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Rajmund Mirdala

The Euro Area and the Economic Crisis



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Rajmund Mirdala

**The Euro Area and the Economic Crisis**

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## From the Editor

Current problems of the euro zone and the euro currency raised various debates concerning monetary union and its further functioning. These debates are based on a well-known theory of optimal currency area which states that floating exchange rates can guarantee the stability only in case of free inner factor mobility and restricted external factor mobility. Within the theory of optimal currency areas, the endogeneity hypothesis offers other view on the potential implications of joining a monetary union. The endogeneity hypothesis thus can be seen as an argument in favour of faster monetary integration of new EU member states to euro area. The opponents support mainly so-called "specialisation hypothesis". In case of EU countries, it would be advantageous to have diversified production and to be open towards the euro area. Recent empirical literature point out that there are still rather significant differences in demand and supply shocks between new European Union member countries.

When European Union was created, it was obvious that it will not be possible to fully meet the optimal currency area criteria. That is why the initial goals were defined with the assumption of necessary future modifications. In 1992, the Maastricht Treaty established a monetary union without a political union. Thus the euro is backed with common central bank but remains without adequate sovereign backing. As a result, member countries share common currency but in case of internal debts they are left to cope with them with their proper instruments. Thus, a contradiction arises between the management of common monetary policy on one hand and the management of independent sovereign fiscal policies on the other. While the monetary adjustments can be realised in relatively short-term period of time, fiscal measures need much longer time horizon. We must realise, that European Union still have not created an effective mechanism in order to eliminate the excessive deficits of public budgets, overlooked in case of many countries. The ambition of Stability and Growth Pact; as a control mechanism for management of public finances, is in reality failing. The economic crisis revealed this weakness to full extent. This leaves open the questions, such as whether the reason is the individual or systemic failure or whether the current euro area and euro issues could be explained by the „inoptimal monetary union“ or „inoptimal local policies“.

The impacts of economic crisis on various countries are different. Even in case of small catching-up countries that had no previous issues with the meeting of Maastricht criteria (e.g. Ireland, Portugal, Slovakia, Slovenia), it can be observed, that the very fulfilment of criteria does not guarantee that country can avoid either the economic crisis or its impacts. The question remains whether this problem is related to size and openness of economies or it is just the result of „inoptimal local policy“. Small European are characterised by their high degree of openness which explains why we cannot simply concentrate on internal balance and why it is necessary to take into consideration also the external balance. Many authors suppose that in the catching-up process, we may expect further problems and

deepening of the external imbalances which may be related to their higher economic growth. The authors expect this development even after the adoption of common currency.

With the entry to monetary union, countries renounce their independent monetary policies, leaving them only with the fiscal policy tools to manage the economy. Overall reduction of deficits at a time of high unemployment, sets in motion a downward deflationary spiral. Higher tax receipts cause further cuts in employment as well as in domestic prices and thus reinforce the exports. Ultimately, the deficit issues are not solved and further reductions are required. And even if the budgetary targets were met, it is difficult to assess how countries could regain their competitiveness and restart their economic growth. In the absence of possible exchange rate depreciation, the adjustment process would require reduction in wages and prices thus further deflation (Soros). The monograph was elaborated within the project VEGA 1/0892/13 on "Economic Crisis and Economic and Monetary Union Member Countries in perspective of the Theory of Optimum Currency Area". The monograph is the result of the three year research and it summarises our main outcomes.

Thus, the goal of this book - **The Euro Area and the Economic Crisis** - is to encourage the exchange of new ideas about challenges the recent economic and debt crisis in the Euro Area. The book consists of seven chapters. Each chapter discusses crucial aspects of the recent problems in the Euro Area in terms of origins and implications of the economic crisis in the Euro Area (chapter 1), asymmetries in the Euro area (chapter 2), issue in growth perspectives (chapter 3), distortionary effects of the single monetary policy on inflation expectations (chapter 4), effects of the fixed exchange rate environment in the currency union on the transmission of inflation pressures (chapter 5), competitiveness issues between North and South of the Euro Area (chapter 6) and asynchronous effects of the fiscal policy shocks on the Euro Area member countries (chapter 7).

Rajmund Mirdala

## Chapter 1

### On Origins and Implications of the Sovereign Debt Crisis in the Euro Area

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## On Origins and Implications of the Sovereign Debt Crisis in the Euro Area

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### 1.1 Introduction

The current Euro Area crisis has revealed certain flaws of the Euro Area, such as its vulnerability to asymmetric shocks and its inability to act as assumed by the optimum currency area theory (Jager and Hafner, 2013). It has highlighted the serious lack of confidence in the ability of the Euro Area to face challenges resulting from political and economic development in the Euro Area countries and in the world economy (Gómez-Puig and Sosvilla-Rivero, 2012). It has emphasized the influence of serious system failures of the global economic and political order and of serious structural failures of the "Euro project" on success and economic growth in the Euro Area. Consequently, it has stressed the need to find a systemic and consistent solution to the current problems of the Euro Area. Also Eichengreen (2012) supports this statement and argues that the Euro Area had been designed with some serious flaws, which are still underestimated. Moreover, Verdun (2012) adds that the current European sovereign debt crisis has put on the agenda the need to redesign the Euro Area due to the lack of symmetry between "economic" and "monetary" union because the main problem is the asymmetrical Euro Area and its mistaken institutional structure (Buti a Carnot, 2012).

The international financial globalization and the integration of financial markets are supposed to lead to a more effective distribution of resources in the global economy and to increase the performance of real economies. The result of related liberalization of global trade and foreign currency regime, inefficient regulation on world's financial markets and the gradual emergence of new technologies and innovative financial instruments on these markets are mainly cumulating the risks in the world financial system and on the world economical market and their destabilization. Each country is under influence of these aspects and becomes more sensitive on financial turbulence and due to their high interdependence; they are more liable to financial spillover effects and other problems (Bekaert et al., 2006; Cubillas and Gonzáles, 2013; Croci Angelini et al., 2014; Eichacker, 2015).



At the same time, in the terms of Economic and Monetary Union (EMU), the politically pursued and often economically unpremeditated spreading of European integration seems as global support of moral hazard in the financial sector. It motivates the private sector and governments to “consciously gamble for redemption” from their problems by making decisions based on morally unjustifiable and economically harmful deficit economy and creates conditions for the implementation of policies like “too-big-to-fail” not just on national, but also on international level, which supports and basically legitimizes indebtedness of subjects of private and public sector including their members (Arellano et al., 2012; Bratis et al., 2015).

Consequently, the result of listed facts is general support and acceptance of debt politics in the EMU and their current expression is the European sovereign debt crisis. The crisis also results from reactions of governments and central banks of the Euro Area member countries on previous private debt crisis in their national economies and in the world economy and from different economic levels and performances of the Euro Area members, from unsustainable public debt of the peripheral Euro Area countries and from the incompleteness of the Euro project (Aizenman et al., 2013; Lothian, 2014). According to Baimbridge et al. (2012) the crisis is a product of fiscal indiscipline, of too expansive budgetary and fiscal policy and of the fact that economies in Euro Area are too competitively inflexible. It is thus not a crisis caused only by inability of southern European countries to maintain their budget expenses, but it is mainly a result of imbalances in the EMU and in the global political economy (Brancaccio, 2012). Its main causes are systemic and their core is in the general system failures of global economic and political order and in serious structural failures of the Euro Area and of Euro as the projects (Detlef, 2012; Lothian 2014).

To ensure the proper progress of European integration and for successful fulfillment of its goals it is necessary to take into consideration the nature and the complexity of the causes of the recent crisis in the Euro Area. The crisis is in fact a serious crisis of confidence (Gómez-Puig and Sosvilla-Rivero, 2012) which creates a demand on systematic and consistent solutions to eliminate it. The aim of this chapter is therefore to identify systematic sources of this crisis and design some of its possible solutions, or more precisely to identify the facts that are necessary to take into consideration when creating adequate and efficient solutions, while keeping in mind the European integration issue and the globalization of world economy. Regarding this ambition, our chapter emphasizes that the crisis is the balance of payments crisis and self-fulfilling crisis. Considering identified issues, suggested remedies and solutions are based on diversification of the monetary policy management in the EMU to eliminate the moral hazard from its financial sector, creation of a functioning system of fiscal transfers and finding a compromise between centralization and decentralization and government interventionism and “laissez faire”.

To achieve the stated objectives, the rest of this chapter is organized in the following way: the first section clarifies basic relations of the transition of the debt crisis in the Euro Area from the private sector to the public sector. The second section discusses selected causes of the current European national debt crisis that are connected with the globalization of world economy. The third section is focused on selected sources and origins of the crisis which are related to the question of ongoing integration in Europe and the last section summarizes recommendations that should be considered when proposing adequate and effective solutions.

## 1.2. From the Debt Crisis of the Private Sector to the Serious National Debt Crisis

European debt crisis is in fact continuation of the recent American mortgage crisis (2007) (Ureche-Rangau and Burietz, 2013) and the following global financial (Reinhart and Rogoff, 2011; De Bruyckere et al., 2013) and economic crisis (2008) (Gennaioli et al., 2010; Claessens a Kose, 2010; Ureche-Rangau and Burietz, 2013). As their result, governments of many developed countries were “forced” to introduce rescue plans and actions to restore confidence of investors, to avoid panic on financial markets and to prevent or reduce the effects of ongoing recession. Using these and other excuses, the following action was made: capital injections and guarantees were provided to bankrupting entities that were considered to be systematically important, e.g. too big to fail. However, introduction of the “too-big-to-fail” policy resulted in creation of huge deficits of public finances and extreme increase of countries national debts that have become unbearable in relatively short time. Problems with repayment of exploded levels of sovereign debts experienced selected Euro Area member countries already at the beginning of 2010 (Ureche-Rangau and Burietz, 2013). This fact was confirmed by several studies, i.e. by Cuestas and Steahr (2014) who analyzed and compared the dynamics of the national debts in the EMU before and after the global financial crisis. Significant impact of the crisis on fiscal variables in individual countries was also investigated (Cuestas et al., 2014). De Grauwe (2010) adds that the growth of the deficit in all Euro Area member countries was due to the three to the financial and credit crisis of 2007-2009 related aspects: “1) the rescue operations of the national banking systems and the stabilization funds; 2) the stimulus packages to prevent a further meltdown of the type experienced in the Great Depression of the 1930s; and 3) the extensive tax revenue losses due to the meltdown of the real economy, the rise of unemployment, and decline in incomes” (Young and Semmler, 2011).

It seems obvious that the governments of Euro Area countries with the help of the central bank and multinational institutions partially managed to “transform” the previous private sector debt crisis to the current public sector debt crisis in the Euro Area (Lothian, 2014; Beirne and Fratzscher, 2013; Grammatikos a Vermeulen, 2012). The main channels that enabled this transition were stock markets and the mentioned government interventions that have influenced the expenses and the national debt of many EMU countries which caused serious problems with its financing (Gennaioli et al. 2010; Ureche-Rangau and Burietz, 2013; De Bruyckere et al., 2013; Pisani-Ferry, 2013).

Despite the obvious negative consequences of the bailout, it is still possible to find supportive arguments. For example Bordo and Eichengreen (1999) are convinced that the government and the central bank are obliged to use all their resources to avoid loan crisis in the economy, and therefore they have the right to conduct any saving actions. However, they also warn that the interest of the government to keep the investor’s confidence in the solvency of the country can lead to a significant increase on its debt burden and increase the risk of failure when financing the debt (Diaz-Alejandro, 1985; Reinhart a Rogoff, 2011; Ureche-Rangau and Burietz, 2013). Moreover, the government acts are also justified by other arguments, i.e. two theoretical reasons explaining the possibility of connecting two types of crises in the economy. The first reason is today’s perception of government as the lender of the last resort (Kindleberger, 2005), which is responsible for maintaining the confidence on the financial markets in the country (Bordo and Eichengreen, 1999; Laeven and Valencia, 2010) and the second is the effect of government bonds on the financial markets as risk-free assets (Ureche-Ranga and Burietz, 2013).

An important cause of the debt crises and their movement along economy sectors, e.g. also the reason of the European national debt crisis is the loss of confidence of investors in the ability of debtors and intermediaries to fulfil their obligations and the related uncertainty in the financial markets (Lothian, 2014). Therefore, a government that wants to stop its increase has to be able to issue its debt without a rapid increase of the risk of its failure (Ureche-Rangau and Burietz, 2013; Wehinger, 2010).

### **1.3. Selected Global Causes of the European National Debt Crisis Related to the Globalization of the World Economy and World Financial Markets**

While taking into account the phenomenon of globalization of world economy and financial markets, it is possible to identify several system resources of the current European national debt crisis that can be classified into four groups.

#### ***Deformed Monetary and Bank Systems***

The first group of causes is related to the current deformed monetary and bank systems. The main cause of manipulation with the economic calculations of market participants, significant systematic support of moral hazard and debt growth of the private and public sector, prolonging and deepening of cyclical fluctuations in the economies and financial crises are the current centrally planned, centrally controlled and significantly deformed monetary and bank systems based on unsecured symbolic fiat currencies and on system of fractional reserve banking (Gonda, 2012; Detlef, 2012).

These arguments can be supported by the fact that the central banks and also significantly involved commercial banks are nowadays live together with governments in some sort of financial-debt symbiosis. Central banks are also not completely independent and are sometimes acts even together with commercial banks to help the government to meet their interests. On the other hand, commercial banks are gaining significant financial resources and guarantees from central banks and governments that leads to a global support of irresponsible reliance of market participants on others to cover the losses of commercial banks and other entities.

A good example of fatal conceit of the governing to design the fates of others to achieve their specific economic and political interests is also the change of character of monetary policy that happened in EMU after 2008. Its result was mostly price deformation on the financial market and inappropriate stimulation of lending activities and associated debt accumulation in EMU. In low interest rates environment fueled by excessive money supply, amount of real investments is increasing even if there is not adequate increase in savings and there is also no increase in demand for goods. Under such circumstances an increase in inflation is generally expected together with a burst of asset price bubbles. As a result, interest rates reduction and introduction of related nonstandard monetary policy actions does not seem to be a proper way of solving problems in the EMU. Such activities may result only in slowing down the market, increased inefficiency and postponing the solution of the crisis to the future.

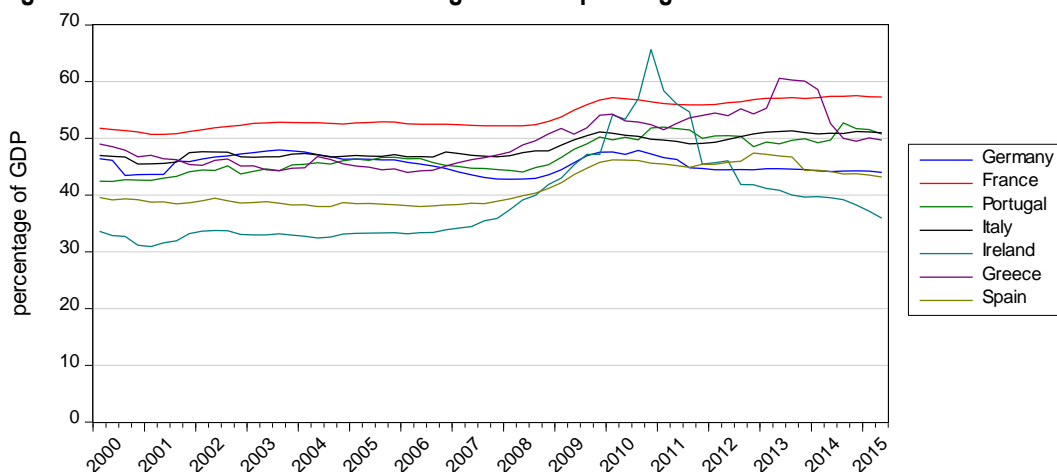
Similar effect is also achieved by bailing of indebted entities from bankruptcy, e.g. introduction of the „too-big-to-fail” policy that has a side effect of creating the precedent eligibility of bailout for all entities that are going to have similar problems in the future, without taking into consideration the origins of the problems (Detlef, 2012).

