV LT HU PL RO SI SK. MT and LU are excluded because of their small country size and role as financial centres.

In order to provide an illustration of the association between the banking system quality indicators and the overall investment share, Figure 4.10 plots the average investment share in GDP and the banking quality indicator. The relationship between the first indicator (overall) and investment growth is positive, but does not indicate causality. The banking structure indicator for the GICIPS countries suffered in the aftermath of the crisis as did the investment share in those countries. The second indicator (NPL) that is primarily associated with the non-performing-loans ratio shows a weak positive association with investment share that is statistically not significant. The econometric methodology we use allows to go beyond this association and to identify causal relationships between banking system quality and investment growth.

4.6.4.Results

Table 4.13 reports the results for the impact of our summary indicators of banking system quality on investment growth. Separate regressions for the growth rate of total investment and of its components are presented. The results for the indicator of overall banking system quality suggest that banking systems with higher overall quality do not foster the allocation of total investment and investment in buildings and structures in financially more dependent industries. However, there is a positive growth differential for financially dependent industries with regard to the growth rate of intangible investment. Even if the methodology controls for many confounding effects (e.g. country or industry effects) this result could be affected by endogeneity issues due to the short–term effects in the period 2008 to 2014, the strong

slowdown of investment in buildings and structures in the GCIPS countries and the short time period under consideration. A negative growth effects is also observed for the second quality indicator related to the nonperforming loan ratio - quality banking system (NPL). However, this result may also be due to the fact that banking systems in many crisis countries have worse NPL ratios.

Table 4.13: Regression results for investment growth and summary banking system quality indicators, 2008 - 2014

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	growth rate				growth rate			
	total inv.	mach. & equip.	buildings	intangible	total inv.	mach. & equip	buildings	intangible
Quality banking sector (overall)	-0.003	-0.012	-0.037**	0.013*				
	(-0.52)	(-1.28)	(-3.19)	(2.48)				
Quality banking sector (NPL)					-0.005	-0.002	-0.057**	0.010
					(-0.77)	(-0.21)	(-4.51)	(1.55)
Observations	2,940	2,668	2,435	2,268	2,940	2,668	2,435	2,268
R2	0.697	0.653	0.630	0.753	0.698	0.655	0.629	0.745

Source: WIFO calculations.
Notes: robust regression results (Huber estimator) **, * and + denote statistical significance at the 1%, 5% and 10% level respectively. t-values are in brackets. Observations for MT and LU are excluded because of their small country size and role as financial centres.

Table 4.14: Regression results for investment growth and single banking system quality indicators, 2008 - 2014

VARIABLES	(1)	(2)	-3	(4)	(5)	(6)	(7)	(8)
	growth rate				growth rate			
	total inv.	mach. & equip.	buildings	intangible	total inv.	mach. & equip	buildings	intangible
banking ROA					-0.007	-0.022*	-0.053**	0.020**
					(-1.30)	(-2.25)	(-4.54)	(3.68)
NPL	0.001	-0.001	0.009**	-0.000				
	(0.52)	(-0.49)	(3.53)	(-0.39)				
Observations	2,940	2,668	2,435	2,268	2,940	2,668	2,435	2,268
R2	0.697	0.652	0.622	0.756	0.697	0.646	0.632	0.753

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	growth rate				growth rate			
	total inv.	mach. & equip.	buildings	intangible	total inv.	mach. & equip	buildings	intangible
Tier 1 capital	0.001	-0.003	-0.014*	0.003				
	(0.47)	(-0.67)	(-2.50)	(1.12)				
leverage of the banking system					0.029	0.035	-0.251**	-0.045
					(0.87)	(0.62)	(-3.59)	(-1.39)
Observations	2,940	2,668	2,435	2,268	2,940	2,668	2,435	2,268
R2	0.698	0.653	0.634	0.756	0.696	0.655	0.622	0.755

Source: WIFO calculations.
Notes: robust regression results (Huber estimator) **, * and + denote statistical significance at the 1%, 5% and 10% level respectively. t-values are in brackets. Observations for MT and LU are excluded because of their small country size and role as financial centres.

Table 4.14 reports the results for the single indicators. For the non-performing loan ratio no statistically significant result can be observed for total investment, investment in intangibles

and investment in machinery. However, there is a positive and statistically significant growth effect for investment in buildings and structures, which is largely counter-intuitive. For the return of investment a negative differential growth is observed for investment in buildings and structures and investment in machinery and equipment, while a positive growth effect emerges for intangible investment. The results for the capital ratio show a statistically negative differential growth effect for investment in buildings and structures, and a similar relationship is observed for the leverage ratio of the banking system. Thus, for countries with a less leveraged banking system and higher capital ratio we observe a negative differential growth effect for investment in buildings and structures. Overall, the results confirm that the quality of the banking sectors is only weakly associated with decreases of the efficiency of allocating financial funds across competing uses. It is important to take into account that these findings are mainly driven by short-term adjustments that may have a long-run impact on the supply of positive net present value loans (cf. Angelini et al. 2015).

Table 4.15: Regression results for gross value added growth and single banking quality indicators, 2008 - 2014

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	growth rate gross value added					
industry size	-6.078**	-5.846**	-6.468**	-6.042**	-5.840**	-5.886**
	(-20.00)	(-19.25)	(-21.32)	(-19.87)	(-19.25)	(-19.53)
Quality banking sector (PC1)	0.001					
	(0.59)					
Quality banking sector (PC2)		-0.001				
		(-0.71)				
Tier 1 capital			0.000			
			(0.46)			
banking ROA				0.00		
				(0.68)		
NPL					0.002	
					(1.26)	
leverage ratio						-0.023*
						(2.19)
Observations	3,223	3,223	3,223	3,223	3,223	3,223
R2	0.765	0.764	0.764	0.761	0.765	0.766

Source: WIFO calculations.
Notes: robust regression results (Huber estimator) **, * and + denote statistical significance at the 1%, 5% and 10% level respectively. t-values are in brackets. Observations for MT and LU are excluded because of their small country size and role as financial centres.

As a first robustness check, we look at the growth rate in value added. Table 4.15 presents the results. A statistically significant growth contribution of a banking quality indicator can only be observed for the leverage ratio. Financially constrained industries in banking systems with higher leverage ratios have a differential growth disadvantage. However, for no other indicator can a statistically significant impact be observed.

Overall, the results suggest that banking systems with a higher "regulatory" quality also do a “weakly” better job of allocating financial funds towards industries with higher need for long

term external finance. Thus, the trade-off between financing industries and more resilient banking systems is small, except perhaps during the period when banking systems need to adjust to a more resilient configuration. However, one could argue that these results are not necessarily related to banking sector quality as such, but could reflect the overall institutional quality of a country, which is relevant in directing finance towards more financially dependent industries. In order to counter such an argument, a second robustness check is presented in Table 4.16 where we use two widely used indicators of institutional quality, rule of law and regulatory quality from the worldwide governance indicator database provided by the World Bank. The results confirm the importance of the structural banking indicators compared to the overall institutional variables.

Table 4.16: Robustness results, growth of investment, banking structure quality and institutional quality, 2008-2014

	(1)	(2)	(3)	(4)
		2008-2014 growth rate		
VARIABLES	total inv.	mach. & equip.	buildings	intangible
Rule of law	-0.127+	0.021	-0.045	-0.008
	(-1.81)	(0.18)	(-0.31)	(-0.12)
Quality banking sector (overall)	0.016*	0.018	-0.009	0.004
	(2.57)	(1.63)	(-0.64)	(0.64)
Observations	2,553	2,315	2,112	1,973
R2	0.661	0.619	0.602	0.772

	(1)	(2)	(3)	(4)
		2008-2014 growth rate		
VARIABLES	total inv.	mach. & equip.	buildings	intangible
Regulatory quality	-0.034	-0.027	-0.339**	-0.004
	(-0.87)	(-0.42)	(-4.19)	(-0.10)
Quality banking sector (overall)	0.016**	0.020+	-0.012	0.004
	(2.66)	(1.84)	(-0.93)	(0.65)
Observations	2,554	2,314	2,112	1,973
R2	0.672	0.610	0.586	0.774

Source: WIFO calculations.
Notes: robust regression results (Huber estimator) **, * and + denote statistical significance at the 1%, 5% and 10% level respectively. t-values are in brackets. Observations for MT and LU are excluded because of their small country size and role as financial centre.

The structural banking sector variable (Quality of banking sector (overall)) gains significance and the institutional variables are generally associated with a statistically significant negative differential investment growth contribution for financially dependent firms. However, these results should not be overstated. The result in Table 4.16 clearly does not suggest that institutions do not matter for investment, but does highlight that institutions per se do not create a differential growth effect for financial dependent firms or relax financial frictions for financial dependent industries.

4.6.5.Financial integration

After having discussed structural characteristics of banking systems, the last remaining research question concerns the impact of financial integration in European banking on investment performance. Banks take on a central role in cross-border capital flows as they acquire foreign assets in addition to domestic assets. Banks issue loans to foreign entities and hold foreign bonds and other assets. On the liability side, banks raise external funding. Since the mid 1990s, financial integration in Europe increased rapidly. Banking became multi-national in many countries due to cross-border mergers and acquisitions. Together with cross-country capital flows to and from foreign banks, multinational banks contributed to the increase in capital flows in Europe. Part of the capital flows within banks became international when they went to or came from foreign affiliates. In fact, however, most of the cross-border capital flows by banks within Europe cross-border flows were dominated by capital flows between banks, even if retail banking remained fragmented, especially in Western Europe (cf. Allen et al. 2011). In Eastern Europe, banking systems were transformed in the time period between 1997 and 2005, when ownership patterns changed from predominantly domestic-owned banking systems - many banks in 1997 were still state-owned - to banking systems where foreign banks dominate. It is generally acknowledged that the entry of foreign banks was long-term orientated and helped to contain and reduce financial frictions in those financial systems (cf. Giannetti and Ongena, 2012, Friedrich et al. 2013).

The financial crisis led to a substantial reduction of cross-country capital flows in banking. The money markets disintegrated. The international interbank market was dramatically reduced as banks relied primarily on domestic counterparties. The process of further financial integration stopped, as international capital flows by banks decreased substantially and also came to halt with regard to cross-border expansions. While Berglöf et al. (2009) found a stabilising effect of foreign bank presence in Eastern Europe, de Haas and van Horen (2013) found that foreign banks reduced lending earlier and faster than domestic banks. The effect of foreign bank presence is thus of primary importance to the transmission of shocks. The question whether foreign banks are a factor that mitigates financial frictions or whether they limit financial access is important from the perspective of financial stability but also for the question of how international capital flows affect the investment across EU member states.

EU member states are quite heterogeneous with respect to the size of their banking sectors as well as the shares of foreign banks operating in domestic markets. While Western European banking sectors are larger than Eastern European ones, the share of foreign banks is substantially higher in the Eastern member states. Table 4.17 shows that in the period 2010-2014 foreign banks accounted on average for 73.7% of all assets in Eastern Europe, while the share of assets attributable to foreign banks in the CORE countries was 24.4% and in the GICIPS countries 23.8%. Table 4.17 also indicates that there is considerable heterogeneity across countries. For example, Slovenia still has a comparatively low foreign bank share although it is part of the Eastern European country group, while Finland and Ireland have a comparatively high foreign bank share although they are part of the CORE and GICIPS country group, respectively.

Table 4.17: Assets of foreign banks to total banking assets in European countries, 2010-2014

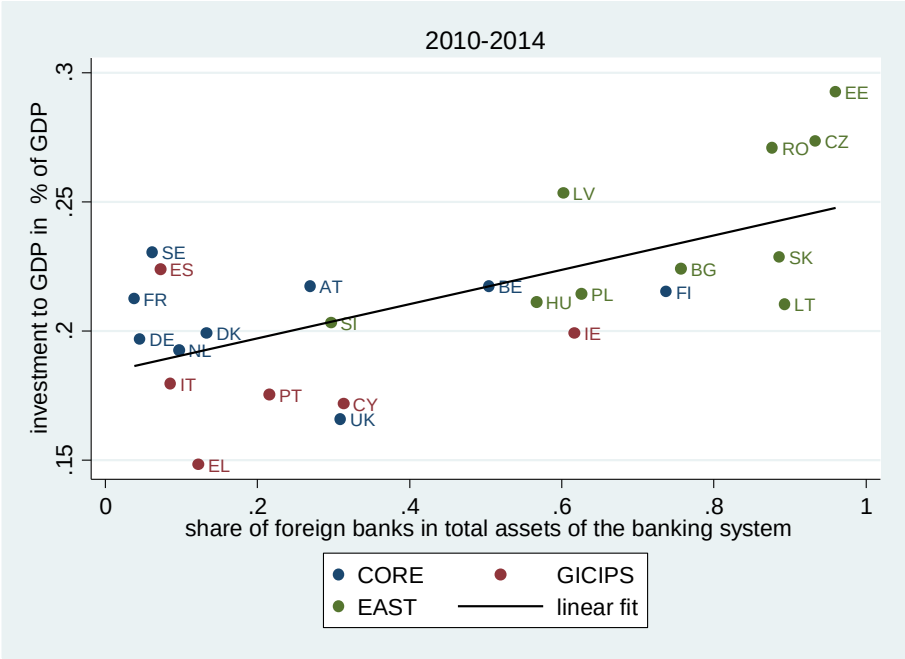
CORE	**24.4%**	**GICIPS**	**23.8%**	**EAST**	**73.7%**
AT	26.9%	CY	31.3%	BG	75.7%
BE	50.4%	EL	12.2%	EE	96.0%
DE	4.5%	ES	7.2%	LT	89.3%
DK	13.3%	IE	61.7%	LV	60.2%
FI	73.7%	IT	8.6%	PL	62.6%
FR	3.8%	PT	21.6%	RO	87.7%
NL	9.7%			SI	29.7%
SE	6.2%			SK	88.6%
UK	30.9%				

Source: ECB consolidated banking statistics.

There are important issues associated with cross-border banking and financial stability. Financial integration makes banking systems more interconnected and the financial crisis spread through financial channels, affecting the balance sheets of banks, as well as through real sector channels (trade). Allen et al. (2011) provide an assessment of the integration of banking systems in the EU countries and show that almost all Eastern European countries have unbalanced banking systems, where inflows dominate outflows. This creates a high vulnerability towards international capital flows. But the presence of foreign banks can be stabilizing, as Berglöf et al. (2011) argue, as Eastern Europe with its large share of foreign banks did not experience a as sudden stop of cross-border lending that is often observed for emerging economies during financial crisis. But foreign bank presence can also be associated with costs. Foreign banks are likely to be more mobile than domestic banks and can decide to scale back lending activities. Schnabel and Seckinger (2015) show convincingly that foreign bank presence helped during the financial crisis and later on in the event of a deleveraging of the domestic banking system. Their results also emphasize that the presence of foreign banks makes the difference. Using the same methodology but using a different financial dependence indicator they show that cross-border lending to non-financial corporations in not associated with a positive growth effect for financially dependent industries, but that the foreign presence in the domestic banking markets is associated with positive growth effects.

Figure 4.11 presents the association between the investment-to-GDP ratio and the share of foreign banks in total banking assets. Overall the relationship is weak but positive. It can clearly be seen that the relationship is positive for the Eastern European countries and weakly negative for the Core and GICIPS country groups. In order to go beyond association and country group specificities it is important to identify a causal impact of foreign foreign bank presence on investment growth. In order to do so, we use the same econometric methodology as before, which is also used by Schnabel and Seckinger (2015) in a very similar exercise that attempts to uncover the risks and benefits of increased financial integration of economic growth. However, Schnabel and Seckinger (2015) use a different indicator of financial dependence, their study concentrates on the manufacturing sector and they study production growth, not investment growth. However, from a methodological perspective the studies are remarkably similar. The econometric specification is:

Figure 4.11: Relationship between the investment-to-GDP ratio and the presence of foreign banks, 2010-2014



Source: WIFO calculations.
Country group CORE consists of BE DK DE FR NL AT FI SE and UK, Country group GICIPS consists of CY IE EL ES IT PT, country group EAST consists of CZ EE LV LT HU PL RO SI SK. MT and LU are excluded because of their small country size and role as financial centres.

(Eq. 4-4) $$gr(I_{ijt}) = \theta_{ij} + \gamma_{it} + \delta_{jt} + b_1 FD_j \times FOB_{it-1} + \varepsilon_{ijt},$$

where $\mathrm{gr}(\mathrm{I}_{\mathrm{ijt}})$ is the growth rate of investment in country i, industry j and time t. θ_{ij}, γ_{it} and δ_{jt} are country-industry, are country-time and industry-time fixed effects, respectively. FD_j is the measure of external financial dependence of industry j based on the country specific measures of external financial dependence in Table 4.4 , FOB_{it-1} is the lagged indicator of the foreign banking presence in country *i*. $\varepsilon_{\mathrm{ijt}}$ is the error term.

4.6.6.Estimation results

Table 4.18 presents the regression results. Results from two specifications are presented. The first specification uses the share of foreign affiliates and subsidiaries in total assets of the banking system as an indicator of foreign presence. The second specification uses an indicator of foreign bank presence that accounts for the both presence and the contribution of foreign and domestic banks to the balance sheet of the aggregate domestic banking system.

Regression results are presented for two separate samples. The first sample consists of all events where the banking sector in a country deleveraged. We follow Schnabel and Seckinger (2015) and define deleveraging as a reduction of the aggregate balance sheet of

a banking system in excess of -1.5%. All other observations are classified as non-deleveraging event. This allows pinning down the impact of foreign bank presence during "good" and "bad" times. The regression results for the first specification suggest a strongly negative growth differential for the presence of foreign banks during times of deleveraging. Only for intangible investment is a positive coefficient observed. For the non-deleveraging time periods we observe a positive and statistically significant growth differential of financially dependent industries for the foreign presence of banks. These results suggest a negative impact of financial integration in times of deleveraging of the banking system. This result strongly suggests that very unbalanced banking systems that are dominated by foreign banks may actually have a negative impact on investment by increasing financial frictions. Foreign banking may be associated with negative spill-over effects, especially if those banks experience difficulties (deleveraging) at home.

However, this need not be the whole story. Deleveraging can be due to foreign banks or due to domestic bank deleveraging. The first specification does not account for the presence and the contribution of domestic banks in the domestic banking system. For this reason, we use a second specification based on Schnabel and Seckinger (2015), that tries to take the behaviour of domestic banks explicitly into account. Schnabel and Seckinger (2015) argue that the share of assets to GDP provides a better measure of the benefits of banks to firms than credit flows, as banks and also foreign owned subsidiaries and affiliates provide services like M&A consulting and the provision of securities for hedge purposes that may affect the investment behaviour of firms. In order to account for such effects we express the presence of foreign and for domestic banks in terms of total assets to GDP for foreign banks and for domestic banks. The results for the specification are in the lower panel in Table 4.18. The estimation results are no longer heavily biased towards a negative impact of foreign bank presence on investment growth, probably because the variable assets of domestic banks to GDP act as a control variable that allows to isolate the effect of foreign bank presence from the change in the banking system as a whole. During times when the banking system experiences deleveraging, we see that the foreign presence of banks is associated with a negative growth differential with regard to total investment and intangible investment, but with a positive growth differential of financially dependent industries for buildings and structures. For domestic banks a positive growth differential is observed for investment growth in machinery and investment. During good times, foreign bank presence is in general associated with a negative growth differential of financially dependent firms for investment in machinery in investment, but domestic banks have a negative growth differential for overall investment growth. This may be an indication that domestically owned banks need not be better at allocating financial resources to industries that rely more on external finance.

Table 4.19 presents the results for gross value added growth as dependent variable as robustness check. Here the results show a negative growth differential for financially dependent industries when the foreign bank share is very high during times of deleveraging, while there is no statistically significant link between foreign bank presence and value added growth when foreign bank presence is measured in terms of assets to GDP ratio.

Table 4.18: Regression results for investment growth and foreign bank presence

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Deleveraging (<-1.5 pp) growth rate				Non-deleveragigng (>-1. 5pp) growth rate			
	total inv.	mach. & equip.	buildings	intangible	total inv.	mach. & equip.	buildings	intangible
Foreign banks share in TA	-1.477**	-1.293**	-1.949**	0.444+	0.237	0.531+	1.229*	-0.056
	(-6.44)	(-6.80)	(-6.89)	(1.84)	(1.01)	(1.68)	(2.50)	(-0.23)
Observations	1,352	1,132	1,013	930	1,581	1,531	1,420	1,336
R2	0.883	0.973	0.973	0.977	0.805	0.831	0.763	0.841

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Deleveraging (<-1.5 pp) growth rate				Non-deleveragigng (>-1. 5pp) growth rate			
	total inv.	mach. & equip.	buildings	intangible	total inv.	mach. & equip.	buildings	intangible
Foreign bank TA to GDP	-0.001**	0.001+	0.001**	-0.001*	0.001+	-0.001*	0.002	0.000
	(-4.89)	(1.72)	(2.66)	(-2.26)	(1.65)	(-2.07)	(1.13)	(0.40)
Domestic bank TA to GDP	0.000	0.001**	0.001	-0.001+	-0.001*	0.001*	0.000	-0.001
	(0.50)	(2.73)	(1.37)	(-1.87)	(-2.05)	(2.40)	(0.26)	(-1.46)
Observations	1,353	1,132	1,011	929	1,581	1,529	1,418	1,335
R2	0.885	0.964	0.972	0.981	0.802	0.815	0.782	0.845

Source: WIFO calculations.
Notes: robust regression results (Huber estimator) **, * and + denote statistical significance at the 1%, 5% and 10% level respectively. t-values are in brackets. Observations for MT and LU are excluded because of their small country size and role as financial centres.

Table 4.19: Regression results for gross value growth and foreign bank presence

VARIABLES	(1)	(2)	(3)	(4)
	Deleveraging (<-1.5 pp) growth rate gross value added		Non-deleveragigng (>-1. 5pp)	
Industry size	-8.948**	-8.722**	-2.893**	-3.059**
	(-16.95)	(-16.45)	(-7.07)	(-7.66)
Foreign banks share in TA	-0.233**		-0.122	
	(-3.40)		(-1.62)	
Foreign bank TA to GDP		0.001		-0.001
		(0.08)		(-0.28)
Domestic bank TA to GDP		-0.001		0.001
		(-1.39)		(0.85)
Observations	1,539	1,533	1,677	1,681
R2	0.915	0.914	0.847	0.855

Source: WIFO calculations.
Notes: robust regression results (Huber estimator) **, * and + denote statistical significance at the 1%, 5% and 10% level respectively. t-values are in brackets. Observations for MT and LU are excluded because of their small country size and role as financial centres.

Overall, the results for foreign bank presence suggest that financial integration is associated with benefits during "bad" times. The results complement the results of Schnabel and Seckinger (2015) for a broader set of industries and using a different measure of financial

dependence. Foreign bank presence and banking sector integration needs to be built on balanced foundations. While Schnabel and Seckinger (2015) show that banking integration has a growth effect during crisis times, the present estimation results show that the growth effect of foreign banks is smaller in the case of overall banking sector deleveraging. However, it also important to note that the analysis did not reveal strong robust and positive growth effects of domestic bank presence. In fact, a dominant position of domestic banks seems to be associated with an overall lower investment growth. This is in line with the current debate that stresses that the size of the banking sector is not the relevant aspect for promoting economic growth (e.g. European Systemic Risk board 2014). Overall, the results suggest that foreign bank presence can reduce financial frictions. A further fragmentation of European banking could therefore be associated with higher financial frictions and thereby reduce investment and value added growth.

4.7. Summary and conclusions

The evidence collected in this chapter clearly shows that investment - although trending up in the last two years - remains well below pre-crisis levels for many EU Member States and that capacity utilization is still weak in most countries. The weakness in investment is partially related to the weakness of expected demand and amplified by the deleveraging of the public and private sectors after the crisis. For some countries, the weakness of demand is also related to a pre-crisis over-investment in housing (buildings and structures). Creating an environment that supports investment and productivity growth in Europe is central. In addition to the question of how to improve investment in Europe, the interrelated question of how the European financial systems can be made more stable to satisfy the financing needs of the corporate sector remains central.

In many countries banks steadily tightened lending standards, and economic uncertainty remains high compared to the pre-crisis episode. The outlook is clouded by macroeconomic risks, including weak demand and geopolitical tensions. As a consequence, bank lending to the corporate sector remains weak. Accommodative monetary policies have promoted balance sheet repair, especially in the financial and non-financial sectors and encouraged economic risk taking, which has contributed to a brighter outlook for capital expenditure. At the same time, however, accommodative monetary policies may cause too much financial risk taking, as reflected in rising asset prices in some countries. The use of accommodative monetary policy involves a trade-off between the upside benefits from support for balance sheet repair and economic risk-taking on the one hand, and the downside risks from an extended period of excess risk-taking in financial markets on the other. Too much financial risk-taking is likely to increase macrofinancial risks that may in turn undermine real economic growth, while on the other hand too much economic risk-taking can result in excess-consumption and/or excess-investment and increased private sector leverage as households and firms ramp up borrowing. Yet economic risk-taking is lagging far behind financial risk-taking. Hence, the benefits of accommodative monetary policies (both conventional and unconventional) have not been successful in restoring investment in Europe. The fragmentation of European financial markets increased after the crisis. This is partly a home-

bias of investors and financial institutions, but also reflects the uneven economic growth and associated balance sheet repair across European countries and low medium-term growth prospects. While the risks associated with financial excesses remain moderate, monetary accommodation remains critical to supporting the recovery by fostering economic risk-taking in the non-financial sector.

It is important to note that the dynamics of investment are heterogeneous across its different components across country groups. The largest impact is observed for investment in housing and buildings and structures, especially in the crisis countries. Similar patterns are found for investment in machinery and equipment. Investment in intangible assets was much less affected by the crisis. This is partly driven by structural change towards intangible investment and partly by the different nature of investment in intangible capital.

The empirical evidence shows that during and after the crisis, capital flows changed dramatically. Capital flows, and especially capital flows associated with cross-border banking activities, saw a sudden halt during and after the crisis. Capital mobility declined and the matching between domestic savings and domestic investments became more important in Europe, leading to a process of slowing down of financial and banking integration, and even reversing it. These quantitative changes in the capital flows also led to qualitative changes in the relationship between investment and capital flows. Before the financial crisis, larger net capital inflows were not associated with an improved allocation of resources toward more financially dependent sectors for total investment. After the crisis, we observe a better allocation of resources to financially dependent sectors for total investments, but not for investment in buildings and structures. However, the results also show, that, when accounting for cross-border banking activities, there is not much evidence for the claim that it had an impact the allocation of financial resources across industries before or after the crisis. Domestic lending remains crucial for investment finance in most bank-based economies in Europe and hints at the importance of foreign bank presence (banking integration) to compensate domestic bank weaknesses in the Single Market.

Due to the different impact of the financial crisis, the banking systems in many European countries still face different cyclical, structural and regulatory challenges. The situation in the banking system has improved as capital buffers have increased and regulation has reduced leverage. But there is still the need for some further measures to strengthen European banking systems. While it is often argued that imposing stricter regulations may lead to a credit crunch, the present study finds there is only a weak impact of an improved quality of the banking system on lending towards more financially dependent industries. This suggests that, while the (necessary) repair of banks balance sheets may have led to heightened financing constraints in some European countries, firms affected by these constraints are not primarily found in those industries which need the most financing for investment.

The situation in the banking system has improved. Capital buffers have increased and regulation has reduced leverage. But there is still a need for further measures to strengthen the integration of European financial markets. As emphasized by Langfield and Pagano (2016), the complexity of the resolution mechanism, the potentially insufficient scale of its

funding and the absence of a centralized deposit insurance mechanism, could hinder the prompt and orderly resolution of large, systemically important banks. This calls for further steps for the regulation of systematically important banks. The single supervisory mechanism (SRM) is still complex and entrusted to national authorities and the single resolution fund may have a limited capacity for the resolution of a truly systemically financial institution. The establishment of a single, centralized deposit insurance mechanism would reduce the risks banks run associated with cross-country deposit flows.

The results of the present study show that an integrated European banking market can be one element in supporting the efficient allocation of financial resources across industries and firms. A diversified domestic banking system with the presence of foreign banks is important to reducing financing constraints in Europe. In this context, foreign banks help alleviate domestic banking shocks and excessive deleveraging, but may also have negative impacts, as foreign banks may also import foreign shocks. Here, the available evidence suggests that well-balanced banking systems with the presence of foreign banks are better at allocating financial resources to competing uses that unbalanced banking systems consisting mainly of domestic or for foreign banks (especially if from a small set of countries).

However, while banks are relevant for investment, security markets are especially relevant for new and fast growing firms. Supporting the development of European securities markets is thus a second pillar of financial integration in Europe. Europe is a collection of mainly bank-based financial systems and many EU member states have quite small securities markets in comparison to other economies. This is especially visible in the fragmentation of stock exchanges in Europe. While initial public offerings in the United States are dominated by two stock exchanges (NYSE and NASDAQ), the European IPO Market is much more fragmented and is served by a number of regional or national stock markets. Euronext covers the Netherlands, France, Belgium and Portugal and OMX the Nordic and Baltic countries. However, in the rest of Europe domestic stock exchanges dominate. This fragmentation reduces market liquidity (eg. See Foucault et al. 2013). However, even a highly liquid stock exchange may not generate much additional investment finance if the number of listed companies remains limited. For this reason, the goal of capital market integration should not be exclusively focused on reducing fragmentation, but rather on increasing liquidity for smaller, growth-oriented enterprises. Reducing initial public offering (IPO) costs and the cost of subsequent offerings of new growth-oriented firms is especially relevant in the context of modern industry, where intangible assets and investment in intangible assets is becoming more and more important. Especially for investment in intangible capital, security markets and stock exchanges could play an important role and encourage the development of a financial "ecosystem" that complements and supports the entrepreneurial "ecosystem". The non-bank financing of firms complements bank-financing and becomes more important when investment becomes intangible. A true capital market union that is geared towards investment needs to include mechanisms that reduce the fragmentation in European stock and bond markets and reduce regulatory costs for enterprises, but do not increase risks for investors.

5. The role of Migration as an Economic Transmission Mechanism

Migration is a controversial issue in economic and social policy debates in most European countries. Opinion polls show that citizens often blame immigration from abroad for increasing unemployment, inequality and criminality, and also perceive immigrants as causing high costs to the welfare state. The public debate thus suggests that immigration is a cause rather than a solution of economic and social problems and that the presence of foreign nationals in host countries' territories has reached or surpassed the optimum. Given this view, a large number of analyses have focused on determining the factual substance of these claims.[36] The consensus emerging from this literature is that, if at all, migration has a much less dramatic negative impact on medium term host country development than a casual observer of the public debate would be led to expect.

According to economic theory, however, migration has the further important, but less analysed, function of contributing to the equilibration of regional and national labour markets and the equalization of living conditions: As migrants move from places with low returns for their specific human capital to places with higher returns, they – aside from increasing their own welfare – also contribute to equilibrating regional and national labour markets, thus also equalizing living conditions across countries and regions. This chapter of the study assesses the degree to which migration in the EU has contributed to the adjustment of regional and national labour markets before, after and during the economic crisis of 2008/09. It uses data from the European Labour Force Survey (ELFS) to ask three central questions related to the role of migration in labour market adjustment in the EU. The first of these is to what extent internal and cross-border migration in the EU has been an important adjustment mechanism to asymmetric shocks since the crisis. The second is whether cross-border migration contributed to regional convergence in labour market conditions in the period between 2004 and 2014. The third is to what degree migration led to a redeployment of labour on the sectoral or regional level in this time period.

To answer these questions, sections two and three of the chapter provide a selective survey of the literature and discuss the available data, respectively. Section four uses this data to recapitulate some of the stylized facts of regional labour market development that will be scrutinized more closely in the subsequent sections. Section five, by contrast, following recent contributions by Caneda and Kovak (2016) for the United States and Jauer et al. (2014) for the OECD countries, assesses the reaction of population growth to regional employment, unemployment and GDP growth in the period before, during and after the financial and economic crisis of 2008 and 2009. Section six then focuses on the impact of immigration from abroad on the development of regional labour markets in the 2005 to 2014 period. In particular, this section first follows the methodology developed in Borjas (2001) to determine

[36] See for instance the meta-studies of Longhi (2005, 2008, 2009) for a survey of the labour market effects of immigration or the literature on the net receipts of immigrants from the welfare state such as for example Barrett and Maitre (2013), Boeri (2010), Dustmann et al. (2010), Huber and Oberdabernig (2016) and Pellizzari (2013).

whether labour market segments that have experienced higher inflows of third-country immigrants showed stronger signs of convergence before, during and after the crisis in Europe. This part thus addresses the question of whether migration from within and outside the EU has contributed to a reduction in regional labour market disparities in the different time periods considered. Furthermore, this section also follows a recent contribution by Braun and Kavasnicka (2014) to assess whether – as predicted by theory – immigration boosts output per worker by expanding high productivity sectors' employment, but decreases output per worker within a sector. Finally, section seven summarizes the results and highlights policy-relevant findings.

5.1. Literature survey

As stated above, economic theory considers lacking regional labour mobility to be an impediment to economic growth, a cause for high and persistent regional labour market disparities and a major factor hampering the improvement of individual living conditions both in the EU and in other regions of the world (e.g. Lall et al, 2006, Janiak and Wasmer, 2008, Quispe-Agnoli and Zavodny 2002; Mas et al. 2008 and Huber and Tondl, 2011). On the one hand, this is because in a world where the region of birth of an individual is a powerful predictor of lifetime income (Bosquet and Overman, 2016) and where large regional disparities in terms of income, unemployment and poverty exist, mobility is an obvious possibility for individuals (and/or households) to improve their well-being and escape from unemployment and poverty. On the other hand, this is because countries with low labour mobility are unlikely to take full advantage of the positive effects of urbanization on productivity and income growth in the long run (see World Bank, 2009) and because in low labour mobility environments (adverse) region-specific shocks to labour demand may lead to large and persistent regional disparities in terms of income and unemployment in the short to medium run. This last point is of particular importance in the context of monetary unions, such as the European Monetary Union (EMU), because ever since the seminal contribution of Mundel (1961) it is clear that a monetary union inter alia requires sufficient labour market flexibility (either in the form of wage adjustments or mobility) to be viable.

Despite this high importance of regional mobility for both individuals' incomes and macro-economic development, available data and studies suggest that immobility rather than mobility is the rule for most people in many countries. For instance, using Eurobarometer data, Vandenbrande et al. (2007) report that the share of those that have never moved (even within their community) after leaving their family is 27% in the EU and may reach up to one third in high-unemployment EU countries such as Greece. Fischer et al. (2000) find that 87% of the Swedish population does not move residence over a 15-year period and Huber (2010) focusing on the EU13 economies covered in the Life in Transition Survey (LITS) finds that more than half of the interviewed respondents in many of the EU13 countries have lived in their current village (town or city) of residence their entire lives.