### ***Deformed Public Finances***

The second major group of the current Euro Area crisis sources is today's public finances from the aspect of globalization and financial integration. The public spending of many EMU countries are in long term excessive and their finances are usually deficient. The fact of consensual acceptance of deficit guarantees to the market players high reliance on the state and the tax payers of other countries. Culture of eligibility and dependence are built on misinterpreted application of the social justice policy which results in growth of public redistribution in many countries, while the development of real economies is being ignored (Gonda, 2012; Balcerowicz, 2014).

The above mentioned idea is also valid the Euro Area. Many of its countries, even during the financial and economic crisis, have not started to reduce their spending, moreover, they have even continued to raise their public expenditures. It is shown on Figure 1 and we can see that even during the crisis years, the rate of redistribution in the selected Euro Area countries, except Ireland, has grown or slightly decreased.

**Figure 1.1 Level of Redistribution through Public Spending within the Euro Area**



**Source:** Compiled by author based on data taken from IMF - International Financial Statistics (November 2015).

Frequently mentioned cause of today's Euro Area problems is also fiscal irresponsibility of many its members, falsification of statistics and usage of questionable practices such as creative accounting (Reinhart and Rogoff, 2011).

### ***Deformed Moral Principles of the Society***

The third important group of system causes of the recent European national debt crisis arises from its global, social, economic and political background and is related with deformed moral principles of the society. The current global economic and political system and further centralization and government interventionism in the EMU on transnational level are creating economically pervert motivation for economic calculations of market players that strengthens their mentality of requiring and culture of relying and depending on countries. At the same time, they also deform the traditional society values, its moral conventions and they are less applying the reciprocity of the market. For example, even Adam Smith in his work the "Theory of moral sentiments" (1579) emphasized the importance of strong

moral habits for the society that, according to him, should have clear business ambitions, but should also respect the basic moral values. Only belief in moral principles and reciprocity ethics of the market can preserve the effectiveness of allocating company resources, freedom and prosperity (Gonda, 2012).

### ***Financial Markets, Speculations and Credit Ratings***

The fourth, and the last group of the Euro Area crisis sources originates in the principles and processes associated with globalization and financial integration, such as the architecture of financial markets, speculations of entities operating on these markets, and the questionable reliability of credit ratings from rating agencies that represents the essential pillar of activities on these markets. Securitization and speculations that are today part of financial markets and actually allow relocating the risks from irresponsible borrowers on other entities that are interested in not transparent and hazardous financial products (Cohen and Villemot, 2014).

Whyte (2010) argues that the creditworthiness judgements of the third-party raters had attained the force of law and he warns about a huge impact of credit ratings on the cost of funding, regardless of whether the rated subject is a private borrower or a sovereign borrower. Moreover, Pagano and Volpin (2010) points out the impact of credit ratings on the achievements of implemented austerity measures in the Euro Area. Also, Afonso et al. (2011a), Afonso et al. (2011b) and Eijffinger (2012) note that credit ratings are the key part of the financial markets, but they conclude that rating agencies lag behind markets, that they are notoriously bad at predicting currency crises, that their business model is flawed, and that the existence of a lack of competition between three rating agencies on the financial markets is the reason for their too strong market position. De Haan and Amtenbrink (2011) criticize business model of rating agencies too and they warn about the herd behavior of investors. Therefore, prudential regulation and accounting standards and more competition and transparency are needed to increase the quality of credit ratings.

Moreover, Wolfgang Schäuble, the German politician, argues that according to the recent problems in the Euro Area the financial markets do not understand the unique and specific construction of the euro and states: "We have a common monetary union, but we don't have a common fiscal policy. We need to convince the international public and international markets that this is a new form, very specific to meeting the demands of the 21st century" (Young and Semmler, 2011).

The mentioned issue can be clarified by Cohen and Villemot's (2014) theory. They distinguish two types of debt crises: those that are the result of external shocks and those that were made endogenously, either as a result of self-fulfilling panic on financial markets, e.g. as the effect of self-fulfilling expectations of investors operating on these markets, or as a result of predatory behavior of "Panglossian" borrowers.

Self-fulfilling crisis that is caused by self-fulfilling panic on financial markets happens, when investors expect that the government of the specific country will have a problem with repayment of its own debts and if they act on financial markets according to these expectations. It is also the same in case if their expectations are positive about the risk of failure with the fact that they are helping them to refinance their liabilities, and in fact they are supporting them in their further indebtedness (Arellano et al., 2012). In such a situation, the most important role is objectivity and truth of information that determine

expectations of investors, and thus the reliability of countries by the credit rating they receive from rating agencies.

Key factor that influences the formation of such type of debt crisis is by Arellano et al. (2012) also represented by the current level of debt of the government. As a result, government is obliged to optimize its indebtedness policy in order to avoid its exposure to an excessive risk of failure.

The formation of the self-fulfilling debt crisis that is caused by predatory behavior of “Panglossian” borrowers, who are characterized by Krugman (1998) as borrowers who focus only on their best prospects for growth and success, while they consciously expect their own failure while paying their own debts. Arellano et al. (2012) blames countries that are in recession, but have motivation to lower their government expenditures very slowly, or even raise them and at the same time, raise their public debt. Such entities would consciously “hazard with their survival”, in the belief of recovery of their economy relying on increased tax incomes and economic growth. In case of persistence of their problems, they would become vulnerable to the sort a self-fulfilling crisis of their national debt and they would be exposed to the risk of a bankruptcy.

An essential factor, that motivates governments to hazard about their survival, is the development of expenditures on their indebtedness. It also depends on the activities of the particular government. For example Arellano et al. (2012) has marked the anti-crisis policies and actions of EU and MMF, as explicitly harmful and supporting indebtedness of other members. In fact any policy, that increases the countries bond prices (reducing the income from them) or reduces the cost of its failure, motivates to gamble for redemption and helps to increase its indebtedness. It is necessary to emphasize the influence of the “Euroillusion” that arose after the creation and introduction of Euro, on the expenses of the GIIPS countries (De Grauwe and Yueimei, 2013). As a result, the governments tend to employ deficit spending policies even if they are going to have even more debts, e.g. it is worth for them to gamble for survivor. Therefore, in the context of EMU issues, it is appropriate to evaluate the fiscal discipline rules that are laid down in the Pact of Stability and Growth in the Fiscal compact (Eijffinger, 2012). The key role in the Euro Area's crisis is represented not only by those four universal systematic global causes of debt crises, but mostly by the specific system failures of EMU project.

#### **1.4. Selected European Integration Related Causes of the European National Debt Crisis**

European national debt crisis was caused mostly by specific systematic failures of the EMU and euro projects, e.g. causes related to the European integration issue, while for simplification purpose we can again divide this issue into four groups.

##### ***Questionable Goals of European Integration***

The first group of the causes is related to the goals of the current progress in the European integration. Based on Winston Churchill's words from 1946, basically the aim of integration in Europe is supposed to preserve the peace on European soil and to ensure freedom, prosperity and wealth of its inhabitants (European commission, 2015). These objectives are also defined by Article 3 of the Consolidated version of the Treaty on the European union and the Treaty about the functioning of EU. More specifically, the primary EU's goal is to preserve peace in Europe, its values and the wealth of its nations on this continent, and puts much less stress on the economic aspects, such as ensuring the economic growth, price stability, full employment, strengthening the competitiveness of its members

and so on (ECB, 2011). Therefore, the Union's principle cannot be described as primarily economic, but rather political. It is also confirmed by later progress of European integration, which has been significantly influenced with geopolitical reasons.

Also Cesarano (2013) writes about the dominance of the political objective of European monetary unification and as well as Hall (2012) adds that the Euro Area was in fact a large political project, initiated by French President François Mitterrand and supported by German Chancellor Helmut Kohl in the line with "une certaine idée de l'Europe" in order to bind a newly unified Germany to Europe. Hall (2012) additionally stresses the conditionality of inception of the Euro Area and euro on French agreement to German unification and on creation of the Stability and Growth Pact. He also gives two important aspects of the new economic doctrines which were deciding in the case of the "Euro project": Firstly, he argues that mainstream economics moved away from the Keynesian view that fiscal policy is crucial tool for stabilizing the economy, towards the monetarist view that fiscal policy is not stabilizing tool for the economy and that monetary policy has few lasting effects on the real economy, and states that the implication of this opinion in the context of European integration was that fiscal policy should remain roughly neutral and diversified and that monetary policy should be rule-based, targeted on inflation and unified. At the same time, the disputable limits placed on debt and deficits of the Stability and Growth Pact were found as adequate. It turned out to be questionable (Hall, 2012; Weeks, 2014). Secondly, he argues that in keeping with the opinion that demand management is essentially irrelevant to economic growth, the new economic doctrines held that economic growth depends largely on structural reform to the supply side of the economy targeting the more intensive competition in markets for goods and production factors, concrete for labor and capital, and states that the implication in this case was that all the Euro Area member countries should use the same approach and the same formula to protect economic growth. According to his opinion, the problem was the belief of responsible persons that competition under the new stringent conditions imposed by a single market and by a common currency but without any better fiscal integration or coordination would force suitable structural reform on the Euro Area member states and lead to gradual institutional convergence in their political economies (Hall 2012).

Therefore, the principle of the European integration cannot be described as primarily economic, but rather as definitely political. It is also confirmed by later progress of European integration, which has been significantly influenced with geopolitical reasons and whose economic aspects have been largely marginalized or taken in to account only very superficially. Namely Klaus (2004) argued that the largest and the most important part of the positive economic impact of the European integration on its members has come only through the liberalization of trade and investment and has been already obtained. The cause of this is according to him the fact that the role of the exchange rate risk as a factor determining the cost of capital and the cost of foreign investment is really relatively small and therefore trade is not important to have the same currency on both sides of the realized transaction (Klaus, 2004; Jager and Hafner, 2013).

On the other side, some economists argue that the euro project have an important economic objective, thus that it "was conceived as a way of completing the single market" (Grant, 2013). He and McNelis (2013) point out that the euro was not only a political project but he also admits that the economic expectations related to this project were mistaken. They state that the euro was a project with the goal to enhance political cohesion in Europe which begun with the creation of the Common Market in 1957.

McNelis (2013) also emphasizes that an important economic argument for the inception of monetary union in Europe “is enhanced price competition, since goods and services would be priced in a single currency, which in turn would lead to greater transparency about relative costs across borders, thus increasing the efficiency of making financial decisions” (McNelis, 2013). He argues that all of this, the countries hoped, would pave the way toward greater convergence in economic growth and economic performance across the Euro Area. However he also states that the introduction of the euro was connected with waiver of countries’ independent monetary policies and of option of currency devaluation to regain their competitiveness, relative to other countries. Thus the assumption that a common currency would generate economic convergence and political unity was unfortunately misleading and had a contrary effect (Baimbridge et al., 2012). A good example is the divergence between peripheral Eurozone countries and Germany. The GIIPS countries have extraordinarily high unemployment rates and their ratios of debt to gross domestic product are at least unpleasant (McNelis, 2013).

In order to prevent that any country or group of European countries gains a strategic advantage in weapon production with the intention to create a common market for that particular commodity, the Treaty establishing the European Coal and Steel Community has been signed as first step on the way towards free and prosperous Europe. With the ambition to ensure the control of nuclear energy in Europe, in 1957 the European Atomic Energy Community has been formed and in order to strengthen the economic cooperation between the signatory countries, the Treaty establishing the European Economic Community was signed within the same year with objective to ensure economic and social progress of participating countries, the constant improvement of living and working condition for the people living in those countries, to ensure and strengthen peace and liberty in Europe by implementing common actions when removing barriers that divide it.

While the objective of the Treaty establishing the European Economic Community was supposed to create a common European market, according to the Single European act that has been signed in 1986, the common European market should be created. The positive aspect of the ongoing integration has been, for example upholding the principle of four freedoms - free movement of goods, services, capital and labor, but its serious negative aspect has been the strengthening of aggressive European political integration that leads towards the creation of European economic and political union (European commission, 2015).

An important milestone of the primarily politically motivated European unification has been the signing of the Treaty on European Union in 1992 that included an agreement of the signatory countries about establishing a single common currency - the Euro. Although this step has been justified by politicians and political scientists as a necessary step for the proper functioning of the single market in the EMU, in fact it has been more a political than an economic decision. It is confirmed by the divergence in opinions of economists about the possible positive impact of this decision on the social, economic, structural and institutional group of heterogeneous countries, as the EMU undoubtedly is. Also the economists had concerns about the establishment of conditions of the common currency, later also about the rules for countries joining the new EMU and about the constantly changing and increasingly riskier conditions for its members. As a result, the closer integration and harmonization in the EMU has been pursued, but in fact there were few exceptions when approving acts in the Union, depending on the situation and individual interests of particular countries.



An important sign of the dominance of political objectives of European integration was also ignoring the opinion and the willingness of the citizens of member countries to form the proposed monetary union, respectively to enter such monetary union with strongly heterogeneous members and acknowledging rational reasons against its creation. Recent crises and problems that EMU challenges in the last years, they support the belief that the unity and solidarity of its members require the conduction of a variety of common economic policy actions to preserve stronger mutual economic convergence among member countries. This is also confirmed by many studies that are emphasizing significant economic disparities in the Euro Area, classifying its countries to several significantly different groups (Artis and Zhang; 2002; Nechio, 2011; Holinski et al., 2012; Monford et al., 2013) and claiming that the economic divergence of the EMU countries is significant, and it's not decreasing over time.

### ***The Design of the Euro Area***

The second relevant group of the sources of current Euro Area crisis is, taking into account the aspect of European Integration, a group of causes related to the issue of the EMU design according to the Optimum Currency Area Theory. As stated in the previous part of this chapter, a basic and really important asymmetry was built into the Euro Area from its inception (Hall, 2012). Although Ishiyama (1975, p. 378) concluded his review with the following obituary: "the theory of optimum currency areas is primarily a stochastic discussion which contributes little to practical problems of exchange rate policy and monetary reform" (Tavlas, 2009). Thus also use of the OCA theory related arguments can be disputable as well.

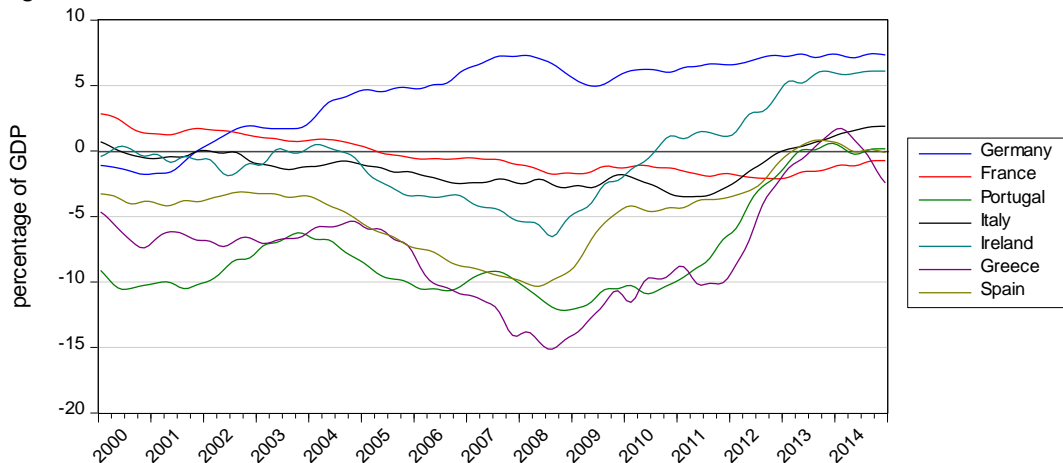
In general, the Euro Area is namely what is well known as a currency area. A number of independent nations share a common currency, have a common monetary authority and a common monetary policy and also have debts denominated in the common currency but still have their own independent fiscal policies for government spending and taxation. Thus, the countries do not have political accountability to the currency union about how they tax and spend. And this is the reason why they run up their debts. Therefore just "this combination of complete monetary union with little or no fiscal coordination or accountability is the Achilles` heel of the euro zone" (McNelis, 2013). In the case of Euro Area is also the problem the common monetary authority, that have in the monetary union a function of a lender of last resort to banks but which have in the individual Euro Area member states only a limited supervisory authority over other banks, thus its activities in the area are relatively limited. It means, while the ECB has the responsibility to be a lender of last resort to the banks in the euro zone, each country has its own banking supervision laws and its own national accounting practices and standards. Also the too late reaction of the ECB to the debt problems in the Euro Area was criticized. Therefore it is easy to state that the introduction of the euro was probably premature for many actual Euro Area countries and that the Euro Area is obviously not an optimum currency area, or a region for which it is optimal to have its own currency and its own monetary policy, while the optimality is defined in terms of the attainment of both internal balance and external balance (Tavlas 2009; McNelis, 2013).

Also the analysis of the ability of the Euro Area to fulfil the criteria of the Optimum Currency Area theory for creation of an optimum currency area requires highlighting various discrepancies (Jager and Hafner, 2013). Mundell together with McKinnon and with Kenen recognized that forming a monetary union requires giving up the ability to realize an independent monetary policy and the ability to adjust

the exchange rate of a national currency. They stressed that separate currencies among economies increased the transactions costs and information costs of money, and resulted in relatively thin foreign exchange markets, raising both the volatility of prices in those markets and the ability of speculators to influence prices. To help guide the decision whether a country should join a monetary union, those authors namely proposed criteria that could help alleviate the loss of an independent monetary policy and the exchange rate tool among countries participating in a monetary union Mundell (1961). emphasizes the importance of the factor mobility, which can help take the place of exchange-rate adjustments, especially he made it clear that it can be the labor mobility as well as the capital mobility. Also Eichengreen (1997) explored the importance of the capital mobility in the short run. Their idea was that, where such mobility exists, adjustments to shocks can be spread out over a longer time period than otherwise. McKinnon (1963) put the accent on the openness of the economy. Kenen (1967) considered fiscal integration as a key criterion. He also argued that economies with either similar, but narrow, production structures or with diversified production structures are suited to form a monetary union. Mussa et al. (2000) pointed out that the quantity of reserves should be a factor guiding the choice of exchange-rate regimes (Tavlas 2009). Thus, while Eichengreen (1991) and Krugman (1998) highlight the increase in regional specialization and the reduction in income correlation under a common currency, Frankel and Rose (1998) point out greater trade integration leading to more correlated business cycles, results that speak against and for optimality respectively (Cesarano, 2013). It is therefore clear that the set of criteria of suitability for membership in a currency union includes two groups of criteria. The first group consists of criteria that reduce the exposure of member states to asymmetric shocks. This group includes similarity of economic structure, intraregional trade and a really low degree of specialization. The second group contains criteria that facilitate the adjustment of the member states to asymmetric shocks and includes homogeneity of preferences of the member states, factor mobility and good functioning system of transfer payments. It is also important to add that the authors of the OCA theory defines an asymmetric macroeconomic shocks as a shocks "if only one part of the currency union is hit by the shock while the other part is spared or if member countries differ widely in terms of the shock's impact on their economies" (Jager a Hafner, 2013). Krugman (1979) defines a balance of payments crisis as the government's inability to defend fixed parities due to the limitation of its power and according to the authors of the Optimum Currency Area Theory (OCA Theory: Fleming, 1971; Kenen, 1967; McKinnon, 1963; Mundell, 1961), the money is an economic instrument which has, in the case of an independent state with its own currency, a key role in the absorption of economic imbalances (such as loss of competitiveness, or unemployment). Thus, when a countries decide to abandon its currency and to join a monetary union, they deprive themselves of an important instruments used to smooth out the internal and external imbalances emerging in the currency union (Guerreiro, 2014; De Grauwe and Yueimei, 2013; Calice et al., 2013). As such, the proponents of OCA theory are talking about the existence of certain "trade-off" between the homogeneity of countries belonging to a monetary union and the existence of real adjustment mechanisms that would operate in the currency union. A very close similarity of the union members should, in fact, prevent from the occurrence of asymmetric shocks caused by imbalances in the union, and the presence of functional adjustment mechanisms should preserve that the currency union and its members will recover from these asymmetric shocks in the case that their homogeneity is not sufficient. As a result, a monetary union in which none of the above mentioned conditions are present

is considered (by the creators of the OCA theory) to be a suboptimal monetary area. In such a case, fixed exchange rate, representing the rule “one-size-fits-all” accompanied by the single monetary policy is by no means an adequate regime for preserving its current internal and external balance. In such a monetary union, a non-compliance of PPP can happen among its members, which in turn leads to external imbalances. Persistence of such imbalances can easily turn into the crisis of balance of payments and, finally, even a sovereign debt crisis (Guerreiro, 2014; Cuestas and Steahr, 2013).

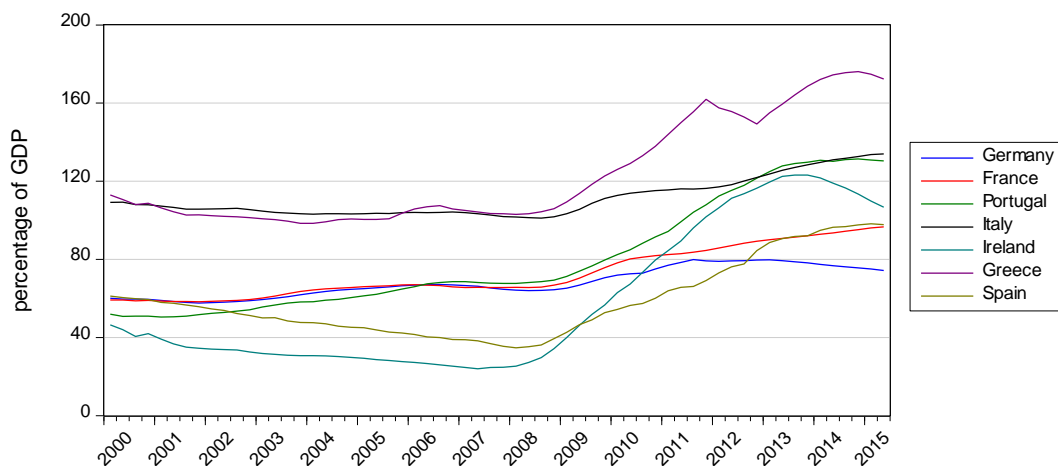
**Figure 1.2 Current Account Imbalances within the Euro Area**



**Source:** Compiled by author based on data taken from IMF - International Financial Statistics (November 2015).

Non-optimality of the EMU is also confirmed by Manolopoulos (2011), saying that the design of the EMU differs significantly from the design of optimum currency area, which was based on criteria of OCA theory. The above mentioned scenario describing the origin of the sovereign debt crisis in the EMU is further supported by Figure 2 (large current account imbalances) and Figure 3 (significant accumulation of sovereign debts). Countries with a higher and faster growing public debt are also experiencing large current account deficits (Gros, 2012; Sklias et al., 2014). Due to low labor force mobility, lack of fiscal transfers, artificial suppression of the German unit labor costs, politics, inflationary policy that serves mainly the countries with surpluses, and low level of diversification of the economies of its members, we must consider the idea of introduction of a single currency by the Maastricht Treaty in 1992 as relatively irrational decision (Detlef, 2012; Persson, 2011). Therefore also Jager and Hafner point out that euro area is „a combination of rapid capital migration and limited labor migration” rather than an economically well-integrated currency union (Jager and Hafner, 2013).

**Figure 1.3 Government Debt in the Euro Area**



**Source:** Compiled by author based on data taken from IMF - International Financial Statistics (November 2015).

Bonatti and Fracasso (2013) state that since the establishment of EMU, intra-European current account imbalances have grown significantly. It reflects diverging trends in competitiveness between core countries and periphery countries of the Euro Area. Introduction of the single currency and the single monetary policy significantly contributed to this divergent trend. Similarly, Cesaratto (2015) insists that the Euro Area sovereign debt crisis is a balance of payments crisis, tied to current account deficits and capital outflows (Lavoie, 2015). De Grauwe (2013) supports this opinion and he argues that the absence of a sovereign central bank caused a liquidity crisis followed by a solvency crisis in the Euro Area. He states that Euro Area member states had to issue debt in a new currency that is not under their control (De Grauwe, 2013; Caseratto, 2015).

Additionally, Weeks (2014) argues that when the global financial and economic crisis struck the continent in 2008, the trade-based deficits of the periphery countries of the Euro Area proved unsustainable. "With the exception of Greece, neither public debts nor fiscal deficits represented a major problem among Euro Area countries prior to 2008" (Weeks, 2014). However, for example Brancaccio (2012) states that internal imbalances in the Euro Area are an integral part of a monetary union attributable to the greater degree of financial integration between the EMU countries and thus it depends only on by the individual country followed theoretical approach to the issue how to secure economic growth.

However, Lavoie (2015) argues that although the continuous loss of foreign reserves must lead to some adjustment, Euro Area member countries can never run out of TARGET 2 balances, because TARGET 2 balance can take unlimited negative values. Therefore, the evolution of the balance of payments cannot be considered as the source of the current crisis in the Euro Area. He sets a parallel between Keynes's proposal of an International Clearing Union and TARGET 2, but he states that TARGET 2 is less constraining than Keynes's Plan because TARGET 2 has no limits as to the size of advances that can be taken by national central banks from the ECB, which acts in the EMU as the international clearing agency (Lavoie 2015; Caseratto, 2015). He recognizes the main cause of the European sovereign debt crisis in the long-run absence of a credible lender of last resort in the Euro Area, which explains the speculative attacks against the securities issued by the governments of the Euro Area periphery countries. Therefore, he and Frenkel (2012) see true causes of the crisis on the

side of investors, in the set up and self-imposed constraints of the ECB and in the imperfect institutional design of the EMU.

Sinn and Wollmershäuser (2012) emphasize that the root of the current European sovereign debt crisis lies in the external imbalances between its core and periphery countries and they claim that these imbalances occur as a reaction on optimistic expectations about income convergence generated in the Euro Area and as a reaction on an investment boom in the Euro Area periphery, which was accompanied by ballooning current account deficits financed by private capital inflows (Bonatti and Fracasso, 2013). According to Bonatti and Fracasso (2013) and Chen et al. (2013) the situation turned sour only when Greece was fingered and when ECB and other international organizations decided to embark on the fiscal consolidation.

Grahl (2011) therefore recommends the EMU to create an adjustment mechanism to smooth out the imbalances arising between the surplus and deficit members. Sklias et al. (2014) criticizes the absence of European mechanism for fiscal transfers. Eichengreen (1991) has the same opinion and proposes a system of budgetary transfers in the form of injections of liquidity between the individual countries of the EMU, a creation of suitable system of redistributing policies and central fiscal authority (Dibooglu a Horváth, 1997). Varoufakis (2012) assumes that this necessary type of “recycling” of budget surpluses can have either the form of standard money transfers between countries or the form of transnational investments in production in countries and regions with a deficit (Sklias et al., 2014; Chen et al., 2013). Also Jager and Hafner (2013) point out that in the case of asymmetric shock, a transfer payments system is a valuable feature in a currency union that helps to effectively re-establish economic equilibrium.

In general, the current European sovereign debt crisis sparked a debate about creation of a fiscal union in Europe. Mac Dougall et al. (1977) and De Grauwe (2009) state that public finance in existing economic union plays a major role in eliminating short term fluctuations and cyclical fluctuations. They say that there is no such mechanism in the EMU and that this is an important reason why in present circumstances monetary union in Europe is impracticable (Bargain et al., 2013). Many economists similarly warn that the Euro Area is too heterogeneous and thus far from being an optimum currency area. Therefore, the EMU will be fragile and vulnerable to economic shocks unless complemented by more fiscal and political integration. Schuknecht et al. (2011) emphasize the importance of fiscal discipline and proposing an independent fiscal council for the Euro Area with the aim of improving governance and compliance.

Fuest and Peichl (2012) suggest some possible elements of a European fiscal union, namely: fiscal rules for the Euro Area member states, a crisis resolution mechanism, a joint guarantee for government debt, a mechanism of fiscal transfers between Euro Area countries, and an extended European budget and European taxes. Bargain et al. (2013) studied effects of a European tax and transfer system and of a fiscal equalization mechanism on the income distribution and automatic stabilizers in the Euro Area. He finds that replacing one third of the national tax-benefit systems with a new European system would lead to significant redistributive effects both within and across Euro Area countries. Introducing a fiscal equalization mechanism would redistribute revenues from high to low income countries, but according his opinion the stabilization properties of this mechanism are ambiguous. He also argues that strengthening of fiscal discipline alone is not sufficient.

The main argument in favor of deeper fiscal integration in Europe is also that it might improve macroeconomic stability in the Euro Area, increase the transparency and improve democratic control of EU policies. However, fiscal integration raises various concerns and the political enforceability of such integration is disputable. Although some economists argue that the unprecedented divorce between the main monetary and fiscal authorities offers advantages in limiting political influence on monetary policy, the current European sovereign debt crisis has renewed doubts about the wisdom of this approach (Goodhart, 1998; Beetsma and Bovenberg, 1998; Beetsma and Giuliadori, 2010).

The European sovereign debt crisis is therefore a balance of payments crisis, which arose and became persistent due to the presence of large external imbalances of members of the Euro Area in relation to their main partners in the Euro Area. It is also necessary to draw attention to the unique position of Germany in the Euro Area as a leading export nation and therefore not only to propose the requirement of an effective system of fiscal transfers in the Euro Area, but also the need to set certain limits on its internal trade that would prevent the emergence and development of a “fatal addiction” among its members similar to that between China and the USA. An increasing number of economists considers German neomercantilist policies as one of the main causes of the current European sovereign debt crisis (Sinn, 2007; Bonatti and Fracasso, 2013; Kaindle, 2013; Caseratto, 2015).

And because the growth strategy of German economy included an “agreement with trade unions for real wage restraint, reduction of labor protection to allow for reduced wages at the low end of a segmented labor market” (Constant and Massey, 2003), and de facto large export subsidies through tax incentives linked to exports, Germany is seen as the main beneficiary of the euro as well as the main reason of the problems of the Euro Area. Germany was criticized regarding to its entry the Eurozone at an uncompetitive exchange rate and regarding to its wage moderation that was equal to a real devaluation against other members in the Euro Area (Young and Semmler, 2011). Also Jager and Hafner (2013) confirmed that competitiveness of Germany has increased since the introduction of the euro (Jager and Hafner, 2013; Baimbridge et al., 2012).

Therefore, Germany now needs to reconsider its position and its steps because “the only way for other Euro Area countries to lower fiscal deficits without their economies collapsing is through a huge net export expansion, based upon both improved productivity and crucially buoyant external demand” (Baimbridge et al., 2012).

The amount of newly created euros and for some Euro Area countries the interest rate which was maintained too low by the ECB, have radically reduced the cost of loans for private sector entities in the peripheral Euro Area countries. In these peripheral countries a formation of bubbles started appearing (i.e. the real mortgage markets in Spain and Ireland or the public sector in Greece) (Stein, 2011; Baimbridge et al., 2012; Soares et al., 2014). Thanks to the support from the government, the euro-illusion of homogeneous Europe, despite its negative consequences, was still growing. There has been a deepening economic recession and moral hazard on the part of ECB and Euro Area governments, which under the temptation of the low cost borrowing and the newly established guarantee of rescue in case of difficulties, decided to “gamble for redemption” from the problems associated with external influences and their irresponsible deficit management (Stein, 2011).

It can be said that that Euro and the membership in the EMU are generally increasing the risk of endogenously caused, self-fulfilling crisis, both when talking about crises caused by self-fulfilling panic in the financial markets, as well as in those of the crisis which are caused by reckless behavior of

“Panglossian” borrowers (Cohen and Villemot, 2014). Therefore, considering that the basic determinant of the self-fulfilling crisis is the starting level of public debt of an individual country, it is necessary to reassess the adequacy of existing rules of fiscal discipline in the Euro Area.