5.1.1. The Blanchard – Katz approach

Despite this large share of immobile persons, a number of contributions have also attempted to assess the efficacy of migration in adjusting asymmetric labour demand shocks in both the EU and other regions of the world. A first wave of this research was motivated by both theoretical and empirical innovations as well as the ongoing debate on the viability of EMU in the 1990s. On the empirical front, in this literature a much cited contribution by Blanchard and Katz (1992) uses pooled data on US states from 1978 to 1991 to run tri-variate vector auto/regressions of the form:

(Eq. 5-1) $$\Delta l_t = \varphi_{0i} + \varphi_1(L)\Delta l_{t-1} + \varphi_2(L) er_{t-1} + \varphi_3(L)\, pr_{t-1} + \xi_t^D$$

(Eq. 5-2) $$er_t = \phi_{0i} + \phi_1(L)\Delta l_t + \phi_2(L) er_{t-1} + \phi_3(L)\, pr_{t-1} + \xi_t^D$$

(Eq. 5-3) $$pr_t = \theta_{0i} + \theta_1(L)\Delta l_t + \theta_2(L) er_{t-1} + \theta_3(L)\, pr_{t-1} + \xi_t^D$$

with l_t, er_t and pr_t the log of employment, the employment rate (i.e. the negative unemployment rate) and participation rate relative to the national average at time t, respectively. In conjunction with the definition of the change in employment ($\Delta l_t = \Delta er_t + \Delta pr_t + m_t$) estimates of this model can be used to assess the contribution of migration to accommodating exogenous shocks to regional labour demand. Blanchard and Katz (1992) find that, in a typical US state, a unit transitory negative labour demand shock raises the unemployment rate by 0.34 percentage points above the national average in the first year and lowers the activity rate by 0.26 percentage points, while emigration accounts for 0.4 percentage points of the total adjustment.

This methodology was subsequently applied to other countries within and outside the EU. These studies mostly aimed to assess the viability of EMU. In general, they find that migration contributes less to the adjustment to labour market shocks in the EU than in the US and that changes in activity rates are more important in the EU than in the US. For instance, Decressin and Fatás (1995) find that in the EU a unit transitory negative labour demand shock lowers the activity rate by 0.75 percentage points and increases unemployment rates by 0.22 percentage points. Immigration, by contrast, only accounts for 4 percentage points of this adjustment. L'Angevin (2007), in a study on the Euro area countries covering the period 1970-2005, finds that inter-state mobility plays a minor role in the Euro area countries and that, compared to the US, it takes more time for unemployment and participation to return to a long-run equilibrium after the shock. Although some authors (Fredrikson 1998, Deglaigle and Lohest 1999, Bentolila and Jimeno 1998) find a larger role for adjustment through migration for some EU countries (i.e. Sweden, Belgium and Spain), these results were further corroborated in a number of country studies and for the (at that time still) first and second wave of eastern European candidate countries of the EU (see Table 5.1).

Table 5.1: Comparison of shares of shock accommodated in the literature

	Employment Rate	Participation Rate	Net Migration
US (1978 – 1990, 51 States) Blachard and Katz (1992)	34	26	40
Australia (1978 – 1997, 7 States) Debelle and Vickery (1998)	20	40	40
Europe (1973-2005, 12 member States) L'Angevin (2007)	33	44	23
Europe (1975 – 1987, 51 Regions) Decressin and Fatas (1995)	22	75	4
Spain* (1976 – 1994, 17 regions) Jimeno and Bentolila (1998)	36	23	41
Sweden (1966 – 1993, 24 regions) Fredrikson (1998)	8	26	66
Finland (1976 – 2000, 11 regions) Pekkala and Kangashartju (2002)	27	65	8
Netherlands* (1993 – 1999, 18 regions)** Boersma and van Dijk (2002)	14	74	12
Belgium (1970 – 1995, 3 Regions)[a)] Deglaigle and Lohest (1999)	-4 to 22	3 to 33	45 to 99
Germany (27 years, 8 regions) Fatas (2000)	12	93	-5
Italy (27 years, 11 regions) Fatas (2000)	37	62	1
UK (27 years, 11 regions) Fatas (2000)	12	91	-3
ES, DE, PT, IT, NL(1989 – 1995, 68 Regions) Gacs and Huber (2005)	34	68	-2
First Round new EU countries (1992 – 1998, 141 regions) Gacs and Huber (2005)	19	75	6
Second Round new EU countries (1992 – 1998, 69 regions) Gacs and Huber (2005)	90	62	-53
		Recent Results	
US (22 years, 51 US States) Dao et al. (2014)	22	24	54
EU (1998-2009, 173 NUTS I regions) Dao et al. (2014)	16	60	24
EU (1977-2011, 47 regions) Beyer and Smets (2014)	30	40	31
EU (1970-2013, 15 countries)* Arpaia et al (2014)	43	32	25
EU (1970-2007, 15 countries)* Arpaia et al (2014)	34	38	28

Source: Gacs and Huber (2005), Arpaia et al (2014).
Note:* Quarterly Data, ** First quarter a) separate for each of three regions

The financial and economic crisis (and the formation of the EMU) has recently raised renewed interest in this strand of research. This second wave of research on regional labour market adjustments in Europe consistently shows an increased responsiveness of migration to asymmetric labour demand shocks. For instance, Dao et al. (2014) assess the adjustment of US states for the 1978 to 2013 period and NUTS 1 EU regions for the 1998 to 2009 period. Consistent with recent evidence on a long-term downward trend in US interstate migration (see Molloy et al., 2011), they find that the role of participation and unemployment has increased, while the contribution of inter-state mobility has decreased in the US. In European regions, by contrast, the short-term response of labour mobility has increased. In a similar vein, Beyer and Smets (2015) compare US and EU labour market adjustments to find that a significant difference between adjustments in the EU and the US only exists with respect to the response of mobility to common shocks. In addition, a recent study commissioned by DG-Employment (Arpaia et al., 2014) finds that the importance of mobility in adjusting regional shocks has increased since the financial and economic crisis and a recent case study on France by Detang-Dessendre et al. (2016) using a slightly different methodological approach finds surprisingly high amounts of economic migration, which indicate that most new jobs are taken up by immigrants (from abroad or within the country) and/or commuters in France.

5.1.2. Single regression approaches

While the Blanchard and Katz (1992) approach generates important insights, it also has some limitations. The first of these is that in the model defined in equations (Eq. 5-1) to (Eq. 5-3) migration is imputed from the response of the participation and the employment rate to aggregate employment fluctuations. Ideally, to assess the responsiveness of migration to changes in labour demand, one would like to have a more direct measure of migration or population changes in a region. The second drawback is that the identification of the parameters of the model in equations (Eq. 5-1) to (Eq. 5-3) relies on the time variation across regions. This requires long time series and thus does not lend itself to analysing potential changes in the responsiveness of migration to labour market shocks found in the previous literature. Finally, the Blanchard and Katz (1992) approach also does not lend itself to analysing the potential differences in mobility reaction to labour demand changes of different population groups (such as persons of different qualification levels, different nationalities or between genders).

As a consequence, a second much followed approach in the literature has been to estimate single equation models of mobility responses to changes in aggregate labour demand of the form:

(Eq. 5-4) $$y_{it} = \beta X_{it} + \gamma Z_{it} + \xi_{it}$$

where y_{it} is a measure of migration or population change in region i and period t, X_{it} are a set of indicators for the labour market (or economic) situation of the same region in the same

time period (such as the region's employment growth, its unemployment rate or its GDP) and Z_{it} is a set of further control variables deemed to be important for migration decisions. [37]

Borjas (2001) uses this approach in a pioneering study that analyses the impact of immigrants on regional labour market adjustment. He argues that immigrants are more responsive to asynchronous changes in labour demand across regions than natives, as they have already paid for some of the psychological and financial costs of moving residence (such as the costs of leaving behind friends and family). According to this argument, therefore, immigrants "grease the wheels" of an economy. Empirically, Borjas (2001) finds that in the US labour market segments which experienced more immigration showed clearer tendencies of regional convergence than ones which experienced below-average immigration. The estimates imply that this "greasing of the wheels" effect, by increasing the productive efficiency of the US economy, generated a welfare increase to natives of somewhere between 10.3 to 22.0 billion US $ (or up to 0.2% of US GDP at the time the study was written).

This analysis has also been repeated for a number of European countries and has recently also been applied to EU-wide data. Most of this evidence suggests higher mobility among immigrants than among natives and therefore favours the greasing-the-wheels hypothesis. Amuedo-Dorantes and de la Rica (2005) show that immigrants are more responsive to regional employment differentials than natives in their migration decision, Schündeln (2007) finds the same for Germany, as do Roed and Schone (2010) for the entry, exit and within country mobility decisions in Norway and Aslund (2005) in a study using quasi-experimental data for Sweden. More recently, Moreno-Galbis and Tritah (2016) find that increased migration to a particular occupation also contributes to native job growth in that occupation due to reducing search costs for potential employers.

The single regression approach has also been used to analyse the labour supply and mobility responses of different groups of the population during and after the financial crisis and to assess the importance of different labour market institutions in making immigrants in a country more reactive to aggregate fluctuations. Jauer et al. (2014), based on previous work by Puhani (2001), estimate a version of equation (Eq. 5-4) in which changes in the overall population, as well as changes in the population of natives, citizens of other EU countries and changes in third-country citizens of a region (as a proxy measure for mobility) are regressed on the regional unemployment rates and GDP per capita. They, too, find that the migration response to the crisis has been considerable in the EU. According to their estimates, migration absorbed a quarter of the asymmetric labour demand shocks within a year in an upper bound estimate. Jauer et al. (2014), however, also show that most of this increased mobility in the EU stems from the response of migration of third-country nationals to the EU.

Candea and Kovak (2016), by contrast, regress regional population changes on measures of regional employment growth in the US to find that low-skilled Mexican-born immigrants

[37] These could include time varying control variables or region- or time-specific fixed effects to account for region-specific time invariant characteristics such as amenities or the common part of the business cycle that affects all regions equally.

responded much more strongly to local labour demand shocks than low-skilled natives. This, according to the authors also led to a reduced impact of local demand shocks on natives in regions with a high share of Mexican-born residents. For a given labour demand shock, natives living in US metro-areas with a substantial Mexican-born population experienced a 50% weaker reduction in employment than natives living in metro areas with only few Mexican immigrants. Monras (2015) extends this by showing that in particular adjustments of the number of in-migrants to a region is an important contribution to the adjustment capability of regional labour markets. He, however, also criticises the study by Candea and Kovak (2016) for not taking into account the different underlying long-term trends in immigrant and native population growth in different regions.[38]

Finally, Guzi et al. (2015) use the single regression approach to regress changes in immigrant labour supply on a wage-based measure of labour shortage as well as regional unemployment rates and GDP per capita. Subsequently, they interact the measure of labour shortage with institutional features of the national labour markets of the EU. Their results indicate that the responsiveness of low-skilled immigrants to labour market shortages is higher than that of low-skilled natives only in countries with social expenditures above the mean, high unemployment protection, high bargaining coverage or more open migration policies and that, regardless of whether they come from the EU or not, high-skilled immigrants are about as responsive to labour shortages as high-skilled natives.

A slightly different approach is used by Landesmann and Leitner (2015). They explore the reaction of natives and immigrants in reallocating employment across sectors to find that immigrants also react more elastically to business cycle fluctuations in terms of both gross and net mobility than natives. These authors, however, also suggest that the presence of immigrants in a labour market only has a direct impact on the adjustment behaviour of natives in some of the many different labour market groups analysed in that study.

The aim of this chapter is to further corroborate these results and to also analyse how the reaction of different groups in terms of regional mobility differs for the pre-crisis, crisis and post-crisis-period. Thus, below we will primarily focus on quantity adjustments in the labour market. This implies that we will miss out on a number of alternative adjustment mechanisms that may also have been important for labour market adjustment in European regions. One of these is wage adjustments, which were, however, analysed in a recent study by Verdugo et al. (2016). This shows that the acyclicality of real wages found in previous studies is mainly due to changes in the composition of employees over the business cycle. After controlling for these composition effects these authors find a real wage elasticity of -0.6 to -1.0 in the 5 European economies considered.

Another adjustment mechanism not considered is working time adjustment, which, as pointed out by Boeri and Brücker (2011) and Balleer et al (2015), has been a more important aspect of labour market adjustment in Europe in the Great Recession than in previous

[38] As explained below we will account for this in the current study by using panel econometric techniques.

recessions, and according to Balleer et al (2015) has also been helpful in saving jobs in this time period.

5.2. Data

The main data source for this chapter is the European Labour Force Survey (ELFS). This is used to construct time series on regional population growth of different demographic groups of the active aged population (aged 20 to 64) that is not in full time training[39] delineated by age, education, gender and migrant status[40] and to obtain information on the respective groups' unemployment rates and employment growth at the regional level. This data is augmented by additional information on aggregate regional GDP per capita taken from the EUROSTAT as well as OECD regional databases.[41]

The ELFS covers all 28 EU countries for the 2004 to 2014 period except for Malta (where data are available only as of 2010) and Croatia and Denmark (where data are available as of 2009), as well as all EFTA countries except for Lichtenstein (i.e. Switzerland, Iceland and Norway). Furthermore, for all of these countries (except for Iceland and the Netherlands) it also includes regional information on the NUTS 1 or NUTS 2 level of the respective countries, although in a number of countries only one NUTS 2 region exists. In total, the data thus provide information on 218 regional units for most years (see Table 5.2). When, however, merging this data with GDP data from EUROSTAT/OECD sources, Switzerland and the year 2014 have to be omitted from the analysis on account of missing data problems. Furthermore, in this case data from Norway is also only available for the years from 2008 to 2012. Thus, whenever GDP indicators are included in the analysis a slightly smaller dataset is available.

To provide a consistent regional classification for the entire time period, the change in the NUTS2 classification in 2010 was accounted for. This applies in particular to Finland where the two 2006 NUTS 2 regions of Pohjois-Suomi and Itä-Suomi (FI1A and FI13 in the 2006 NUTS version were merged to one single region (Pohjois- ja Itä-Suomi - FI1D) in the 2010 version of the NUTS2 classification, while the region of Etelä-Suomi was split in two new NUTS2 regions (Helsinki-Uusimaa and Etelä-Suomi). To provide for an as large as possible number of observations, the Finnish NUTS2 regions of Helsinki-Uusimaa and Etelä-Suomi in the 2010 NUTS2 classification were merged to the pre-existing Etelä-Suomi. Similarly, the two 2006 NUTS 2 regions of Helsinki-Uusimaa and Etelä-Suomi were merged to the new Pohjois- ja Itä-Suomi.

[39] These restrictions, following Caneda and Kovak (2016), are set to focus only on that part of the population, whose mobility decisions are most likely to be influenced by economic considerations. They also justify the use of the ELFS rather than standard macroeconomic and regional data sources, as these usually only provide information on active aged population (in the age bracket 15-64).

[40] The focus on demographic groups is another justification for the use of the ELFS as this provides for more flexibility in defining these groups than standard macro data.

[41] This data was constructed by using regional GDP data from EUROSTAT and as far as possible filling in gaps with information taken from the OECD regional data base. In detail data for Germany from 2004 to 2009, Italy from 2004 to 2010, and Iceland for the complete period and Norway from 2008 to 2010 are taken from OECD sources. Since OECD reports GDP in national currencies and EUROSTAT in Euro we use average annual exchange rates to calculate EURO values, where necessary.

Table 5.2: Country and regional coverage of the ELFS

	Regional lev	Time period		No. of Regions
		From	To	
AT	NUTS1	2004	2014	3
BE	NUTS2	2004	2014	11
BG	NUTS2	2004	2014	6
CH	NUTS1	2004	2014	7
CY	NUTS2	2004	2014	1
CZ	NUTS1	2004	2014	8
DE	NUTS1	2004	2014	16
DK	NUTS2	2008	2014	5
EE	NUTS2	2004	2014	1
ES	NUTS2	2004	2014	19
FI	NUTS2	2004	2014	4
FR	NUTS2	2004	2014	22
GR	NUTS2	2004	2014	13
HR	NUTS2	2008	2014	2
HU	NUTS2	2004	2014	7
IE	NUTS2	2004	2014	2
IS	NUTS0	2004	2014	1
IT	NUTS2	2004	2014	21
LT	NUTS2	2004	2014	1
LU	NUTS2	2004	2014	1
LV	NUTS2	2004	2014	1
MT	NUTS2	2010	2014	1
NL	NUTS0	2004	2014	1
NO	NUTS1	2004	2014	7
PL	NUTS2	2004	2014	16
PT	NUTS2	2004	2014	7
RO	NUTS2	2004	2014	8
SE	NUTS2	2004	2014	8
SI	NUTS1	2004	2014	2
SK	NUTS1	2004	2014	4
UK	NUTS1	2004	2014	12

Source: ELFS, WIFO calculations.

5.2.1. The sample used

The available data provides a sufficiently large country and time coverage to differentiate our analysis by a number of different country types (such as EU member states[42], EMU

[42] We classify all 28 countries that were EU members in 2014 as EU28 countries and differentiate between countries that were already members in 2004 (these are referred to as EU15 countries) and the countries that joined after 2004 (the EU13). The 3 EFTA countries will be considered as a separate group of analysis.

countries and non-EMU countries with different exchange rate regimes[43]). It also provides for a differentiation among countries according to when they introduced the freedom of movement of labour vis a vis the 13 EU member states that joined the EU in 2004 and 2007, respectively. Furthermore the data also provide sufficient information to allow for a separate analysis of different sub-periods such as a pre-crisis period, which will be the period from 2004 to 2008, the crisis period (2009 to 2011) and the post-crisis period (2012 to 2014).[44]

The ELFS is, however, based on a questionnaire conducted on a sample of residents and is thus subject to sampling errors. One consequence of this is that to avoid issues related to providing data that is unreliable due to high sample errors, EUROSTAT provides upper and lower reliability bounds below which either data should be reported with a special note or should not be reported at all[45]. We will follow this suggestion. This implies that for descriptive analyses such data will have to be either highlighted as unreliable (when failing to achieve the higher limit) or suppressed (when failing to achieve the lower limit). At the level of aggregation of the current chapter, this issue is particularly relevant when considering the group of foreign-born[46] (both in aggregate as well as disaggregated into foreign-born from other EU countries and from third countries). This is because the number of observations in a number of CEE countries is too low to allow for a reliable analysis of the data for the one or the other group (or for both).

Furthermore, the measurement of the foreign-born population is complicated because the German and Bulgarian LFS do not pose the question on the country of birth. It is thus only known whether a person was born abroad or not, but not whether they were born in another EU country or in third countries. One way to deal with this is to use nationality data to impute country of birth. Another possibility is to omit these countries altogether. Since according to our results imputation may lead to sizeable discrepancies[47], we follow both approaches when presenting a number of results that differentiate between foreign-born from other EU countries and from third countries.

There are also some limitations to the data with respect to regional break down. In particular only one region is available in a number of countries (i.e. Cyprus, Estonia, Iceland, Latvia, Lithuania, Luxemburg, Malta and the Netherlands). This implies that for the analysis of regional

[43] Aside from the 13 countries that joined the EU after 2004, during our period of analysis Slovenia (in 2007), Cyprus and Malta (2008), Slovakia (2009), Estonia (2011) and Latvia (2014) joined the Euro zone. Furthermore, according to (https://en.wikipedia.org/wiki/List_of_countries_by_exchange_rate_regime) of the countries considered Bulgaria, Denmark; Lithuania, Switzerland, Norway and Romania had fixed exchange rates as did all those countries that joined the Euro during our observation period, before joining the Euro. By contrast, the Czech Republic, Norway, Poland, Iceland, Sweden and the UK had floating exchange rates as did Hungary after 2008. We will use this time variation to analyse the impact of Euro adoption on labour market adjustment through migration below.

[44] The motivation for this periodisation was to strike a balance between accurately capturing the period of crisis and subsequent recovery and to also provide sufficient time variation for a meaningful econometric analysis.

[45] For details see: http://ec.europa.eu/eurostat/statistics-explained/index.php/EU_labour_force_survey_%E2%80%93_data_and_publication#Publication_guidelines_and_thresholds.

[46] Measures of the stock of migrants residing in a country are based on their country of birth throughout. This avoids issues with differences in naturalisation laws across EU countries

[47] According to ELFS data in 2010 3.4 million of the estimated 7.7 million foreign born in Germany had a German citizenship while an estimated 692.7 thousand persons born in Germany had a foreign citizenship.

disparities within a country separate country by country results cannot be provided for these countries.

In addition, there was a structural break in the NACE classification in 2008, when the previously applicable sector division according to NACE Rev. 1.1 was replaced by NACE Rev 2. This implies that structural data on the section level of NACE Rev. 2 before and after 2008 is based on a different structure of the sectors and is incomparable.[48] As a consequence, the ELFS reports sector of employment (for the employed) for NACE Rev. 2 in the post 2008 period only. There are thus no data available at the sectoral level before 2008 in the ELFS. All analyses related to structural change (in section 5) can therefore be conducted for the 2008-2013 period only[49]. This clearly has the drawback that for this step of the analysis only the crisis and post-crisis period can be analysed while the pre-crisis analysis has to be skipped.

Furthermore, there was also a structural break in the occupational ISCO classification in the time period under consideration (from ISCO-88 to ISCO-08). Thus, we base all occupational information before 2011 on ISCO-88 and all that after 2011 on ISCO-08. This, however, is of lesser importance for the current chapter, as this information is only used to construct instruments of the predicted employment change in a region (see below for details).

5.3. Stylized facts

5.3.1. Regional changes in employment and unemployment

The data reflect many of the stylized facts concerning regional development, regional labour market disparities and the persistence of regional employment and unemployment rates that have been documented in the literature on regional labour market development after the economic crisis (see e.g. Brakman et al. 2015, Fingleton et al. 2012, Fratesi and Rodriguez-Pose 2016) and will be scrutinized in more detail below. For instance, even in the economic boom period preceding this crisis (i.e. the period from 2004 to 2008), which was marked by an overall decline in the unemployment rate of the countries in our sample by over 2 percentage points, more than a fifth (44 out of 210) of the regions considered (mostly located in Spain, the southern UK and Eastern Hungary) experienced an increase in their unemployment rates. The maximum increase in the unemployment rate in this period was 5.9% (in the Canary Islands), while a number of regions located in the east of Poland experienced double digit declines (see Figure 5.1).

Average annual employment growth (see Figure 5.2) was only slightly less heterogeneous. In aggregate, employment grew by 2.3% annually in the economies for which we have data in this period, but 23 regions (mostly located in Hungary but also including Latvia and some

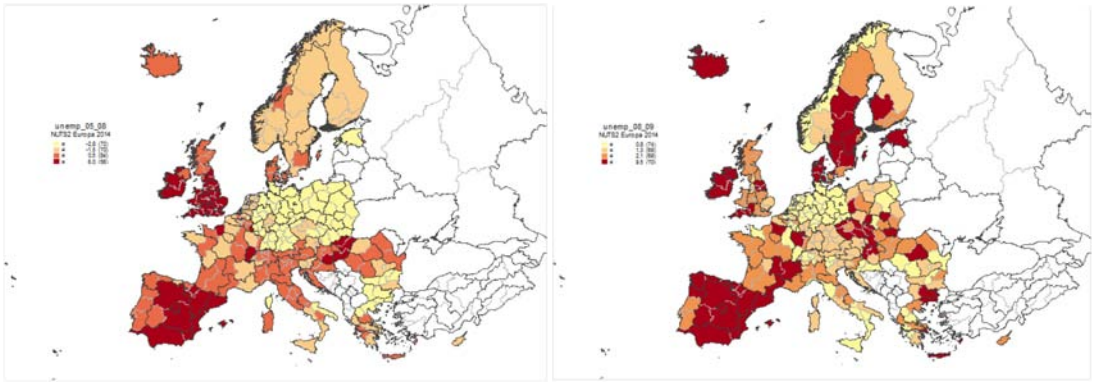
[48] In particular relative to the previously applicable NACE Rev 1.1 the current classification provides a substantially more detailed classification of the service sectors, with some industries, that were previously affiliated with manufacturing branches regrouped to services. For instance the NACE Rev. 1.1 had 17 sections and 62 divisions; NACE Rev. 2 has 21 sections and 88 divisions. While correspondence Tables between NACE Rev. 1.1 and NACE Rev. 2 exist at the 3-digit or lower levels the introduction of some new sections, makes easy overall comparison between NACE Rev. 2 and its previous version at the highest level of aggregation impossible.

[49] 2014 has to be dropped on account of missing GVA data for this year.

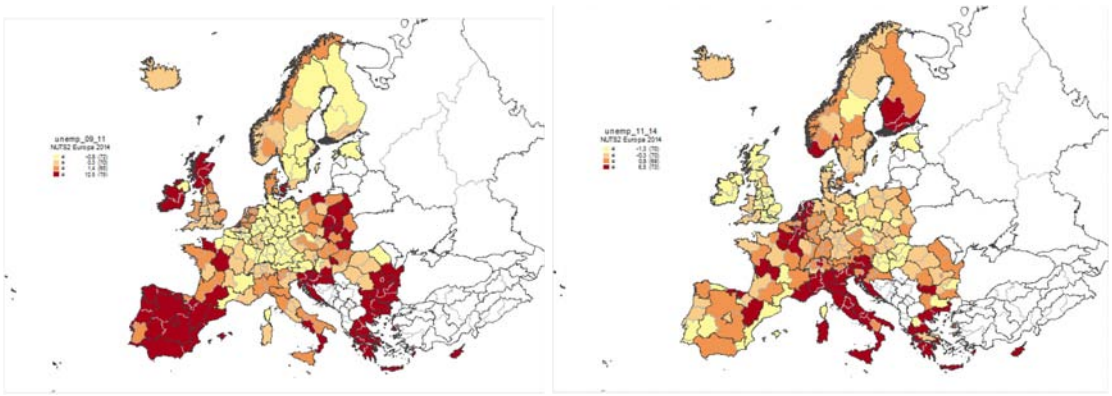
Spanish and Italian regions) registered declines. Thus, the maximum average annual employment growth rate among the European regions in this period amounted to 7.4% in the Polish Mazowieckie region and the maximum average annual decline was -2.3% in the Del-Dunatul in Hungary.

Figure 5.1: Changes in unemployment rates of the active aged population not in full time training by NUTS2 regions and periods (in percentage points)

2005-2008 2008-2009



2009-2011 2011-2014



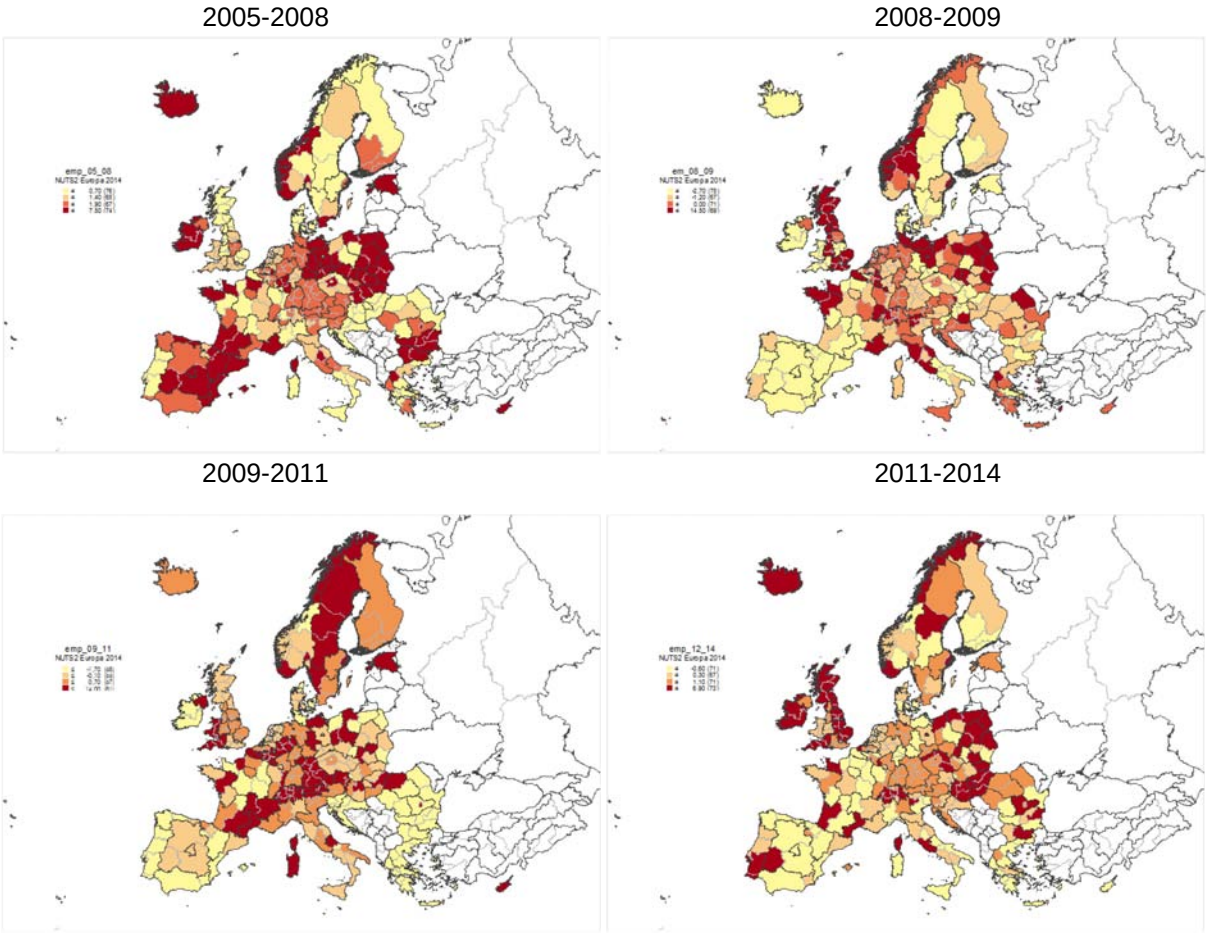
Source: ELFS, WIFO calculations.
Note: Sample: Active aged population (aged 20 to 64) not in full time training. Darker areas show larger increases.

In part, these highly asymmetric developments reflect national asymmetries in economic development. For instance, the poor performance of the Hungarian and Latvian labour market in terms of employment as well as of the UK and Spanish labour market in terms of unemployment can be explained by the economic effects of the crisis setting in already in the second half of 2008 in the UK and Spain and the financial crises in Latvia and Hungary in 2008 and 2007 respectively. In part, the asymmetry, however, reflects the regional divergence within individual countries such as for instance Hungary, Spain or Romania.

Heterogeneity also applies to the immediate crisis period. Thus even in the year 2009, when in aggregate around 15% of the jobs were lost in the European economies sampled by the ELFS,

some regions (mostly located in Germany) experienced declining unemployment rates, while Spanish and Irish regions as well as regions located in the south of Sweden experienced increases in unemployment rates in excess of 2 percentage points. Furthermore, positive employment growth was registered in around a quarter (58 of 212) of the regions, with most of these regions located in Poland, Norway and the north of the UK.

Figure 5.2: Average annual employment growth rates of the active aged population not in full time training by NUTS2 regions and periods (in %)

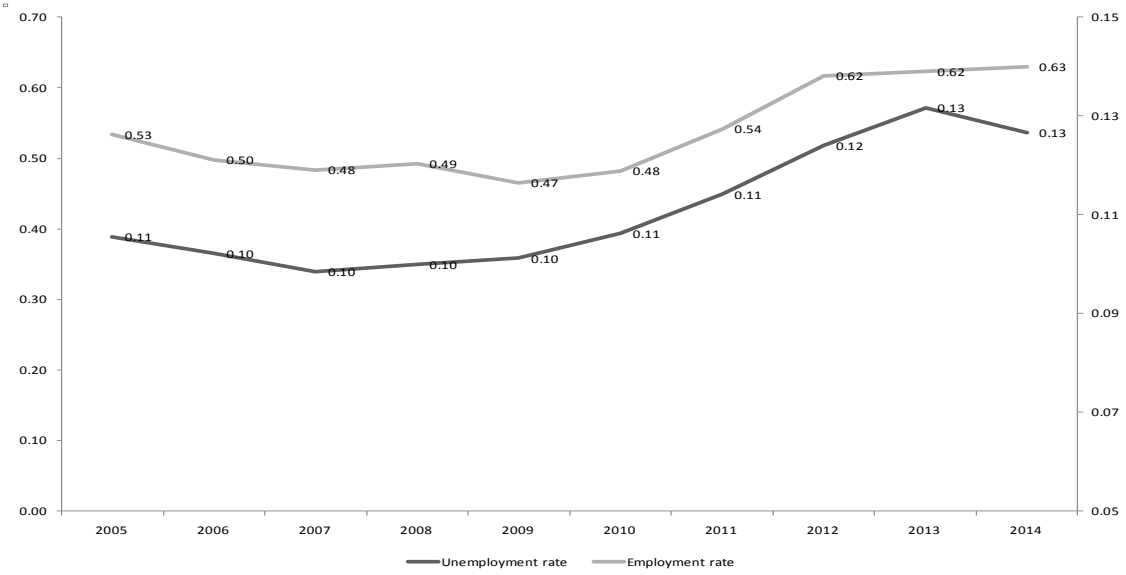


Source: ELFS, WIFO calculations.
Note: Sample: Active aged population (aged 20 to 64) not in full time training. Darker areas show larger increases.

Similarly, the timing and persistence of the crisis effects differed substantially among different parts of Europe. While unemployment declined and employment grew (or at least stagnated) in most of the regions located in the European core countries in the years after 2009, the opposite applied to many regions located in Southern Europe (Greece, Spain, Portugal and - after 2011 - also Italy) and Ireland. This reflects the differences in economic development of the northern and southern European countries since 2009. It, however, also accords with the findings of the literature, attempting to identify the factors determining regional resilience. This often finds that regions with a high industrial employment share and

high employment density as well as a high share of high-tech industries have been more resilient to the crisis than regions with low urbanisation, low industrial employment shares and less technology-intensive industries (see e.g. Brakman et al. 2015, Crescenzi et al. 2016, Fingleton et al. 2012, Fratesi and Rodriguez-Pose 2016).