### ***The Euro-Illusion and Economic Myths of EMU***

The third relevant group of the systematic causes behind the current European Sovereign Debt Crisis, considering a clarification of the main aspects of the European integration, is represented by a group of sources related to the euro-illusion and economical myths of EMU. “The euro has been promoted on the basis of spreading of myths and illusions which fail to respect economic principles, which postulated a prerequisite for a common market, competition and economic integration in Europe that are the one and only (the administratively established - fiat) currency and harmonized conditions” (Gonda, 2012). The general preconditions for a trouble-free and efficient functioning of the market, however, are unrestricted competition supported by diversity and the absence of core barriers to the free exchange (Arghyrou and Kontonikas, 2012).

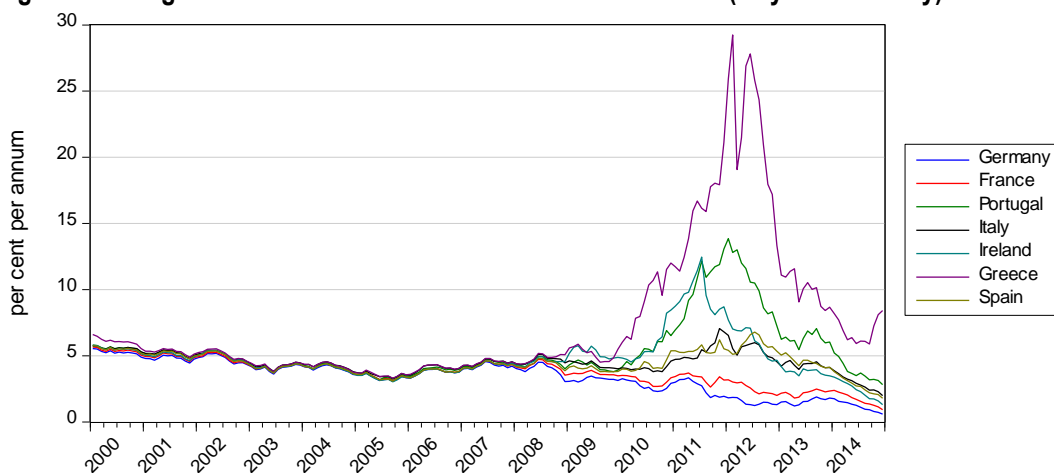
At the same time, the argument that strict compliance of the Maastricht criteria and the fiscal rules in their current form, without a working and automatically acting sanctioning mechanism, will preserve trouble-free functioning of the monetary union with diverse members, which the EMU undoubtedly is, is very optimistic. The formerly listed rules are, in fact, mainly administrative measures. For many countries, the above mentioned compliance can prove to be inappropriate and even harmful. They are often perceived as a strong stranglehold of their economic growth, as a factor which deepens the disparity between economies and as a reason for their deterioration. Also De Grauwe (1995) states that the criteria are not based on arguments of economic theory but they result from political economy of monetary union in Europe. For example, in 1994, only Luxembourg satisfied these conditions and many of current Euro Area member states do not satisfy some of these condition now. As a result, there is a great likelihood that these convergence requirements will have the effect of keeping the monetary union small. Already De Grauwe (1995) warns that the Maastricht criteria will be ineffective. Moreover, they have no root in the OCA theory. The relevance of the criteria consists, according his opinion, only in two elements. One has to do with the hegemonic position of Germany in the Euro Area, the other with the possible inflation bias of the monetary union caused by inflation development in Germany in the time introducing of the euro.

Marelli and Signorelli (2010) have highlighted the complexities between nominal convergence and real convergence of the EMU countries. The OCA theory also indicates the existence of functional chain between these forms of economic convergence and emphasizes the task that real convergence plays in creating an effective monetary union, which would be able to yield pure growing benefits out of its existence. On the other hand, many authors are pointing out that the benefits of a nominal convergence manifest themselves rather macroeconomically unstable economies at later stages. They argue that balancing the disparities in the structural conditions of the EMU countries, the growth of their economic openness and the effects of fortifying the integration of international trade within EMU require many years, if not decades. De Grauwe and Yueimei (2013) point out the possible short-term negative effect when enforcing adherence of the nominal convergence EMU member’s criteria for their economic growth. Efforts to maintain the nominal convergence criteria and fiscal discipline rules often lead to the enforcement of restrictive economic policies, and thus to introducing measures

that slow down economic efficiency and performance and support economic divergence among member countries.

Opinions on the criteria of nominal convergence and the rules of fiscal discipline pushed in the EMU are generally quite divergent. Buitier (2004) underestimates the role of an inflation criterion, criteria of progress in long-term interest rates and criteria of the exchange rate control, and only highlights the criteria for fiscal sustainability. On the other hand, De Grauwe and Schnabi (2005) who emphasize the conflict between nominal and real convergence, emphasize just the requirement for stability of exchange rates.

**Figure 1.4 Long-term Government Bond Yields in the Euro Area (10 years maturity)**



**Source:** Compiled by author based on data taken from IMF - International Financial Statistics (November 2015).

A single currency also means one central bank for all Euro Area countries, with one interest rate regardless of the economic level and national competitiveness of the country. A system of unspoken guarantee was formed, promising the weaker members to be rescued by the stronger, and a dangerous illusion of prosperity in Euro Area was created (Gibson et al., 2012). While before entering the Euro Area countries paid a premium corresponding to the state of their economies for the money borrowed on the financial markets, the introduction of euro has reconciled the development and the level of interest rates on government loans. Thus, as shown in Figure 4, since the idea of a common currency was adopted, interest rates of the peripheral economies have stabilized and moved to the level of interest rates the core countries (i.e. Germany and France) (Gajewski, 2014).

### ***Euro Economic and Euro-Political Factors***

The fourth and last relevant group of the causes behind the current European Sovereign Debt Crisis is represented by a group of sources associated with the euro-political factors. The European Sovereign Debt Crisis has highlighted the fact that having a single currency and a “one-size-fits-all” monetary policy prolongs and deepens the economic cycles and supports the growth of debt in the EMU member countries. At the same time it confirmed, that a single monetary policy conducted in the EMU wasn’t equally desirable for all of its members. It was only apparently convenient for the core countries, while being too expansive and harmful for the peripheral countries (Lothian, 2014; Panico,



2010; Crowley and Lee, 2009). Initially the ECB adopted a low interest rate policy in 2002-2003. The policy stimulated financial speculation. However, after 2005 it changed strategy so that interest rates climbed until the autumn 2008 crash. Its goal was to curb “external inflation” despite an already tight monetary environment (Baimbridge et al., 2012).

Huge capital inflows had an identically negative impact on the debt in the Euro Area, as reported by all stressed countries during the period leading to the crisis. These capital inflows reflected the belief of the investors to the “Euro Illusion”. These large capital inflows were accompanied by a substantial reduction in long-term bonds, a large increase in the growth rate of money and credit supply, the relatively sharp increase in price levels and a deterioration of competitiveness. All these factors demotivated governments of the Euro Area members to implement reforms to comply with the budgetary constraints to which they are committed (Dellas and Tavlas, 2012; Lothian, 2014).

## Conclusion

The Euro is essentially a political project with an unprecedented character. Namely the adoption of a common fiat money, common monetary authority and common monetary policy by a large number of independent and heterogeneous countries (insufficient progress in cyclical and structural convergence), but still without any better fiscal integration or coordination, attracts great attention worldwide, particularly with regard to its long-term prospects (Hall, 2012; Baimbridge et al., 2012). It is questionable, what is the optimum number of countries participating in the common European currency so that the Euro Area can be considered as the optimum currency area and what are the necessary integration forms for effective functioning of this currency area. Especially the political integration issue is an important subject of a further discussion. This admits also Bordo (2004), which states that monetary union without political union proved to be short-lived (Bordo 2004). The prevalence of the one-money-one-country pattern is namely a striking regularity, something like a general natural law, which clashes with the implications of the Optimum Currency Area Theory (Cesarano, 2013). Consistent with this opinion is also the current Eurozone crisis considered as a result of a large failure of political will, because the proximate cause of declining confidence in the bond markets lay in increases in public or private sector debt that might have been avoided if governments had taken steps to limit it. Additionally, some economists claim that the crisis might have been prevented by more assertive structural reforms focused on competition in markets for goods and production factors. They also stress the importance of coordination of strategies for preserving a sustainability of economic growth in the Euro Area and the fact that degree of financial integration is unequal in several countries using the euro (Cesarano, 2013; Ferreira et al., 2016). Eichengreen et al (2014) also emphasizes the crucial roles of the real exchange rate, of the external environment, i.e. of external shocks, and of the debt restructuring.

Thus, by taking the role of financial market agents and rating agencies into account, the current Euro Area crisis is mainly the crisis of confidence. Moreover, the euro turned out to be a heavy burden for some periphery countries when the monetary union was hit by an asymmetric shock, i.e. by the financial crisis of 2007-2008 (Jager and Hafner, 2013). Also governing institutions of the Euro Area, the ECB and the European Commission, are generally seen as no subject to democratic accountability, let alone control (Baimbridge et al., 2012). Therefore, the solutions of the crisis have to be systemic and consistent. However, the results of previous actions indicate a lack of efficiency, do

not solve its nature, but even worsen it, and move it into the future. They also have created a precedent of certain eligibility for salvation for all entities that fall into similar problems with the fulfilment of their debt obligations in the future, irrespective of the causes of these problems (Detlef, 2012). Forms of assistance to indebted countries and austerity measures underlying this aid depend namely on the sentiment in the financial market without a sufficient economic base (De Grauwe and Yueime, 2013). Considering that during the current crisis the Euro Area members cannot adjust interest rates or exchange rates to stabilize their economies, they have to find another solution. One of the possible solutions is moral suasion and to castigating debtor countries for their lack of responsibility and for their profligacy. However, the effect of this solution is disputable, it has only short duration and it is not rational (Chick and Pettifor, 2011). More generally it indicates that implementation of austerity policies across the Euro Area has been asymmetric. Hence, if the euro is to prove permanent, it requires a firmly based equilibrating mechanism.

Relying on the OCA theory, according to which the euro area is clearly a sub-optimal currency area, and on views of Keynes, one can consider a working mechanism of fiscal transfers as an appropriate adjustment tool for smoothening out the imbalances between surplus and deficit Euro Area member countries (Sklias et al., 2014). However, implementation of such mechanism in the EMU requires establishment of a fiscal union and, despite the fact that centralization and regulation are one of the main problems of the EMU, a further strengthening of the political integration. A common European tax system, which would be complementary to existing national tax systems and a common European budget, is necessary (Baimbridge et al., 2012).

One of the possible ways of solving the current European debt crisis is to create some sort of the United States of Europe, i.e. a European (federal) state; similar to what Winston Churchill declares in his discourse in 1946. However, the basis for correct functioning of this state should be a suitable compromise between government interventionism and *laissez faire* approach of government to the economy of the country. Keynes insists on the unavoidability of the government affecting the economy because of the uncertainty that is formed when relying on the free hand of the market. However, experience shows that excessive centralization and excessive government intervention in the economy only lead to the growth of costs and inefficiency. When handling this compromise, it is necessary to consider that alongside the government, the market is another factor capable of manipulating economic agents and influencing their decisions (Sklias et al., 2014).

When creating an adequate system of fiscal transfers in the EMU, again according to views of Keynes, it is necessary to ensure an expansionary effect of this mechanism in the years of economic recession and crisis. However it should be based on the rationalization of government expenditures. The fiscal transfers in the EMU on the supranational level would be able to mitigate the volatility of investments of the Euro Area in the turbulent years (Kuhn, 2014).

Considering fiscal centralization, it's appropriate to propose a common European tax system, which would be complementary to national tax systems. Major European investment projects should be founded. They would be realized in the peripheral Euro Area countries and would lead to more efficient use of resources in the EMU and would be an essential mechanism for preserving converging development of the EMU member countries. It is also important to implement sanctions for trade within the EMU, especially for countries with large surpluses on their current account, such as Germany. The

funds that would flow from them could be part of a system of fiscal transfers in the EMU and could be invested in the development of deficient regions (Cesarano, 2013).

Establishment of a European super-state is obviously a last resort and not a very realistic solution. "It ignores constraints imposed by current political reality. It also intensifies long-held fears about the diminution of national sovereignty involved in closer integration, whereby such an attack upon the independence of nation-states camouflages the fact that the single currency project was inadequately conceived, ignoring many of the tenants of OCA theory in favor of a preference for a political "fix" (Baimbridge et al., 2012). Thus, this strategy is at least politically impassable and would cause massive waves of nationalism and resistance against the idea that the disciplined countries would have to pay for the mistakes and irresponsibility of the less disciplined countries. Likewise, British Prime Minister David Cameron commented on the idea of closer political integration: "For us, the European Union is a means to an end - prosperity, stability, the anchor of freedom and democracy both within Europe and beyond her shores - not an end in itself" (Kuhn, 2014).

Of course, there are several other alternatives how to solve the Euro Area crisis, such as the managed or unmanaged breakdown of the EMU. For example Baimbridge et al. (2012), in this context suggests that "Germany could leave the single currency, taking Austria, Finland and the Netherlands (if they so desire) with it to form a German-mark area. Exiting from a position of strength would generate less panic, reducing the threat of bank runs and contagion. Many legal and technical challenges would remain, but the reputation of the Bundesbank would permit time to erect the required institutions and controls. The remaining euro countries would secure immediate gains from the devaluation of the slimmed-down currency, following a debt restructuring aimed at controlling private and public sector debt whilst promoting the demand required for economic growth. The demise of the currently constituted Euro Area would impose fewer costs than the status quo or alternative scenarios" (Brancaccio, 2012).

Controlled collapse of the Euro Area, however, it is unlikely alternative because in such a case, the European leaders would have to admit their failure and the failure of the euro project. However, this solution would be possible and real if the political prominent members of the EMU would be opened to compromises. Voluntary withdrawal of individual countries from the EMU would create a precedent and a wave of mass exodus from the Euro Area countries (Gonda, 2014). In such a case the proposal of a multi-speed monetary union could be the solution, in which the new members, or markedly underdeveloped countries of Euro Area would be inserted into a different regime of monetary policy. This measure would allow them to reduce the gap with other, more efficient and developed members of the union and sufficiently adapt to the conditions of a single currency. However, a crucial problem of this solution is the absence of sufficient data to indicate where this process of disintegration or fragmentation of the Euro Area might end (McNelis, 2013). Although Klaus (2004) is convinced that such a way from the problems of the Euro Area is real and he states: "My own experience with the termination of the Czechoslovak monetary union in February 1993 suggests that it can be done without serious costs, smoothly and efficiently" (Klaus, 2004).

"Current account imbalances among Euro Area members and the resulting accumulation of external private and public credit and debt appear to be further causes of instability. The gap between unit labor costs seems to be one of the determinants of trade imbalances. More specifically, Germany, despite its current account surplus, has adopted a policy of relative wage deflation in recent years that has

increased this gap” (Brancaccio, 2012). According to him the possible paths are adjustment of effective demand and of unit labor costs in the Euro Area, i.e. introduction of an “European wage standard”. It “may prompt countries with surpluses to generate higher growth in nominal wages, prices, and wage shares, thus helping to restore the balance in trade and safeguard European unity. This means that any asymmetric shocks would be absorbed through the flexibility of wages” (Brancaccio, 2012). Additionally, the adoption of adequate expansionary economic policies by countries with surpluses, and of the EU as a whole is necessary.

However, changes in EMU regardless of the implementation of any concepts of solving its problems should necessarily include appropriate reforms and structural policies. These should be focused on employment and the labor market, to promote flexibility in wages and prices, to minimize bureaucracy and regulatory burden on businesses and the elimination of patents that are a significant drawback to progress and innovation in EMU. Despite the shortcomings of the project EMU and the euro, it is necessary to make an effort to sustain a common currency. Only the united Europe is competitive enough to its competitors on world markets, e.g. China and the USA. However, the question about the optimum design of the common currency union consisting of the European nations remains unanswered.

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## Chapter 2

### The Effects of the Crisis on Euro Area Member Countries

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### 2.1 Introduction

When the project of monetary union among European countries was being prepared it was not expected that Europe would be hit by such severe crises as occurred few years ago. “Shortcomings” of the euro area were well known even at the beginning, as well as the fact that future EMU countries were far from being the optimum currency area. However, it was not anticipated it would be necessary to address these issues and existing asymmetries in such a short time. Even after more than a decade a position of certain countries, especially of so-called former transition economies can be still described as a lagging. What is more, differences and asymmetries can be found also in the group of “founder” countries, or EMU core countries, as they are often called.

Recent crises (economic and debt crisis) pointed to a number of serious issues of European Union; such as particularly persistent asymmetries and differences in development. What is more, each case of EU enlargement brings up the question how much are these “new” countries prepared to introduce also a common currency. Persisting unequal position of individual members is particularly visible in case of small, former transition economies. It is expected that after the currency changeover, these countries should be able to absorb shocks even in the absence of their own monetary policies. Thus a project of the monetary union among European countries took away a significant degree of sovereignty from member states and the common currency eliminated the possibility of using an exchange rate as an offsetting tool in case of serious economic fluctuations. And due to the Stability and Growth Pact the countries are also partially restricted in the domain of fiscal policy as they should respect the limits set for budget deficit and government debt. All of this limits the extent to what these policies can be used in case of macroeconomic destabilisations and various problems. Measures chosen for stabilisation highly depend on the type of occurring shocks or crisis, on the degree of similarity of the shocks in various member countries and the speed with which the countries are able to adjust. (Frenkel, Nickel, Schmidt 1999)

However, with regards to current rates of globalisation and interdependence of individual economies, EMU accession can be highly beneficial especially for small economies. It should enable deeper and

more extensive cooperation with larger and stronger economies. On the other hand, this can be limited by the fact that new members are still considered to be lacking in certain areas.

That is why a persisting unequal position of individual member countries at the current rate of globalisation and interdependence together with a restricted scope of country's economic policy is still feeding debates of maintaining or improving national competitiveness or managing country's responses to various shocks in demand or supply.

On the other hand, there is an issue of the strict fiscal stance. A fiscal policy that is too restrictive and accompanied by a forced consolidation of budgets in order to ensure the reduction of deficits rise also new questions. These issues show the limits of these measures when applied in times of high unemployment and the associated risks of launching a deflationary spiral and worsening the overall macroeconomic situation.

This section will be focused on the comparison of selected macroeconomic indicators across of EMU member states. Firstly we wanted to verify whether we could still talk about similar convergence trends among "new" members or if these countries are rather "drifting apart" in their economic development due to the crisis. The deeper look will be focused on current situation on labour markets of EMU. Theory of OCA suggests that high unemployment can be simply solved by flexible markets together with the higher mobility of labour force. We will analyse relationship of indicators of labour market flexibility and unemployment rate.

Another issue is the analysis of the shocks on the group of selected variables in these countries in order to analyse the strength of their individual responses. As a result we should be able to verify whether a common European policy might be suitable in tackling the issues, such as high unemployment or weak economic growth in general.

In order to construct a model that will estimate the impact of the demand and supply shocks on macroeconomic variables we used the basic macroeconomic assumptions. In basic Keynesian models, a positive demand shock implies an increase in the aggregate demand and an expansion of the real output in case of positive reactions. These shocks are also accompanied by a rise in the general price level and by decreasing unemployment. The sudden increase of supply (supply shock) will shift the aggregate supply curve rightward, increasing output and decreasing the price level. We have investigated the effects of demand shock on different economies in the current circumstances.

## **2.2. Overview of the Literature**

The beginnings of the Optimum Currency Area Theory can be dated back to 1960s to works of Mundell, McKinnon and Kenen. This theory answered many questions about economic consequences of merging several currencies into a single one. Generally, an optimum currency area or OCA can be defined as a (geographical) group of countries using the same single currency or whose exchange rates are irrevocably pegged to each other but float against other currencies. With no mutual exchange rates serving as an offsetting mechanism between countries, other "mechanisms" are necessary in order to establish macroeconomic equilibrium of monetary union countries or to absorb the various shocks. Logically it is convenient to create such a union (or currency area) only if benefits exceed the costs for every country. There are various criteria used to evaluate the optimality in case of currency areas, namely: the mobility of factors of production (especially of labour), flexibility of prices and wages, economic openness, diversification in production, fiscal and political integration or similarity in inflation

rates. Similar reaction of countries in case of shocks belongs to one of the newest criteria. (Mongelli, 2002; Ďurčová, 2010)

Price or wage flexibility or mobile labour force can serve as an additional adjustment mechanism in case of negative development that can replace the missing instrument of exchange rate. (Stambøl, 2005) On the other hand, similarity in other criteria should guarantee that in case of such development, there will not be any asymmetric shocks and the reaction of member countries will remain alike. (Raisová and Bánociová, 2012)

Mundell's theory is based on the issue of eligibility of individual currency regimes for particular regions. He observes that a floating currency exchange rate only brings stability when the world is divided into currency areas where each of these areas has internal mobility of production factors but such mobility is impossible between the areas. In such case, each area can have its own currency that will fluctuate in relation to other currencies. If labour and capital mobility in a currency area are insufficient, flexibility of the external value of the national currency cannot sustain stability and therefore fluctuations of unemployment and inflation in individual regions may occur. Similarly, if the production factors were mobile even across borders of the currency union, floating rate would no longer be efficient. (Mundell, 1968) In his later works, Mundell was more and more concerned with advantages of a single currency and he promoted the plan for a single European currency. He pointed out that a single currency can lessen the shock and its consequences by re-distributing the common reserve and higher diversification. (McKinnon, 2000) Mundell also mentions factors that form the basis for a strong currency union. They include: the size of the union (the larger the union, the better), stability of currency policy and inflation. He argues that individual states may reach various rates of GDP growth even inside a currency union which proves that a single currency area does not hinder growth. (Mundell, Harris, 2000)

Mundell's important conclusions include arguments for and against joining a single currency area. A country should consider the membership in a common currency area if it wants to keep the inflation rate independent from the inflation rate of the currency area, wants to use the currency exchange rate as a tool of unemployment policy to decrease or increase wages, wants to use the currency exchange rate to influence the balance of trade (by currency depreciation) or prefers using money expansion to fund government expenses (which is forbidden by the required discipline in conditions of stable currency rates). Another example is a situation, in which a government is unable to abandon currency funding as international means of payment, country uses regime of fixed currency rates that might collide with the central bank policy which has a mandate for keeping price stability. The currency integration with several countries also means the elimination of national sovereignty which is a symbol of national independence. Furthermore, the country may prefer confidentiality of statistic data or has no domestic political or economic elite able to keep the fixed currency rates system in balance. In some cases, political authorities are unable to reach budget balance and gain trust in a permanent budget balance or sustainability of fixed currency rates. And lastly, there are equally countries, unable to accept the integration level determined by the agreement about the optimum currency area (e.g. common standards, immigration, tax legislation, etc.). (Muchová, 2002)

The theory has been developing throughout the years and nowadays it comprises various criteria which should be met by countries that want to create an optimum currency area: high level of production factors mobility, high level of economy openness, fiscal and financial integration, convergence in

inflation rate, high level of commodity diversification of international trade, wage and price flexibility, similarity of production structures (i.e. comparable conditions in industry, agriculture, services etc. in relation to GDP as well as in individual fields inside this basic division) and favourable political factors. (Dévoluy, 1998) Meeting these criteria should create conditions for elimination of asymmetric shocks as they form the base for homogenous environment where these shocks should cease to exist. However, there are still disputes as to what extent these above mentioned requirements should be met.

The hypothesis on the endogenous character of optimum currency area's criteria also assumes that further liberalisation of European trade after creation of European currency union will stimulate the development of mutual trade that will lead to closer correlation. This will prepare favourable conditions for increasing the effectiveness of common currency policy of ECB which would, together with other benefits of currency integration, also bring advantages to those countries that do not meet the necessary requirements of optimum currency areas. (Frankel, Rose, 1996) Endogenous hypothesis sounds like an argument for a prompt entry of new EU member countries into the currency union. Opposition to this hypothesis is formed by supporters of hypothesis on specialisation who suppose that together with the growth of trade integration grows also the specialisation of individual countries in production where they have comparative advantage. However, in such cases, countries are more sensitive to retribution shocks. On the contrary, countries with high level of production diversification where component markets are relatively independent easily absorb shock of any kind. In case of EU it would be best if a country had an open economy with relation to Eurozone but with diversified production. (Iša, 2005)

The question of consequences of entry into the currency union has been discussed mainly in "new" member countries whose economies are still different from economies of "old member states". Fidrmuc and Hagar note that there is great diversity among new EU member states regarding demand and supply shocks. Their study showed that the country closest to Eurozone requirements was Poland whose correlation of shocks was the most similar to Germany, Belgium or France. Hungary's correlation was at the time of the analysis at the level of the smaller Eurozone countries. Czech Republic and Slovakia were influenced by different demand or supply shocks than Eurozone member states what authors identified as a possible risk for a prompt entry into the Eurozone. Several other studies came to the same conclusion. However, the study of economic cycles still does not have a very long tradition in transitive economies and therefore conclusions of these analyses are not yet sufficiently convincing. (Iša, 2005)

Recent circumstances in Eurozone clearly pointed out that the interest of study should be increased in the area of adaptation mechanisms to asymmetric manifestation of shocks such as demand and supply shocks. Study of aggregate demand shocks includes consumption or preference shocks, investment demand shocks, monetary policy shocks and fiscal policy shocks. While the increased consumption and investment expenditure would imply inflationary pressures, the lower lending rate implies a lower cost which could potentially lead to decreasing prices. (Gambetti, Musso, 2012) The shocks may be shifts in consumption coming from changes in consumer confidence, shifts in investment, shifts in the demand for money, etc. Or they may come from changes in policy, such as the introduction of a new tax law, a new program of infrastructure investment, a decision by the central bank to fight inflation by tightening the money supply. Each shock has dynamic effects on output and its components. These

dynamic effects are called the propagation mechanism of the shock and they differ for various shocks. The effects of a shock on activity may build up over time, affecting output in the medium run. Or the effects may build up for a while and then decrease and disappear. What we call economic fluctuations are the result of these shocks and their dynamic effects on output.

The analysis of the shocks in aggregate demand and aggregate supply should be made using the basic AS-AD model. The model is based on assumption that there is a difference between a short-run and a long-run aggregate supply what can be explained by the sticky character of prices in economy. (Fidrmuc, 2003) In the short run, movements in output come from shifts in either aggregate demand or aggregate supply. In the medium run, output returns to its natural level, which is determined by equilibrium in the labour market. (Blanchard, Johnson, 2013)

Therefore the effects of a positive demand shock (i.e. sudden increase in aggregate demand) will lead to higher output as well as higher prices in the short-run, depending on the reactions of both, supply and demand sides of the economy. However, in the long run, the long run-supply must be considered. As the output cannot be increased past the output corresponding to a long-run supply (and also to economy's production maximum) the prices will go up in order to compensate this limit in production. (Fidrmuc, 2003) In the long run, wages respond to higher prices and the demand shock increases prices but leaves output unchanged. (Frenkel, 1999)

The output effects of the demand shocks are usually only temporary and pass away with the time. As a result, it is only a shock in the aggregate supply that can permanently affect the economy. The effects of an expansionary supply innovation usually lead to an increase in the economy's short-term supply, gradual rise in wages, and the economy's adjustment to its long-run equilibrium. This means that a supply shocks lead to positive output and negative price effects both in the short and in the long run. We can also say that positive shocks in AD tend to have inflationary effects while positive shocks in AS tend to act inversely and thus reduce price levels. Contrary to output effects, impact of shocks on the price level has a lasting character. (Fidrmuc, 2003) (Frenkel, 1999)

Krugman and Wells (2009) explain how a positive demand shock leads to higher short-run equilibrium aggregate output and a higher short-run equilibrium aggregate price level (aggregate output and the aggregate price level to move in the same direction). In the opposite case of low aggregate output and falling prices, the government could intervene to avoid a temporary fall in aggregate output associated with high unemployment by using policy measures to increase aggregate demand. The temporary fall in aggregate output that would happen without policy intervention is not viewed as a favourable development as it is always associated with high unemployment. Some policy measures aimed at aggregate demand stimulation, especially those that increase budget deficits, may have long-term costs in terms of lower long-run growth. On the other hand there is also price stability, generally regarded as a desirable goal. Most economists now believe that any short-run gains from an inflationary gap must be paid back later. So policy makers today usually try to offset both types of output gaps – those issued from the negative as well as those issued from the positive demand shocks. However, the elimination of inflationary gaps usually relies on measures of monetary policy rather than fiscal policy.

The effects of demand shocks on economies are studied by numerous authors. There has been a growing literature focusing on the fluctuation of output as a result of demand side shocks in DSGE models. In general equilibrium models, demand side shocks, such as preference shocks to



consumption demand or shocks to government spending, have a strong tendency to crowd out investment. (Baxter, King, 1991; Benhabib, Wen, 2004; Wen 2006 and Leduc and Liu, 2014) Other authors study the similarity of countries' responses to shock. They focus on the synchronisation of economic evolution that can be measured by the correlation between macroeconomic shocks. (Boone, 1997) The analysis made by Pentecôte and Huchet- Bourdon (2012) showed that new EMU member countries remain at the EMU periphery with stronger shock asymmetries than either the founder members or the three Opt-Out countries. As for the "older" members (e.g. Ireland, Portugal or Netherlands), there is a general movement to get closer to the EMU core. The similar results were also obtained by Fidrmuc and Korhonen (2003) by using vector autoregressive methods. They assessed the correlation of supply and demand shocks between the euro area and EU accession during the 1990s. The goal was to assess whether the accession countries belong to the same optimum currency area as the other existing EMU members. Countries of central and Eastern Europe have strong foreign trade cooperation with EU countries. Therefore it would be expected that a shock in western EU country would be highly correlated to a shock in the newest members, i.e. the shock would be transmitted via business bonds. The authors analysed following countries: Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. Their findings suggest that the correlation of supply shocks differs considerably from country to country but remains usually stronger than the correlation of demand shocks calculated for accession countries and EMU. The force of the shocks was lower for the newer EMU members. What is more, demand shocks were rather different in CEE countries what these two authors explain by the countries' different policies and priorities during 1990, i.e. transition period toward market economies. Results indicated that even among accession countries there are some differences in the symmetry of their business cycles. Higher level of symmetry for newer members was also confirmed by the analysis of e.g. Arfa (2009). We can also find older analyses, e.g. by Blanchard and Quah (1989) who presented a restricted VAR method according to which the observed country is hit simultaneously by demand and supply shocks or the one by Bayoumi and Eichengreen (1993). They tried to identify and evaluate supply and demand shocks from 1960 to 1988 in different countries in Europe (with Germany as a benchmark country) using a structural vector autoregression model. Their results show that supply shocks were highly correlated in countries such as Germany, France, Denmark, Belgium, and the Netherlands, although the correlation was lower for England, Portugal, Ireland, Spain, Greece, and Italy. The correlation of demand shocks in European periphery countries with demand shocks of Germany was very low. The obtained results for convergence of business cycles are not very evident for the beginning of the observed period. However, after the introduction of the economic reforms in the transitions countries, the similarities in business cycles between EU or Germany and the CEE countries grew more significant. It may be explained by the fact that once these countries recovered from the transitional depression, they oriented their exports mainly to EU countries that helped to some extent with a synchronisation of business cycles. The authors state that the continuing integration of European countries (single market and later on monetary union) enabled to "bring" periphery countries closer to the EMU core. According to results, the higher correlation of demand shocks indicates which countries adjusted their macroeconomic policies to EMU core to a higher extent. They explain that a higher correlation of demand shocks may be increased by monetary union. Other authors also analysed the similarity of particular aggregate demand components within the various European Union countries.