Figure 5.3: Coefficient of variation of unemployment and employment rates in the EU 2005 - 2014



Source: ELFS, WIFO calculations.
Note: Sample: Active aged population (aged 20 to 64) not in full time training. Chart excludes countries with missing observations (i.e. Denmark, Malta, and Croatia). Employment rate = active aged employed as a share of the active aged population not in education, unemployment rate = active aged employed as a share of the active aged labour force (employed + unemployed).

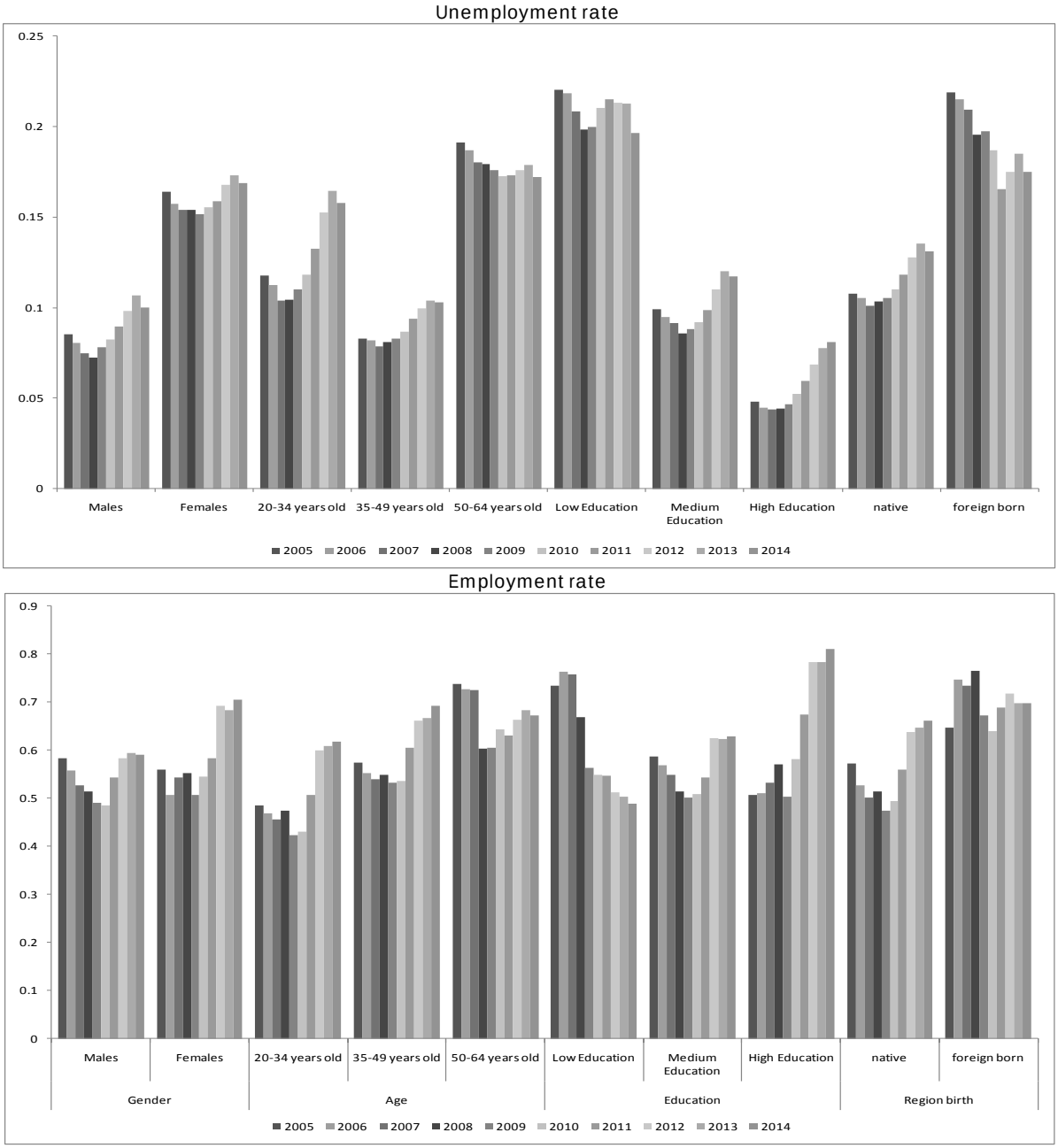
5.3.2.Labour market disparities

The heterogeneity in regional labour market development also had a noticeable impact on regional labour market disparities in Europe. As documented in the literature (see Janiak and Wasmer 2008, Caroleo and Pastore 2007) these were already large in 2005. As shown in Figure 5.3 which displays the coefficient of variation[50] in unemployment and employment rates as a measure of regional dispersion of labour market conditions in the EU, regional disparities in employment and unemployment rates tended to decrease in the period from 2004 to 2008. This tendency was more pronounced for unemployment than for employment rates. This was mainly due to a catching up of the Eastern and Southern European countries during this time period (see e.g. Crespo-Cuaresma et al. 2014). During and after the financial and economic crisis, these catching-up processes of, in particular, the regions in the southern European countries, however, came to a halt. As a consequence, regional labour market disparities

[50] The coefficient variation is defined as the standard deviation relative to the mean of an indicator. It is used as a measure of dispersion here on account of it being independent of the dimension of the indicator used.

started to increase again and reached a level that was even higher than in 2005 by 2012. Since this time they have remained at this historically high level.

Figure 5.4: Coefficient of variation of unemployment and employment rates in the EU 2005 – 2014 by demographic groups



Source: ELFS, WIFO calculations.
Note: Sample: Active aged population (aged 20 to 64) not in full-time training. Charts exclude countries with missing observations (i.e. Denmark, Malta, and Croatia). Employment rate = active aged employed as a share of the active aged population not in education, unemployment rate = active aged employed as a share of the active aged labour force (employed + unemployed).

Table 5.3: Coefficient of variation of unemployment and employment rates in the EU 2005 – 2014 by demographic groups

	Employment Rate				Unemployment Rate			
	2005	2009	2012	2014	2005	2009	2012	2014
AT	0.30	0.24	0.37	0.34	0.03	0.03	0.04	0.04
BE	0.46	0.50	0.55	0.53	0.08	0.08	0.08	0.08
BG	0.21	0.28	0.25	0.15	0.09	0.08	0.09	0.08
CH	0.26	0.24	0.40	0.28	0.05	0.05	0.04	0.05
CZ	0.50	0.38	0.38	0.33	0.06	0.05	0.06	0.04
DE	0.38	0.34	0.38	0.38	0.05	0.04	0.03	0.04
DK		0.10	0.12	0.07		0.02	0.01	0.02
ES	0.39	0.29	0.29	0.27	0.09	0.08	0.11	0.10
FI	0.47	0.30	0.65	0.36	0.07	0.09	0.08	0.07
FR	0.22	0.21	0.21	0.24	0.06	0.05	0.05	0.05
GR	0.25	0.17	0.19	0.11	0.06	0.04	0.07	0.05
HR		0.04	0.09	0.01		0.03	0.02	0.01
HU	0.26	0.29	0.25	0.34	0.10	0.09	0.08	0.06
IE	0.01	0.09	0.11	0.10	0.01	0.03	0.06	0.04
IT	0.59	0.44	0.44	0.44	0.13	0.15	0.16	0.17
NO	0.12	0.26	0.23	0.10	0.01	0.03	0.03	0.02
PL	0.15	0.20	0.15	0.18	0.06	0.05	0.05	0.05
PT	0.33	0.20	0.12	0.11	0.04	0.03	0.04	0.05
RO	0.17	0.30	0.34	0.36	0.05	0.06	0.08	0.08
SE	0.16	0.13	0.13	0.17	0.03	0.03	0.02	0.02
SI	0.25	0.27	0.23	0.23	0.04	0.03	0.04	0.05
SK	0.53	0.44	0.44	0.40	0.13	0.09	0.11	0.08
UK	0.24	0.17	0.16	0.23	0.04	0.04	0.03	0.04
EU15*	0.49	0.45	0.63	0.62	0.09	0.10	0.13	0.14
EU13*	0.48	0.37	0.35	0.35	0.10	0.08	0.09	0.08
Non-EU*	0.28	0.40	0.41	0.30	0.04	0.04	0.03	0.04
All*	0.53	0.46	0.61	0.63	0.11	0.10	0.12	0.13

Source: ELFS, WIFO calculations.
Note: Sample: Active aged population (aged 20 to 64) not in full-time training. * Figures for country groups exclude countries for which observations are missing for part of the observation period (i.e. Denmark, Malta, and Croatia), but include countries with only one region (i.e. Cyprus, Estonia, Iceland, Lithuania, Latvia, Luxemburg and the Netherlands) that are not reported in country-by-country results. Employment rate = active aged employed as a share of the active aged population not in education, unemployment rate = active aged employed as a share of the active aged labour force (employed + unemployed).

As with all indicators of regional labour market developments, in Europe the development of regional labour market disparities also differed substantially among demographic groups and countries (see Figure 5.4 and Table 5.3). For instance, the reduction in the coefficient of variation of employment rates in the 2005 to 2009 period was most pronounced for the less educated, while regional employment rate disparities continued to increase in this period for

the foreign born. Regional disparities in unemployment rates, by contrast, decreased most pronouncedly among the foreign-born but least pronouncedly among the highly educated.

Similarly, during the subsequent period of divergence the increase in the coefficient of variation of regional employment rates was highest among the highly educated, while this indicator continued to decline among the less educated. Regional disparities of unemployment rates, by contrast, increased most among the highly educated in this later period while they continued to decline for the foreign-born. The decrease in regional disparities was also more pronounced for the unemployment rate of males and the oldest age groups than for females and other age groups, and disparities in unemployment rates decreased more among females and the oldest age groups in the pre-crisis period.

By contrast, the increase in regional disparities in the post-2009 period was more pronounced for the unemployment rates of the males than the females and also strongest for the youngest age group. This thus suggests substantial heterogeneity of regional disparities for different demographic groups in European labour markets.

These differences also apply to the country and country-group level (see Table 5.3). For instance, the coefficient of variation in regional unemployment and employment rates in different country groups, shows that the decrease of regional disparities of unemployment rates found among European regions in the pre-crisis period was mainly due to a decrease in regional disparities among the regions of the EU15 countries (i.e. the 15 countries that were EU members already in 2004) and the EU13 countries (i.e. countries that joined the EU after 2004), while disparities among the regions of the non-EU countries (Iceland, Norway, Switzerland) increased. It also shows that the increase in regional unemployment rate disparities in the post-crisis period was mainly driven by the increase among regions located in EU15 countries.

Furthermore, on the country level Table 5.3 shows the somewhat exceptional development of countries such as Finland, Hungary and Slovenia where regional disparities in unemployment rates increased within the countries in the pre-crisis period, but post-crisis development suggests reducing disparities. Similarly, employment rate disparities – in contrast to overall developments - increased in Belgium, Bulgaria, Hungary, Ireland, Norway, Romania and Slovenia in the pre-crisis period, but reduced in the post-crisis period in Bulgaria, the Czech Republic, Denmark, France, Greece, Spain, Portugal, Poland, Norway, Slovenia and Slovakia.

5.3.3.Persistence of regional employment and unemployment rates

Regional employment and unemployment rates were, however, also rather persistent over the time period considered. To show this, Table 5.4 reports the result of a regression of regional unemployment and employment rates on their lagged values.[51] The coefficient number in this table is the coefficient α in a regression of the form:

[51] In this specification we do not control for the well-known Nickel (1981) bias in dynamic panel data models. The reason for this is that popular ways to deal with this bias (e.g. the Blundell-Bond (1998) or Arellano-Bond (1999) estimators) rely on a large number of cross-sectional observations, which are not always available to us. The reported results are thus subject to this bias, which is of order 1/T.

(Eq. 5-5) $$y_{it} = \alpha y_{it-1} + \pi_i + \varepsilon_{it}$$

where y_{it} is the dependent variable (i.e. either the unemployment or employment rate) in region i at time t, y_{it-1} is its' lagged value by one period, π_i is a region fixed effect and ε_{it} an error term. The coefficient α therefore measures the persistence of the unemployment and employment rates. If it is larger than one in absolute value the series will not be stationary. If it is smaller than one but larger than zero the series under consideration is stationary, but exhibits persistence. If it is negative but larger than -1 the series will also be stationary, but there will be cyclicality, (i.e. the value of y_{it} will alternate between positive and negative values as a reaction to a shock). Persistence is higher the closer the coefficient is to unity in absolute value, since this indicates that past shocks influence current developments more strongly.

Table 5.4: Persistence of regional unemployment and employment rates by country groups

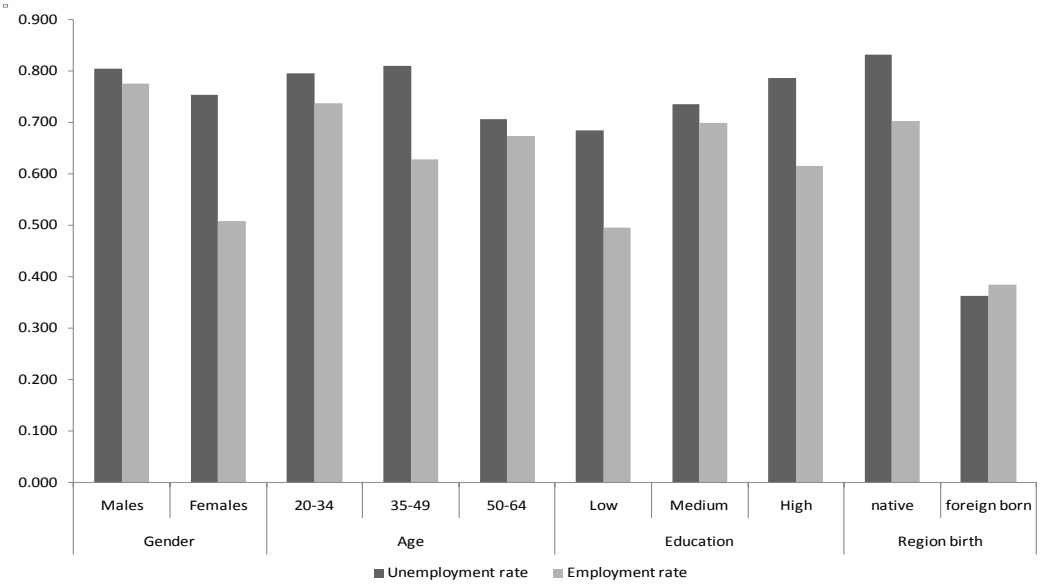
	All	EU15	EU13	Non-EU
	Dependent variable: Unemployment rate			
Unemployment rate$_{t-1}$	0.835***	0.888***	0.573***	0.416***
	(0.026)	(0.028)	(0.034)	(0.125)
Obs	1881	1251	495	135
R2	0.696	0.743	0.468	0.197
	Dependent variable: Employment rate			
Employment rate$_{t-1}$	0.722***	0.752***	0.630***	0.436***
	(0.040)	(0.050)	(0.031)	(0.092)
Obs	1881	1251	495	135
R2	0.518	0.547	0.432	0.244

Source: ELFS, WIFO calculations.
Note: Sample: Active aged population (aged 20 to 64) not in full-time training. Values in brackets are heteroskedasticity robust standard errors, region fixed effect are not reported, R-squared value is overall R-squared, ***(**)(*) signify significance at the 1% (5%) (10%) level respectively. Figures for country groups exclude countries for which observations are missing for part of the observation period (i.e. Denmark, Malta, and Croatia), but include countries with only one region (i.e. Cyprus, Estonia, Iceland, Lithuania, Latvia, Luxemburg and the Netherlands). Employment rate = active aged employed as a share of the active aged population not in education, unemployment rate = active aged employed as a share of the active aged labour force (employed + unemployed).

According to the results, both employment and unemployment rates have been highly persistent over the period analysed. A shock, which increased the unemployment rate of a region by 1 percentage point in a particular year, still led to an almost 0.5 percentage point higher unemployment rate in that region after 4 years (0.835^4=0.49). For an equivalent shock to the employment rate, this implied "half-life" time is between two to three years when all European regions are considered.

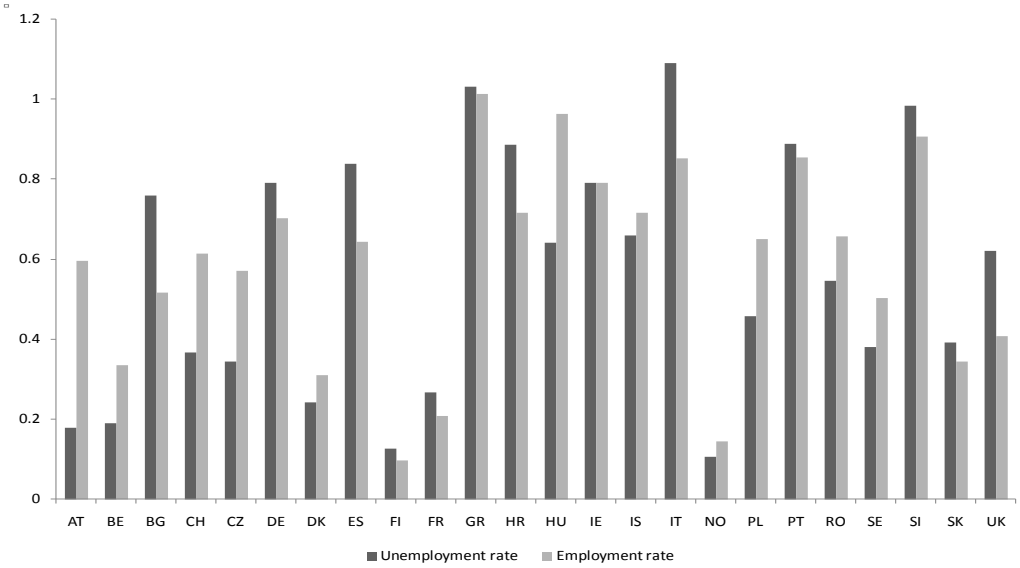
Once more these results differ markedly across different demographic groups as well as among countries and country groups. The persistence of both regional unemployment and employment rates was substantially lower among regions located in EU13 as well as non-EU

Figure 5.5: Persistence of regional unemployment and employment rates by demographic groups



Source: ELFS, WIFO calculations.
Note: Sample: Active aged population (aged 20 to 64) not in full-time training. Figure reports the results of a regression as in equation (Eq. 5-5) for each demographic group for all countries in the sample. Employment rate = active aged employed as a share of the active aged population not in education, unemployment rate = active aged employed as a share of the active aged labour force (employed + unemployed).

Figure 5.6: Persistence of regional unemployment and employment rates by countries



Source: ELFS, WIFO calculations.
Notes: Sample: Active aged population (aged 20 to 64) not in full-time training. Figure reports the results of a regression as in equation (Eq. 5-5) on a country-by-country level excluding countries which have only one region (i.e. Cyprus, Estonia, Iceland, Lithuania, Latvia, Luxemburg, Malta and the Netherlands). Employment rate = active aged employed as a share of the active aged population not in education, unemployment rate = active aged employed as a share of the active aged labour force (employed + unemployed).

countries than among regions located in the EU15 countries. Similarly, the persistence of regional unemployment rates was highest among males and the middle-aged as well as high-skilled individuals (see Figure 5.5). For regional employment rates, by contrast, persistence was highest among males, the youngest workers and the medium education groups. In addition, persistence of both employment and unemployment rates is substantially lower for the foreign-born than for natives. This indicates higher regional labour market flexibility in the EU13 and non-EU countries than among EU15 countries as well as among the foreign-born than among natives.

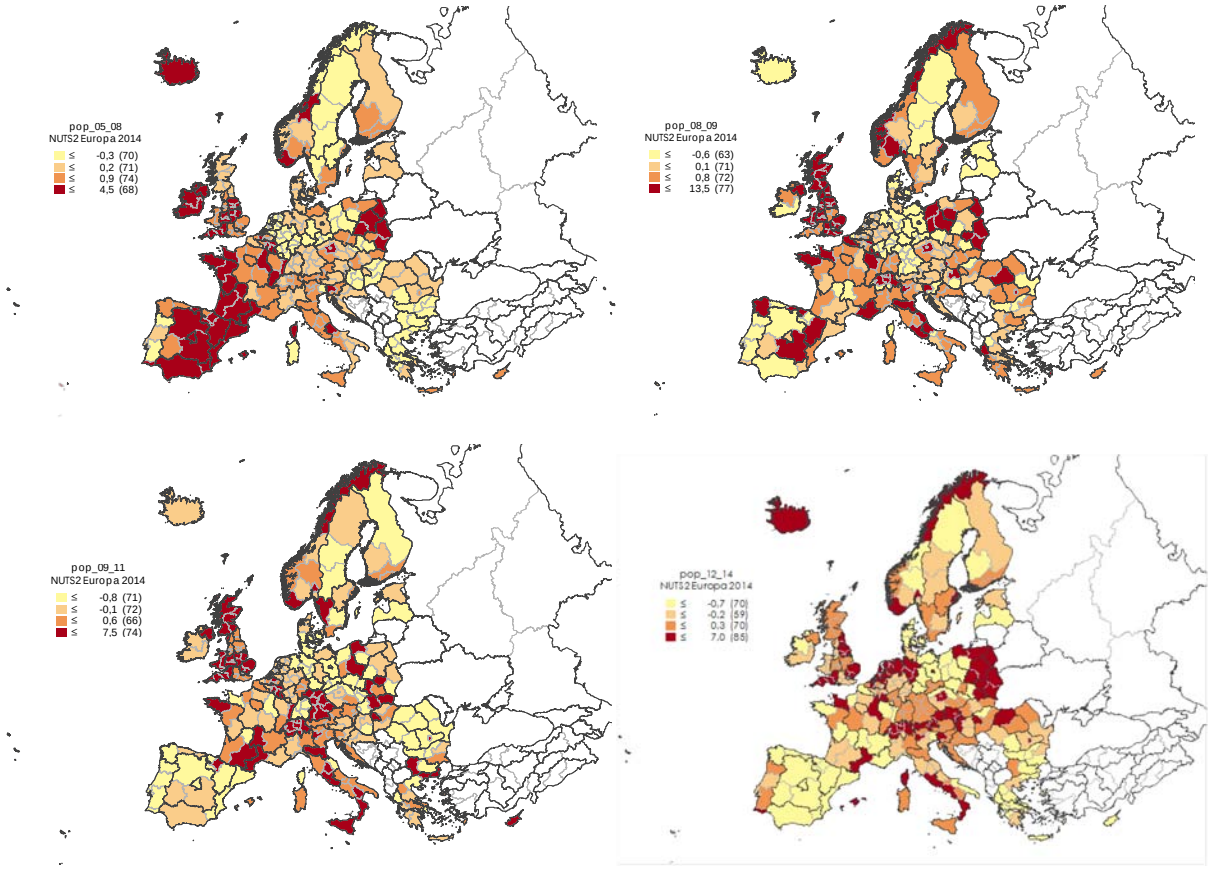
According to country-by-country regressions (see Figure 5.6) some of the southern European countries (e.g. Greece, Italy and Portugal) – whose labour markets have been repeatedly shown to have rather inflexible labour markets (see e.g. Bentolila and Jimeno 1998) – but also Slovenia, had a very high persistence of both regional unemployment and employment rates and in Spain the persistence of regional unemployment rates was much higher than in average. By contrast, some of the Nordic countries such as Norway, Finland and Denmark – that have been considered to have more flexible labour markets – had much lower persistence in regional unemployment and employment rates and in addition also Austria and Belgium have a comparatively low persistence of their regional unemployment rates.

5.3.1.Population growth

The substantial shifts in relative employment growth and unemployment rates in the post-crisis period were also associated with shifts in population growth across the European regions. In part these were associated with the substantial institutional changes in the governance of inter-EU migration that marked the first decade of the 2000's in Europe, such as the stepwise liberalisation of EU internal migration for citizen of countries that joined the EU in 2004 (between 2004 and 2011) and in 2007 (between 2007 and 2014).

In part, these developments were, however, triggered by differences in regional labour market conditions. The correlation between the average annual employment growth and the average annual population growth (shown in Figure 5.7) at the regional level ranges between 0.4 and 0.6 in the four periods considered. The correlation coefficients with relative unemployment rate changes are somewhat lower (below 0.1). This suggests that population growth among the active aged population not in full time education was highest in those regions where employment growth and thus employment prospects for migrants from other regions were best. There are, however, also some important exceptions. These apply in particular to the pre-crisis period from 2005 to 2009, where - in part as a consequence of the accession of the EU10 countries - European East-West migration increased substantially. This particularly affected Ireland and large parts of the UK, which received a substantial part of the migrants from the acceding countries in this time period. It also applied to population growth in most Spanish regions, which were the main receiving regions of migration from Bulgaria and Romania. As a consequence, regional population growth in this time period is also highly correlated with the growth of the foreign-born population residing at a regional level (see Figure 5.8).

Figure 5.7: Average annual population growth rates of the active aged population not in full time training by NUTS2 regions and periods (in %)

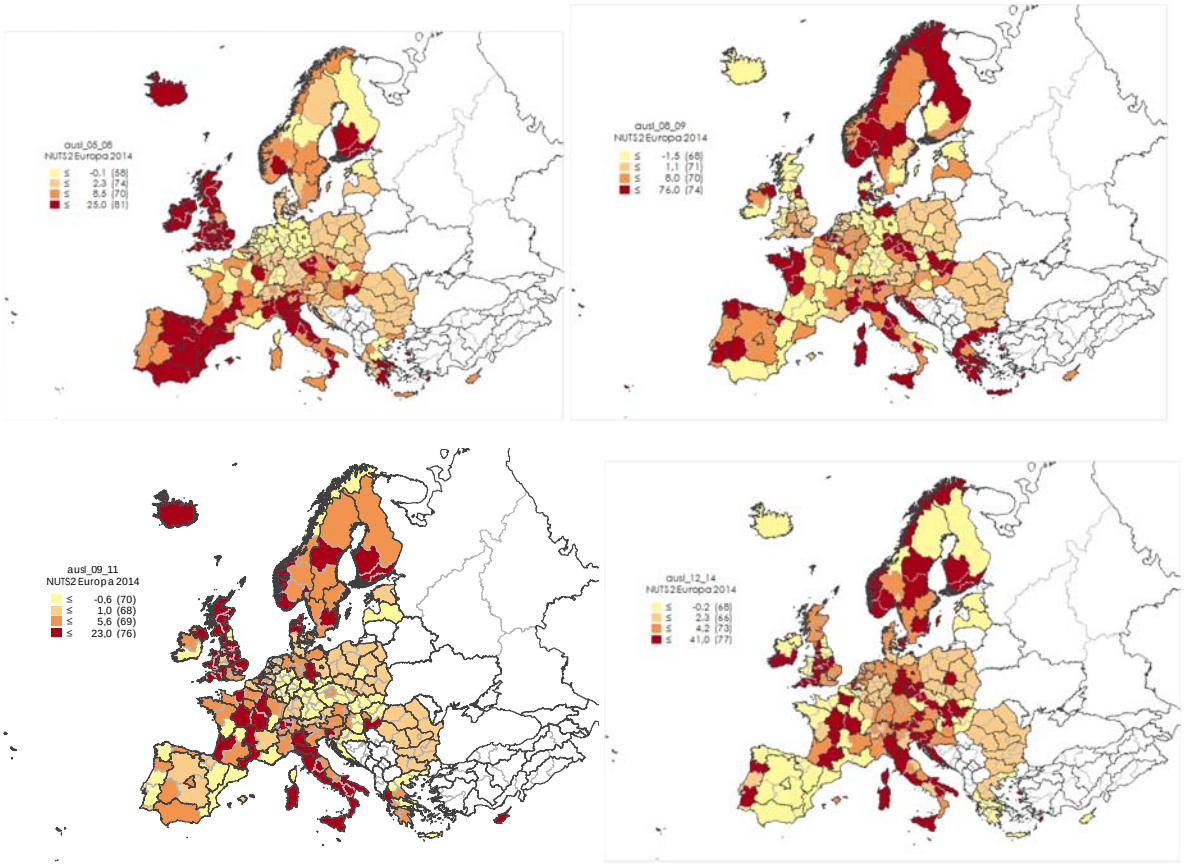


Source: ELFS, WIFO calculations.
Note: Sample: Active aged population (aged 20 to 64) not in full time training.

This correlation with the change in the foreign born population is less pronounced in the immediate crisis and post-crisis period. For instance, the highest population growth rates in the time period immediately after the crisis were registered in the north of the UK, and – potentially on account of Polish return migration from Ireland and the UK - in parts of Poland. The lowest population growth rates are, by contrast, found in the core of Europe (in particular German regions). This is less strongly associated with the bad labour market performance of these regions but more with the ageing of the population. This contributes to a long-term negative population trend in the active aged population in this country, which is particularly noticeable in periods of low migration such as during the Great Recession.[52]

[52] According to the OECD (2011), international migration to the OECD member countries reduced by 7% in the immediate crisis year 2009.

Figure 5.8: Average annual growth rates of the foreign born active aged population not in full time training by NUTS2 regions and periods (in %)



Source: ELFS, WIFO calculations.
Note: Sample: Active aged population (aged 20 to 64) not in full time training.

5.4. Migration and labour market adjustments in Europe

5.4.1. Measuring the migration response to employment and unemployment

Descriptive evidence therefore highlights the substantial heterogeneity in regional labour market developments in Europe over the years from 2005 to 2014, but also suggests that population moves have been an important part of labour market adjustment before, during and after the crisis. To analyse the responsiveness of such population moves to labour market shocks, we follow the approach of Candea and Kovak (2016) for the US. This means that we run regressions which link the logarithm of population growth ($\dot{N}_{it}$) in a region i and year t to the (log) employment growth ($\dot{L}_{it}$) as a measure of the labour market shock, such that:

(Eq. 5-6)

$$\dot{N}_{it} = \delta \dot{L}_{it} + \gamma_i + \xi_{it}$$

In this regression the region-fixed effects (γ_i) control for any region-specific long term trends in population growth, such as for instance the long term population decline due to ageing of

the population affecting a region in the absence of immigration. These fixed effects thus account for the Monras' (2015) criticism of Caneda and Kovak's study. δ by contrast measures the contemporaneous impact of a 1 percentage point increase in employment growth on regional population growth (in percentage points).[53]

Table 5.5: Reaction of population growth rates to changes in regional labour market indicators (regression results) by country groups

	All	EU15	EU13	non-EU
		OLS		
ln(employment growth)	0.296***	0.220***	0.389***	0.833***
	(0.045)	(0.048)	(0.055)	(0.125)
Observations	2090	1390	550	150
R2	0.225	0.145	0.362	0.714
		IV		
ln(employment growth)	0.154***	0.171***	0.0384	0.746***
	(0.041)	(0.055)	(0.051)	(0.110)
Observations	2041	1369	550	122
R2	0.31	0.272	0.386	0.696
	Alternative measures of labour demand shock			
Unemployment rate$_{t-1}$	-0.127***	-0.142***	-0.0324	-0.120
	(0.017)	(0.018)	(0.037)	(0.509)
ln(gdp per capita$_{t-1}$)	0.009*	0.013	0.007	0.059
	(0.005)	(0.009)	(0.005)	(0.053)
Observations	1790	1251	495	44
R2	0.051	0.084	0.005	0.066

Source: ELFS, WIFO calculations.
Note: Sample: Active aged population (aged 20 to 64) not in full time training. Values in brackets are heteroskedasticity robust standard errors, region fixed effect are not reported, R-squared value is overall R-squared, ***(**)(*) signify significance at the 1% (5%) (10%) level respectively. Results exclude countries for which observations are missing for part of the observation period (i.e. Denmark, Malta, and Croatia).

Table 5.5 in its top panel presents the results of this analysis for both the overall sample of regions in the data as well as for different groups of countries (i.e. the EU15, EU13 and non-EU countries). These results suggest a relatively high responsiveness of the growth of the active aged population not in full-time training to regional employment growth. A 1 percentage point increase in employment growth increased population growth by 0.30 percentage points. Comparing this to results of Caneda and Kovak (2016), whose coefficients range between 0.16 and 0.50 for similar specifications for men of different skill groups in US metropolitan areas, suggests a higher responsiveness of immigration to regional employment growth in Europe than in the US.

[53] This is because $\dot{N} = log\left(\frac{N_{it}}{N_{it-1}}\right) \approx g_{it}^{N}$ and $\dot{L} = log\left(\frac{L_{it}}{L_{it-1}}\right) \approx g_{it}^{L}$ with N the population, L the employment and g_{it}^{N} and g_{it}^{L} the employment and population growth in a region

Table 5.6: Reaction of population growth rates to changes in employment growth (regression results) by country groups in comparison to the US.

	Female			Male		
	All	**National**	**Foreign**	**All**	**National**	**Foreign**
			ALL			
Low educated	0.418***	0.428***	0.547***	0.364***	0.430***	0.711***
	(0.065)	(0.068)	(0.053)	(0.063)	(0.051)	(0.070)
N	209	209	198	209	209	192
R2	0.293	0.367	0.516	0.278	0.447	0.507
High educated	0.812***	0.824***	0.702***	0.920***	0.929***	0.838***
	(0.049)	(0.043)	(0.059)	(0.024)	(0.022)	(0.046)
N	209	209	182	209	209	186
R2	0.768	0.787	0.699	0.916	0.918	0.78
			EU15			
Low educated	0.237***	0.351***	0.564***	0.304***	0.399***	0.559***
	(0.078)	(0.079)	(0.083)	(0.079)	(0.061)	(0.096)
N	139	139	139	139	139	139
R2	0.099	0.275	0.605	0.209	0.422	0.354
High educated	0.720***	0.726***	0.694***	0.946***	0.952***	0.789***
	(0.072)	(0.069)	(0.064)	(0.027)	(0.026)	(0.045)
N	139	139	135	139	139	136
R2	0.651	0.669	0.643	0.922	0.926	0.78
			EU12			
Low educated	0.385***	0.381***	0.453***	0.369***	0.390***	0.791***
	(0.061)	(0.066)	(0.078)	(0.062)	(0.064)	(0.087)
N	55	55	44	55	55	38
R2	0.429	0.419	0.391	0.377	0.415	0.6
High educated	0.918***	0.921***	0.698***	0.826***	0.825***	0.891***
	(0.053)	(0.054)	(0.093)	(0.038)	(0.038)	(0.109)
N	55	55	32	55	55	35
R2	0.883	0.879	0.773	0.908	0.906	0.751
			US			
			(Candea and Kovak 2016)			
Low educated	0.408***	0.196	0.616***	0.163***	0.041	0.388*
	(0.115)	(0.156)	(0.186)	(0.061)	(0.072)	(0.196)
High educated	0.475**	0.440***	0.826***	0.498***	0.463***	0.605**
	(0.126)	(0.118)	(0.271)	(0.090)	(0.092)	(0.205)

Source: ELFS, WIFO calculations.
Note: Sample: Active aged population (aged 20 to 64) not in full-time training. Values in brackets are heteroskedasticity robust standard errors, region fixed effect are not reported, R-squared value is overall R-squared, ***(**)(*) signify significance at the 1% (5%) (10%) level respectively. Results exclude countries for which observations are missing for part of the observation period (i.e. Denmark, Malta, and Croatia).

This is confirmed by results which replicate those of Caneda and Kovak (2016) (in their Table 2) as closely as possible (reported in Table 5.6). In this analysis we exclusively focus on the

employment growth for the rather detailed demographic groups considered by Caneda and Kovak (2016) between the two years of 2006 and 2010. These results should be interpreted with care. On the one hand this is because the focus on small demographic groups implies larger measurement error in the ELFS and the focus on just two time periods precludes the inclusion of region fixed effects. This may attenuate endogeneity bias. Both these caveats may lead to biases in estimates (see Monras 2015 on this point). On the other hand, this is because, despite our best efforts to follow Caneda and Kovak (2016) as closely as possible, a number of differences, rooted in the nature of the data available, remain. Thus we use the 20 to 64 year old population in all NUTS2 regions of Europe, while Caneda and Kovak (2016) focus on the 18 to 64 year olds living in metro areas of large cities. This may lead to higher estimates in for European data, if more rural parts of the EU are more responsive in their population change to employment growth than urban centres and an overestimation if the opposite applies.

Despite these drawbacks, the results indicate a higher responsiveness of most demographic groups to employment changes in Europe than in the US, irrespective of whether all countries, only the EU15 countries or only the EU13 countries are considered. This applies to high and low-skilled men, irrespective of whether they are natives or foreign-born. It also applies to high skilled women when they are natives. The only groups where the responsiveness of population changes to employment growth is lower in Europe than in the US are foreign-born, less-skilled women in EU15 and EU13 countries. As a consequence, these results thus at least question, whether the lower responsiveness of migration in regional labour markets in Europe found in much of the literature of the 1990s, still applies to the crisis period. They, however, also indicate larger challenges in inducing mobility among low-skilled (in particular female) workers in the EU than the US.

The responsiveness of migration to employment growth, however, also varies substantially among country groups. It is highest in regions belonging to non-EU countries, where a percentage point increase in employment is associated with a 0.83 percentage point increase in population growth. By contrast, it is somewhat lower in the regions of EU15 and EU13 countries, where this coefficient ranges between 0.22 (in EU15 countries) and 0.39 (in EU13 countries).

There are also a number of issues related to the estimation of equation (Eq. 5-6). The first of these is the potential endogeneity of the measure of employment growth caused by omitted variable bias. This may for instance arise if changes in mobility are driven by other determinants of the location choice of migrants and natives that simultaneously also result in changes in employment (e.g. through increased consumption).[54] To account for this potential endogeneity in the second panel of Table 5.5 we present results of an IV-analysis in

[54] As argued by Caneda and Kovak (2016) this may, however, be a lesser concern for the short time period considered here. On the one hand these short estimation periods imply that after accounting for region fixed effects the impact of additional controls for time varying characteristics on estimation results is likely to be only minor. On the other hand endogeneity is also of lesser relevance for the immediate crisis period as, due to the rapid decline of demand in this period, wage adjustments are likely to have had only a minor effect on relative employment performance.

which we use a Bartik (1991) type measure as an instrument for change in regional employment and regional unemployment rates. This "Bartik instrument" predicts a regions' employment change by applying the regions' occupational structure in the initial period to the national employment changes in the respective occupations.[55]

Using this instrument reduces the estimate of the responsiveness of population growth to employment growth. According to the instrumental variables regression, a one percentage point increase in the employment rate increased population growth by 0.15 percentage points in a European region. Furthermore, these results – as the uninstrumented ones - suggest that migration reacted more strongly to employment growth in non-EU countries than in either the EU15 or EU13 countries. In contrast to the previous results, they, however, also suggest that the reaction in EU15 countries was stronger than in EU13 countries, where the estimated coefficient – after instrumenting – remains insignificant.

A second issue with these regressions relates to the measurement of the region-specific labour demand shock. This is defined as the group-specific employment growth rate in equation (Eq. 5-6). This may be the wrong measure of regional labour market conditions if immigrants both from the same or another country are more concerned about other aspects of regional labour market conditions when making their migration decision. To circumvent this concern, following Jauer et al. (2014), in the bottom panel of Table 5.5 we report results of a further specification in which regional population growth is regressed on the lagged unemployment rate relative to the EU average (u_{it}) as well as the lagged (log) GDP per capita relative to the EU average (g_{it}) in a region. In this case the specification thus reads:

(Eq. 5-7) $$\dot{N}_{it} = \tau u_{it} + \pi g_{it} + \gamma_i + \xi_{it}$$

In these regressions the parameters π and τ are measures of the responsiveness of migration to changes in GDP per capita and unemployment rates, respectively. They are thus the central parameters of interest, while the γ_i are a set of period fixed effects, that, as previously, account for long-term region-specific demographic trends.

Relative to the previous one there are a number of disadvantages to this specification. This is, first of all, due to the lower number of observations available for regional GDP per capita in particular for the non-EU countries, where we have information on GDP per capita of 8 Norwegian regions for only five years and for one Icelandic region. This makes results for this group of countries rather questionable. Second, this is also due to the higher persistence of regional unemployment rates than employment growth. This implies that the regional unemployment rates are highly co-linear with region-fixed effects. This complicates the identification of the impact of unemployment rates in particular in cases where this regression is applied to short time series. Third, this is also because in this specification we do not have any instruments available to account for the even more severe endogeneity issues, which arise because immigration of new employees, almost by definition has a direct impact on

[55] Similar instruments have been used in a large number of regional applications including Candea and Kovak (2016) but also Blanchard and Katz (1992) Wozniak (2010) Charles, Hurst and Notowidigo (2013).

both the GDP and unemployment rate in a region. The only possibility to reduce this endogeneity bias is to use lagged explanatory variables.

Despite these reservations, the results in Table 5.5 also suggest a rather strong reaction of regional migration to regional unemployment rate differences. A 1 percentage point higher unemployment rate reduces population growth statistically significantly (at the 5% level) by 0.13 percentage points. The reaction of population growth to GDP per capita growth is somewhat weaker, however. When considering all regions, a 1 percentage point increase in GDP per capita increases average annual population growth in that region by 0.01 percentage points, and this correlation is statistically significant at the 10% level only.

Furthermore – consistent with the results in the upper two panels of Table 5.5 –population growth was also more responsive to unemployment rate differences in the regions of EU15 countries than in the EU13 countries. A 1 percentage point increase in regional unemployment rates increased population growth (statistically significantly) by 0.14 percentage points in the former set of countries, but was statistically insignificant in the latter. By contrast, GDP per capita was statistically insignificant in all country groups. In addition, in contrast to previous findings, population growth in the regions of the non-EU countries seems to have been less responsive to differences in regional GDP per capita and unemployment rates than in EU15 countries, as both the coefficient on regional unemployment rates as well as on regional GDP per capita are insignificant determinants of population growth for these regions. This difference in findings – as explained above – may, however, be attributed to the substantially smaller sample of non-EU regions and the more limited number of time periods considered in this specification than in the previous one.

5.4.2.Results for different periods

The reaction of regional population growth to regional economic conditions has also varied substantially over different time periods and across different population groups. For instance, comparing the results of the regressions in equations (Eq. 5-6) and (Eq. 5-7) for the pre-crisis, crisis, and post-crisis period (see Table 5.7) suggests that the responsiveness of regional employment growth was strongest in the period from 2005 to 2008 and has been reduced somewhat since. This finding applies in particular to the EU15 countries, where results for both instrumented and uninstrumented regressions for the post-crisis period suggest an insignificant impact of employment growth to population growth. In the EU13 countries, by contrast, the evolution of the responsiveness of population growth to economic conditions has differed somewhat from that experienced among the regions of the EU15, as in these regions this responsiveness peaked in the crisis period 2009 to 2011.

The estimates of the regression in equation (Eq. 5-7), in contrast to the estimates for equation (Eq. 5-6) as well as to the results for the overall period, however, indicate that the responsiveness of population growth to GDP per capita differences was lower in the pre-crisis period than either during the crisis or afterwards, while regional unemployment rates remain insignificant throughout. This may once more be the result of the rather short time periods for which the model in equation (Eq. 5-7) is estimated. In the face of the high persistence, this

implies that the regional unemployment rates in this specification are highly co-linear with region-fixed effects, and thus poorly identified.

Table 5.7: Reaction of population growth rates to changes in regional labour market indicators (regression results) by country groups and time periods

	All			EU15			EU13		
	2005-2008	2009-2011	2012-2014	2004-2008	2009-2011	2012-2014	2004-2008	2009-2011	2012-2014
					OLS				
ln(employment growth)	0.397***	0.231**	0.248***	0.327***	0.086	0.136	0.458***	0.552***	0.492***
	(0.039)	(0.107)	(0.094)	(0.043)	(0.112)	(0.119)	(0.070)	(0.117)	(0.068)
Observations	836	627	627	556	417	417	220	165	165
R2	0.304	0.119	0.173	0.234	0.021	0.072	0.39	0.458	0.492
					Instrumental variables				
ln(employment growth)	0.297***	-0.054	-0.312	0.313**	-0.150	-0.691	0.132	0.02	0.195
	(0.106)	(0.104)	(0.530)	(0.139)	(0.134)	(1.284)	(0.147)	(0.128)	(0.147)
Observations	787	627	627	535	417	417	220	165	165
R2	0.44	0.205	0.181	0.479	0.07	0.089	0.358	0.502	0.383
					Alternative measures of labour demand shock				
Unemployment rate$_{t-1}$	-0.043	0.058	0.021	-0.161	0.043	0.030	0.020	0.090	0.072
	(0.102)	(0.045)	(0.131)	(0.151)	(0.045)	(0.160)	(0.123)	(0.098)	(0.124)
ln(gdp per capita$_{t-1}$)	0.028**	0.167***	0.213***	0.083***	0.154***	0.245**	0.012	0.195***	0.141***
	(0.012)	(0.033)	(0.070)	(0.024)	(0.038)	(0.111)	(0.010)	(0.054)	(0.048)
Observations	585	606	599	417	417	417	165	165	165
R2	0.024	0.14	0.134	0.084	0.092	0.151	0.006	0.239	0.086

Source: ELFS, WIFO calculations.
Note: Sample: Active aged population (aged 20 to 64) not in full-time training. Values in brackets are heteroskedasticity robust standard errors, region fixed effect are not reported, R-squared value is overall R-squared, ***(**)(*) signify significance at the 1% (5%) (10%) level respectively. Results exclude countries for which observations are missing for part of the observation period (i.e. Denmark, Malta, and Croatia).

5.4.3. Results for different demographic groups

Similar observations apply to the reaction of different population groups to regional labour market conditions and income differentials. This is shown in Table 5.8, which displays the results of estimating equations (Eq. 5-6) and (Eq. 5-7) for different population groups.[56] The results pertaining to these groups point to a substantially larger reaction of the population growth of the foreign-born to their regional employment growth than of natives. When considering all country groups for the complete period, a one percentage point increase in employment growth of the foreign-born increases their population growth by between 0.49 and 0.85 percentage points. Similarly, a 1% increase in GDP per capita has an impact of around 0.77 percentage points. For natives the coefficient on employment growth, by contrast, is between 0.47 and 0.52 and that on regional GDP per capita is 0.03 and only weakly statistically significant.

The coefficients on employment growth also increase with educational attainment. A one percentage point increase in the employment growth rate for the highly educated in a region leads to a 0.90 to 0.97 percentage point increase in the population growth in that

[56] Since employment growth differed substantially between different groups in the time periods considered we use group specific employment growth and unemployment rates as dependent variables in these regressions.

region. By contrast, an equivalent increase in employment growth of the less educated increases the population growth by only 0.61 to 0.56 percentage points. A one percent increase in the GDP per capita of a region increases the population growth of the highly educated by 0.28 percentage points and that of the less educated by 0.07 percentage points, although in this specification the medium educated show the weakest response to the regional unemployment growth rate.

Table 5.8: Reaction of population growth rates to changes in regional labour market indicators (regression results) by population groups

		dempl	Obs	Rsq	dempl	Obs	Rsq	L.lurate	L.lgdp	Obs	Rsq
		OLS			**IV**			**Alternative indicators**			
Gender	Males	0.387***	2100	0.352	0.164***	2051	0.336	-0.089**	0.0300**	1799	0.032
		(0.051)			(0.038)			(0.041)	(0.012)		
	Females	0.266***	2100	0.205	0.231**	2051	0.206	-0.108***	0.0184***	1799	0.027
		(0.087)			(0.105)			(0.024)	(0.006)		
Age	20-34	0.562***	2100	0.509	0.331***	2051	0.506	-0.0290**	0.0842***	1799	0.050
		(0.049)			(0.068)			-0.136***	(0.013)		
	35-49	0.638***	2100	0.669	0.471***	2051	0.662	-0.033	0.0593***	1799	0.037
		(0.020)			(0.061)			(0.014)	(0.012)		
	50-64	0.452***	2100	0.436	0.443***	2051	0.429	-0.038	0.096***	1799	0.048
		(0.040)			(0.069)			(0.038)	(0.026)		
Education	Low	0.560***	2100	0.563	0.607***	2051	0.559	-0.309***	0.0704***	1799	0.059
		(0.034)			(0.045)			(0.066)	(0.016)		
	Medium	0.765***	2100	0.829	0.864***	2051	0.810	0.067	0.0933*	1799	0.023
		(0.015)			(0.024)			(0.189)	(0.056)		
	High	0.897***	2100	0.902	0.973***	2051	0.900	-1.167***	0.275***	1799	0.108
		(0.017)			(0.019)			(0.184)	(0.053)		
Region birth	Native	0.521***	2088	0.518	0.469***	2088	0.48	0.019	0.0276*	1793	0.009
		(0.055)			(0.071)			(0.048)	(0.014)		
	foreign born	0.853***	2084	0.822	0.490***	2084	0.838	0.121	0.770***	1786	0.699
		(0.038)			(0.145)			(0.142)	(0.053)		

Source: ELFS, WIFO calculations.
Note: Sample: Active aged population (aged 20 to 64) not in full-time training. Values in brackets are heteroskedasticity robust standard errors, region-fixed effect are not reported, R-squared value is overall R-squared, ***(**)(*) signify significance at the 1% (5%) (10%) level respectively. Results exclude countries for which observations are missing for part of the observation period (i.e. Denmark, Malta, and Croatia).

Differences in the reaction to employment growth between males and females and workers of different age groups are less pronounced. Although the instrumented results in Table 5.8 suggest a stronger reaction of population growth among the middle age groups, the differences between age groups are rather low. Furthermore, the gender effect differs between instrumented and uninstrumented results.

5.4.4.Results for different groups of foreign-born

Since in particular the foreign-born are highly responsive to regional labour market conditions and Candea and Kovak (2016) find large differences in this respect between different groups of foreign-born, it may be interesting to know whether these results differ between immigrants from within or outside the EU. In Table 5.9 we therefore present the results of estimations of equations (Eq. 5-6) and (Eq. 5-7) separately for foreign-born from other EU countries and for foreign-born from non-EU countries. Since the place of birth of foreign-born persons is not available for Germany and Bulgaria, the top panel of the table shows a specification in

which missing data on the place of birth of foreign-born is imputed from nationality data for these two countries. The bottom panel, by contrast, reports results after excluding Germany and Bulgaria.

Table 5.9: Reaction of population growth rates of foreign-born to changes in regional labour market indicators (regression results) by country groups and region of birth

	All		EU15		EU13	
	Germany and Bulgaria imputed					
	EU-born	Third country	EU-born	Third country	EU-born	Third country
	OLS					
Employment growth	0.607***	0.691***	0.682***	0.750***	0.498***	0.698***
	(0.038)	(0.044)	(0.036)	(0.059)	(0.069)	(0.062)
Obs	1902	2004	1228	1249	369	445
R2	0.544	0.603	0.667	0.63	0.385	0.625
	Instrumental Variables					
Employment growth	0.569***	0.792***	0.535***	0.745*	0.703***	0.787***
	(0.083)	(0.10)	(0.110)	(0.404)	(0.163)	(0.115)
Obs	1874	1976	1228	1249	369	445
R2	0.554	0.606	0.667	0.632	0.409	0.626
	Alternative measure of labour market shock					
Unemployment rate$_{t-1}$	-0.045	-0.112	0.004	-0.066	-0.018	-0.063
	(0.129)	(0.145)	(0.110)	(0.159)	(0.251)	(0.207)
GDP per capita$_{t-1}$	0.364***	0.506***	0.686***	0.613***	0.290***	0.625***
	(0.054)	(0.053)	(0.056)	(0.047)	(0.070)	(0.071)
Obs	1656	1755	1234	1250	378	461
R2	0.202	0.267	0.385	0.352	0.164	0.310
	Germany and Bulgaria excluded					
	OLS					
Employment growth	0.586***	0.673***	0.693***	0.727***	0.498***	0.698***
	(0.041)	(0.047)	(0.035)	(0.032)	(0.069)	(0.062)
Obs	1752	1844	1094	1105	369	445
R2	0.523	0.606	0.693	0.68	0.385	0.625
	Instrumental Variables					
Employment growth	0.527***	0.811***	0.387*	1.088**	0.703***	0.787***
	(0.104)	(0.098)	(0.212)	(0.527)	(0.163)	(0.115)
Obs	1724	1816	1094	1105	369	445
R2	0.532	0.609	0.692	0.684	0.409	0.626
	Alternative measure of labour market shock					
Unemployment rate$_{t-1}$	-0.091	-0.01	-0.051	-0.025	-0.018	-0.063
	(0.138)	(0.140)	(0.142)	(0.078)	(0.251)	(0.207)
GDP per capita$_{t-1}$	0.383***	0.583***	0.552***	0.474***	0.290***	0.625***
	(0.056)	(0.051)	(0.049)	(0.040)	(0.070)	(0.071)
Obs	1518	1611	1096	1106	378	461
R2	0.224	0.300	0.327	0.278	0.164	0.310

Source: ELFS, WIFO calculations.
Note: Sample: Active aged population (aged 20 to 64) not in full -ime training. Values in brackets are heteroskedasticity robust standard errors, region-fixed effect are not reported, R-squared value is overall R-squared, ***(**)(*) signify significance at the 1% (5%) (10%) level respectively. Results exclude countries for which observations are missing for part of the observation period (i.e. Denmark, Malta, and Croatia).

The results suggest that the reaction of foreign-born from third countries to regional economic conditions is larger than that of EU immigrants. This applies to all of the specifications used, although the differences in coefficients are rarely significant from each other. Thus, irrespective of whether we consider OLS or instrumented results, a unit increase in the employment growth of foreign-born from third countries has a slightly higher impact on the population growth of foreign-born from third countries in a region than does a unit increase of the employment growth EU-immigrants on the population growth of EU-immigrants. Similarly, a one percentage point increase in GDP per capita in a region has a slightly stronger impact on the population growth of the foreign born from third countries than on foreign-born from other EU-countries in all cases except for when focusing on EU15 countries. By contrast, the coefficient on regional unemployment rates remains insignificant in all specifications for both foreign-born from the EU as well as from non-EU countries.

5.4.5.The impact of European integration

Aside from being marked by the crisis, the time period from 2005 to 2014 was also marked by a number of major integration steps in Europe. In this time period, three countries (Bulgaria, Romania – in 2007 - and Croatia - in 2013) joined the EU and both the citizens of the new member states that joined the EU in 2004 as well as those that joined in 2007 successively gained free access to the labour markets of the pre-existing 15 EU member states. In addition, a total of six countries (Slovenia in 2007, Cyprus and Malta in 2008, Slovakia in 2009, Estonia in 2011 and Latvia in 2014) joined the European Monetary Union and a further country (Hungary in 2009) had to leave the ERM II system due to substantial economic problems.

Each of these changes may have had an impact on the reaction of migration to regional economic conditions. For instance, accession to the EU, which was associated with freedom of movement of citizens from the joining countries to some of the incumbents (as well as among joining countries) and the subsequent liberalisation of migration to the remaining countries resulted in a substantial reduction of administrative barriers to migration in Europe. This may also have increased the responsiveness of migration to economic conditions. Similarly, joining the EMU may have increased this responsiveness on account of lower transaction costs for migrants across countries of a monetary union.

Two central questions with respect to the effects of European integration on the responsiveness of migration to regional economic conditions are therefore whether different groups of countries delineated by EU membership, different exchange rate regimes and different stipulations in the regulations concerning freedom of movement of labour differed in their responsiveness of migration to economic conditions, and whether changes in policy had an impact on the responsiveness of migration to employment growth.

Table 5.10: Differences in the responsiveness to migration between EU and non-EU countries, countries with different exchange rate regimes and different degrees of freedom of movement

	Countries			
	All	EU28	EU15	EU13
Employment growth	1.182***	0.612***	0.305***	0.459***
	(0.157)	(0.077)	(0.108)	(0.085)
Freedom of movement 2004* employment growth	0.255***	0.242***	0.370***	-0.004
	(0.061)	(0.061)	(0.076)	(0.065)
EU13*employment growth	-0.875***	-0.283***		
	(0.154)	(0.085)		
EU15*employment growth	-0.572***			
	(0.134)			
Fixed exchage rate* employment growth	-0.050	-0.063	0.058	
	(0.074)	(0.075)	(0.082)	
Euro*employment growth	-0.571***	-0.563***		-0.460***
	(0.085)	(0.086)		(0.068)
Joined EURO in period*employment growth	-0.554***	-0.544***		-0.395***
	(0.092)	(0.092)		(0.085)
Obs	2090	1940	1390	550
R2	0.400	0.353	0.297	0.595

Source: ELFS, WIFO calculations.
Note: Sample: Active aged population (aged 20 to 64) not in full-time training. Values in brackets are heteroskedasticity robust standard errors, region-fixed effects are not reported, R-squared value is overall R-squared, ***(**)(*) signify significance at the 1% (5%) (10%) level respectively. Results exclude countries for which observations are missing for part of the observation period (i.e. Denmark, Malta, and Croatia).

To address the first of these questions in Table 5.10 we report the results of a regression in which we divided countries into different groups depending on whether they:

- were EU members already in 2004 (i.e. were an EU15 country), joined the EU during our observation period (i.e. belonged to the EU13 countries), or were non-EU members throughout.
- were a Eurozone country in 2004 (Euro) or joined the Euro in the time period of consideration (joined Euro), with non-Euro countries as a base group.
- Applied the freedom of movement in the 2004 round of enlargement as of 2004 or granted this right only during our observation period.
- were a non-Eurozone country with a fixed exchange rate in 2004, or with floating exchange rates.

and regress these typologies interacted with the regional employment growth rate on regional population growth after controlling for time-specific changes in the reaction of regional population growth to employment growth common to all regions.[57]

Since the criteria for defining country groups in Table 5.10 are not mutually exclusive, the base category in this regression are non-EU countries that are not part of the Eurozone that applied the freedom of movement in 2004 and had a flexible exchange rate (e.g. Iceland and Norway). The significant coefficient in the 4th row of this table thus implies that on average the reaction of regions located in EU15 countries was by 0.572 percentage points lower than that of the base category. By contrast, a EU13 country had a 0.873 percentage point lower reaction. In general, the results in Table 5.9 thus indicate that the responsiveness of population growth to employment changes was significantly higher in non-EU countries than in both EU15 and EU13 countries. By contrast, countries that were members of the Eurozone or joined the Eurozone[58] in our period of analysis had a significantly lower responsiveness of population growth to employment changes in their regions. Furthermore, countries that introduced freedom of movement to the 10 members joining in 2004 immediately (i.e. Sweden, the UK and Ireland) had a 0.255 percentage point higher responsiveness.

These results can, however, not be interpreted causally, as it could well be that countries with fixed exchange rates and EU countries had a lower responsiveness of population growth than countries with flexible exchange rates and non-EU countries for reasons other than their exchange rate regime and their EU membership status. To move the analysis slightly more in the direction of a causal analysis, in Table 5.11 we therefore report results of a further regression in which we focus on status changes with respect to exchange rate regime, EU membership and freedom of movement vis a vis newly joining countries. In this regression we define a set of dummy variables that take on a value of one if a country joined the EU, joined the Eurozone or granted freedom of movement to the EU countries of the 2004 or 2007 enlargements in the year when this status change occurred. As a consequence, in this specification for instance the dummy variable for a country joining the EU takes on the value of 1 only for Bulgarian and Romanian regions in the period after 2007, while the dummy variable for joining the Eurozone takes on the values of one for Slovene regions after 2006, Maltese and Cypriot regions after 2007, Slovak regions after 2008 and Estonia and Latvia after 2010 and 2013, respectively.[59] Similarly, the dummy variables indicating freedom of

[57] Thus the relevant specification is as follows $\dot{N}_{it} = \delta D^k \dot{L}_{it} + \gamma_i + \tau_t \dot{L}_{it} + \xi_{it}$ where $\dot{L}_{it}$ and $\dot{N}_{it}$ symbolize log employment and population growth rates, D^k is a family of indicator variables for the various country groups and τ_t a set of dummy variables for each year.

[58] Note that all the countries that joined the Eurozone in the period 2005 to 2014 had to be members of the ERMII before joining and had fixed exchange rates since 2005.

[59] In this regression we do not identify effects of moving from a flexible to a fixed exchange rate regime as according to the best of our knowledge the only country moving between these two exchange rate regimes in our observation period was Hungary in 2009 in reaction to a severe crisis. Furthermore in this specification aside from controlling for different responses of population growth in each period we also allow for a (time invariant) region specific reaction to changes in employment growth by interacting employment growth with region dummies.

movement after the 2004 enlargement and after the 2007 enlargement take on the value of 1 for a country's regions only after it granted freedom of movement.[60]

Although by focusing on the changes in status this specification can identify changes in the responsiveness of population growth to employment growth after a status change, the results can also not be interpreted causally. On the one hand, this is because some events such as joining the EU and granting freedom of movement occurred simultaneously in some countries. This blurs the identification-separate effects of granting freedom of movement and EU-accession. On the other hand, this is because we cannot preclude that countries may have self-selected into a status change on account of higher/lower responsiveness of their labour markets which potentially makes status changes endogenous.

Table 5.11: The impact of policy changes on the responsiveness to migration

	Countries			
	All	EU28	EU15	EU13
Employment growth	0.013	-0.001	0.036	0.145
	(0.089)	(0.093)	(0.112)	(0.242)
JoinedEU*employment growth	0.376**	0.369**		0.478
	(0.174)	(0.177)		(0.295)
Joined EMU* Employment growth	0.094	0.099		0.036
	(0.151)	(0.154)		(0.203)
Granted freedom of movement in enl. 2004*employment growth	0.059*	0.048	0.098*	0.396
	(0.035)	(0.079)	(0.055)	(0.241)
Granted freedom of movement in enl. 2007*employment growth	-0.065	-0.058	-0.062	-0.299
	(0.050)	(0.059)	(0.072)	(0.266)
Obs	2075	1953	1399	554
R2	0.524	0.478	0.406	0.708

Source: ELFS, WIFO calculations.
Note: Sample: Active aged population (aged 20 to 64) not in full-time training. Values in brackets are heteroskedasticity robust standard errors, region-fixed effect interactions of region fixed effects with employment growth and direct effect of state changes on employment growth are not reported, R-squared value is overall R-squared, ***(**)(*) signify significance at the 1% (5%) (10%) level respectively. Results exclude countries for which observations are missing for part of the observation period (i.e. Denmark, Malta, and Croatia).

Nonetheless the results reported in Table 5.11 suggest that in particular EU accession and the associated freedom of movement for citizen of newly acceding countries was an important factor increasing the responsiveness of migration to regional employment growth in the time period from 2004 to 2014. Thus, the acceding countries of the 2007 enlargement of the EU experienced a significant increase in the responsiveness of population growth to regional employment growth. Here, the statistically highly significant coefficient of 0.38 for the interaction between countries joining the EU in 2007 and the employment growth variable indicates that after EU accession the reaction of population growth to a 1 percent increase in employment growth was by 0.38 percentage points higher than before accession. Similarly,

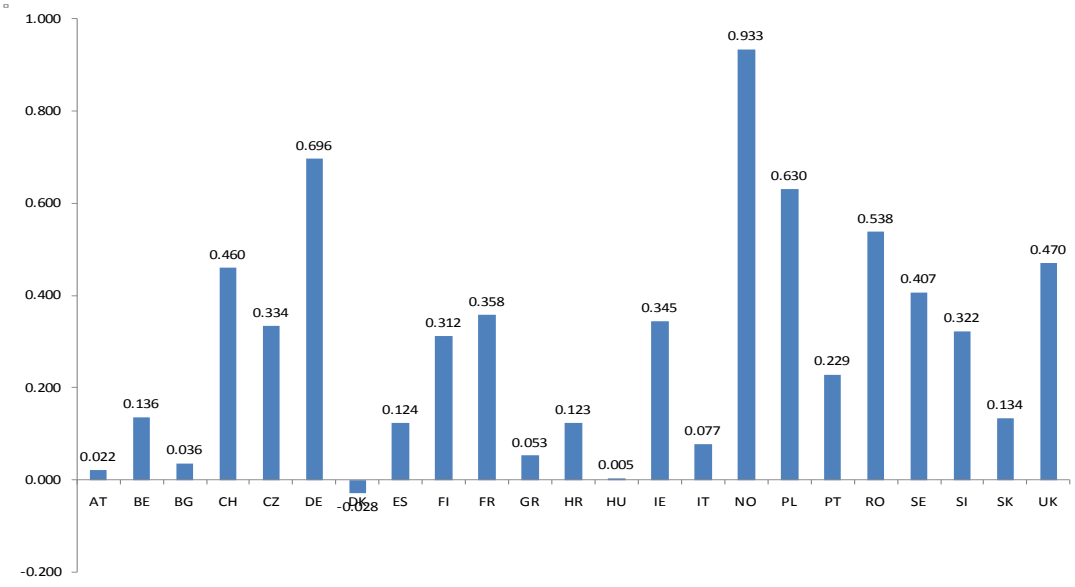
[60] This variable is defined according to information on https://en.wikipedia.org/wiki/Freedom_of_movement_for_workers_in_the_European_Union which provides the dates on which European countries bilaterally granted freedom to each other.

countries that granted freedom of movement to the acceding countries of the 2004 enlargement round experienced a weakly significant increase in the responsiveness of population growth to employment changes of 0.06 percentage points, with this impact mainly being significant for the EU15 countries (i.e. those countries which granted the freedom of movement). This suggests that EU accession and freedom of movement of labour contributed positively to the responsiveness of migration to regional labour market adjustment in the EU. Joining the EMU, by contrast, had no significant (positive or negative impact) impact on the responsiveness of regional population growth to employment growth.

5.4.6.The role of labour market institutions

As with most of the other findings in this chapter, so far there are also huge differences in the reaction of population changes to employment growth among countries. For instance, the results of the uninstrumented version of equation (Eq. 5-6) on a country-by-country basis (for countries with more than one NUTS 2 region) shown in Figure 5.9 suggest that the coefficient on employment growth varies from a statistically highly significant 0.93 for Norway to statistically insignificant and very low (and in some cases even negative) values in countries such as Austria, Bulgaria, Hungary and Denmark. This is consistent with the substantial variation in the adjustment capabilities of the regional labour markets of individual European countries found in the previous literature.

Figure 5.9: Reaction of population growth rates to regional employment growth (regression results) by countries



Source: ELFS, WIFO calculations.
Note: Sample: Active aged population (aged 20 to 64) not in full-time training. Figure shows results of estimating equation (Eq. 5-6) on a country-by-country basis.

This stylized fact has often been linked to the institutional features of the national labour markets in individual countries. This literature (starting with Bertola and Ichino 1995) has

argued that wage and income compression reduces migration incentives. In consequence, a number of authors have considered policy interventions as provided through social and regional policy or formal institutions applying to labour market governance (such as employment protection, trade union density, generous unemployment benefits or distortive income taxes) as potential culprits for the low responsiveness of migration to regional labour market conditions in the EU. According to these authors, such institutions and transfers primarily provide additional disposable income to depressed regions or insure workers against the income loss resulting from job loss. They will thus countervail existing unemployment and wage disparities, and reduce migration incentives.