(e.g. Masson, 1999 or Frenkel and Nickel, 2002) Frenkel (1999) used similar methods but he analysed the problem of business cycle correlation. He found out that the correlation between shocks in the EMU members and non-members is rather high. The group of the analysed countries was rather heterogeneous. However this study covers only a short period of time (authors used quarterly data for period of 1992-1998). The results may be influenced by the fact that accession countries were still in their transition period, many of them suffering from the transformational depression or undergoing various structural changes what subsequently impacted the availability of quality data for most of the CEE countries.

The comparison of business cycles of western EU countries to business cycles of those of central and eastern European countries is also a relatively common topic. (Boone and Maurel 1998 or 1999) Boone and Maurel (1999) tried to assess the similarities in business cycles and their correlations but using different methodology. They found out that German shocks have strong impact on the accession countries with the strongest bonds for Hungary and Slovakia. Korhonen (2001) analysed monthly data for industrial production for EMU countries as well as for the accession countries in Central and Eastern Europe. He focused on the similarity of impulse response functions calculated via VAR models in order to evaluate the (as)symmetry and correlations in business cycles of these countries. He found out that the most advanced from the group of accessing countries exhibited also the highest correlations with the EMU's business cycle. As for the accessing countries, there were significant differences in the degree of correlation. For example, in case of Slovenia, shocks coming from the EMU explained to a large extent the variation in industrial production. However it was not confirmed in other countries. Generally the influence of EMU business cycle can be considered more important in smaller countries. Korhonen also found out that at the beginning of the EMU, in 2001, small EMU members (Greece, Portugal and Ireland) were approximately at the same level of integration to EMU core as the accession countries. According to his findings, a lower correlation does not need to block automatically the adoption of common currency and EMU entry. He suggested that these asymmetric shocks were absorbed via flexible labour or other markets. In case of small and rather undiversified European economies, their correlations to EMU might be limited. However they seem to be integrated to EMU without problems. But in case of some countries, the links can be too close and the response to shocks in EMU too intensive what can be considered as an overshooting. The results suggested that the costs of the business cycle, asymmetric to the EMU business cycle, can be considered manageable for the most advanced accession countries. However, he recommends that the results were further verified and it was analysed whether and how these correlations would change over time. Fidrmuc and Korhonen, 2002 studied the business cycle with regards to intra-industry trade. As the levels of intra-industry trade were already important at the time of the analysis, they assumed their significant impact on correlations would only increase further in the future. This convergence in business cycles can be explained by the importance of intra-industry trade which fosters common cyclical behaviour. Foreign direct investment in "new" member countries and their production of similar products to EMU producers is also an important factor increasing the similarity of behaviour in the industrial sector. We can equally find some studies that focus not only on last accession countries but study also the similarity of particular components of aggregate demand within the of EU data. For example Tvrdon, Tuleja and Verner (2012) chose to compare V4 countries and focused more closely on the relationship of

economic performance and the labour markets in context of the last economic crisis. Similar issues were also analysed by Lungová (2011).

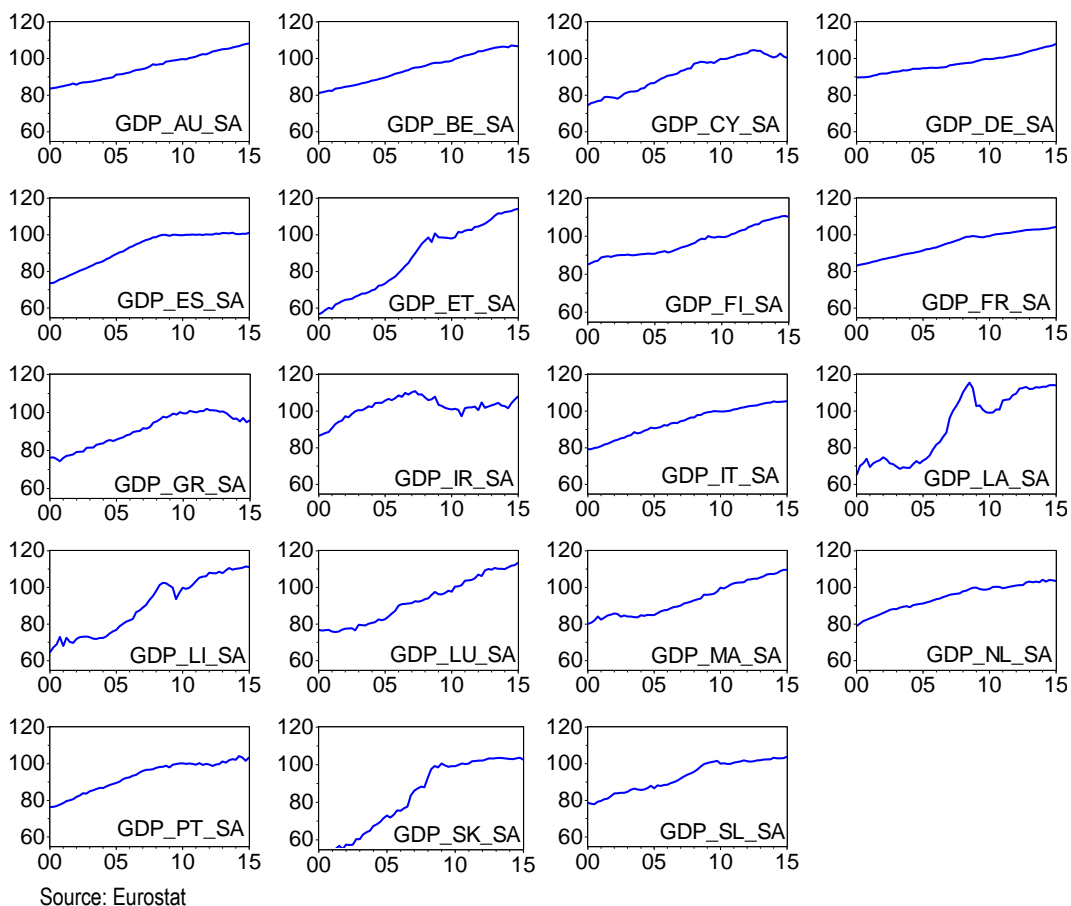
### 2.3. Comparison of Crisis Effects Across EMU Countries

After year 2000 almost all EMU economies had a rather successful decade accompanied by a growth of the selected variables as well as by the overall economic growth. However, despite generally increasing trend in EMU members, there are certain common as well as distinctive features. These countries can be divided into several groups based on their response to crisis and the subsequent recovery and the speed or extent of the resuming of the growing trend. The evolution of basic macroeconomic variables such as private consumption and investment, aggregate demand, as well as gross domestic product, unemployment and inflation over the period 2000-2015 for all countries is depicted on next figures. All variables are represented as indices with the base in 2010. The unemployment and inflation rate is expressed in %.

Firstly we compare the evolution of countries' gross domestic product represented on Fig.2.1. The lowest "starting level" can be attributed to Slovakia with its GDP starting at the approximately 55 % of the 2010 level of GDP. This favourable development was stopped by the crisis and afterwards we can see the evolution resembling an economic stagnation or rather slow economic growth. Economic stagnation or weak growth in the years after the crisis was also typical for Spain, Ireland, Slovenia, Portugal and Greece. Three Baltic countries, Latvia, Lithuania and Estonia are examples of countries with strong economic growth over the observed period. Their GDP increased from approximately 60 % of 2010 levels of GDP to almost 120 % of their 2010's GDP. These countries also marked a rather pronounced dip of GDP growth caused by the crisis but resumed their growth rates rather quickly. Another group of countries, such as Austria, Belgium, Germany, France, Italy, Luxembourg, Netherland or Finland or (i.e. the majority of the so-called original members of the Eurozone) were marked with the slow but steady increase of their gross domestic product. The impact of the crisis is not very visible and can be thus considered almost negligible.

Generally, growth in the GDP of all EMU countries slowed substantially in 2008 and GDP contracted considerably in 2009. There was a recovery in the level of overall EMU's GDP in 2010 and this development continued in 2011–2013, before growth started to accelerate again in 2014. The evolution of GDP was mainly influenced by the five largest EU member (Germany, the United Kingdom, France, Italy and Spain) accounting for 71.4 % of overall GDP.

Within the EMU, real GDP growth varied considerably, both over time and between member states. The highest growth rates in 2014 were recorded in Ireland (4.8 %), in Slovakia (3.8 %) and Malta and Latvia (3.5 %), high above the EU average (1.3 %). Growth in Spain was only marginally higher (1.4 %) and it represented the first annual growth in the Spanish economy since 2008. The lowest GDP growths in 2014 were recorded in Portugal (0.9 %) and Greece (0.8 %). However, for both countries it meant the first annual growth since the crisis (for Portugal since 2010 and for Greece 2007). The Cypriot, Italian and Finnish economies contracted for the third consecutive year in 2014. The product's contraction in 2014 was the most prominent in Cyprus not small with GDP falling by 2.3 %.

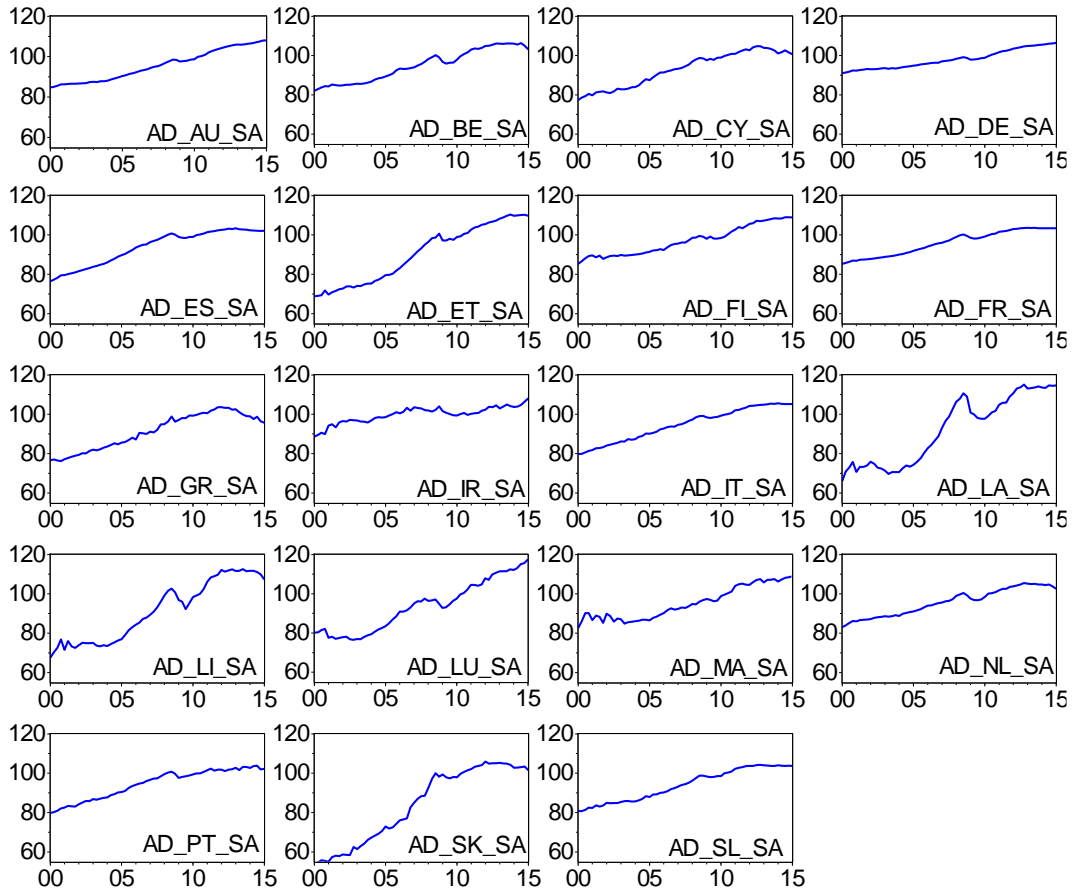


**Figure 2.1 Evolution of Gross Domestic Product**

As for the average GDP per capita in PPS within the EU, it reached 26.6 thousand in 2013. The highest value among the EMU member states was recorded for Luxembourg, where GDP per capita in PPS was about 2.6 times the EU average in 2013 (which can be partly explained by the importance of cross-border workers from Belgium, France and Germany). In the period after 2000 Austria and Germany also moved further ahead of the EU average while several other member states, notably the Ireland, France and Belgium moved closer to the EU average. However Italy and Spain moved from above level or EU average level to a position below it. The most significant improvement in of the position from below the EU average at the beginning of 2000s to EU average has been made by Lithuania, Estonia, Slovakia and Latvia. Greece fell further below the EU average, as did Cyprus. Slovenia experienced similar evolution but to a much lesser extent. (Eurostat, 2015)

Fig. 2.2 depicts the evolution of aggregate demand for EMU member countries. Generally, we can see a common characteristic, i.e. an increasing trend with a less or more pronounced dip around 2009 caused by the global crisis. In some cases, the aggregate demand was growing with only minimal fluctuations, such as e.g. Austria, Germany, Spain, Finland, France, Italy or Ireland but also in Netherland, Portugal and Slovenia.

In Latvia and Lithuania the periods of up and downs were the most significant and the evolution of aggregate demand can be as marked with the highest fluctuations due to crisis. These countries, together with Slovakia, Estonia and Luxembourg also present the strongest or the fastest growth, especially in the pre- crisis period. The only country that was marked by the decreasing trend after the crisis is Greece; here we can also observe the worsening of the situation after 2012, linked to country's over-indebtedness and subsequent problems.

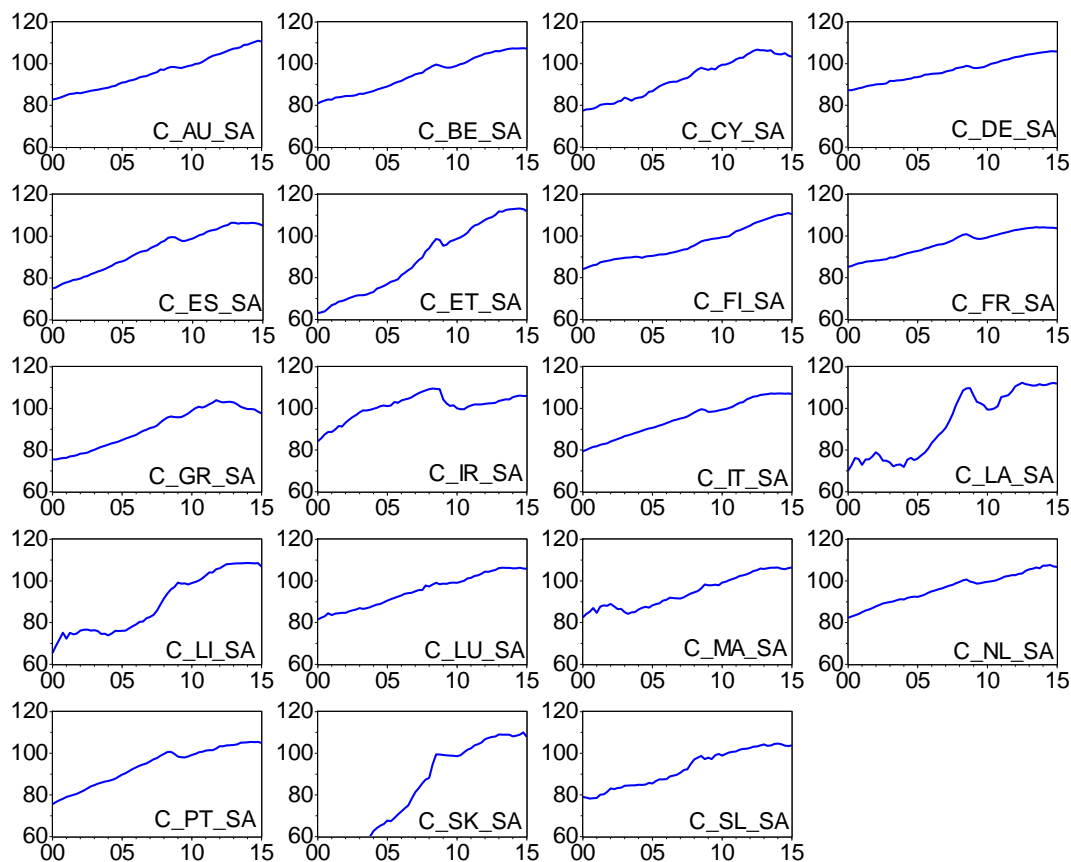


Source: Eurostat

**Figure 2.2 Evolution of Aggregate Demand**

The evolution of aggregate demand components shows that final consumption expenditures across the EMU rose in terms of volume between 2000 and 2014 even though there were slight falls in 2009 and 2012. Final consumption expenditure of general government slowed in terms of volume and this rate of change remained relatively stable over 2011- 2013, before returning to somewhat stronger growth in 2014. During the same period, gross capital formation decreased by 1.8 %, due, in large part, to sharp falls in 2009, 2012 and 2013. In 2014 gross fixed capital formation increased also in real terms, accounting for the largest increase since 2007. As for the evolution of export, its growth substantially exceeded the growth in imports over the observed period. (Eurostat, 2015)

Next, the interest is focused on the main GDP aggregates such as consumption and investments. The Fig. 2.3 presents the evolution of the domestic consumption, or consumption of households, a variable that usually represents the most important part of the domestic aggregate demand. As we can see, the evolution of household consumptions shows again a definitely growing trend. Here again, the fluctuations are less pronounced and only present for certain countries. It can be explained by the fact that aggregate demand comprises equally other types of domestic expenditures, such as investment expenditures of domestic firms (or gross fixed capital formation), government expenditures and net exports.