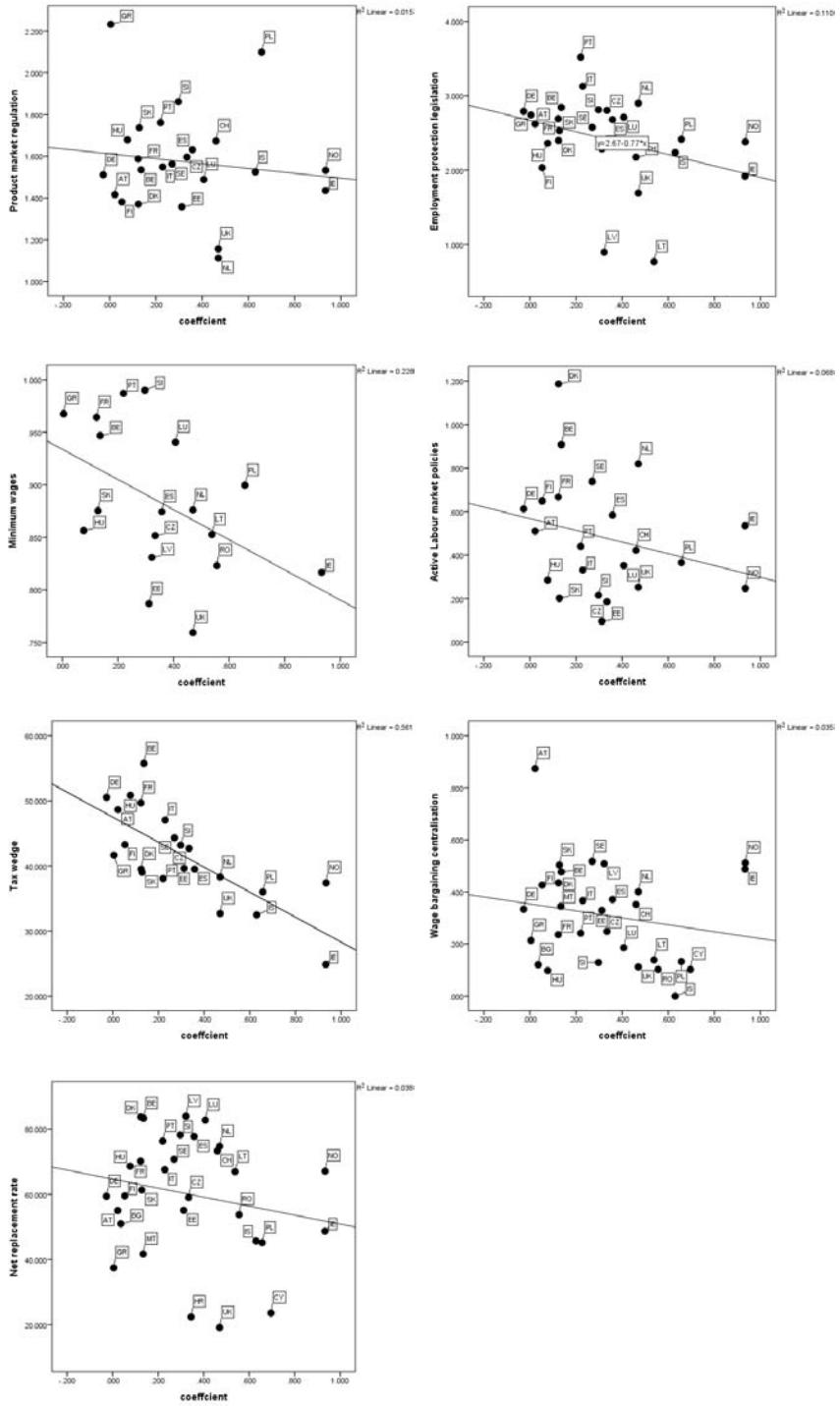
Table 5.12: Sources and definition of institutional variables used

Variable	Description	Sources
Centralisation of wage bargaining (CENTR)	Centralisation of wage bargaining	Visser (2011)
Minimum wages	Minimum wage in % of median wage (0 if no minimum wage)	OECD
Generosity unemployment of benefits	Net replacement rate for short term unemployed single	OECD
Product market regulation (PMR)	Product market regulation index	OECD
Active labour market policy	Active labour market policy expenditure in % of GDP	OECD
Taxation	Effective marginal tax rate for unemployed moving to employment at 33% of mean wage	OECD
Employment protection (EPL)	Employment protection index	OECD

Source: OECD, Visser (2011).

Interestingly, the many case as well as cross-country regression studies (see Arpaia and Mourre, 2005 for a recent survey) have mostly looked at the effects of such institutions on unemployment (e.g. Nickell et al, 2005) and labour market flows (e.g. Boeri and Garibaldi, 2009), with only very few applications looking at the role of institutions on migration or the responsiveness of migration to labour demand shocks. As a consequence, in Figure 5.10 the country level measures of labour market adjustment reported in Figure 5.9 are correlated to measures of expenditures for active labour market policies, the generosity of unemployment benefits, employment protection, centralization of wage bargaining, or minimum wages and measures of tax wedges from OECD, ECTTS and EU sources (see Table 5.12 for details), as these have been proposed as the main potential explanation for the country differences in labour market flexibility in the EU (see e.g. Belot 2007, Felbermayr and Pratt 2011, Herwatz and Niebuhr 2011 and Sachs 2012 for recent contributions).

Figure 5.10: Correlation of country-level coefficients with institutional measures



Source: ELFS, WIFO calculations, OECD, Visser (2011).
Note: Sample: Active aged population (aged 20 to 64) not in full-time training.

Table 5.13: Correlation of country-level coefficients with institutional measures for individual subgroups

	Product market regulation	Employment protection legislation	Minimum wages	Active labour market policy	Tax wedge	Wage bargaining centralisation	Net replacement rate
Total	-0.124	-0.331*	-.478**	-0.261	-.749***	-0.187	-0.196
Less educated	-0.473*	0.297	-0.035	0.500*	-0.082	0.340	0.679***
Medium educated	0.256	0.042	0.082	-0.069	-0.416	0.077	-0.324
Highly educated	0.010	-0.179	-0.229	-0.165	-0.211	0.262	-0.238
Natives	-0.324	-0.257	-0.391	0.064	-.603**	-0.055	0.024
Foreign born	-0.055	-0.234	-0.523*	-0.063	0.013	0.052	0.034
Aged 20-34	-0.056	-.467**	-0.306	-0.031	-.679***	-0.032	-0.094
Aged 35-49	-0.109	-0.192	-0.546	-0.204	-.845***	0.002	-0.028
Aged 50-64	-0.047	0.04	-0.271	-0.145	-.803***	-0.414*	-0.117
Male	-0.287	-0.363	-.659**	-0.208	-.856***	-0.108	-0.090
Female	-0.326	-0.309	-0.541*	-0.233	-.774***	-0.199	-0.276

Source: ELFS, WIFO calculations, OECD, Visser (2011).
Note: Sample: Active aged population (aged 20 to 64) not in full-time training. ***(**)(*) signify significance at the 1% (5%) (10%) level respectively.

For each of the indices listed in Table 5.12 we correlate the average of the respective index over the period from 2004 to 2014, with the results of the estimating equation (Eq. 5-6) on a country-by-country basis for the full time period considered.[61] The results of this correlation analysis suggest a negative but often very weak correlation of the country level reaction of population growth to the institutional features of the national labour markets. For instance, the average of the OECD index of product market regulation for the 2005 to 2014 time period as well as the average of active labour market expenditures (in % of the GDP), the index of centralisation of wage bargaining and net replacement rates are statistically insignificantly correlated to the responsiveness of population growth to employment changes on the country level. While the negative sign of these correlations is consistent with the hypothesis that these institutions reduce labour market flexibility (and thus also the responsiveness of population changes to employment growth), the lacking significance of these correlations heavily questions the relevance of the hypothesis.

The correlation is, however, significant at the 5% level for the OECD measure of minimum wages as a percent of the median and the taxation indicator referring to the effective marginal tax rate for unemployed of moving to employment at 33% of mean wages. Therefore, while most institutional indicators (potentially on account of the low number of observations provided in our analysis) impact only rather weakly (or not at all) on the responsiveness of population growth to employment growth, evidence on the negative impact of high marginal tax rates and minimum wages on this responsiveness is somewhat more conclusive.

[61] In additional estimates we also separated this correlation analysis into three time periods (2005-2008, 2008-2011and 2011-2014) and correlated the coefficients with the average of institutional indices for the respective years. This, however, often resulted in insignificant coefficients for the measures of the responsiveness of regional population growth to regional employment growth and also did not lead to more significant results for the correlation coefficients between this responsiveness and institutional variables.

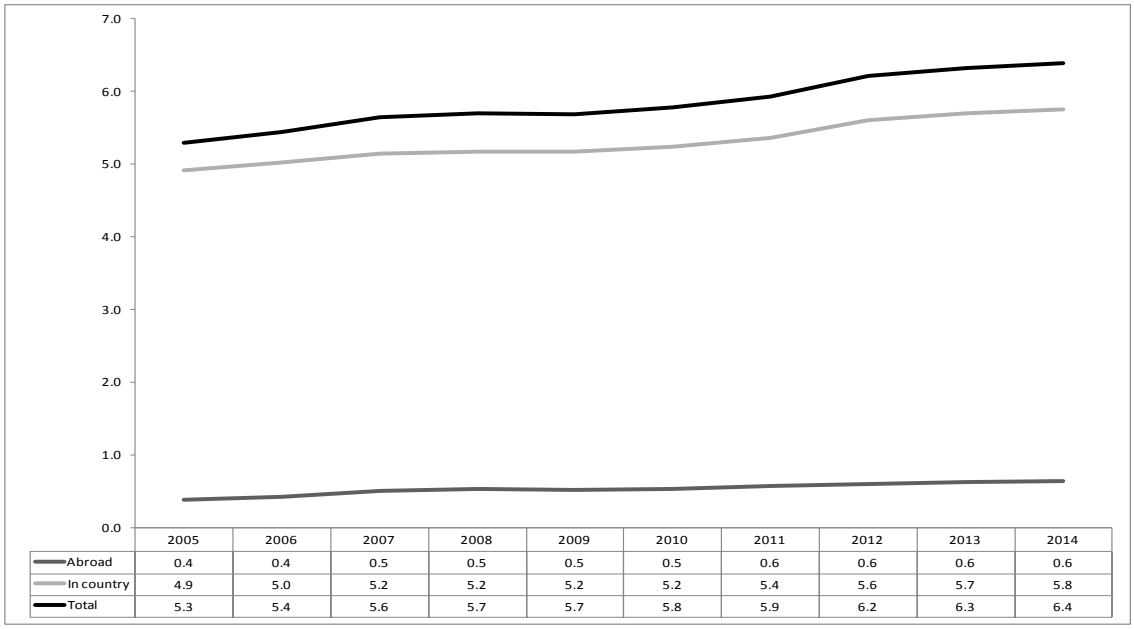
This conclusion is also supported by the results of a similar correlation analysis as in Figure 5.10 for estimates of the responsiveness of population growth at the country level for the individual population groups already considered in section 5.5.2 (reported in Table 5.13). In this analysis the only instances where there is a clear indication of a negative correlation between the responsiveness of population growth to employment growth and labour market institutions apply to the tax measure and minimum wage measures. For the taxation measure this applies to all age groups and genders. For the minimum wages this is the case for both genders and the foreign born. By contrast, the product market regulation measure is only significantly negatively correlated to the responsiveness of population changes for the less educated and for the strictness of employment protection the same only applies to the responsiveness of the population growth of the 20 to 34 year old population. Finally, for the measure of active labour market polices and the net replacement rate there is even a positive correlation to the responsiveness of population growth of the less educated. This would indicate that higher replacement rates and more active labour market policies actually support the mobility of less educated workers to employment differences in European labour markets.

5.4.7. The responsiveness of commuting

Finally, one group of highly mobile workers in the EU, whose potential impact on regional labour market adjustment is often overlooked are commuters (i.e. persons that live in one NUTS2 region and work in another one). This is despite the fact that, overall, the share of commuters has substantially increased in the EU over the last decade and that both cross-border and internal commuting, due to its regionally concentrated nature also attains a rather high importance as a form of regional mobility in some regions. As shown in Figure 5.11 the share of the population commuting across NUTS2 regions on a daily basis in the EU has increased from 5.3% to 6.4% in the last decade, with 5.8% of the population commuting between two regions of the same country and around 0.6% of the population moving across national borders.

Although these shares, and in particular those applying to cross-border commuting, may seem to be rather low when considering the overall population of the EU, Figure 5.12 also shows the spatially concentrated nature of commuting. High rates of cross-border out-commuting occur in border regions or regions close to the border. The major areas of cross-border commuting are located in border regions of countries which share a common language (e.g. Belgium and France or Austria, Switzerland and Germany), have strong historic ties (e.g. the Czech Republic and Slovakia) or in small countries (such as Belgium, Austria and the Baltic countries), where most regions are located close to the border. In these regions cross-border commuting may exceed 5% of the active aged population, and in all other border regions (except those located at the German-French border), the share of cross-border out-commuters is lower than 0.5% of the resident workforce. Furthermore, cross-border commuting has also increased rather strongly in the EU13 countries in the last decade. This is primarily due to the successive introduction of the freedom of movement of labour between these countries and the nearby German and Austrian labour markets.

Figure 5.11: Share of commuters in the total active aged population of the EU by region of origin



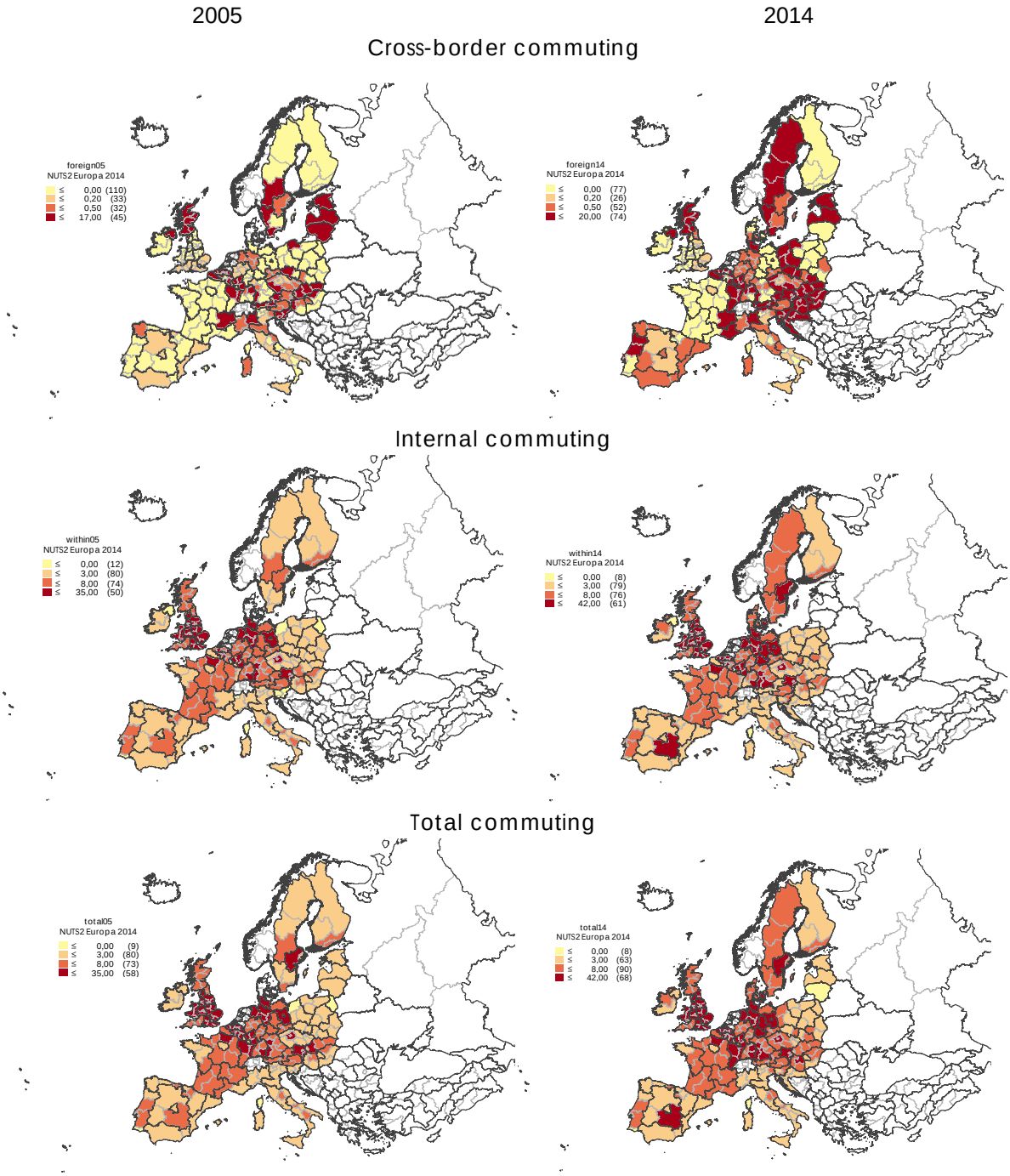
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Abroad	0.4	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6
In country	4.9	5.0	5.2	5.2	5.2	5.2	5.4	5.6	5.7	5.8
Total	5.3	5.4	5.6	5.7	5.7	5.8	5.9	6.2	6.3	6.4

Source: ELFS, WIFO calculations.
Note: Sample: Active aged population (aged 20 to 64) not in full-time training. Romania, Bulgaria, Greece and the Netherlands are excluded from the sample, for countries with only one NUTS2 region (Cyprus, Estonia, Lithuania, Luxemburg, Latvia and Malta) internal commuters cannot be observed. In country=commuters that commute within a country (but across NUTS2 regions). Abroad = cross-border commuters

High rates of internal out-commuting, by contrast, are primarily found near large urban agglomerations (e.g. London, Berlin, Vienna, Prague and in 2014 Stockholm and Madrid) and in smaller NUTS2-regions located, for instance, in Germany. In these regions, out-commuting rates often exceed 20% of the active aged population and have also been rather dynamic in the last decade (see Figure 5.12).

One reason for the neglect of commuters in the literature on regional labour market adjustment may be the poor data situation with respect to this group. Since in general commuting affects only a small part of the workforce in the EU, data from the ELFS very often fail to attain the minimum standards to be representative and other national sources of information on commuting often lack reliability across countries. Thus, many of the studies that focus on commuting in Europe (see Huber 2012, MKW, 2009) either take averages over a number of years of ELFS data to obtain a more representative sample or collect data through interviews.

Figure 5.12: Share of commuters in the total active aged population of the EU by region of origin, NUT2 regions (2005 and 2014)



Source: ELFS, WIFO calculations.
Note: Sample: Active aged population (aged 20 to 64) not in full time training. Romania, Bulgaria, Greece and the Netherlands are excluded from the sample, for countries with only one NUTS2 region (Cyprus, Estonia, Lithuania, Luxemburg, Latvia and Malta) internal commuters cannot be observed. In country=commuters that commute within a country (but across NUTS2 regions). Abroad = cross-border commuters.

Table 5.14: Responsiveness of commuting to employment growth in the region of work by region of origin and country group

	Total			In country			Abroad		
	EU28	EU15	EU13	All	EU15	EU13	All	EU15	EU13
					OLS				
Employment growth	-0.745***	-0.835***	-0.464	-0.559***	-0.725***	-0.013	-0.578*	-0.230	-1.280**
	(0.214)	(0.169)	(0.694)	(0.177)	(0.161)	(0.484)	(0.311)	(0.350)	(0.517)
N	1376	1049	327	1353	1040	313	860	609	251
R2	0.020	0.031	0.005	0.013	0.026	0.001	0.004	0.001	0.019
					Alternative measures of labour demand shock				
Unemployment rate$_{t-1}$	0.216	0.165	0.563	0.141	0.158	0.0256	0.603**	0.377	1.326
	(0.155)	(0.149)	(0.681)	(0.138)	(0.141)	(0.507)	(0.278)	(0.265)	(0.843)
GDP per capita$_{t-1}$	-0.135***	-0.211***	-0.054	-0.105***	-0.154***	-0.081	-0.184*	-0.332***	-0.082
	(0.042)	(0.041)	(0.057)	(0.039)	(0.045)	(0.058)	(0.096)	(0.120)	(0.144)
Obs	1376	1049	327	1353	1040	313	860	609	251
R2	0.008	0.011	0.008	0.006	0.007	0.004	0.010	0.011	0.014

Source: ELFS, WIFO calculations.
Note: Sample: Active aged population (aged 20 to 64) not in full-time training. Romania, Bulgaria, Greece and the Netherlands are excluded from the sample, for countries with only one NUTS2 region (Cyprus, Estonia, Lithuania, Luxemburg, Latvia and Malta) internal commuters cannot be observed. Independent variable is employment growth in the region of residence. In country=commuters that commute within a country (but across NUTS2 regions). Abroad = cross-border commuters. Values in brackets are heteroskedasticity robust standard errors, region fixed effect are not reported, R-squared value is overall R-squared, ***(**)(*) signify significance at the 1% (5%) (10%) level respectively. Results exclude countries for which observations are missing for part of the observation period (i.e. Denmark, Malta, and Croatia).

In the current study – to avoid having to use non-representative data – we use information on internal and cross-border commuting provided in the EUROSTAT regional data base to run similar regressions as in equations (Eq. 5-6) and (Eq. 5-7) for the responsiveness of the growth of cross-border out-commuting to employment growth in the region of residence of the commuters. This data provides information on the number of persons commuting out of a region, within a country or across borders, as well as on the overall number of commuters. It, however, does not report data for Romania, Bulgaria, Greece and the Netherlands as well as the non-EU countries and also does not allow for a more detailed analysis of the extent and responsiveness of commuting by different demographic groups.[62]

Nonetheless, the results from these regressions (see Table 5.15 and Table 5.14) suggest a rather strong response of commuting choices to regional employment growth. According to the results, a 1 percentage point increase in the employment growth rate of a region reduces the growth of out-commuters from that region by 0.75 percentage points.[63] This high responsiveness applies in particular to commuting within a country where results imply that a 1 percentage point increase in the employment growth of region reduces the growth of out-commuters by 0.73 percentage points. Cross-border commuting, by contrast, is uncorrelated to regional employment growth in all cases, except for when focusing on EU13 countries.

[62] Previous research focusing on the pre-crisis period, however, suggests that cross-border commuters are more often manufacturing workers, males and young than non-commuters and in comparison to migrants also more often have medium educational attainment.
[63] Since we focus on out-commuting throughout, a negative coefficient is expected in the regressions for regional employment growth and GDP per capita and a positive one for regional unemployment rates.

Furthermore, in accordance with the results for population growth, internal commuting also seems to be more responsive to regional employment changes in the EU15 than in the EU13 countries. In the latter set of countries, coefficients remain insignificant throughout. This may however also be due to the substantially smaller number of observations available for the EU13 countries than for the EU15 countries.

Table 5.15: Responsiveness of commuting to employment growth in the region of work by period and country group

	All			EU15			EU13		
	2005-2008	2009-2011	2012-2014	2004-2008	2009-2011	2012-2014	2004-2008	2009-2011	2012-2014
					OLS				
Employment growth	-0.718	-1.080**	-0.987***	-0.744	-1.075***	-1.050***	-0.632	-1.094	-0.657
	(0.578)	(0.448)	(0.261)	(0.587)	(0.331)	(0.250)	(1.580)	(1.470)	(0.974)
N	453	461	462	346	350	353	107	111	109
R2	0.011	0.034	0.054	0.015	0.046	0.066	0.004	0.020	0.017
					Alternative measures of labour demand shock				
Unemployment rate$_{t-1}$	-0.349	0.984	-0.472	-0.555	0.586	-0.657	0.080	2.344	1.487
	(1.293)	(1.035)	(0.639)	(1.071)	(1.165)	(0.665)	(1.978)	(2.167)	(2.452)
GDP per capita$_{t-1}$	-0.102	-0.200	-0.059	-0.286	-0.403**	-0.149	0.075	0.058	0.199
	(0.206)	(0.20)	(0.274)	(0.293)	(0.178)	(0.300)	(0.306)	(0.352)	(0.686)
Obs	453	461	462	346	350	353	107	111	109
R2	0.001	0.016	0.002	0.005	0.023	0.005	0.001	0.020	0.007

Source: ELFS, WIFO calculations.
Note: Sample: Active aged population (aged 20 to 64) not in full-time training. Romania, Bulgaria, Greece and the Netherlands are excluded from the sample, for countries with only one NUTS2 region (Cyprus, Estonia, Lithuania, Luxemburg, Latvia and Malta) internal commuters cannot be observed. Independent variable is employment growth in the region of residence. In country=commuters that commute within a country (but across NUTS2 regions). Abroad = cross-border commuters. Values in brackets are heteroskedasticity robust standard errors, region fixed effect are not reported, R-squared value is overall R-squared, ***(**)(*) signify significance at the 1% (5%) (10%) level respectively. Results exclude countries for which observations are missing for part of the observation period (i.e. Denmark, Malta, and Croatia).

Somewhat in contrast to the results for population growth, however, commuting is more responsive to GDP per capita differences and less responsive to unemployment rate differences, and has also been more responsive to regional employment growth in the crisis and post-crisis period than in the pre-crisis period. In particular, when regressing the growth of out-commuting on lagged values of GDP per capita and unemployment rates, only GDP per capita differences have a significant impact on out-commuting. A 1% increase in GDP per capita in a region reduces the growth of out-commuting from that region by between 0.1 to 0.2 percentage points, while regional unemployment rates are an insignificant determinant of the growth of regional out-commuting. Similarly, the responsiveness of employment growth to the growth of out-commuting from a region was higher in the crisis and post-crisis periods, where coefficients in certain cases even exceed unity, than in the pre-crisis period, where the coefficients on employment growth are mostly insignificant. The impact of GDP per capita on the growth of out-commuting is, however, insignificant for all sub-periods reported in Table 5.15, which once more is probably due to the poor identification of effects in this specification.

5.5. The impact of cross-border migration on labour market convergence and structural change

5.5.1. Introduction

In sum, the results so far suggest that migration was more responsive to regional economic conditions than found in the literature before the 2000s and thus accommodated a significant part of the asymmetric shocks to regional labour markets in the time period considered. At the same time, however, they also suggest a number of areas (e.g. concerning the mobility of less skilled or natives) in which the contribution of migration to the mitigation of asymmetries in labour demand in the EU could still be increased. In an integrated labour market with free mobility and in the absence of impediments to cross-border mobility, migration should, however, also contribute to an equalisation of regional unemployment rates across regions and should also facilitate structural change at the sector level. As people move from high-unemployment to low-unemployment regions which offer better labour market opportunities, this, over time, reduces labour supply in the high-unemployment regions and increases labour supply in the low-unemployment regions, and eventually eliminates regional unemployment rate differences. Similarly, if migrants disproportionately often find employment in highly productive, growing sectors they will also contribute to increasing structural change at the regional level.

Regional imbalances, however, can not only be equilibrated by the movement of natives – who, as shown in the last section, are less responsive to regional asymmetries – across regions within a country, but could equally well be adjusted for international immigrants, either from other EU or third countries. This – as suggested by the evidence of a higher responsiveness of immigrants to regional disparities presented in the last section – may be a particularly relevant adjustment mechanism. This is because (as pointed out by Borjas 2001), in contrast to natives, immigrants have already incurred the costs of mobility, and can therefore react more flexibly to regional labour market disparities. In doing so, they therefore "grease the wheels of the labour market" (Borjas 2001).

In this section we analyse, first, whether regional unemployment rates in the European Union converged between 2004 and 2014 and, second, whether unemployment rates converged faster in regional labour market segments that have experienced a higher inflow of migrants than in labour market segments that have not. While section 3 has already shed some light on the first issue by examining regional employment and unemployment rate disparities over time ("σ-convergence"), the focus here will be on β-convergence. In short, β-convergence supposes that labour market segments with high unemployment rates at the beginning of a period experience a faster decline (slower increase) in unemployment over the following period than labour market segments starting with low unemployment rates. Second, we, also analyse the contribution of migration to structural change within regions.

5.5.2. Migration and labour market convergence

In order to analyse the first of these questions, the regional labour markets represented in our data are divided into skill groups based on educational attainment and age, which is used as a proxy for labour market experience (cf. Borjas, 2003). Based on all combinations of three age groups *j*={"20-34", "35-49", "50-64"} and the three education groups *k*={"Compulsory education", "Secondary education", "Tertiary education"}, nine skill groups are defined for each region *r*.[64] As a consequence, the analysis assumes that labour markets are segmented along the lines of these nine groups and that workers compete in the labour market only if they have the same level of educational attainment and labour market experience (see also Borjas, 2003).

Method

To estimate the rate of unemployment convergence, two linear regression models are estimated. In both of these, the dependent variable is the annualized change in the log unemployment rate (u) for workers of age group *j* with educational attainment *k* in region *r* over period *p:*

(Eq. 5-8) $$\Delta \ln u_{jkrp} = \frac{1}{p_t - p_0}(\ln u_{jkr\,p_t} - \ln u_{jkr\,p_0})$$

where p_0 and p_t are the start and end points of period p. The dependent variable is calculated for each skill group in each region for three periods: 2004-2008, 2008-2011, and 2011-2014.

In the first model, the annualized change in the log unemployment rate over period p is regressed on a constant, the log of the regional unemployment rate at time p_0 and a set of control variables X_{jkrp} :

(Eq. 5-9) $$\Delta \ln u_{jkrp} = \alpha + \beta \ln u_{jkr\,p_o} + \lambda X_{jkrp} + \varepsilon_{jkrp}$$

where ε_{jkrp} is an unobserved error term, X_{jkrp} includes age group, educational attainment as well as region-fixed effects,[65] and α, β and λ are parameters to be estimated from the data.[66]

The central parameter of interest is the convergence coefficient β. If $\beta < 0$, a 1% higher unemployment rate at p_0 was associated with a β% decrease in the unemployment rate per year over the period p. A negative coefficient thus indicates that unemployment rates converged. The convergence coefficient can also be used to calculate the speed of the

[64] The ELFS also contains observations where educational attainment is "unknown". These observations are not included. Furthermore in this step of the analysis we also exclude Bulgaria from the analysis to avoid issues with the low number of immigrants measured in individual age-education cells.

[65] The model is thus one of conditional convergence where we allow unemployment rates for each region-age-education cell to converge to different steady state unemployment rate levels.

[66] In further regressions we also omitted region fixed effects from the regression and thus estimated unconditional convergence regressions. This had only little impact on the qualitative results reported below. In consequence we concentrate on conditional convergence results throughout this section (see Barro and Sala-i-Martin, 1992, or Borjas, 2001, for other applications of convergence regressions).

convergence process. The "half-time", i.e. the time it takes for regional unemployment disparities to be halved, is given by: $\ln(0.5)/\ln(1+\beta)$. If, for example, $\beta = -0.1$, it takes around 6.6 years for unemployment disparities to be cut by half (see Monfort 2008, p. 4).

To answer the question whether regional labour market segments that have experienced a higher inflow of immigrants from abroad show stronger signs of convergence and to measure the effect of migration on unemployment rate convergence, this model is extended by including the coefficient of immigrant penetration g_{jkrp} as well as an interaction of g_{jkrp} with the regional unemployment rate at the beginning of the period, $\ln u_{jkr\,p_o}$. The coefficient of immigrant penetration is defined in analogy to Borjas (2001, p. 106) as:[67]

(Eq. 5-10)
$$g_{jkrp} = \frac{M_{jkr\,p_t} - M_{jkr\,p_0}}{N_{jkr\,p_o}} * 100$$

where $M_{jkr\,p_t}$ ($M_{jkr\,p_0}$) is the number of migrants in age group *j* with educational attainment *k* at time p_t (p_0) in region *r* and $N_{jkr\,p_0}$ is the number of natives in the same regional skill group at time p_0. This coefficient thus measures the change in the number of migrants within a regional skill group (an age/education cell) over period *p* relative to the number of natives in the same skill group in region *r* at the beginning of period p. The second model is thus given by:

(Eq. 5-11)
$$\Delta \ln u_{jkrp} = \alpha + \beta \ln u_{jkr\,p_o} + \gamma g_{jkrp} + \delta(g_{jkrp} * \ln u_{jkr\,p_0}) + \lambda X_{jkrp} + \varepsilon_{jkrp}$$

In addition to the convergence coefficient β, the parameters γ and δ are of central interest in the second model. γ measures the direct effect of immigration on the change in the (log) unemployment rate. If it is negative, the unemployment rate decreased more (increased less) in regional labour market segments that have experienced higher immigration. The second parameter δ measures how the rate of regional unemployment convergence depends on the coefficient of immigrant penetration. If δ is negative, the convergence coefficient decreases with rising immigrant penetration, and unemployment rate convergence was faster for regional labour market segments that experienced higher immigration. If it is positive, the convergence coefficient increases with rising immigrant penetration, and unemployment rate convergence was slower in regional labour market segments that were characterized by higher immigration. Immigration thus has two possible effects on unemployment convergence in equation (Eq. 5-11): a direct effect on the change in the (log) unemployment rate, and an effect on the speed of convergence.

Stylized facts

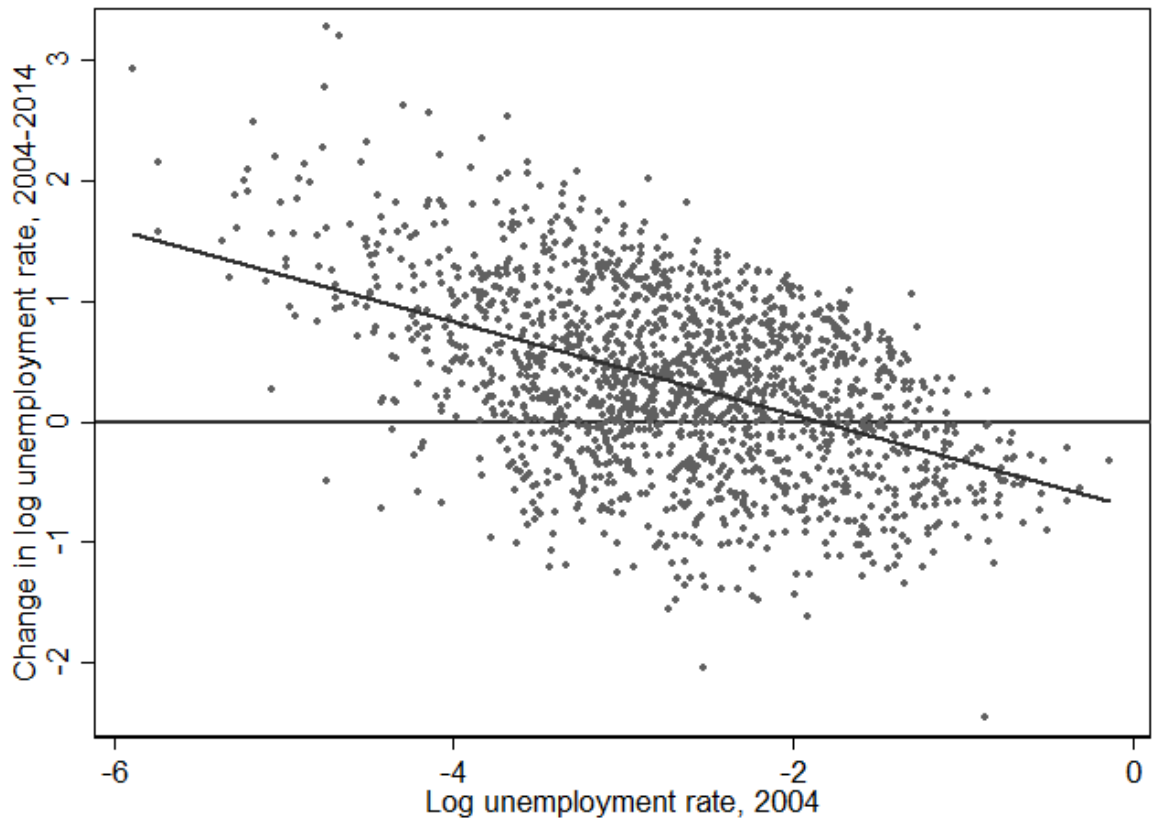
To provide some preliminary evidence on the potential convergence of unemployment rates across all regions in the EU28 (except for Bulgaria[68]), Figure 5.13 plots the difference between

[67] This definition differs from the one in Borjas (2001)—who defines the coefficient of immigrant penetration as the natural logarithm of g_{jkp}—because $M_{jk\,p_t} - M_{jk\,p_0}$ is negative for some age/education cells in some periods (some labour market segments experienced a decline in the number of migrants, see below) and the natural logarithm is not defined for negative numbers.