Source: Eurostat

**Figure 2.3 Evolution of Consumption**

As well as in the case of aggregate demand, the more pronounced decrease due to crisis is clearly visible on the graphs of Greece, Ireland, Latvia, and Lithuania. In case of Austria, Germany, Italy, France, Netherland, Luxembourg or also Slovenia and Malta, the increase of household consumptions is almost a straightforward line with an increasing slope.

It is also interesting to note that the growing trend was reversed only in Greece in Cyprus; in other countries it either picked up its pace or seems to be stagnating at the same level (Lithuania, Latvia and Slovakia).

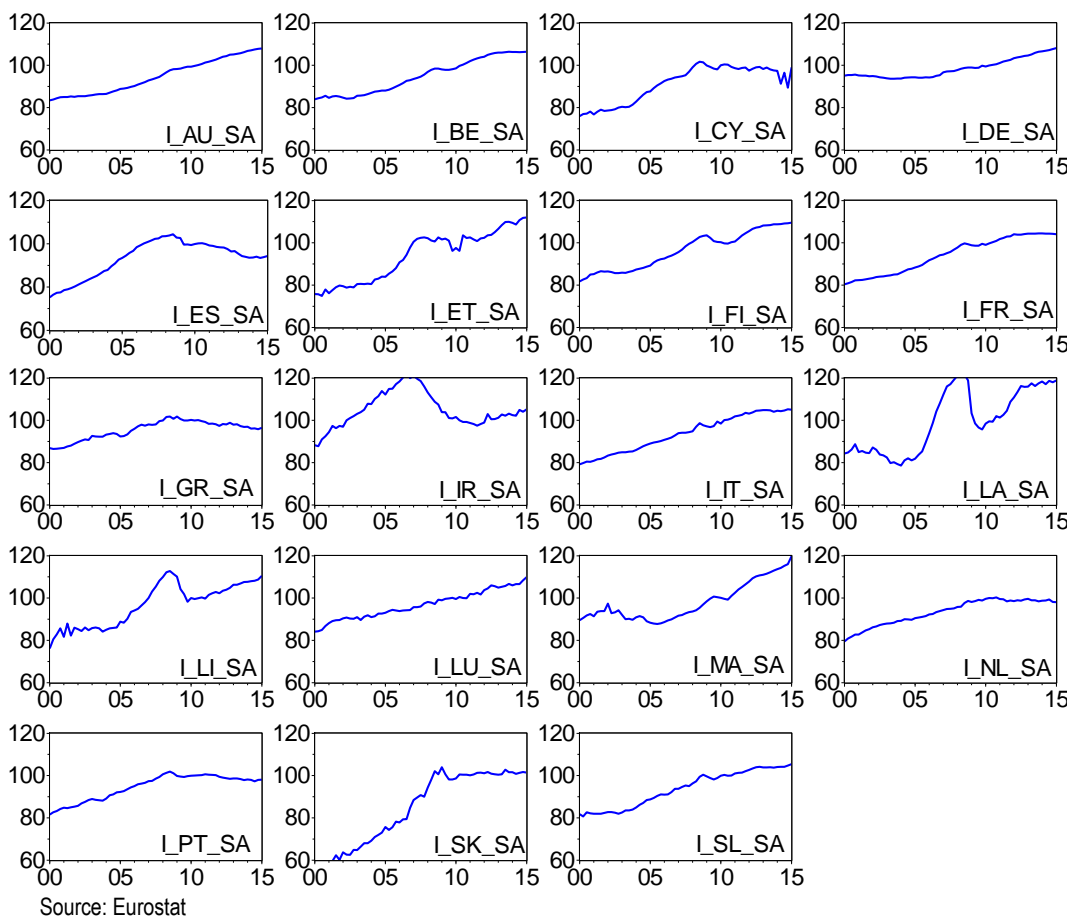
The consumption expenditure of households accounted for at least half of GDP in the majority of EMU member states in 2014; this share was highest in Greece (69.5 %), Cyprus (68.7 %), Portugal (64.0 %) and Lithuania (63.7 %). By contrast, it was lowest in Luxembourg (29.6 %) which had, nevertheless, the highest average household consumption expenditure per capita (24.6 thousand EUR). The highest increase in average household consumption expenditure per capita appeared in Finland with 2014 level of 5.3 thousand higher than 10 years earlier. The smallest increases over the same period were recorded for Greece and Ireland.

The distribution between the production factors of income resulting from the production process was dominated by the compensation of employees, which accounted for 47.9 % of GDP in 2014. Greece had the lowest share of the compensation of employees in GDP (33.4 %). The share of gross operating surplus and mixed income was 40.2 % of GDP while that of taxes on production and imports less subsidies was 11.9 %. (Eurostat, 2015)

Fig. 2.4 depicts the evolution of investments for EMU member countries. In general, we can say that the evolution of investment expenditures of domestic firms was slightly less straightforward than the evolution of consumption of households. We can also observe a bit more pronounced fluctuations. The lowest “starting level” can be again attributed to Slovakia with its investment starting at the level of approximately 55% of the 2010 level of investment expenditures. This favourable development was stopped by the crisis and afterwards we can see the evolution resembling a stagnating expenditures or rather slow growth. For other countries, the decade starting in 2000 was marked by investment expenditures that were representing approximately 80% of their 2010 level. Germany is the only case of the exception with investment expenditures almost at their 2010 level.

Baltic countries, namely Latvia, Lithuania, as well as Ireland, are also examples of countries with the most pronounced growth in investment expenditures over the observed period. Their investment expenditures increased from approximately 80% of 2010 levels of investment to almost 120% of their 2010's investment. These countries also experienced a rather pronounced dip in the growth of this variable which was caused by the crisis but they resumed the growth rates rather quickly. As for the growth of investment in the remaining countries (Austria, Belgium, Germany, France, Italy, Luxembourg, or Slovenia, i.e. the majority of the so-called original members of the Eurozone), it was marked with the slow but steady increase of their investments. The impact of the crisis is not very visible and can be thus considered almost negligible. In case of Netherland, Portugal, Cyprus, Greece and Slovakia the after-crisis period can be characterised mainly by stagnation in investment expenditures, sometimes at the levels, lower to pre-crisis period.

Among the EMU member states, there was a wide variation in the overall investment intensity and this may, in part, reflect different stages of economic development as well as growth dynamics over recent years. In 2014, gross fixed capital formation accounted to 19.3 % of the EU's and 19.5 % of the EMU's GDP. The highest shares were in case of Estonia (25.8 %), Belgium, (23.1 %) and Latvia (23.0 %), the lowest shares in Cyprus (10.8 %) and Greece (11.6 %).



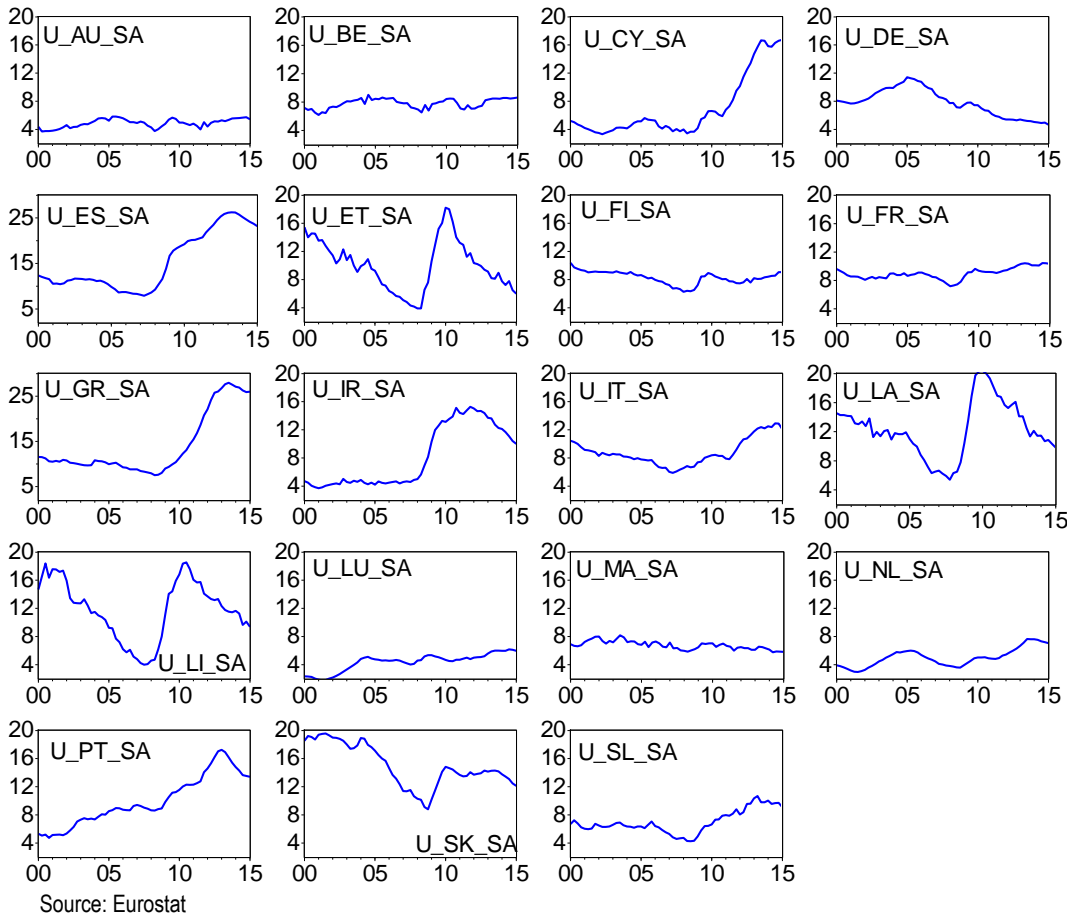
**Figure 2.4 Evolution of Investments**

The vast majority of investment was made by the private sector. In 2013, investment by businesses and households accounted for 16.7 % of the EU's GDP whereas the equivalent for public sector investment was 3.0 %. In relative terms, Estonia had the highest public investment (5.5 % of GDP) and investment by the business sector (17.8 %) while investment by households was highest in Finland (6.4 %). The share of household investment on GDP decreased over observed period in Ireland, Spain and Cyprus. A similar comparison shows a relatively large fall in Estonia, Slovenia and Slovakia for business investment. (Eurostat, 2015)

The labour market analysis in this section is based on the indicator of unemployment. The following graphs for evolution of unemployment rates (Fig. 2.5) also show that we can divide Eurozone countries into several groups: firstly there are countries such as Austria, Belgium, France, Malta or Finland where the unemployment rates seem to be rather stable and at the relatively lower levels than in other countries. Then there are countries such as Slovakia, Lithuania, Latvia or Estonia with a strong decreasing trend of the unemployment reversed by the crisis. Unemployment plummeted to the almost 20 % levels but resumed its descent again in a short time. In case of Slovakia this favourable development was postponed by several years of stagnation around 14% level of unemployment rate. The third group of countries comprises Cyprus, Spain, Greece, Ireland, and Portugal or also Italy where



we can see a relatively positive evolution before crisis even though the unemployment rates were mostly higher than 10 % level. However, the crisis caused its increase to almost 20 % (or more than 25 % in case of Greece and Spain) and the reversal of the trend was not very evident in these countries.



**Figure 2.5 Evolution of Unemployment**

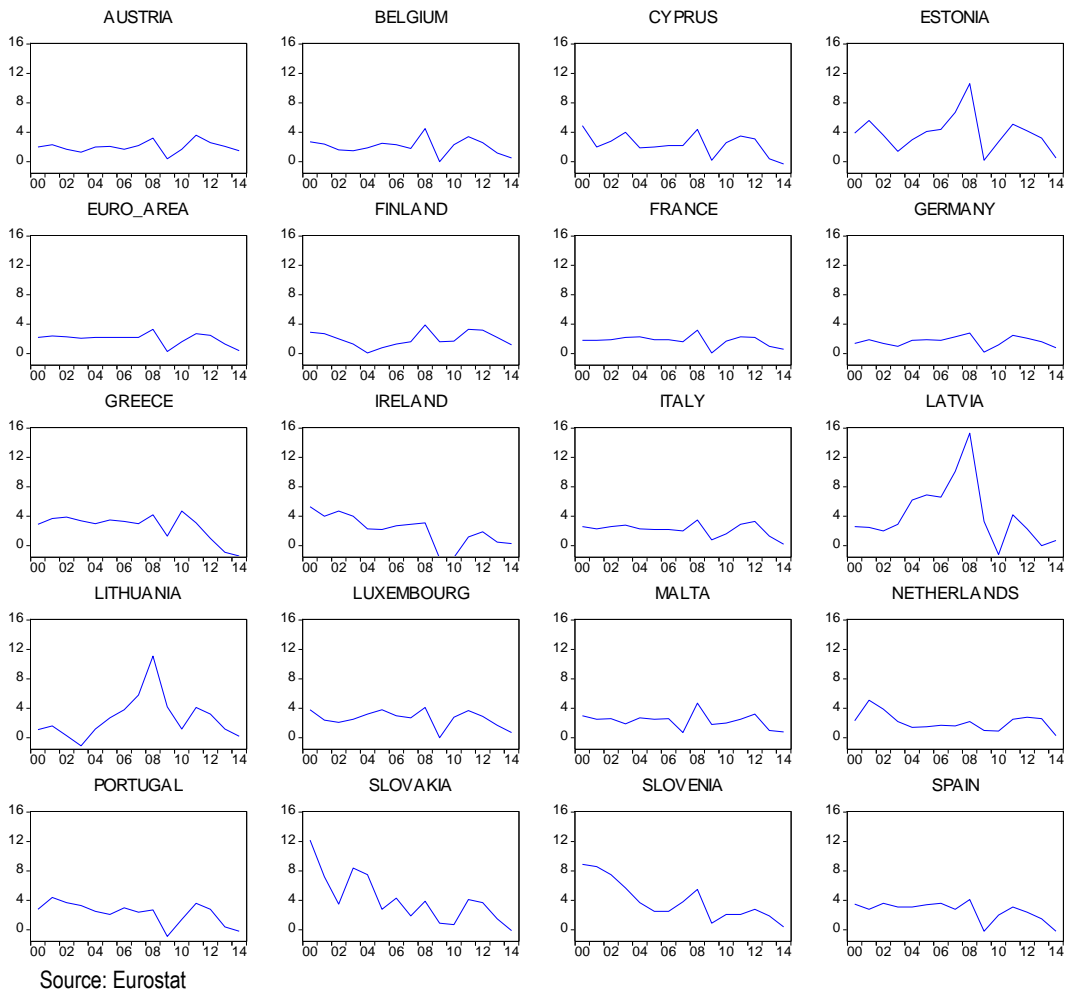
At the beginning of 2000, 9.2 % of the total labour force in the EU was unemployed. The unemployment rate followed a downward path and by the first quarter of 2001 the number of unemployed persons had dropped. The unemployment rate in the EMU followed roughly the same development as in the EU. However, between 2000 and the beginning of 2004 the unemployment rate in the euro area was below that recorded in the EU. This pattern was subsequently reversed as, between 2005 and the beginning of 2008, unemployment declined more rapidly in those member states which did not have the euro. During the financial and economic crisis euro area unemployment increased at a considerable pace, with the exception of the period between mid-2010 and mid-2011 when it temporarily declined. The euro area unemployment level peaked at 19.2 million in the second quarter of 2013, before falling modestly in the second half of the year. The largest decreases in the annual average unemployment rates between 2012 and 2013 were recorded in Latvia (-3.1 %), Ireland and Lithuania (both -1.6 %). The unemployment rate also fell in Estonia and Germany. The highest increases in unemployment

rates among the EMU states between 2012 and 2013 were reported in Cyprus (up 4.0 %), Greece (3.0 %), Italy (1.5 %), the Netherlands (1.4 %), Spain (1.3%) and Slovenia (1.2 %). The unemployment rate increased by less than a single percentage point in Belgium, France, Luxembourg, Malta, Austria, Portugal, Slovakia and Finland. At 27.5 %, Greece recorded the highest overall unemployment rate among the EMU member states in 2013. The dispersion of unemployment rates across the EMU continued to increase during 2013, following a pattern that started in 2008. (Eurostat, 2015)