[68] Bulgaria is dropped on account of the very low number of immigrants residing in this country.

the log unemployment rates in 2004 and 2014 for all skill groups in all regions by the log unemployment rate in 2004. Each point in the Figure thus represents a specific regional skill group. As shown in Figure 5.11, regions that started with low unemployment rates in 2004 tended to experience an increase in the unemployment rate between 2004 and 2014. Conversely, regions that started with high unemployment rates in 2004 tended to experience a smaller increase or even a decrease in the unemployment rate over the same period. Unemployment rates have thus converged in the European Union, although the majority of regional skill groups experienced an increase in the unemployment rate over the whole period.

Figure 5.13: Change in log of regional unemployment rate for all skill groups between 2004 and 2014, by log of regional unemployment rate in 2004, EU28



Source: ELFS, WIFO calculations.
Note: Bulgaria excluded.

Table 5.16 shows the average coefficients of immigrant penetration g_{jkrp} for the nine skill groups over all regions in the EU28, both for the 2004-2014 period as well as for the sub-periods 2004-2008, 2008-2011 and 2011-2014. On average, all skill groups experienced an increase in immigrant penetration over the ten-year period between 2004 and 2014. The strongest increase can be observed for skill groups with tertiary education, where immigrant

penetration has increased by 5.4 to 9.6%, depending on age. On average, it is thus the highly skilled who have experienced the largest relative increase in immigration between 2004 and 2014.

Table 5.16: Average coefficient of immigrant penetration g_{jkrp} by skill groups and sub-period, EU28

Period	Educational attainment	Age		
		20-34	35-49	50-64
2004-2014	Primary	0.431	1.411	0.010
2004-2014	Secondary	0.824	4.130	5.977
2004-2014	Tertiary	5.384	8.407	9.63
2004-2008	Primary	2.592	1.883	0.657
2008-2011	Primary	-0.587	1.125	0.848
2011-2014	Primary	-2.188	-1.548	-1.064
2004-2008	Secondary	2.949	2.739	2.113
2008-2011	Secondary	-0.273	1.131	1.359
2011-2014	Secondary	-1.104	0.047	1.215
2004-2008	Tertiary	1.715	2.748	2.507
2008-2011	Tertiary	1.004	1.589	2.030
2011-2014	Tertiary	2.370	2.906	3.152

Source: ELFS, WIFO calculations.
Note: Bulgaria excluded.

Conversely, the average immigrant penetration over the 2004-2014 period was relatively low (0.01 to 1.4%) for those with compulsory education and for the youngest age cohort (20-34 years) and among those with secondary education (0.8%). Among the low-skilled, this is mostly due to a decrease in g_{jkrp} for those in the 20-34 age group during the crisis years 2008-2011 and for all age groups between 2011 and 2014. The same pattern can be observed for those with secondary education between 20 and 34 years of age. Conversely, immigrant penetration was still positive among those with secondary education who were between 35-49 and 50-64 years of age during and after the economic crisis, as well as for those with tertiary education.

Table 5.17 shows the average change in the log of the unemployment rate for all skill groups in all regions of the EU28. Focusing on the whole period from 2004 to 2014, it can be seen that unemployment rates have on average not only increased for those with primary education, but also for those with tertiary education, albeit starting from a lower level. Looking at the three sub-periods, average unemployment rates uniformly decreased between 2004 and 2008 for all skill groups. During the economic crisis, unemployment rates increased considerably. This trend continued in the post-crisis periods, albeit to a smaller extent (see: section 3.4.1 for further details).

Table 5.17: Average change in log of unemployment rate by skill group and sub-period, EU28

Period	Educational attainment	Age		
		20-34	**35-49**	**50-64**
2004-2014	Primary	0.347	0.369	0.443
2004-2014	Secondary	0.324	0.266	0.214
2004-2014	Tertiary	0.319	0.405	0.246
2004-2008	Primary	-0.022	-0.024	-0.014
2008-2011	Primary	0.124	0.135	0.133
2011-2014	Primary	0.022	0.024	0.035
2004-2008	Secondary	-0.043	-0.052	-0.067
2008-2011	Secondary	0.138	0.129	0.132
2011-2014	Secondary	0.03	0.034	0.03
2004-2008	Tertiary	-0.048	-0.05	-0.071
2008-2011	Tertiary	0.133	0.14	0.144
2011-2014	Tertiary	0.054	0.079	0.041

Source: ELFS, WIFO calculations.
Note: Bulgaria excluded.

A simple correlation analysis using the data from Table 5.17 and Table 5.16 shows that the average coefficient of immigrant penetration and the average change in the unemployment rate by skill groups are negatively correlated: both when looking at the whole 2004-2014 period ($\rho = -0.461$) as well as when the data are divided into the three sub-periods ($\rho = -0.272$) we find that, on average, the increase in the unemployment rate was below the mean in labour market segments where immigrant penetration was above the mean (and vice versa). The regression analysis will reveal whether this result also pertains to the regional level.

Regression analysis

Table 5.18 shows the coefficients β, γ and δ estimated from both the model excluding equation (Eq. 5-9) and the model including the coefficient of immigrant penetration equation (Eq. 5-11). Both models were estimated for all regions in the EU28, the EU15, and the EU13 as well as for country groups based on their exchange rate regime (see previous chapter for a definition). Two additional regressions show the effects of immigration when only immigrants from the EU28 or from non-EU countries are considered.[69]

[69] The results in Table 6.18 and Table 6.19 also include period, region, age group and education fixed effects whose coefficients are not reported. In all specifications and for all country groups we find negative coefficients for secondary and tertiary education as well as for the second and third age group fixed effects. This implies that (compared to regional labour market segments with compulsory education and compared to those in the youngest age group) unemployment rates decreased more (increased less) for the medium and high skilled and for more

As can be seen from the first model estimated for the full sample, the convergence coefficient β is significantly negative throughout, supporting the preliminary evidence in favour of unemployment rate convergence across the EU regions presented above. Unemployment rates thus decreased faster (increased slower) for skill segments in regions that had higher unemployment rates to begin with. The estimate for the EU28 is -0.166, which implies that a 1% higher unemployment rate at the beginning of the period is – ceteris paribus – associated with a 0.166% decline in the unemployment rate per year. The convergence coefficient is slightly higher in the EU13 countries (-0.179), but this difference is not statistically significant. It is, however, significantly higher in the countries with floating exchange rates to the Euro than in countries where the exchange rate is pegged to the Euro or in the Eurozone countries.

The estimated convergence coefficients suggest that the half-time (the time it takes for unemployment disparities to be halved) in the EU28 is 3.8 years. The half-time is slightly lower in the EU13 (3.5 years) than in the EU15 (3.8 years), and it is also slightly lower in the countries with flexible exchange rates (3.2 years) than in the Eurozone (4.0 years) or ERM II/pegged exchange rate countries (4.1 years). On average, it thus takes around four years for regional unemployment disparities to halve. The convergence coefficient remains significantly negative after including the coefficient of immigrant penetration as well as its interaction with the log unemployment rate. The size of the coefficient is also virtually unchanged, confirming that unemployment rates did converge between 2004 and 2014 with a half-time of around 4 years.

The estimated direct effect of the coefficient of immigrant penetration on the change in the log unemployment rates (γ) is significant and negative for all country groups. This shows that regional labour market segments where immigrant penetration has increased experienced a larger decline (a smaller increase) in the unemployment rates, irrespective of which country groups we focus on when considering the full estimation period. Although this effect is not necessarily causal in the sense that higher immigration caused unemployment rates to decrease more/increase less, it at least shows that there is no evidence that immigration was associated with rising unemployment rates at the regional level.

This effect is mostly driven by immigration from non-EU sending countries. For the EU28 as a whole, as well as for almost all country groups, the direct effect γ is insignificant if only migrants from EU28 sending countries are considered and significantly negative if only migrants from non-EU sending countries are considered. Only in the ERM II/pegged exchange rate countries is the parameter γ significantly negative (at the 5% level) when considering only immigrants from the EU28 sending countries and insignificant when considering only immigrants from non-EU sending countries. This indicates that for most country groups it is non-EU migrants and not EU-internal migration that contribute to the negative overall association

experienced workers. The fixed effects for the 2008-2011 and 2011-2014 periods are positive. As expected, therefore, compared to the pre-crisis (2004-2008) period, unemployment rates decreased less (increased more) in the crisis and post-crisis period.

of changes in immigrant penetration with the change of unemployment rates in the EU28 in the overall estimation period.

Table 5.18: Estimation of convergence model for full sample

Countries	EU28	EU15	EU13	Eurozone	ERM II/Pegged	Floating
Excluding coefficient of immigrant penetration						
β (convergence term)	-0.166***	-0.166***	-0.179***	-0.159***	-0.156***	-0.197***
	(0.005)	(0.006)	(0.009)	(0.006)	(0.018)	(0.007)
Observations	5,010	3,702	1,308	3,266	449	1,295
R2	0.505	0.470	0.609	0.473	0.599	0.644
Including coefficient of immigrant penetration, all sending countries						
β (convergence term)	-0.163***	-0.163***	-0.179***	-0.155***	-0.156***	-0.194***
	(0.005)	(0.006)	(0.009)	(0.006)	(0.018)	(0.007)
γ (direct migration effect)	-0.003***	-0.002***	-0.019***	-0.003***	-0.029***	-0.009***
	(0.001)	(0.001)	(0.005)	(0.001)	(0.011)	(0.003)
δ (conv. effect of migration)	-0.002***	-0.001***	-0.006***	-0.001***	-0.011***	-0.004***
	(0.0004)	(0.0004)	(0.002)	(0.0004)	(0.004)	(0.001)
Observations	5,010	3,702	1,308	3,266	449	1,295
R2	0.508	0.472	0.617	0.476	0.605	0.652
Including coefficient of immigrant penetration, EU28 sending countries						
β (convergence term)	-0.165***	-0.166***	-0.181***	-0.159***	-0.155***	-0.196***
	(0.005)	(0.006)	(0.009)	(0.006)	(0.018)	(0.007)
γ (direct migration effect)	-0.002	0.001	-0.018*	0.001	-0.045**	-0.013*
	(0.003)	(0.003)	(0.009)	(0.003)	(0.018)	(0.007)
δ (conv. effect of migration)	-0.001	0.00002	-0.005	0.00002	-0.016**	-0.006**
	(0.001)	(0.001)	(0.004)	(0.001)	(0.007)	(0.003)
Observations	5,010	3,702	1,308	3,266	449	1,295
R2	0.506	0.47	0.612	0.474	0.605	0.647
Including coefficient of immigrant penetration, non-EU sending countries						
β (convergence term)	-0.163***	-0.163***	-0.178***	-0.156***	-0.157***	-0.195***
	(0.005)	(0.006)	(0.009)	(0.006)	(0.018)	(0.007)
γ (direct migration effect)	-0.004***	-0.003***	-0.020***	-0.004***	-0.020	-0.010**
	(0.001)	(0.001)	(0.007)	(0.001)	(0.015)	(0.005)
δ (conv. effect of migration)	-0.002***	-0.002***	-0.007***	-0.002***	-0.008	-0.005***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.006)	(0.002)
Observations	5,010	3,702	1,308	3,266	449	1,295
R2	0.508	0.472	0.615	0.476	0.600	0.651

Source: EU-LFS.
Note: Dependent variable: annualized difference in log regional unemployment rates between 2004 and 2008, 2008 and 2011, and 2011 and 2014. Bulgaria excluded. Robust standard errors in parentheses. All regressions include a constant as well as age, education, region and period fixed effects (coefficients not reported). ***significant at 1%, **significant at 5%, *significant at 10% level.

The regressions also show that the speed of convergence increases with the coefficient of immigrant penetration. The interaction effect δ is statistically significant and negative, not only for the EU28 as a whole, but also for the EU15, EU13, Eurozone, ERM II/pegged exchange rate and floating exchange rate country groups. Unemployment rate convergence was thus more pronounced for labour market segments that experienced an increase in immigration.

Table 5.19: Estimation of convergence model by sub-periods, age and education groups

Countries	EU28	EU15	EU13	EU28	EU15	EU13	EU28	EU15	EU13
	Period 2004-2008			**Age group 20-34**			**Compulsory education**		
β (convergence term)	-0.119***	-0.133***	-0.121***	-0.159***	-0.153***	-0.172***	-0.203***	-0.191***	-0.252***
	(0.008)	(0.011)	(0.015)	(0.007)	(0.009)	(0.013)	(0.008)	(0.010)	(0.015)
γ (direct migration effect)	-0.005***	-0.004***	-0.019***	-0.001	-0.0005	-0.018**	-0.001	-0.001	-0.007
	(0.001)	(0.001)	(0.007)	(0.001)	(0.001)	(0.009)	(0.001)	(0.001)	(0.009)
δ (conv. effect of migration)	-0.002***	-0.002***	-0.006**	0.0002	0.0003	-0.005	-0.0001	-0.001	0.0004
	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.005)
Observations	1,613	1,189	424	1,706	1,262	444	1,708	1,268	440
R2	0.560	0.493	0.612	0.549	0.494	0.693	0.573	0.538	0.663
	Period 2008-2011			**Age group 35-49**			**Secondary education**		
β (convergence term)	-0.172***	-0.173***	-0.188***	-0.185***	-0.203***	-0.217***	-0.204***	-0.196***	-0.245***
	(0.009)	(0.012)	(0.017)	(0.009)	(0.011)	(0.019)	(0.008)	(0.010)	(0.011)
γ (direct migration effect)	-0.004**	-0.003	-0.027***	-0.004**	-0.001	-0.020**	-0.001	-0.002	0.006
	(0.002)	(0.002)	(0.009)	(0.002)	(0.002)	(0.008)	(0.002)	(0.002)	(0.017)
δ (conv. effect of migration)	-0.002***	-0.002**	-0.009***	-0.002**	-0.0004	-0.006**	0.0003	-0.0001	0.006
	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.007)
Observations	1,685	1,249	436	1,678	1,247	431	1,701	1,257	444
R2	0.607	0.617	0.585	0.559	0.544	0.657	0.625	0.559	0.838
	Period 2011-2014			**Age group 50-64**			**Tertiary education**		
β (convergence term)	-0.152***	-0.166***	-0.128***	-0.212***	-0.218***	-0.217***	-0.194***	-0.168***	-0.265***
	(0.008)	(0.009)	(0.019)	(0.008)	(0.010)	(0.015)	(0.009)	(0.011)	(0.013)
γ (direct migration effect)	-0.001	0.001	-0.014**	-0.007**	-0.005	-0.018*	-0.008	-0.010*	-0.030**
	(0.002)	(0.002)	(0.006)	(0.003)	(0.003)	(0.009)	(0.005)	(0.005)	(0.012)
δ (conv. effect of migration)	-0.001*	-0.0004	-0.006***	-0.003***	-0.002**	-0.006**	-0.003**	-0.004**	-0.009***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.003)	(0.001)	(0.002)	(0.003)
Observations	1,712	1,264	448	1,626	1,193	433	1,601	1,177	424
R2	0.585	0.594	0.52	0.562	0.545	0.635	0.531	0.473	0.712

Source: EU-LFS.

Note: Dependent variable: annualized difference in log regional unemployment rates between 2004 and 2008, 2008 and 2011, and 2011 and 2014. Bulgaria excluded. Robust standard errors in parentheses. All regressions include a constant as well as age, education, region and period fixed effects (coefficients not reported). ***significant at 1%, **significant at 5%, *significant at 10% level.

The size of this effect is, however rather small: in the EU28, a one unit increase in immigrant penetration decreases the half-life time of unemployment convergence by only 0.04 years (around 0.5 months). The separate regressions by country groups show that the effect on convergence speed is larger in the EU13 countries – where a one unit increase in immigrant penetration decreases the half-life time by about 0.13 years (around 1.5 months) – than in the EU15 countries (change in half-time: -0.03 years/0.4 months). Furthermore, the effect is considerably higher in the ERM II/pegged exchange rate countries (-0.30 years) than in the Eurozone (-0.04 years) or in countries with floating exchange rates to the Euro (-0.08 years). This is consistent with the results above, since most of the ERM II/pegged exchange rate countries are in the EU13.

Separate regressions by period (Table 5.19) show that the direct effect γ as well as the effect on the speed of convergence δ are not significant in all time periods. In the post-crisis period 2011-2014, they are only significant for the EU13 countries, but insignificant for the EU15. In the crisis period 2008-2011 the direct effect is negative but insignificant in the EU15, and only the effect on the speed of convergence is significantly negative. Only in the 2004-2008 period both are they significantly negative for the EU28, EU15 and EU13. Conversely, the convergence coefficient β is always significantly negative. Thus, even in the crisis and post-crisis periods unemployment rates have converged in the EU.

Additional regressions by age and educational attainment groups in Table 5.19 show that unemployment rates converged for all skill groups, even if the sample is further differentiated by country groups.

The significance of γ and δ however varies over age and education groups. Among those in the youngest age cohort (20-34 years), the direct effect of immigrant penetration γ is only significant for the EU13, but not for the EU15 or the EU28 as a whole, while the interaction effect δ is insignificant. In the second age cohort (35-49 years) both γ and δ are significant for the EU28 as a whole and for the EU13, but again not for the EU15. Only among those in the oldest age group (50-64 years) is the effect on the speed of convergence significantly negative for both the EU15 and the EU13, although the direct effect is only significant at the 5% level for the EU28 as a whole.

Similarly, among different education groups the effect of immigrant penetration on the speed of convergence is only significant for those with a tertiary education. The direct effect on the change in the log unemployment rate is only significant at the 5% level for the EU13, and only at the 10% level for the EU15. On the one hand, unemployment convergence among skill groups with low education and low labour market experience thus appears to be unaffected by immigration. On the other hand, neither γ nor δ are significantly positive in any of the regressions. There is, thus, also no evidence that immigration was related to rising unemployment levels or a lower speed of convergence for any sub-period or any subgroup defined by age or education.

In sum, thus, although the speed of convergence increases with immigration from non-EU countries, this effect is driven mainly by non-EU immigrants, with the exception of the ERM

ll/pegged exchange countries where it appears to be driven by immigrants from the EU-28 and also seems to have decreased over time, as it is of lower significance in particular in the EU15 countries in the post-crisis period than both in the crisis and pre-crisis period.

5.5.3. Migration, productivity growth and structural change

Next to its function as an equilibrating mechanism of regional labour markets that fosters the reduction of regional labour market disparities, migration, however, also plays an important role in influencing structural change within regions. For instance, Hekscher-Ohlin models of international trade (which assume perfect mobility of labour across sectors) suggest that immigration and in particular its structure will also trigger structural change. In these models, high-skilled immigration will lead to expansion of production and exports of products that primarily require high-skilled labour inputs in the receiving country. Low-skilled immigration, by contrast, will result in the expansion of production and export of products that primarily require low-skilled labour inputs.

Furthermore, in a recent contribution Braun and Kavasnicka (2014) show that in a model with costly labour mobility across sectors, immigrants, on account of having lower mobility costs, also increase the speed of growth of high productivity sectors in the receiving country. The mechanism underlying this result is similar to that used by Borjas (2001) and analysed in the above section to highlight the role of immigrants in fostering regional convergence. Thus, the lower mobility costs of immigrants arise from migrants already having quit their job when arriving in their new region of residence and thus facing lower cross-sector mobility costs than natives.

Braun and Kvasnicka (2012) show that, under this assumption, two predictions can be derived from economic theory. The first holds that regions with higher immigrant inflows should have higher employment growth in high productivity sectors. This arises because high immigration regions are better able to reallocate labour resources from low to high productivity sectors and tends to increase productivity in immigrant-receiving regions. The second one states that regions with higher immigration should see slower productivity growth within the high-productivity sectors of their regions in the short run. This is because of higher labour inputs in high-productivity sectors in high-immigration regions and a decreasing marginal productivity of labour.

As a consequence, the effect of immigration on average labour productivity in a region is ex ante indeterminate. On the one hand, labour productivity growth in the high productivity sectors is reduced by immigration. This would, ceteris paribus, reduce aggregate productivity growth. On the other hand, high immigration regions should – all else being equal - experience higher average productivity growth on account of these regions being better able to shift labour from low to high productivity uses. As pointed out by Braun and Kvasnicka (2012), one immediate consequence of this is that the within sector productivity component of a standard Oaxaca-Blinder decomposition of productivity growth (see Fagerberg 2000, Timmer - Sirmai 2000 and Peneder 2003) should be negatively correlated to the share of immigrants a region receives, while the between-sector component of this decomposition

should be positively correlated to the share of immigrants received. To see this, note that the growth of productivity ϱ_{it} in region i between time points t and t-1 can be written as:

(Eq. 5-12)

$$\varrho_{it} - \varrho_{it-1} = \left[\sum_{s=1}^{S}(\varrho_{ist} - \varrho_{ist-1})\sigma_{ist-1}\right] + \left[\sum_{s=1}^{S}\varrho_{it-1}\{\sigma_{ist} - \sigma_{ist-1}\}\right] + \left[\sum_{s=1}^{S}(\varrho_{ist} - \varrho_{ist-1})\{\sigma_{ist} - \sigma_{ist-1}\}\right]$$

with ϱ_{ist} the productivity of sector s at time t in region i and σ_{ist} the sector's employment share in region i at time t.[70]

The first term in square brackets of this equation is the within-industry productivity growth effect (within component). This measures the hypothetical increase in a region's average labour productivity that would have resulted between time period t and t-1 if all sectors had a constant employment share throughout. This part of the decomposition according to Braun and Kavasnicka (2014) should be negatively related to immigration.

The second term in square brackets is the share of productivity growth due to cross-sector employment growth (between component). It measures the hypothetical increase in a region's average productivity, if sector specific productivities had remained constant over the time period and only sector employment shares had changed. It will be positive if – as would be expected – high productivity sectors increase their employment share, while low productivity sectors reduce their employment share. This component according to Braun and Kavasnicka (2014) should be positively correlated to immigration.

Finally, the third term is an interaction (residual) component resulting from the interaction of employment and productivity growth. It is often referred to as the dynamic structural shift effect. For this component no clear hypothesis on its link to immigration can be derived. It will be positive if sectors with higher productivity growth also increase their employment share and are otherwise negative.

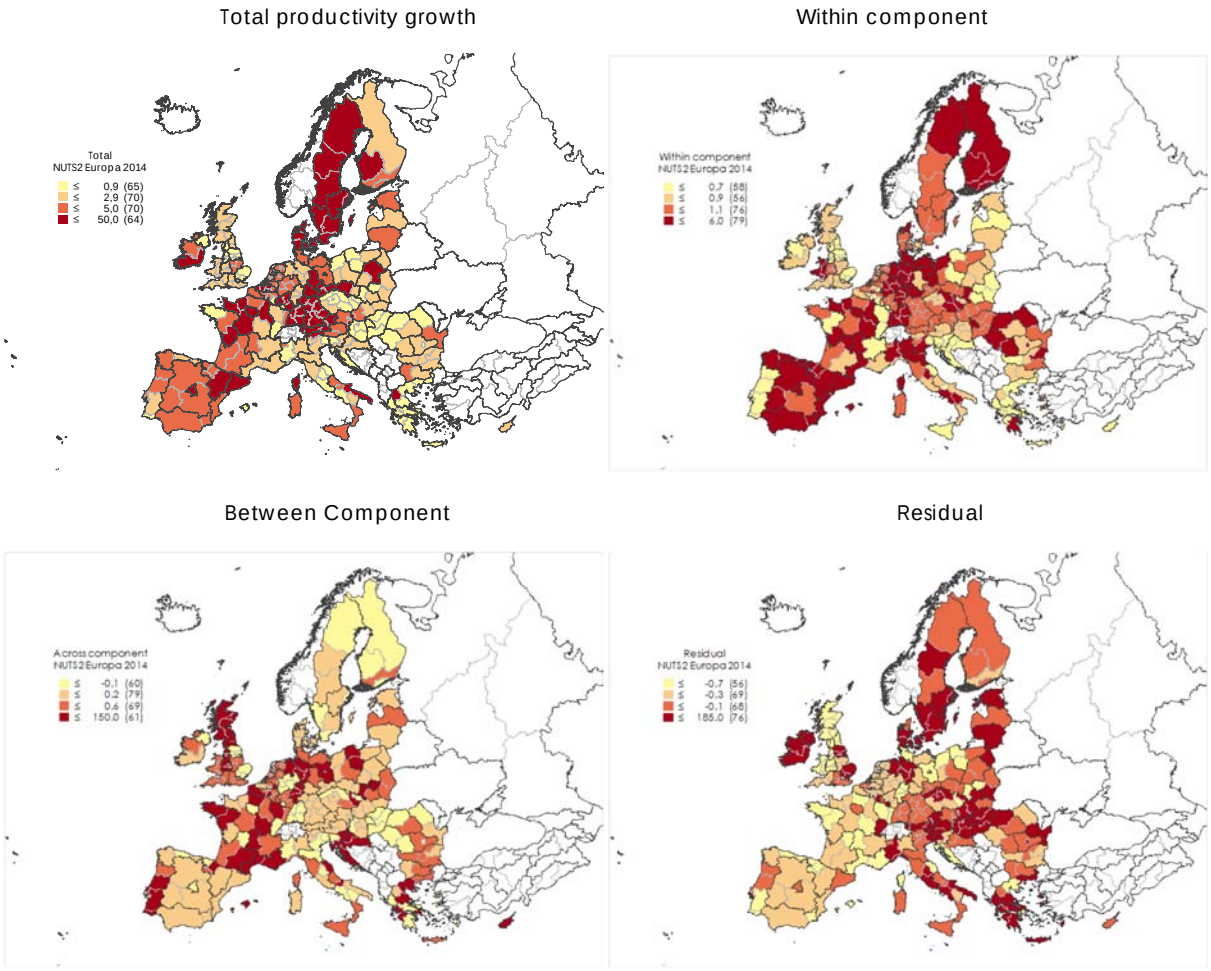
Results of the shift share analysis

Figure 5.14 graphs the results of the shift share analysis defined in equation (Eq. 5-12) for each of the NUTS 2 regions of the EU28 for which we have data for the time period from 2008 to 2013[71] based on a sector break down of GVA to six sectors (agriculture, industry (except construction), construction, personal services[72], financial services and real estate[73] and non-market services[74]). This Figure suggests that, overall, in particular the German and Austrian

[70] The equation can be very simply verified by multiplying out and cancelling out the respective terms.
[71] As explained in section 5.2 data constraints preclude an analysis of the pre-crisis period as well as of the non-EU countries in this step of the analysis.
[72] That is wholesale and retail trade; transport; accommodation and food service activities; information and communication
[73] This includes financial and insurance activities; real estate activities; professional, scientific and technical activities; administrative and support services.
[74] These consist of public administration and defence; compulsory social security; education; human health and social work activities; arts, entertainment and recreation.

NUTS 2 regions in the core of the EU as well as Swedish regions experienced the highest productivity growth in the period from 2008 to 2013, while productivity growth in the Eastern European regions as well as in Greece was markedly slower.

Figure 5.14: Total labour productivity growth and its components by NUTS2 regions and 2008 – 2013 (in%)



Source: ELFS, EUROSTAT WIFO calculations.
Note: Productivity measures are calculated as GVA per employed.

The contributions of the components of productivity growth also vary substantially across regions. Thus, the contribution of within-sector productivity growth was highest in the Spanish regions and in the Finnish and northern Swedish regions, as well as in a number of German regions. By contrast, this contribution was lower in particular in the UK and Irish NUTS2 regions. Structural change on the sector level contributed most strongly to total productivity growth in French, UK and Portuguese NUTS 2 regions, while its contribution to productivity growth was rather low in many Eastern European regions (in particular in Romania and Bulgaria). Finally, the residual component contributed most strongly to total productivity growth in the Austrian

and Hungarian NUTS 2 regions of the EU, but also in Greece and southern Italy, while the contribution of this component to total labour productivity growth was rather weak in Spanish and French NUTS 2 regions.

In sum, this implies that the strong productivity growth in the core regions of the EU from 2008 to 2013 is mainly due to a combination of intermediate or high contribution of within-sector productivity growth as well as a high contribution of the residual component. The low productivity growth in many Eastern European countries, by contrast, is mainly due to a low impact of the between-sector component, while the weak productivity growth in Greece was mainly caused by weak within-sector productivity developments.

A regression analysis

To link the results of this decomposition to immigration on a year-to-year basis, we regress total regional productivity growth as well as the within, between and residual component on measures of changes in labour supply, such that:

(Eq. 5-13)

$$\frac{\Delta\rho_{it}^{C}}{\rho_{it-1}} = \alpha\frac{\Delta pop_{it}^{n}}{pop_{it-1}} + \beta\frac{\Delta pop_{it}^{f}}{pop_{it-1}} + \gamma_i + \varphi_{it}$$

where $\Delta\rho_{it}^{C}$ is the share of productivity growth in region i between two years (t and $t-1$) due to component c of the decomposition and $\frac{\Delta pop_{it}^{n}}{pop_{it-1}}$ and $\frac{\Delta pop_{it}^{f}}{pop_{it-1}}$ are the contributions to total population growth due to an increase in the native and foreign-born population, respectively, while γ_i is a region fixed effect and φ_{it} is an identically and independently distributed error term.

Following Braun and Kavasnicka (2014), we hypothesize that immigration should impact negatively on the first part of the decomposition (associated with within sector productivity developments), but should be positively correlated to the second component of this decomposition (associated with between-sector developments arising from shifts in employment shares between industries), while theory makes no clear predictions with respect to the residual component. As a consequence, we expect the coefficient α and β to be negative in regressions where the within component of the decomposition is the dependent variable, and positive in regressions where the between component of the decomposition is the dependent variable.

There are a number of issues that impinge on the causal interpretation of the results. The first of these is related to the measure $\Delta pop_{it}^{n}/pop_{it-1}$. This is used as a proxy measure for immigration of natives from other regions of the country. In contrast to the measure of immigration from abroad $\Delta pop_{it}^{f}/pop_{it-1}$, this proxy is measured very noisily. This is because population changes of natives in a region are also a result of demographic trends in the region (such as natural population growth). As a consequence, we expect that our estimate of β much better measures the impact of migration on the respective productivity growth components than the estimate of α, which is primarily included in this regression as a control variable. The second issue arises from the potential endogeneity of the population change

measure that may be due to immigrants choosing their region of residence according to where they can be expect to be most productive and thus earn the highest wages. As we have no good instruments, we once more use lagged values of the independent variables to mitigate the potential effects of endogeneity as far as possible.

The results of this estimation (the top panel of Table 5.20) suggest that indeed higher contributions of the foreign-born to population growth of a region are associated with a statistically significant reduction in the contribution of the within component to productivity growth. The coefficient estimates suggest that in the average of all EU28 regions a one percentage point higher growth rate of the foreign-born population reduces the within component of productivity growth by 0.76 percentage points. This coefficient is slightly (and statistically insignificantly) higher (0.81) in the average of the regions located in EU15 countries. Furthermore, it is somewhat lower and statistically insignificant in the regions of the EU13 countries. This may, however, be due to the substantially smaller number of observations available for these countries, as well as the lower share of foreign-born residing in the average region of the EU13 countries.

Also – in accordance with prior expectations – an increase in the contribution of the foreign-born to the population growth rate of a region is associated with a statistically significant increase in the contribution of the between sector component to productivity growth. The coefficient for this component is, however, smaller than for the within component. It suggests that a 1 percentage point increase in population growth due to immigration of foreign-born increases the between-sector component of productivity growth by 0.15 percentage points in the average of the EU28 regions. Once more, this effect is slightly higher among the regions of EU15 countries and substantially lower and statistically insignificant in the regions of EU13 countries.

As a consequence of the negative effect on the within component being larger than the positive effect on the between industry component, the impact of an increase in the population growth due to immigration of the foreign-born on total productivity is weakly significantly negative in the average region of the EU28 countries as well as of the EU15 countries, but statistically insignificant in the average region of the EU13 countries. Thus, in sum the impact of an increase in the population growth of the foreign born on the different components of population growth is highly consistent with prior expectations and also suggests an in aggregate slightly negative but only weakly significant impact of foreign born migration on aggregate productivity.

The same does not, however, apply to an increase in population growth due to natives. This is statistically significantly positively correlated with the within component of productivity growth in the EU13 countries and significantly positively correlated with total productivity growth in the average region of EU28 and EU13 countries. In all other regressions, by contrast, its impact on the components of productivity growth is statistically insignificant. This thus suggests that this variable – as expected – is only an imperfect proxy measure of within country migration and is strongly contaminated by the different demographic trends in the regions of the EU.

Table 5.20: Population growth and the development of the components of GVA growth (regression results)

	Within			Across			Residual			Total		
	All	EU15	EU13	All	EU15	EU13	All	EU15	EU13	All	EU15	EU13
						(1)						
Foreign pop. growth	-0.757**	-0.812**	-0.531	0.148**	0.154**	0.013	-0.00004	0.010	-0.041	-0.609*	-0.649*	-0.559
	(0.370)	(0.388)	(0.472)	(0.070)	(0.074)	(0.273)	(0.052)	(0.046)	(0.042)	(0.322)	(0.333)	(0.365)
Native pop. growth	0.108	0.0466	0.463***	0.036	0.038	0.021	0.017	0.025	0.004	0.161**	0.109	0.488***
	(0.105)	(0.124)	(0.129)	(0.023)	(0.028)	(0.049)	(0.038)	(0.049)	(0.014)	(0.078)	(0.087)	(0.120)
N	815	584	231	815	584	231	815	584	231	815	584	231
R2	0.136	0.083	0.474	0.028	0.036	0.012	0.011	0.019	0.033	0.132	0.074	0.494
						(2)						
EU born pop. growth	-0.373	-0.379	-0.785	-0.12	-0.121	-0.337	0.009	0.021	0.106	-0.484*	-0.479*	-1.016
	(0.311)	(0.319)	(1.074)	(0.090)	(0.095)	(0.339)	(0.055)	(0.061)	(0.076)	(0.277)	(0.284)	(0.964)
Third country pop. Growth	-0.822**	-0.879**	-0.389	0.247***	0.257***	0.209	-0.002	0.008	-0.157	-0.577	-0.615	-0.337
	(0.407)	(0.421)	(0.818)	(0.070)	(0.073)	(0.297)	(0.077)	(0.069)	(0.130)	(0.373)	(0.380)	(0.765)
Native pop. growth	0.107	0.045	0.459***	0.0411*	0.045	0.014	0.017	0.025	0.008	0.164**	0.115	0.482***
	(0.108)	(0.129)	(0.129)	(0.024)	(0.028)	(0.051)	(0.037)	(0.048)	(0.016)	(0.080)	(0.089)	(0.121)
N	815	584	231	815	584	231	815	584	231	815	584	231
R2	0.135	0.082	0.475	0.045	0.059	0.016	0.011	0.019	0.044	0.128	0.068	0.495
						(3)						
Unskilled foreign born	-1.172***	-1.276***	-1.485*	0.258**	0.280**	-0.893***	-0.108	-0.104	0.019	-1.022**	-1.100***	-2.358***
	(0.427)	(0.446)	(0.858)	(0.119)	(0.122)	(0.292)	(0.125)	(0.114)	(0.085)	(0.393)	(0.403)	(0.782)
Skilled foreign born	-0.897*	-0.933**	-0.231	0.128	0.127	0.222	-0.025	-0.022	-0.049	-0.794*	-0.828*	-0.058
	(0.470)	(0.471)	(0.607)	(0.083)	(0.086)	(0.281)	(0.115)	(0.121)	(0.061)	(0.447)	(0.448)	(0.540)
Native pop. growth	0.079	0.001	0.470***	0.0457*	0.0530*	0.028	0.007	0.010	0.004	0.132	0.064	0.501***
	(0.112)	(0.132)	(0.129)	(0.024)	(0.029)	(0.048)	(0.028)	(0.037)	(0.014)	(0.086)	(0.096)	(0.120)
N	815	584	231	815	584	231	815	584	231	815	584	231
R2	0.168	0.135	0.475	0.038	0.051	0.024	0.024	0.031	0.033	0.163	0.124	0.499

Source: ELFS, EUROSTAT, WIFO calculations.
Note: Sample: Active aged population (aged 20 to 64) that is not in full-time training in EU28 countries for the time period 2008 - 2013. Values in brackets are heteroskedasticity robust standard errors, region-fixed effect are not reported, R-squared value is overall R-squared, ***(**)(*) signify significance at the 1% (5%) (10%) level respectively.

Given these findings, it may also be interesting to ask whether there are differences in the impact of immigration between immigrants of different origin regions or of different skill levels. The middle panel of Table 5.20 thus reports the results of a regression in which the contribution of foreign-born to total population growth was split into the contribution of migrants from other EU countries and the contribution from immigrants from third countries.[75] The bottom panel, by contrast, shows similar results, in which the contribution of the foreign-born to total population growth was split into a part stemming from skilled and unskilled migrants in an analogous way.[76]

The results of these additional regressions suggest that the negative effects of increased immigration on the within-sector component of productivity growth are primarily associated with the immigration of third-country immigrants and low-skilled immigrants. A 1 percentage point increase in the contribution of third-country immigrants to population growth reduces the within-sector component of productivity growth (statistically significantly) by 0.8 to 0.9 percentage point in the average region of EU28 and EU15 countries, while the same change remains statistically insignificant in the EU13 countries. An equivalent change in the contribution of immigration from other EU countries has a negative but statistically insignificant impact on the within component of productivity growth in all parts of the EU28.

A 1 percentage point increase in the contribution of unskilled immigrants to population growth, by contrast, reduces the within-sector component of total productivity growth (statistically significantly) by 1.2 to 1.3 percentage points in EU28 and EU15 countries and (weakly statistically significantly) by 1.5 percentage points in the EU13 countries. An equivalent increase in the share of skilled immigrants reduces the within component of productivity growth by 0.9 percentage points in the EU28 and EU15 countries and is only slightly (but statistically insignificantly) lower than that of unskilled immigrants. Furthermore, the impact of an increase in the share of skilled immigrants on the within component of productivity growth – contrary to prior expectations – is significantly negative for the EU13 countries.

Similarly, the positive impact of immigration on between sector productivity growth is mainly associated with the immigration of unskilled and third-country immigrants. Thus, a 1 percentage point increase in the population growth contribution of third country immigrants statistically significantly increases between-sector productivity growth by 0.25 to 0.26 percentage points in the average EU28 or EU15 region, but has no statistically significant effect on the between-sector productivity growth component in regions of the EU13 countries. A 1 percentage point increase in the contribution of unskilled immigrants to population growth, however, increases the between-sector component of aggregate productivity growth by between 0.26 to 0.28 percentage points in the EU28 and EU15 countries, while it (somewhat unexpectedly) has a statistically significant negative impact on the between-sector productivity growth component in the regions of EU13 countries, which once more may be due to the low number of immigrants residing in these countries as well as to the low number of observations available.

[75] These contributions are calculated in an analogous way to the overall contribution of foreign born to total productivity growth. Thus they represent the increase in the foreign born population from third countries or other EU countries relative to the total population of the region in the base period, respectively.

[76] In this disaggregation immigrants (of the age between 20 and 64 that are not in full time education) with at most a completed compulsory education are considered unskilled and those with a completed vocational or higher education are considered skilled.

As a consequence of these different impacts on the components of productivity growth, the results in the right-hand panel of Table 5.20 suggest that unskilled immigrants have a statistically significant negative impact on aggregate productivity growth, while the impact of skilled immigration on aggregate productivity growth is also negative but only weakly statistically significant in the EU28 and EU15 countries. An increase in the contribution of unskilled immigration to total population growth by 1 percentage point reduces aggregate productivity growth by between 1.0 and 1.1 percentage points in EU15 and EU28 countries, and – on account of a hard-to-explain strong negative impact of unskilled immigration on the between-sector component of productivity growth – by 2,4 percentage points in EU13 countries. An equivalent increase in the contribution of skilled immigration to total population growth, by contrast, reduces aggregate productivity growth by only around 0.8 percentage points in EU15 and EU28 countries, with these effects being statistically only weakly significant in both of these country groups and statistically insignificantly in EU13 countries.

Furthermore, an increase in the immigration of third-country immigrants has the expected impact on the components productivity growth in the EU28 and EU15 countries. The negative impact of overall immigration on the within-sector component of productivity growth is due to a 0.88 percentage point reduction of this component per percentage point contribution of third-country immigrants to population growth in EU28 and EU13 countries. The positive impact of total immigration on the between-country component of productivity is due to a 0.25 to 0.26 percentage point increase of this component per percentage point contribution of third-country immigrants to population growth in EU28 and EU13 countries. By contrast, the (weakly significant) overall negative impact of immigrants on total productivity growth is mainly due to immigrants from other EU countries, although these immigrants have statistically insignificant effects on the components on productivity growth. A one percentage point increase in the contribution of third-country immigrants to population growth has a weakly statistically significant negative impact of -0.5 percentage points for EU28 and EU15 countries.

Table 5.21: Population growth and the development of the components of GVA growth (regression results) by time period

	Within		Across		Residual		Total	
	2008-2011	2011-2013	2008-2011	2011-2013	2008-2011	2011-2013	2008-2011	2011-2013
Foreign population growth	-0.299*	0.717*	0.197*	-0.132	-0.013	0.203	-0.115	0.788*
	(0.191)	(0.395)	(0.111)	(0.141)	(0.070)	(0.141)	(0.366)	(0.423)
Native population growth	0.494***	0.306	0.057	-0.041	-0.0389*	0.068	0.512***	0.334
	(0.180)	(0.350)	(0.050)	(0.038)	(0.022)	(0.058)	(0.160)	(0.332)
N	407	408	407	408	407	408	407	408
R2	0.168	0.048	0.058	0.009	0.050	0.070	0.158	0.061

Source: ELFS, EUROSTAT, WIFO calculations.
Note: Sample: Active aged population (aged 20 to 64) that is not in full-time training in EU28 countries for the time period 2008 - 2013. Values in brackets are heteroskedasticity robust standard errors, region-fixed effect are not reported, R-squared value is overall R-squared, ***(**)(*) signify significance at the 1% (5%) (10%) level respectively.

Table 5.21 takes these results one step further by separately analysing the crisis and post-crisis periods. These results add to previous insights, in so far as they suggest that the negative impact of immigration on the within sector productivity growth component as well as on total productivity growth is mainly a result of the behaviour of productivity growth in the crisis period. The coefficients of the contribution of the foreign-born population are negatively significant only for this first period and insignificant for the post-crisis period, while the coefficients for the between-sector productivity growth component are weakly significant for the first period, but insignificant for the second.

Table 5.22: Population growth and the development of the components of GVA growth (regression results) by exchange rate regimes

	EMU	Peged Ex.rate	Floating
		Within	
Foreign population growth	-0.734*	0.520	-0.565
	(0.384)	(1.269)	(0.869)
Native population growth	0.090	0.551	0.167
	(0.126)	(0.332)	(0.139)
N	518	85	212
R2	0.078	0.283	0.501
		Across	
Foreign population growth	0.130*	0.262	0.347**
	(0.078)	(0.546)	(0.136)
Native population growth	0.033	0.013	0.03
	(0.029)	(0.108)	(0.049)
N	518	85	212
R2	0.035	0.027	0.042
		Residual	
Foreign population growth	0.009	0.012	0.013
	(0.048)	(0.091)	(0.034)
Native population growth	0.025	-0.017	0.012
	(0.050)	(0.021)	(0.018)
N	518	85	212
R2	0.020	0.028	0.036
		Total	
Foreign population growth	-0.595*	0.794	-0.204
	(0.322)	(1.276)	(0.853)
Native population growth	0.148*	0.546*	0.209
	(0.086)	(0.272)	(0.143)
N	518	85	212
R2	0.087	0.314	0.505

Source: ELFS, EUROSTAT, WIFO calculations.
Note: Population sample: Active aged population (aged 20 to 64) that is not in full-time training and does not reside in group quarters in EU28 countries for the time period 2008 - 2013. Values in brackets are heteroskedasticity robust standard errors, region fixed effect are not reported, R-squared value is overall R-squared, ***(**)(*) signify significance at the 1% (5%) (10%) level respectively.

Finally, Table 5.22 further splits the country groups analysed into EU countries that are members of the EMU and non-EMU countries, that have a fixed (or pegged) exchange rate or that have flexible exchange rates, respectively. This further analysis suggests that most of the effects found in the aggregate analysis are due to the results for EMU countries. Even in these cases they are only weakly statistically significant, while for regions in both fixed and flexible exchange rate countries – where, however, the number of observations available is also often very low – these results are often statistically insignificant or have the opposite sign relative to the overall benchmark results reported in Table 5.20

Thus, among EMU countries overall effects accord with the aggregate effects found above. For countries with a flexible exchange rate, by contrast, the effect of immigration on the within-sector component and on aggregate employment growth are insignificant and only effects on the between-sector component accord with the previous results. Finally, for

countries with a fixed or pegged exchange rate – for which, however, we only have very few observations, effects are insignificant throughout.

5.6. Conclusions

This chapter asked whether migration was an important labour market adjustment mechanism in the time period before, during and after the economic and financial crisis of 2008/09. In particular, the chapter used data from the European Labour Force Survey (ELFS) to ask three central questions related to the role of migration in labour market adjustment in the EU. The first of these was to what extent migration within and across countries was an important adjustment mechanism to asymmetric shocks. The second was whether cross-border migration contributed to regional convergence in labour market conditions in the period between 2004 and 2014. The third was to what degree cross-border migration led to a redeployment of labour on the sector or region level in this time period. The results of the chapter thus pertain to the efficacy of migration in adjusting to regionally asymmetric shocks in Europe to the role of international migration in shaping the patterns of regional labour market convergence and divergence in the EU and to the role of migration in fostering structural change at the sector level.

5.6.1. Main results

The results suggest that migration was more responsive to regional economic conditions than found in the literature before the year 2000 and thus accommodated a significant part of the asymmetric shocks to regional labour markets in the time period considered. Over the whole time period analysed (i.e. from 2005 to 2014), a 1 percentage point increase in regional employment growth (as a proxy measures of asymmetric shocks) increased regional population growth (as a proxy for migration) by 0.36 percentage points. Similarly, migration has also responded rather strongly to differences in regional unemployment rates and in GDP per capita. Over the period 2005 to 2014 a 1 percentage point higher unemployment rate reduced population growth statistically significantly by 0.13 percentage points and a 1% increase in GDP per capita increased average annual population growth in that region by 0.01 percentage points.

The results also indicate that migration may have been more important in adjusting asymmetric labour market shocks in Europe than in the US in the last decade. A comparison of our results to previous findings for the US suggests that migration responded more strongly to regional employment growth in Europe than in the US for most of the population groups analysed. This thus at least questions whether the results of the pre-crisis literature, which often found a lower responsiveness of migration to regional labour market conditions in the EU, still applies in the more recent period considered in the current study. It is also consistent with much of the more recent literature on regional labour market adjustment in Europe, which repeatedly finds that labour market flexibility increased in post 2000s in Europe

Migration from abroad (both from other EU countries as well as from third countries) has also contributed to the reduction of regional labour market disparities in the EU and has facilitated the reallocation of labour to more productive sectors in the time period considered. Although regional labour market disparities, both in terms of unemployment rates as well as employment rates, increased in the overall period considered, regions that received more immigrants from abroad converged significantly more rapidly (or diverged less rapidly) to their respective steady states than did regions that received fewer immigrants. A one-unit increase in immigrant penetration decreases the half-life time of unemployment

convergence by 0.04 years (around 0.5 months). Similarly, regions that received more immigrants from abroad significantly more rapidly reallocated their labour inputs to high productivity sectors than regions that received only few immigrants from abroad. On average, a one percentage point increase in population growth due to immigration from abroad increased productivity growth by 0.15 percentage points through this enhanced reallocation of labour from low to high productivity sectors.

Differentiation by demographic groups, sub-periods and countries and country groups

These results thus highlight the increased labour market flexibility of the European Union in the last decade. They also underline the positive contribution of immigration to the equalisation of living conditions across regions as well as to the capability of regions to reallocate labour inputs to high productivity uses, also stressed in previous research. The differentiated analysis in this study, however, also highlights the substantial heterogeneity across demographic groups and time periods, as well as countries and country groups. This, together with the additional findings on the impact of immigration on convergence and productivity growth provides a number of insights into areas in which policy could still contribute to increasing the efficacy of migration in adjusting regional labour market imbalances and to fostering convergence and structural change in the EU.

Differences across demographic groups

In particular, the study identifies a number of demographic groups where the contribution of migration to regional labour market adjustment, convergence, and also structural change still seems to be limited. For instance, all results indicate that migration of foreign-born responded much more strongly to differences in regional labour market conditions than the migration of natives. Similarly, the responsiveness of migration to differences in regional economic conditions increases with educational attainment in virtually all results. In addition, the positive contribution of immigration from abroad to regional convergence is much more pronounced among high-skilled immigrants from abroad than among the low-skilled. The only area of analysis where low-skilled immigration contributes more positively to regional development than high-skilled immigration is in terms of structural change, however, here too, the contribution of immigration to structural change is primarily associated with the immigration of foreign-born from third countries.

This implies that the mobility of high-skilled workers as well as cross-border migration contributed more strongly to the adjustment of labour markets and the convergence of regional unemployment rates than the migration of less-skilled and natives. As a consequence, increasing the mobility of less-skilled workers and natives remains an important policy issue in the EU.

Heterogeneity between sub-periods

The results also indicate that the contribution of migration to regional labour market adjustment was substantially higher in the pre-crisis period (from 2004 to 2008) than in either the crisis (from 2008 to 2011) or the post-crisis period (from 2011 to 2014). This also applies to both the role of migration in fostering convergence as well as to the contribution of immigration from abroad in facilitating structural change. Thus, most results for the responsiveness of migration to regional labour market conditions indicate a noticeable fall in this responsiveness after 2008, and once we instrument for the potential endogeneity of

employment growth in the EU regions the significance of the response of population growth to employment growth pertains only to the pre-crisis period.

The pre-crisis period therefore seems to have been somewhat of an exceptional period in terms of labour market adjustment in the EU. On the one hand, this may have been due to high employment growth in that period. This facilitated mobility on account of allowing migrants to easily find jobs outside their home region. On the other hand, this is because in that time period a large number of policy changes (such as the accession of 13 countries to the EU that resulted in a successive liberalisation of immigration from these countries, or the accession of a large number of countries to EMU) substantially reduced (administrative) barriers to cross-border mobility in Europe. These major integration steps also worked to improve the adjustment capability of regional labour markets in the EU. In particular, according to our results, the acceding countries of the 2007 enlargement of the EU experienced a significant increase in the responsiveness of population growth to regional employment growth (by 0.38 percentage points) after accession. Similarly, countries that granted freedom of movement to the acceding countries of the 2004 enlargement experienced an increase in this responsiveness.

Freedom of movement of workers in the EU as well as EU accession – which is a precondition for obtaining this freedom of movement – was therefore an important force increasing the responsiveness of regional labour markets to differences in economic conditions in the time period considered. By extension, this also implies that a further reduction of administrative barriers to mobility could contribute to substantially increasing labour market flexibility in the EU. The removal of such barriers to mobility should therefore continue to be a major focus of policies that aim to increase labour market flexibility in Europe.

Differences across countries and country groups

The contribution of migration to regional labour market adjustment, however, also varies substantially among different countries and country groups analysed in this study. In particular, the responsiveness of population growth to employment growth varies dramatically across EU-countries and ranges from high and statistically significant values for countries such as Germany and France to statistically insignificant and very low (and in some cases even negative) values in countries such as Austria, Bulgaria, Hungary and Denmark. This heterogeneity is on the one hand is probably with differences in the formal and informal national institutions of labour market governance in the EU member states. On the other hand, this is also associated with strong differences among different parts of the EU, with these results in particular indicating a stronger contribution of immigration from abroad to regional convergence, but a weaker impact of immigration from abroad on structural change at the sector level in the 13 countries, that have joined the EU after 2014, and have experienced a low levels of immigration in the past. In addition, labour market mobility was also higher in regions belonging to non-EU countries and somewhat smaller in the regions of EU15 and EU13 countries. In sum, this therefore suggests that differences in labour market governance and differences in the extent and structure of immigration from abroad are still major factors impeding labour market flexibility in the EU.

The evidence on the impact of differences in formal labour market institutions on the flexibility of regional labour markets in the EU collected in this chapter, however, warns that a "one size fits all" approach to institutional reforms may not yield the expected results. Of the six institutional variables considered in this analysis (centralisation of wage bargaining, minimum wages, net replacement rates, product market regulation employment protection

legislation, active labour market policies and tax wedges of moving from unemployment to employment) the responsiveness of population growth to employment changes at the country level is significantly negatively correlated to only two of these indicators. These are the OECD measure of minimum wages (as a percent of the median) in a country and the taxation indicator referring to the effective marginal tax rate for unemployed of moving to employment at 33% of mean wages. Furthermore, for some labour market groups this responsiveness at the country level is even significantly positively correlated to some indicators. This applies in particular the share of spending on active labour market policy in percent of GDP and the net replacement rate for the less qualified.

Securing incentives for workers to also search for work in other regions through appropriate institutional reforms should therefore continue to be a priority of EU-wide efforts to increase regional mobility in the EU. These institutional reforms, however, will have to be addressed on a country-by-country basis and have to be based on more detailed analyses than can be achieved in the current study. Furthermore, they will also have to take into account the interactions of different institutional arrangements in labour markets that have been stressed in much of the recent empirical literature on labour market reforms and to also consider the role of a wider set of institutions, such as for instance the role of housing markets, in preventing higher mobility.

Impact of immigration on within-sector productivity growth

Finally, one additional finding of the current study is that while immigration from abroad enhances convergence and productivity growth through fostering the reallocation of labour from low productivity to high productivity sectors, this positive effect hinges very strongly on immigration from third countries and only applies weakly to immigration from other EU countries. Cross-border migration within the EU is thus less effective at contributing to convergence and sector restructuring along competitive advantage than migration from abroad. Furthermore, the positive effect of immigration from abroad on productivity growth through structural change is countered by a negative one of immigration on the productivity growth of those sectors which receive the most immigrants. This is mainly due to the immigration of less-skilled workers. As a consequence of this countervailing impact on productivity growth, an increase in immigration of the foreign-born on total productivity growth is negative in the average region of EU28 countries as well as that of the EU15 countries.

Although the correlation with total productivity growth is only weakly statistically significant and even statistically insignificant in the average region of the EU13 countries, this does suggest that in aggregate the effectiveness of intra-EU migration in fostering convergence and productivity growth is still limited and that EU countries are still not sufficiently successful at achieving the double goal of on the one hand attracting highly qualified immigrants to the EU and on the other hand appropriately integrating these immigrants into their national labour markets. As a consequence, policies that seek to attract more highly skilled immigrants to the EU as well as policies to improve the labour market integration of immigrants, will remain high on the agenda of European policy makers in the future.

5.6.2.Policy implications

In sum, therefore, from a policy perspective the results of the current chapter imply that the adjustment capability of regional labour markets through migration seems to have improved substantially in the last decade in the EU. Furthermore, they also indicate that immigration

from abroad has also fostered convergence (or at least reduced divergence) tendencies in the EU and contributed to a redeployment of workers to higher productivity sectors. The results, however, also highlight a number of areas in which further policy efforts are needed.

Such policy efforts should on the one hand include continued efforts to reduce (administrative) barriers to mobility within the EU. Given that freedom of movement is by now applied among almost all of the EEA countries (all except for the citizens from Croatia in Austria, the Netherlands, the United Kingdom, Malta, Slovenia), and that the remaining restrictions on freedom of movement will end in 2018, such policies could in the future focus on many of the less spectacular, but nonetheless obstructive barriers to mobility that have been identified in the previous literature. They could therefore consist of improving systems of mutual skill recognition between countries of the EU, improving the transferability of qualifications in the EU, reducing administrative costs of transferring social security entitlements across borders, improving cross-border placement services through the EURES system and improving language skills among in particular low skilled migrants, all of which have often been mentioned as desirable in previous research on the contribution of migration to labour market adjustment in the EU.

Such policies should, however, also focus on concerted efforts to improve the integration of both within-EU as well as third-country immigrants into national labour markets in the EU, so as to ensure a maximum contribution of immigration to EU-wide productivity growth and labour market convergence. In this respect, the current mass migration of asylum seekers to Europe has once more highlighted the need for an improved and intensified co-ordination of EU-wide migration policies in all areas of immigration. In addition, it has also highlighted the importance of using the potential for mutual policy learning in the area of policies focusing on the integration of immigrants in national labour markets.

Furthermore, ensuring incentives for mobility through reforms to national labour market governance institutions should also be continued. These reforms will, however, have to be based on more detailed national-level evidence than is available in the current study and will also have to consider the interaction of various institutions on national labour markets.

Finally, the results reconfirm that policies to support mobility in the EU are likely to have the highest returns when they effectively increase the within-EU mobility among the less-skilled. These have, however, been found to be a group that is notoriously hard to address in such policies in the past.

6. Summary and Policy Conclusions

6.1. Summary of the main findings

The financial and economic crisis of 2008/09 induced severe adverse effects in most of the EU member states. The initial external shock caused by turmoil in the US housing and financial markets spread to the global financial markets, very rapidly affecting the real economies of the EU. Most European economies responded to these negative spillovers with expansionary fiscal policies. The ECB provided additional support by implementing loose monetary policies. However, the demand-stabilizing fiscal policy measures undertaken by the national governments as well as the bailouts of governments to bankrupt banks led to a further intensification of the crisis. The financial markets began to question the sustainability of overall (government) debts in some EU member states, including e.g., Greece, Portugal, Ireland, Spain and Cyprus. In most of these economies, these developments substantially increased uncertainty in the markets. This translated into sharp drops in economic activity and demand. Subsequently, due to the deep integration of the European economies in the single market, the internal shock was transmitted and propagated across national borders in the EU. As a consequence, the EU in general and the Eurozone in particular were harshly hit by the 2008/09 crisis. Total EU real GDP declined by 4.4% in 2009, while extra-EU exports dropped by more than 20% and unemployment rose from 7.0% in 2007 to 10.8% in 2013.

The financial and economic crisis, however, did not affect all EU economies to the same extent. Some economies including Germany successfully coped with the crisis and soon showed improved economic performance in its aftermath. Other countries like Italy or Greece, by contrast, are still struggling to recover and have not been able to keep pace with the most dynamically developing countries inside and outside the EU. This observation – in addition to suggesting substantial asymmetries in the reaction to the initially symmetric external shock induced by the bursting of the US housing and financial market bubble – also raises a number of policy-relevant issues. One of these is how vulnerable the single market institutions and the economic structure of the real economies participating in the EU and/or Eurozone are to future asymmetric shocks and how this vulnerability can be reduced without at the same time sacrificing the welfare-improving effects of the freedom of movement of goods, services, capital and labour (defined in the single market program) for EU members or the common currency for the current member states of the European Monetary Union. Another one is related to the viability of the EU in general and the European Monetary Union in particular, thereby focusing on the effectiveness of alternative economic adjustment mechanisms addressing the asymmetries in economic development of the EU.

The current report studied these issues by focussing on the economic developments just before, during and after the Great Recession, both from a macroeconomic and a microeconomic point of view. This was done by highlighting the main shock absorption and transmission mechanisms relevant for the European single market and the European Monetary Union. The theoretical framework guiding this analysis and the selection of the transmission and adjustment mechanisms scrutinized in greater detail was on the one hand guided by OCA-theory, as this addresses both the likelihood of shock asymmetry within an economic region and its ability to return to a symmetric equilibrium. In particular, the policy-relevant part of this theory suggests that, for symmetric shocks that have symmetric consequences, meaningful policy measures can be more easily identified and are also more likely to be undisputed among policy makers. In the case of asymmetric shocks or asymmetric consequences of initially symmetric shocks, different member states would be

expected to prefer different policy interventions, which would complicate the formulation of common policy responses.

On the other hand, the choice of the transmission and adjustment mechanisms scrutinized in greater detail was guided by a screening of the literature on the most important adjustment and transmission mechanisms considered in the past, as well as on the macro-economic analysis conducted in the first chapter of the report. In this respect the report therefore identifies and extensively studies distinct transmission and adjustment mechanisms through which the shock generated by the bursting of the US housing and financial market bubble was initially transmitted (and at the same time at least partly absorbed) asymmetrically to different EU member states. In this way, the report also identifies a number of remaining challenges with respect to the asymmetry of the transmission and absorption of economic shocks in the EU.

6.1.1. Macro-economic analysis

To set the stage for more comprehensive investigations at the microeconomic level and to also empirically assess the relevance of the transmission and absorption channels analysed, Chapter 2 provides a macroeconomic framework for analysing the main mechanisms at work. Based on both a calibrated DSGE model and on estimations of an empirical VAR-model, this chapter studies the main structural breaks in the transmission of economic shocks induced by the Great Recession. The analyses also explicitly account for varying degrees in the depth of integration observed within the EU. This is achieved by analysing countries that are part of the Eurozone (and thus share a common monetary policy) as well as countries that are not (yet) EMU member states (which in principle could also apply autonomous monetary policies to cope with negative (external) shocks).

The simulations of the calibrated DSGE model in this chapter highlight distinct adjustment paths along time and cross-sectional dimensions in the EU. On the one hand, the adjustment paths vary between the three groups of countries differentiated in the simulations: (i) Greece, Italy, Cyprus, Ireland, Portugal and Spain that face structural economic problems and difficulties in refinancing sovereign debt, (ii) the central and eastern European countries, and (iii) the core comprising the remaining countries. Among these groups, the Central and Eastern European countries were initially much less severely affected by the Great Recession than the other two groups, on account of a relatively low share of trade with the rest of the world (and a high one with other EU countries). This suggests that trade relationships before the crisis were one major transmission mechanism of the shocks that should be analysed in more detail.

On the other hand this analysis also shows that adjustment paths have changed over time, as important structural parameters such as private and public indebtedness as well as investment ratios have changed in the aftermath of the global financial crisis. In general, this seems to have worked to increase the resilience of the EU to different kinds of shocks, albeit on account of different forces and to a different degree in the different country groups analyzed. For instance, the ongoing process of deleveraging in the corporate sector of the first group of countries (Greece, Italy, Cyprus, Ireland, Portugal and Spain) has increased the resilience of their economies to external economic and financial shocks. This thus implies that, next to trade, financial markets also played an important role in the asymmetric transmission of the Great Recession in the EU. By contrast, the resilience of the central and eastern European countries has been bolstered by the exchange rate acting as a shock absorber and the low levels of private debt. In the core countries, by contrast, transmission

mechanisms and resilience have not changed, despite subdued economic growth and significantly higher public debt.

In addition, the chapter presents estimation results pertaining to the effects of a US and UK house price shock in a Bayesian Panel VAR model, based on quarterly data covering key macroeconomic, labour market and macro-financial variables. These findings augment those of the simulations of the DSGE model by allowing for the analysis of a number of further shocks for a larger set of countries. Thus, they are also able to highlight the within-group heterogeneity, which is by necessity missed when using large-scale calibrated DSGE models. In particular, these results draw out differences in the transmission of global house price shocks in a sample of 10 countries (Germany, France, the Netherlands, Italy, Ireland, the UK, Sweden, the US, Canada and Japan) that differ with respect to a) their banking system (bank-based versus market-based financial systems), b) their patterns of labour and product market governance (flexible versus more highly regulated labour and product markets), c) their respective exchange rate regimes (Eurozone versus floating exchange rate countries), and d) their integration with the EU (i.e. EU and non-EU countries)

The patterns that emerge from this estimation suggest that the strongest transmission of the collateral shock is via bond markets (as measured by collateral spreads) in the relatively market-based economies (i.e. the UK, US and Ireland). In contrast, transmission to the more bank-based economies such as Italy and France mainly occurs through investments. This implies that the organisation of the national banking system is an important variable determining how global shocks are transmitted to individual economies, and that this requires a more in-depth analysis.

Furthermore, the results suggest little transmission of the global shock to unemployment in countries with more flexible labour markets. By contrast, in countries with more highly regulated labour markets and presumably more rigid wages, unemployment rates respond more sensitively to the global financial shock. This points to an important role of labour market institutions and flexibility in determining both the transmission of and adjustment mechanisms to global shocks.

6.1.2. Micro-economic analysis

Based on these findings as well as the theoretical predictions of OCA theory and previous literature, the subsequent analysis thus shifts perspective and studies individual transmission mechanisms at a more disaggregated level of economic activity. In particular, these chapters focus on:

a) trade relationships, - as according to the findings of the macro simulations the intensity of trade has been pivotal in determining the timing and severity of crisis effects
b) the impact of the banking system and financial markets on investment behaviour - as one of the central mechanisms through which financial shocks are transmitted to the real economy highlighted by the macro simulations
c) The role of labour mobility in adjusting to regional asymmetries - as labour market flexibility has been identified as a main determinant of the type of adjustment following an asymmetric shock in the macro simulations.

Analysis of bilateral trade flows

Accordingly, Chapter 3 of the report is devoted to studying the role of direct and indirect trade relationships for transmitting and absorbing negative (external) shocks. The central

objectives of this chapter were to assess whether some industries and/or countries were asymmetrically affected in their direct trade performance before, during and after the crisis, and to determine how trade relationships in intermediary goods transmit shocks within the EU's real economy. The main takeaways from the investigations in this chapter are that:

1. The EU economies are generally very open to trade, but this is mainly due to trade with other EU-economies. In case of an internal shock this concentration on intra-EU trade can be harmful, as indicated by the sharp decline in exports observed as a consequence of the European government debt crisis.
2. Disaggregated analyses at the country- and industry level reveal substantial heterogeneities in intra- and extra-EU trade performances across the EU member states in general and Eurozone economies in particular. Idiosyncratic factors which cannot be easily quantified and assessed by applying a quantitative approach seem to be crucial in shaping these differences.
3. Labour demand within the EMU economies is identified as behaving the most persistently relative to other EU member states and the rest of the world. This finding can likely be traced back to national labour market institutions in EMU countries which complicate flexible labour demand adjustments.
4. Since 1995, the EU has fallen behind in terms of net job creation relative to the 13 other major economies included in the empirical analysis. This finding especially holds for annually calculated net job creation rates. Accordingly, the dynamics in the creation of new jobs are (much) faster outside the EU. Within the EU, the EMU member states provide 2/3 of all available jobs. Since the outbreak of the crisis, the non-Eurozone economies, however, have outperformed the Eurozone in terms of new net job creation.
5. This relatively poor employment growth performance of the Eurozone economies can be partially linked to non-trivial adjustment costs in labour demand prevailing in this group of EU member states. An analysis based on dynamic labour demand equations highlights the crucial importance of adjustment costs to shaping persistence in the employment dynamics within the Eurozone. These adjustment costs are likely driven by labour market institutions which reduce flexibility in employment adjustment over time with likely (additional) negative employment effects in times of economic downturns.
6. Labour demand in the non-Eurozone economies is systematically affected by fluctuations in domestic demand induced by both final consumption and intermediary demand. For Eurozone participants fluctuations in foreign intermediary demand seem to be more relevant while foreign final consumption exhibits virtually no impact on employment, both in the EU in general and the EMU in particular.
7. Across industries and countries labour demand adjustment is identified as taking place in a rather heterogeneous manner, especially within manufacturing industries. Most of the other industries located within the EU/EMU behave very similarly in their employment adjustments compared to the other main rest-of-the-world economies considered.

The microeconomic analysis on the role of direct and indirect trade relationships as a mechanism for the transmission of economic shocks therefore reveals substantial heterogeneities. Intra-EU trade has been pivotal in transmitting the negative (external) demand shock within the single market, although the responsiveness of different industries and countries to this shock differs substantially. In a similar vein, labour demand in European industries is characterized by varying degrees of path dependence (via adjustment costs)

and heterogeneously responds to fluctuations in final-versus-intermediate and domestic-versus-foreign demand.

Analysis of investments, capital flows and banking integration

As a consequence, Chapter 4 of the study shifts the focus to the relationship between financial flows and investment activities in the pre-, during- and post-crisis periods. Based on the findings of the macro-economic simulations and on the theoretical expectation that investment is one of the central transmission mechanisms of financial shock to real activities within the single market and the Eurozone, the study asks how cross-border financial flows, the quality of banking systems and financial integration impacted on investment in the EU countries before, during and after the financial and economic crisis of 2009.

This chapter finds that in many countries of the European Union, corporate investment – although trending up in the last two years – still remains below pre-crisis levels. The weakness in investment is therefore partially related to the weakness of expected demand and amplified by the deleveraging of the public and private sectors after the crisis. For some countries, the weakness of demand is related to over-investment in housing. Creating an environment that supports investment and productivity growth in Europe is of central importance. In addition to the question of how to improve investment in Europe, another central, interrelated question is how the European financial systems can be made more stable to satisfy the financing needs of the corporate sector.

The results of the present study show that

1. The dynamics of investments are heterogeneous across different components. The largest impact is observed for investment in housing, buildings and structures, especially in the crisis countries. Similar patterns are found for investment in machinery and equipment. Investment in intangible assets was much less affected by the crisis. This is partly driven by structural change towards intangible investment and partly by the different nature of investment in intangible capital.
2. Capital flows, and especially capital flows associated with cross-border banking, saw a sudden stop during and after the crisis. Capital mobility declined and the matching between domestic savings and domestic investments became more important in Europe, leading to a process of slowing down financial and banking integration.
3. These quantitative changes also led to qualitative changes in the relationship between investment and capital flows. Before the financial crisis, larger net capital inflows were not associated with an improved allocation of resources toward more financially dependent sectors for total investment. After the crisis, we observe a better allocation of resources to financially dependent sectors for total investments, but not for investment in buildings and structures. However, for cross-border banking there is not much evidence of the claim that it impacted the allocation of financial resources before or after the crisis. Domestic lending remains crucial for investment finance in most bank-based economies in Europe.
4. Due to the different impact of the financial crisis, the banking systems in many European countries still face different cyclical, structural and regulatory challenges. The situation in the banking system has improved, as capital buffers have increased and regulation has reduced leverage. However, there is still a need for further measures to strengthen European banking systems.
5. While it is often argued that imposing stricter regulations may lead to a credit crunch, the present study finds there is only a weak impact of an improved quality of the banking

system on lending towards more financially dependent industries. This suggests that while the (necessary) repair of bank balance sheets may have led to heightened financing constraints in some European countries, firms affected by these constraints are not primarily found in those industries which need the most external financing for investment.

6. An integrated European banking market is one important element in supporting the efficient allocation of financial resources. The findings show that a diversified domestic banking system with the presence of foreign owned and domestically owned banks can help reduce financing constraints in Europe, as it provides insurance to deleveraging shocks in the domestic banking system – i.e. foreign banks help alleviate domestic banking shocks and excessive deleveraging, but may also have negative impacts, as foreign banks may also import foreign shocks. Here, the available evidence suggests that balanced banking systems with the presence of foreign and domestic banks are better at allocating financial resources to competing uses than unbalanced banking systems consisting of mainly domestic or mainly foreign banks.

Analysis of migration as a labour market adjustment mechanism

Finally, chapter 5 is based on the macroeconomic finding that countries with more rigid labour markets have reacted to the global financial crisis with higher unemployment rates, and analyses labour migration in more detail. It thus also relates to the literature preceding the formation of the European Monetary Union, which suggested that European countries lack sufficient labour mobility to form a monetary union. It studies how labour market adjustment and cross-border mobility evolved over the course of the financial and economic crisis by using regional data from the European Labour Force Survey from 2004 to 2014. In particular, this chapter addresses three central questions related to the role of labour mobility in adjusting regional asymmetries in the EU. The first of these is to what extent internal and cross-border migration in the EU was an important adjustment mechanism to asymmetric shocks before, during and after the Great Recession. The second is whether cross-border migration contributed to regional convergence in labour market conditions in the period between 2004 and 2014. The third asks to what degree migration led to a redeployment of labour on the sectoral or regional level in this time period.

The results suggest that migration was rather responsive to regional economic conditions in the time period under consideration. Furthermore, migration from abroad (both from other EU countries and third countries) has also contributed to the reduction of regional labour market disparities in the EU as well as to facilitating the reallocation of labour to more productive sectors in the time period considered. These results therefore reflect positively on labour market flexibility in the European Union during the last decade and also underline the positive contribution of immigration from abroad to the equalisation of living conditions across regions and to the capability of regions to reallocate labour inputs to high productivity sectors.

The more detailed analysis, however, also points to a substantial heterogeneity in the results across demographic groups, time periods, countries and country groups. These provide indications of areas in which the efficiency of migration in adjusting regional imbalances, fostering convergence and supporting structural change could still be increased. Thus, according to the results

1. The contribution of migration to regional labour market adjustment, convergence, and structural change still hinges strongly on a limited number of groups. The mobility of high-

skilled, cross-border migrants contributed much more strongly to the adjustment of labour markets and the convergence of regional unemployment rates than the migration of less-skilled immigrants and natives.

2. The contribution of migration to regional labour market adjustment was also substantially higher in the pre-crisis period (2004 to 2008) than during the crisis (2008 to 2011) or in the post-crisis period (2011 to 2014). This also applies to the role of migration in fostering convergence and to the contribution of immigration from abroad in facilitating structural change. The pre-crisis period therefore seems to have been an exceptional period in terms of labour market adjustment in the EU.
3. The large integration steps from 2004 to 2014 (i.e., the accession of 13 countries to the EU and the successive liberalisation of immigration from the countries joining the EU after 2004) worked to improve the adjustment capability of regional labour markets.
4. The contribution of migration to regional labour market adjustment also varied substantially across different countries.
5. The impact of differences in formal labour market institutions on the regional migration in the EU suggests no simple connection between labour market flexibility and formal labour market institutions. Only two of six institutional variables considered in this study are significantly negatively correlated to the responsiveness of population growth to employment changes at the country level. This responsiveness is even significantly positively correlated to the share of spending on active labour market policy in percent of GDP and the net replacement rate for the less qualified.
6. The positive effects of immigration from abroad on convergence and sector reallocation hinge very strongly on third-country immigrants.

6.2. Policy implications

From a policy perspective, the results of the current study on all the individual adjustment and transmission mechanisms analysed therefore imply that, first of all, "one size fit all" policies may be very ineffective in increasing the resilience of the EU's single market. As this is also true for the most integrated countries, such as the Eurozone economies, this also rationalizes the increasing emphasis on European macro-economic and structural policies that are based on tailor-made, country-specific analyses and recommendations, such as is for instance the case in the framework of the European Semester.

In particular, the evidence in the current study suggests that such recommendations and analyses should be broad in scope and – inter alia – should focus on policy measures related to product market regulation and adjustment costs in labour markets. Furthermore, the assessment process related to these recommendations should also take explicit account of a country's industrial structure and the competitiveness of its industries. The success of such country-specific recommendations will, however, crucially depend on the willingness to implement reforms in the member states. For this purpose, a close and constructive cooperation between EU authorities (i.e., the European Commission) and the individual member states is needed. One option for increasing transparency and willingness to reform could be provided by the implementation of evaluation processes concerning the suggested measures and the economic outcomes targeted by the measures proposed. In the long-run, this could potentially reduce the idiosyncrasies in the economic performance

across different EU/EMU member states and further contribute to a successful achievement of the goals laid down in the European Semester.

From a macro-economic perspective, high public and private debt levels continue to impede economic recovery, as they weaken the resilience of the economies of EU countries to adverse global economic shocks. Several countries have made progress in fostering macroeconomic stability, not least by implementing structural reforms in labour and product markets. Nevertheless, the corporate sector remains highly leveraged. In this context, the policy challenge lies in removing the impediments to balance sheet repair and reinforcing the need to strengthen balance sheets by implementing sustainable new business models. Ensuring that nonviable firms (both financial and non-financial) exit markets in an orderly way would help relieve pressures in a market environment that is in some sectors marked by excess capacity, and allow viable firms to set up sustainable business models. To create fiscal space for macroeconomic stabilization policy it is essential to reduce excessive public debt levels in line with the European fiscal framework.

Specifically, with respect to direct and indirect trade effects, the idiosyncrasies in the performance of different countries and industries seem to be closely related to product market and labour market regulations. Persistence in labour demand which is closely related to (extensive) adjustment costs seems to be closely related to the low flexibility of EMU industries with adverse effects for the overall competitiveness of the industries under consideration. Furthermore, exporting economies which are characterised by a lower level of product market regulation and thus intensify completion seem, in the long-run, to be more successful in international markets.

With respect to the future development of the EU's banking system, the results indicate that further steps for the regulation of systematically important banks are needed, as it is clear that the single supervisory mechanism (SRM) is still complex and entrusted to national authorities and the single resolution fund may have limited capacity for the resolution of a truly system-relevant financial institution. In this respect, the establishment of a single, centralized deposit insurance mechanism would reduce the risks for banks run associated with cross-country deposit flows.

In addition, capital market integration should not exclusively focus at reducing fragmentation but also on increasing liquidity for smaller and growth-oriented enterprises. In this context, according to the results a reduction of initial public offering (IPO) costs and the costs of subsequent offerings of new growth-oriented firms is especially relevant in modern industry environments, where intangible assets and investment in intangible assets are gaining in importance. Especially for investment in intangible capital security markets, stock exchanges could play an important role and encourage the development of a financial "ecosystem" which complements and supports the entrepreneurial "ecosystem". The non-bank financing of firms complements bank-financing and will be of increasing importance as investments turn intangible. A true capital market union that is geared towards investment thus needs to include mechanisms that reduce the fragmentation in European stock and bond markets and reduce regulatory costs for enterprises without increasing risks for investors.

The policy-relevant results of the analysis of labour mobility, by contrast, also indicate that efforts to reduce (administrative) barriers to mobility within the EU (e.g., by improving systems of mutual skill recognition, reducing the administrative costs of transferring social security entitlements) should be continued. In addition, policy should focus on concerted efforts to improve the integration of both within-EU as well as third-country immigrants into national

labour markets in the EU, so as to ensure a maximum contribution of immigration to EU-wide productivity growth and labour market convergence. Ensuring incentives for mobility through reforms of national labour market governance institutions should also be continued. These reforms will, however, have to be based on more detailed national level evidence than is available in the current study and will also have to consider the interaction of various institutions on national labour markets.

Finally, the results reconfirm that policies to support mobility in the EU are likely to have the highest return when they effectively increase the within-EU mobility among the less skilled. This group has, however, been found to be notoriously hard to address with such efforts in the past.

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8. Appendix

8.1. Appendix A. GIMF model description

The GIMF is a Dynamic Stochastic General Equilibrium (DSGE) model that depicts the bilateral trade flows between regions and the relative prices for each region. The version used in this project comprises the three regions defined above (Core, GICIPS, CEE), plus an aggregate representing the Rest of the World. The shocks simulated with the model are assumed to originate from this external aggregate. In the following we briefly describe the main features of the GIMF model. A detailed description of the GIMF model and its various applications can be found, for example, in Kumhof et al. (2010) and Anderson (2013).

The GIMF model implements a comprehensive intertemporal stock-flow accounting framework. This framework includes the government and optimizing private households and firms as economic agents. The model accounts for numerous types of economic frictions, such as sticky prices and wages, real adjustment costs, liquidity-constrained and finite-horizon planning households, as well as distortions caused by fiscal policy.

The asset markets are incomplete in the model. The government and private debt is held domestically in the form of nominal, non-contingent, one-period bonds denominated in domestic currency. The only assets traded internationally are nominal, non-contingent, one-period bonds denominated in the currency of the Rest of the World. Firms are owned domestically. Equity is not traded in domestic financial markets; private households receive lump-sum dividend payments instead. Firms employ capital and labour to produce tradable and nontradable intermediate goods. The model includes a financial sector a la Bernanke et al. (1999).

The household sector includes two types of households. There are overlapping-generation households (OLG) that optimize their borrowing and saving decisions over a 20-year planning horizon, and liquidity-constrained households (LIQ), who do not save and have no access to financial markets. Both types of households consume goods and services and supply labour. They both pay direct taxes on labour income, indirect taxes on consumption spending and a lump-sum tax.

The assumption of a finite planning horizon for the Ricardian (OLG) households distinguishes the GIMF model from standard monetary DSGE models. The OLG households save by holding domestic government bonds and fixed-term deposits. They maximize their utility subject to an intertemporal budget constraint. Aggregate consumption of the OLG households is a function of financial wealth, the present discounted value of after-tax wage and investment income. The consumption of liquidity-constrained households (LIQ) is equal to their current net income, so their marginal propensity to consume out of current income is unity by construction.

The production sector includes firms that produce tradable and nontradable intermediate goods. The firms are managed in accordance with the preferences of their owners, the finitely-lived (OLG) households. This ownership structure implies a finite planning horizon for firms. The main substantive implication of this assumption is the presence of an equity premium driven by impatience. Firms are subject to nominal rigidities in price setting as well as real adjustment costs in labour hiring and investment. They pay capital income taxes to governments and wages and dividends to households.

Retained earnings are insufficient to fully finance investment, so that firms must borrow from financial intermediaries. If earnings fall below the minimum required to make the contracted interest payments, the financial intermediaries take over the firm's capital stock, minus any auditing and bankruptcy costs, and redistribute it back to their depositors (OLG households).

Firms operate in monopolistically competitive markets, so that goods and services are sold at a price involving a markup over the marginal production cost. Exports are priced to the local destination market, whereas imports are subject to quantity adjustment costs. There are also domestic price adjustment costs that lead to sticky prices. Firms use public infrastructure represented by a public capital stock as an input in combination with tradable and nontradable intermediate goods. The government capital thus adds to the productivity of the economy.

The financial sector of the GIMF model contains several financial assets. Government debt consists of one-period bonds denominated in domestic currency. Banks offer households one-period fixed-term deposits, their source of funds for loans to firms. These financial assets, as well as ownership of firms, are not tradable across borders.

Banks pay a market rate of return on deposits, and charge a risk premium on loans. Because of the costs of bankruptcy (capital can only be liquidated at a discount), the lending rate includes an external financing premium, which varies directly with the debt-to-equity (leverage) ratio. This non-linearity implies steep increases in the risk premium for large negative shocks to net worth.

The uncovered interest parity does not hold due to the presence of country risk premiums. The premiums create deviations, both in the short run and the long run, between interest rates in different regions, even after adjustment for expected changes in exchange rates.

All bilateral trade flows are explicitly modeled, as are the relative prices and exchange rates for each region. These flows include the export and import of intermediate and final goods. They are calibrated in the steady state to match the flows observed in the recent data. International linkages are driven by the global saving and investment decisions, a by-product of consumers' finite horizons. This leads to uniquely defined current account balances and net foreign asset positions for each region. Since asset markets are incomplete, net foreign asset positions are represented by nominal non-contingent one-period bonds.

Together with the uncovered interest parity and long-term movements in the world real interest rate, the magnitude of the international trade linkages is the main determinant of spillover effects from shocks in one region to other regions in the world.

The fiscal policy is conducted using a variety of expenditure and tax instruments. Government spending may take the form of consumption or investment, or lump-sum transfers to either all households, or targeted towards LIQ households. Public revenue accrues from the taxes on labour and corporate income, consumption taxes and lump-sum taxes. The model also allows for tariffs on imported goods to be a potential source of public revenue. Government investment spending augments public infrastructure, which depreciates at a constant rate.

There is a fiscal policy rule which ensures long-run sustainability, while allowing for short-run counter-cyclical policies. Changes in both labour and capital income taxes provide the standard instrument to implement the rule. This can be replaced with other tax, transfer or spending instruments to better reflect the public finance architecture of specific regions. The fiscal rule ensures that, in the long run, the government debt-to-GDP ratio eventually converges to its target level, as does the deficit-to-GDP ratio. This excludes the possibility of sovereign default, as well as the risk that excessive financing requirements of the government would override monetary policy. Second, the fiscal rule allows for countercyclical fiscal policy via automatic stabilizers.

When conducting monetary policy, the central bank uses an inflation-forecast-based interest rate rule. The central bank varies the gap between the actual policy rate and the long-run equilibrium rate to achieve a stable target rate of inflation over time.

The parameterization of the GIMF model relies on a calibration rather than on empirical estimation. We calibrate the GIMF model for the four regions: core, GICIPS and CEE countries of the EU and the Rest of the World. The base scenario considered in the simulations is based

on annual data and involves the years before the global financial crisis (2004-2008). The data used for the calibration are taken from the AMECO database and the Statistical Annex of Alert Mechanism Report 2016 prepared by the European Commission.

Steady state GDP decompositions, trade flows and debt ratios are based on averages on the actual values observed between 2004 and 2008. We use the 4 percent per year estimate by Kamps (2004) for the growth in the public capital stock we assume. Ligthart and Suárez (2005) estimate the elasticity of aggregate output with respect to public capital at 0.14. This is reflected in the productivity of public capital in the distribution sector's technology.

8.2. Appendix B. Empirical methodology

We follow the methodology of Canova and Ciccarelli (2009), which has previously also been used to study the transmission of shocks by Ciccarelli, et. al. (2012). In this approach, the panel VAR model is specified as:

$$y_{it} = D_{it}(L)Y_{t-1} + e_{it}$$

where y_{it} is a G x 1 vector of variables for country i at date t, Y_{t-1} is a stacked NG x 1 vector of the N lagged country vectors $[y_{1t-1}^{'}, y_{2t-1}^{'}, \dots y_{Nt-1}^{'}]'$,and $D_{it}(L)$ is composed of the G x NG coefficient matrices for each lag j, and e_{it} is a G x 1 vector of zero mean random disturbances for each country's variables.[77]

This very general formulation of the panel VAR model has several key features which are important for investigating the asymmetric transmission of shocks.[78] First, (1) allows for time-varying coefficients (i.e. the elements of $D_{it}(L)$ can vary over time t), making it feasible to analyse the differences in transmission in the pre-crisis, crisis and post-crisis periods. Second, it allows for cross-country transmission of shocks (i.e. country i's variables y_{it} can be affected by variables from other countries $k \neq i$ which form part of Y_{t-1}). This is important to be able to capture the cross-country linkages, in particular within the EU, which might amplify or dampen the transmission of shocks. Third, it allows for heterogeneity in the ways in which countries or groups of countries react to shocks (i.e. $D_{it}(L)$ can vary across countries i). This makes it feasible to draw out similarities and differences in the reactions to particular kinds of shocks within groups of countries, such as the Euro-zone members or the EU members.

Of course, this panel VAR specification runs into the curse of dimensionality. If there are p lags, then there are NGp parameters to estimate for each of the NG variables in Y_t, making it necessary to apply some sort of shrinkage. Canova and Ciccarelli (2009) show how to reduce the dimensionality of (1) by using a factor approach to break down the model into a global factor, country-specific and variable-specific factors. Specifically, the model is transformed into:

$$Y_t = \mathcal{Z}_{1t}\theta_{1t} + \mathcal{Z}_{2t}\theta_{2t} + \mathcal{Z}_{3t}\theta_{3t} + v_t$$

$\mathcal{Z}_{1t}$ contains all variables, so that $\mathcal{Z}_{1t}\theta_{1t}$ captures the impact common to all variables and countries and θ_{1t} is the 'global factor' to be estimated. Similarly, $\mathcal{Z}_{2t}\theta_{2t}$ captures the impact common to a given country or group of countries across all variables (θ_{2t} is the'country factor'), while $\mathcal{Z}_{3t}\theta_{3t}$ captures the impact common to a variable or group of variables across all countries (θ_{3t} is the 'variable-specific factor').

For example, consider the simplest case of two countries (N=2) and two variables (G=2), with y_{jt}^{i} representing variable j for country i at date t. The equation corresponding to (1) would be

$$\begin{bmatrix} y_{1t}^{1} \\ y_{2t}^{1} \\ y_{1t}^{2} \\ y_{2t}^{2} \end{bmatrix} = \begin{bmatrix} d_{1,1,t} & d_{1,2,t} & d_{1,3,t} & d_{1,4,t} \\ d_{2,1,t} & d_{2,2,t} & d_{2,3,t} & d_{2,4,t} \\ d_{3,1,t} & d_{3,2,t} & d_{3,3,t} & d_{3,4,t} \\ d_{4,1,t} & d_{4,2,t} & d_{4,3,t} & d_{4,4,t} \end{bmatrix} \begin{bmatrix} y_{1t-1}^{1} \\ y_{2t-1}^{1} \\ y_{1t-1}^{2} \\ y_{2t-1}^{2} \end{bmatrix} + e_t$$

[77] This version of the panel VAR model was developed by Canova and Ciccarelli (2009).
[78] cf. Ciccarelli, et. al. (2012)

That is, there are 16 parameters to estimate for each lag, i.e. NG=4 parameters for each of the 4 variables.

Canova and Ciccarelli (2009)'s method shrinks the number of parameters to be estimated down from (NG)*(NG)=16 to 1+N+G=5 parameters for each lag. The equation corresponding to (2) becomes:

$$\begin{bmatrix} y_{1t}^1 \\ y_{2t}^1 \\ y_{1t}^2 \\ y_{2t}^2 \end{bmatrix} = \begin{bmatrix} y_{1t}^1 + y_{2t}^1 + y_{1t}^2 + y_{2t}^2 \\ y_{1t}^1 + y_{2t}^1 + y_{1t}^2 + y_{2t}^2 \\ y_{1t}^1 + y_{2t}^1 + y_{1t}^2 + y_{2t}^2 \\ y_{1t}^1 + y_{2t}^1 + y_{1t}^2 + y_{2t}^2 \end{bmatrix} \theta_{1t} + \begin{bmatrix} y_{1t}^1 + y_{2t}^1 & 0 \\ y_{1t}^1 + y_{2t}^1 & 0 \\ 0 & y_{1t}^2 + y_{2t}^2 \\ 0 & y_{1t}^2 + y_{2t}^2 \end{bmatrix} \begin{bmatrix} \theta_{2t}^1 \\ \theta_{2t}^2 \end{bmatrix} + \begin{bmatrix} y_{1t}^1 + y_{1t}^2 & 0 \\ 0 & y_{2t}^1 + y_{2t}^2 \\ y_{1t}^1 + y_{1t}^2 & 0 \\ 0 & y_{2t}^1 + y_{2t}^2 \end{bmatrix} \begin{bmatrix} \theta_{3t}^1 \\ \theta_{3t}^2 \end{bmatrix} + v_t$$

For example, y_{2t}^1 (variable 2 for country 1) is modelled as a function of a common component, a country specific component and a variable specific component:

$$y_{2t}^1 = (y_{1t}^1 + y_{2t}^1 + y_{1t}^2 + y_{2t}^2)\theta_{1t} + (y_{1t}^1 + y_{2t}^1)\theta_{2t}^1 + (y_{2t}^1 + y_{2t}^2)\theta_{3t}^2$$

Thus, the parameter θ_{1t} captures the impact of the global factor (all variables), θ_{2t}^1 captures the impact of the country factor (all variables for country 1), and θ_{3t}^2 captures the impact of the variable-specific factor (variable 2 for all countries).

8.3. Appendix C. Additional tables chapter 5

Table 8.1: Composition of investment shares to GDP, 2004 to 2008 and 2010 to 2014

Country/ Group	Construction		Machinery and Equipmer		Intangible A	GFCF_int2010_	GFCG (total)	
	2004 - 200	2010 - 2014	2004 - 2008	2010 - 2014	2004 - 2008	2010 - 2014	2004 - 2008	2010 - 2014
CORE	11.1	10.0	6.7	6.1	3.7	4.1	21.6	20.2
AT	11.5	10.6	7.9	7.3	3.7	4.3	23.2	22.3
BE	10.3	11.0	9.0	7.5	3.2	3.9	22.6	22.5
DE	8.9	9.7	7.5	6.7	3.2	3.5	19.7	20.0
DK	11.1	8.4	7.3	5.4	4.1	4.9	22.4	18.7
FI	13.0	12.1	5.4	4.7	4.9	4.8	23.3	21.6
FR	12.6	12.4	5.3	4.8	4.5	4.9	22.4	22.2
LU	11.6	9.8	6.6	7.0	2.2	2.1	20.5	18.9
MT	12.2	8.4	7.3	7.1	1.8	2.9	21.3	18.4
NL	11.8	9.4	5.5	5.2	3.9	4.3	21.3	19.0
SE	9.0	9.1	7.8	7.3	6.1	6.2	23.0	22.7
UK	10.1	8.6	4.4	3.9	3.6	3.7	18.2	16.2
GICIPS	**15.8**	**9.0**	**7.0**	**5.5**	**2.1**	**2.7**	**25.0**	**17.4**
CY	16.9	10.1	6.4	4.8	0.8	1.0	24.1	16.3
EL	13.9	7.1	8.1	5.0	1.7	1.6	23.7	13.8
ES	20.4	11.7	7.2	6.0	2.2	2.8	29.9	20.7
IE	18.5	6.0	6.0	6.6	3.7	5.6	28.3	18.2
IT	11.5	9.6	7.3	6.1	2.4	2.6	21.3	18.4
PT	13.7	9.3	6.8	4.7	2.1	2.6	22.9	16.9
EAST	**14.1**	**11.2**	**11.3**	**8.7**	**1.9**	**2.2**	**27.5**	**22.1**
BG	13.0	11.8	12.4	8.1	1.3	1.3	27.0	21.5
CZ	12.9	11.2	12.5	11.3	3.0	3.4	28.6	25.9
EE	19.3	12.8	13.0	10.2	1.4	2.1	33.8	25.2
HU	12.1	9.5	9.3	8.1	2.1	2.5	23.7	20.4
LT	15.0	10.4	8.7	5.8	1.5	1.7	25.4	18.0
LV	17.1	12.0	13.8	8.9	1.6	1.7	32.6	22.6
PL	10.5	11.3	8.4	7.2	1.2	1.3	20.2	19.8
RO	14.5	14.1	12.8	9.7	2.1	2.4	29.5	25.8
SI	14.3	9.3	10.7	7.5	2.7	3.1	27.8	20.0
SK	12.2	9.4	11.5	10.1	1.9	2.0	26.4	21.8
EU28	**11.9**	**10.2**	**6.7**	**5.9**	**3.4**	**3.7**	**22.0**	**19.8**

Source: Eurostat National Accounts.

Table 8.2: Composition of investment shares of total investment, 2004 to 2008 and 2010 to 2014

Country/ Group	Construction		Machinery and Equipmer		Intangible Assets	
	2004 - 2008	2010 - 2014	2004 - 2008	2010 - 2014	2004 - 2008	2010 - 2014
CORE	**51.4**	**49.3**	**31.1**	**30.1**	**17.3**	**20.4**
AT	49.7	47.4	34.2	32.9	15.8	19.4
BE	45.6	49.0	40.1	33.5	14.1	17.3
DE	45.4	48.8	38.1	33.5	16.5	17.6
DK	49.3	44.9	32.5	28.8	18.2	26.4
FI	55.5	56.2	23.3	21.6	21.0	22.1
FR	56.1	56.0	23.7	21.7	20.0	22.1
LU	56.8	51.9	32.2	36.7	10.8	11.2
MT	57.2	45.7	34.1	38.2	8.4	15.9
NL	55.3	49.3	25.9	27.7	18.6	22.8
SE	39.1	40.1	34.1	32.3	26.5	27.3
UK	55.6	52.8	24.2	23.9	19.9	22.8
GICIPS	**62.7**	**51.7**	**28.5**	**31.9**	**8.5**	**15.3**
CY	70.1	61.8	26.7	29.2	3.2	4.8
EL	58.6	51.5	34.2	36.1	7.0	12.0
ES	68.1	56.4	24.2	29.3	7.3	13.9
IE	65.5	33.1	21.3	36.0	13.2	30.8
IT	53.8	52.3	34.5	33.1	11.5	14.3
PT	60.0	55.0	29.8	27.7	9.0	16.0
EAST	**51.0**	**50.7**	**41.3**	**39.0**	**6.9**	**9.7**
BG	47.7	55.1	46.0	37.9	5.0	6.3
CZ	45.2	43.2	43.8	43.4	10.6	13.1
EE	57.0	51.0	38.5	40.1	4.2	8.5
HU	51.0	46.7	39.4	39.9	8.8	12.5
LT	58.8	57.6	34.3	32.3	5.7	9.2
LV	52.2	53.1	42.7	39.1	4.9	7.5
PL	51.9	56.9	41.7	36.5	6.2	6.4
RO	48.3	53.5	44.6	37.1	6.8	9.1
SI	51.5	46.5	38.5	37.5	9.6	15.5
SK	46.2	43.0	43.6	46.1	7.1	9.2
EU28	**54.0**	**51.5**	**30.6**	**29.7**	**15.2**	**18.5**

Source: Eurostat National Accounts.

Table 8.3: Average tier 1 capital ratios for European banking systems, 2007 - 2014

	2007	2008	2009	2010	2011	2012	2013	2014
Austria	-	7.7	9.3	10.0	10.3	11.0	11.9	11.8
Belgium	11.9	11.5	13.2	15.5	15.1	15.9	16.4	15.3
Bulgaria	10.8	11.2	14.0	15.2	15.7	15.1	16.0	19.6
Cyprus	-	8.3	9.5	10.9	7.4	6.3	12.3	14.6
Czech Republic	9.7	10.6	12.3	13.6	13.6	14.9	16.0	16.5
Germany	-	9.3	10.6	11.4	11.7	13.8	15.2	14.8
Denmark	-	10.2	13.5	14.1	14.9	16.7	17.3	16.2
Estonia	-	10.3	11.8	12.7	18.5	22.8	22.7	41.3
Spain	-	8.1	9.3	9.6	10.3	9.8	11.8	11.8
Finland	-	12.5	13.8	13.7	13.7	16.3	15.5	16.6
France	-	8.4	10.1	10.8	10.9	13.3	13.2	13.1
United Kingdom	-	8.2	9.9	10.9	10.7	12.3	14.4	-
Greece	-	7.9	10.8	10.9	10.9	8.0	13.2	13.8
Croatia	- -	-	-	-	-		18.6	19.4
Hungary	-	10.9	11.9	11.5	11.3	13.3	14.7	13.8
Ireland	-	9.2	9.8	11.6	16.7	16.7	17.3	20.5
Italy	7.0	6.9	8.3	8.7	9.5	10.6	10.6	11.8
Lithuania	6.4	9.2	9.3	10.8	12.0	14.6	17.0	20.9
Luxembourg	-	12.7	15.6	15.1	15.3	18.6	21.3	18.5
Latvia	-	9.6	10.8	10.9	13.5	14.5	16.5	17.3
Malta	18.4	15.6	21.3	49.6	52.2	49.6	43.9	23.1
Netherlands	-	9.7	12.5	11.8	11.8	12.3	12.9	15.4
Poland	11.1	10.2	12.1	12.6	11.9	13.1	14.0	13.7
Portugal	6.9	6.6	7.9	8.3	8.6	11.3	12.2	11.5
Romania	10.0	11.6	12.9	14.1	14.2	14.8	15.8	14.5
Sweden	-	7.9	10.6	10.7	10.9	11.3	11.5	19.2
Slovenia	7.1	8.8	9.0	8.6	9.3	9.8	12.9	17.1
Slovakia	10.8	10.1	11.6	11.4	12.5	14.9	16.2	16.0

Source: European Central Bank.

Table 8.4: Loan to deposit ratios, Euroarea countries, 2007 -2014

	2007	2008	2009	2010	2011	2012	2013	2014
Austria	121.3	128.5	121.8	125.1	125.8	123.4	122.5	119.0
Belgium	88.8	79.7	69.0	63.8	60.8	61.7	60.8	63.3
Cyprus	77.2	97.4	99.3	90.6	100.1	102.5	132.4	130.5
Germany	132.1	126.7	119.8	114.9	112.1	107.3	102.9	101.5
Estonia		184.4	173.0	151.1	129.6	119.3	115.3	109.4
Spain	205.3	195.8	186.9	169.8	168.2	161.5	141.0	131.5
Finland	157.8	155.1	153.0	148.4	154.2	156.4	159.6	168.6
France	134.9	138.5	136.4	133.9	133.2	126.3	121.8	117.6
Greece	79.5	78.2	75.6	98.3	113.4	112.5	112.8	111.3
Ireland	176.0	190.6	173.4	170.7	161.9	151.6	142.2	124.6
Italy	139.1	136.6	130.4	138.1	142.7	131.8	122.8	117.7
Lithuania	155.5	189.5	168.3	141.4	128.9	117.8	112.7	98.4
Luxembourg	88.5	108.1	98.4	97.8	105.7	97.8	96.2	99.2
Latvia				146.9	125.1	100.6	85.4	70.0
Malta	141.5	157.2	125.2	95.1	98.1	90.7	71.1	74.7
Netherlands	130.2	130.9	128.7	122.4	122.1	125.3	122.2	116.0
Portugal	160.8	164.6	166.6	158.2	152.0	147.1	136.1	123.6
Slovenia	160.7	175.6	172.7	170.5	165.0	158.5	132.0	102.2
Slovakia	83.8	84.2	91.1	90.3	94.8	93.2	94.3	97.4

Source: European Central Bank.

Table 8.5: Leverage ratio of European banking systems, 2007 - 2014

	2007	2008	2009	2010	2011	2012	2013	2014
Austria	-	18.5	15.4	13.8	14.7	13.5	13.4	14.2
Belgium	23.4	30.5	22.2	20.1	21.7	17.4	15.7	15.1
Bulgaria	9.5	8.8	7.5	7.4	7.4	7.6	7.8	7.9
Cyprus	-	16.9	17.2	15.2	19.9	26.0	16.2	10.3
Czech Republic	14.0	13.6	12.1	11.9	11.8	10.4	10.8	10.0
Germany	-	34.2	26.6	25.8	25.7	23.5	20.3	19.2
Denmark	-	23.9	22.2	21.8	21.1	20.3	18.4	18.4
Estonia	-	12.2	14.2	12.4	8.1	7.1	6.8	6.6
Spain	-	18.0	16.4	17.2	17.4	17.9	14.9	14.0
Finland	13.7	18.2	16.8	19.6	26.1	26.3	21.7	24.3
France	23.2	26.7	20.7	20.1	21.1	20.1	18.1	18.9
United Kingdom	-	26.2	22.0	20.8	20.5	19.1	17.9	17.9
Greece	-	18.5	14.6	15.4	15.4	26.6	14.0	12.8
Croatia	-	-	-	-	-	-	7.5	7.2
Hungary	-	15.5	13.4	12.3	13.5	11.5	10.7	10.9
Ireland	-	29.9	20.9	21.1	17.7	15.8	15.0	9.1
Italy	13.0	14.3	12.8	12.7	14.9	14.4	15.0	14.0
Lithuania	14.9	14.4	17.8	14.2	11.3	10.2	9.6	9.7
Luxembourg	-	25.8	18.5	16.8	17.7	15.1	13.9	13.4
Latvia	-	12.2	13.2	12.7	10.7	10.2	9.9	10.2
Malta	10.8	12.4	9.5	5.0	5.1	5.0	6.6	11.9
Netherlands	-	31.9	23.2	23.2	24.2	22.3	20.8	18.5
Poland	9.7	10.8	9.3	10.0	9.9	9.1	9.0	9.3
Portugal	15.7	18.1	16.1	16.2	19.6	15.5	14.8	13.6
Romania	12.5	10.9	11.0	10.1	10.0	9.7	9.7	10.5
Sweden	-	26.1	22.8	22.4	24.1	22.1	21.3	20.6
Slovenia	12.7	12.7	12.9	13.2	13.3	12.9	11.3	9.3
Slovakia	13.6	12.3	10.5	10.4	9.4	8.5	8.2	8.4

Source: European Central Bank.