Only in an environment with stable purchasing power of the national currency it is possible to build the conditions for sustainable economic growth. Therefore, the main objective of the ECB's single monetary policy is to maintain price stability in the medium term. This target was initially difficult to achieve in the new member countries where economic transformation activities did not contribute to its stabilisation. In reality, the inflation rates should have to converge across EMU member states. However, price levels diverged somewhat within the EU, while in the euro area there was no notable convergence or divergence.

Compared with historical trends, consumer price indices rose at a relatively modest pace during the last years. The annual inflation rate of the EU settled within the range of 1.2 % to 2.3 % during the period from 2000 to 2007. Since 2008, higher volatility in food and especially in energy prices has led to broad changes in inflation rates. In the EMU, average annual inflation reached 3.7 % in 2008. The highest increase of inflation was reported in Baltic countries (Fig. 2.6). The annual average of inflation in 2008 reached 15.3% in Latvia, 11.1 % in Lithuania and 10.6 % in Estonia. After sharp movements during the period 2008–2014, the rate at which prices were rising slowed to 0.6 % in 2014, the lowest point since records began. Moreover, during several months of 2014 negative inflation rates (indicating deflation) were recorded. (Eurostat, 2015)

Over the last years, inflation was low in the EMU, mainly as a result of low imported inflationary pressures and the ongoing weakness in economic activity. The price stability thus takes into account the fact that common shocks (stemming, for example, from global commodity prices) can temporarily drive inflation away from levels compatible with price stability in the euro area. Looking back over the past ten years, inflation has been volatile in all EU countries, though to different degrees, largely reflecting the developments in commodity prices, administered price measures and the macroeconomic environment. Exchange rate developments as well as monetary policy conditions have also contributed to the volatility of inflation in most countries. During a period of robust economic growth before 2008, inflation accelerated in most of the countries, before declining substantially in 2009 as a result of the negative global commodity price shock and the significant downturn in economic activity. However, inflation rose from 2010 to 2012 in spite of persistently weak domestic demand, largely owing to external factors and administered prices. During 2013, inflation decreased in all countries. The sharp disinflation process was largely induced by decreases in global oil and non-oil commodity prices and good harvests. It was also supported by still negative output gaps in most countries and the absence of inflationary pressures stemming from exchange rate developments. In some countries, cuts in administered prices and indirect taxes or base effects from past increases in indirect taxes helped to bring inflation rates further down. (ECB, 2014)



**Figure 2.6 Evolution of Inflation (HICP Annual average rate of change)**

#### 2.4. Labour Markets and Labour Force in the Euro Area

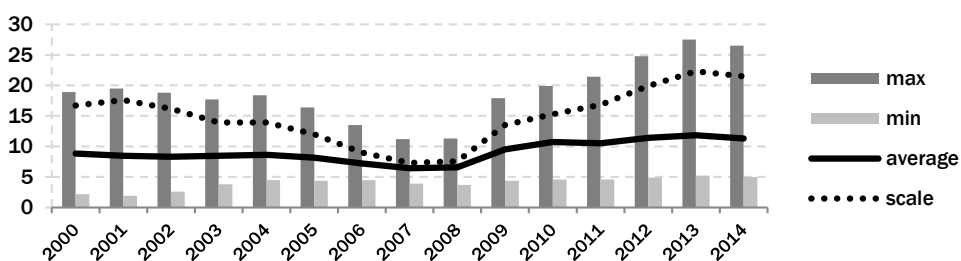
European integration and creation of monetary union caused that exchange rates and foreign trade policy have lost their significance as instruments of economic flexibility. As a result, the importance of flexible labour markets has been reinforced. Over the last decade, EMU countries have been becoming more and more alike in many areas, yet it certainly cannot be said about their labour markets. This domain is one of those where the differences are the most accentuated and persistent. The recent economic crisis as well as the following debt crisis deepened the unfavourable conditions in many European countries and revealed others problems. (Nosáľová, 2011)

In various analyses, European labour markets are often compared to those of United States. (Nickell, 1997) While US markets are viewed as flexible and with a favourable labour environment (and thus low unemployment), European labour markets suffer from many inflexibilities. As a result, problems of high (and persisting) unemployment and shortages of skilled labour in certain domains exist simultaneously. In general, labour markets can be characterised by wide range of indicators, such as unemployment and employment rates, free job vacancies or labour shortages, level of employment

protection, level of labour mobility within and between countries, educational attainment of workers, their language skills and various other particularities in national legislations. Specific features of national markets may significantly improve overall country's economic environment.

### 2.4.1 Unemployment Rates across Countries

High unemployment rates represent one of the most serious current issues in many European countries. As assumed by the OCA theory, the mobility of labour force together with high level of labour market integration are likely to help in solving this problem and to offset differences between countries. That is why flexible labour market and high mobility of labour force present an important absorption mechanism especially in case of economies hit by asymmetric shocks. As mentioned before, EMU labour markets can be characterised by significant differences in national rates of unemployment.



Source: Own Calculations, Eurostat

**Figure 2.7 EMU Labour Markets – Unemployment Rate (%)**

As can be seen on the Fig. 2.7, covering the period of 2000-2014, the maximum unemployment rate in EMU countries stayed within the range 10-20 % until 2011 when the maximum rates came close to almost 30 %. We can observe a temporary decrease before crisis with the lowest maximum values slightly above 10 % around 2007-2008. Later on, the unemployment rates started to increase and the maximum value soared up to 27.5 % in 2013 (Spain and Greece). On the other hand, minimum rate of unemployment almost doubled, yet it stayed close to 5.0 % level (the highest minimum of 5.2 % in 2013). As a result, scale curve for EMU countries is increasing after 2008, reflecting the significant growth of rates starting around the time of global economic crisis. However, when we look at the average level of unemployment, the values increased from 8.8 % in 2000 to 11.0 % in 2014.

It is obvious, that existing differences deepened over the surveyed period with the highest values accounted for 2013. That is why we looked more closely at the extent of this variation. Matrix (Table 2.1) shows that current imbalances in unemployment rates across EMU are large. We can see they are the most prominent in case of Spain and Greece that had to settle up with unemployment rates more than five times higher than e.g. Austria, country with the lowest unemployment rate.

Based on the observed differences in unemployment rates, it is also interesting to look at employment possibilities for surveyed countries. One of the possible indicators is a job vacancy rate (JVR) that measures the percentage of job vacancies (free positions) over total number of posts in economy (number of occupied posts together with the number of job vacancies). Next two graphs illustrate

quarterly evolution of this indicator for EMU members over the period 2008-2014 (no data available before 2008).

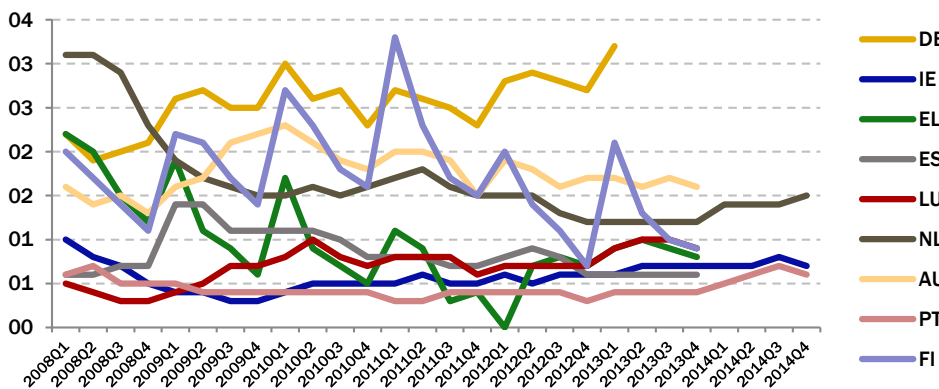
**Table 2.1 Unemployment Rate Differences in Percentage Points – 2014\***

	AT	BE	CY	DE	EE	EL	ES	FI	FR	IE	IT	LU	MT	NL	PT	SI	SK
AT	0.0	-	-	-	-	-	-	-3.4	-5.9	-	-6.4	-0.8	-2.1	-1.0	-	-4.6	-9.7
BE		0.0	-	2.1	-	-	-	-0.1	-2.6	-7.1	-3.1	2.5	1.2	2.3	-8.3	-1.3	-6.4
CY			0.0	6.4	1.7	-	-	4.2	1.7	-2.8	1.2	6.8	5.5	6.6	-4.0	3.0	-2.1
DE				0.0	-	-	-	-2.2	-4.7	-9.2	-5.2	0.4	-0.9	0.2	-	-3.4	-8.5
EE					0.0	-	-	2.5	0.0	-4.5	-0.5	5.1	3.8	4.9	-5.7	1.3	-3.8
EL						0.0	-0.7	<b>16.6</b>	<b>14.1</b>	9.6	<b>13.6</b>	<u>19.2</u>	<b>17.9</b>	<u>19.0</u>	8.4	<b>15.4</b>	<b>10.3</b>
ES							0.0	<b>17.3</b>	<b>14.8</b>	<b>10.3</b>	<b>14.3</b>	<u>19.9</u>	<b>18.6</b>	<u>19.7</u>	9.1	<b>16.1</b>	<b>11.0</b>
FI								0.0	-2.5	-7.0	-3.0	2.6	1.3	2.4	-8.2	-1.2	-6.3
FR									0.0	-4.5	-0.5	5.1	3.8	4.9	-5.7	1.3	-3.8
IE										0.0	4.0	9.6	8.3	9.4	-1.2	5.8	0.7
IT											0.0	5.6	4.3	5.4	-5.2	1.8	-3.3
LU												0.0	-1.3	-0.2	-	-3.8	-8.9
MT													0.0	1.1	-9.5	-2.5	-7.6
NL														0.0	-	-3.6	-8.7
PT															0.0	7.0	1.9
SI																0.0	-5.1
SK																	0.0

\*more than 10 pp. differences are highlighted by bold, and more than 15 pp. differences are also underlined.

Source: Own Calculations, Eurostat

Fig. 2.8 shows the evolution of job vacancy rate in case of original members. Countries such as Portugal, Ireland, or Spain can be characterised by rather stable percentage of job vacancy rate mostly under 1 %. On the other hand, Germany, Austria or Finland experienced more visible volatility of this indicator and also higher percentage from the interval 1.5-3.5 %.

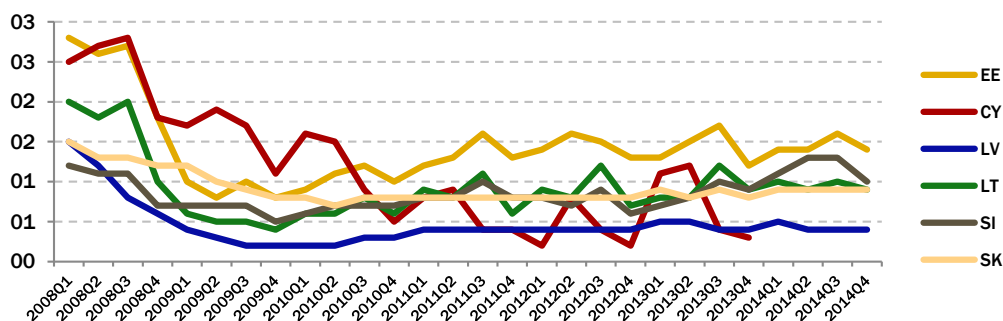


Source: Eurostat

**Figure 2.8 Job Vacancy Rate (%) in original EMU members (FR and IT data as well as 2013 data were NA)**

The evolution of this indicator in countries that joined EMU later on (Fig. 2.9) resembles that of Portugal, Ireland, or Spain. The values stayed mostly in the range 0.5-1.5 % The highest percentage was

recorded for Estonia, at the beginning of 2008 as well as for the most of this period, with the short period around 2009.



Source: Eurostat

**Figure 2.9 Job Vacancy Rate (%) in new EMU members (MT data were NA)**

When we compare total stocks of unemployed (U) for EMU countries with stocks of free job vacancies (V), we obtain an Unemployed - Vacancies Ratio (UVR), i.e. a number of unemployed persons corresponding to single job vacancy. Table 2.2 compares UVR with unemployment rates for 2013. This year was chosen with regards to data availability as well as the results obtained in previous comparisons. It is evident, that overall national markets show no shortages of free labour force. Nevertheless, comparisons across sectors would certainly present different results with simultaneous lack of skilled workers in certain domains and surpluses in the others.

**Table 2.2 UV Ratio and Unemployment Rate, 2013**

	AT	BE	CY	DE	EE	ES	FI	FR	EL	IE	IT	LU	MT	NL	PT	SI	SK
UVR	3.3	4.9	47.0	2.3	11.0	<b>70.2</b>	6.5	49.3	<b>1083.4</b>	<b>65.6</b>	<b>224.3</b>	5.3	21.9	5.0	<b>84.2</b>	23.0	28.6
UR %	4.3	7.6	11.9	5.5	10.2	<b>25.0</b>	7.7	10.2	<b>24.3</b>	<b>14.7</b>	10.7	5.1	6.4	5.3	<b>15.9</b>	8.9	<b>14.0</b>

Source: Own Calculations, Eurostat, Ameco

As expected, Table 2.2 confirms that five countries with the highest unemployment-vacancies ratio have also the highest unemployment rate percentages. However, there are significant differences between these countries. They can be probably explained by imbalances between supply and demand sides of labour market. Different skills offered by unemployed and demanded by potential employers point out to structural nature of unemployment in some countries. More detailed statistics of job vacancies by sectors confirm there are important cross-countries differences for some professions. (European Vacancy Monitor, 2013) In countries such as Greece, Spain, Portugal or Ireland high unemployment rates as well as high unemployment-vacancies ratio are mirroring the overall unfavourable economic situation.

#### 2.4.2 Employment Protection - Factor Decreasing Labour Market Flexibility

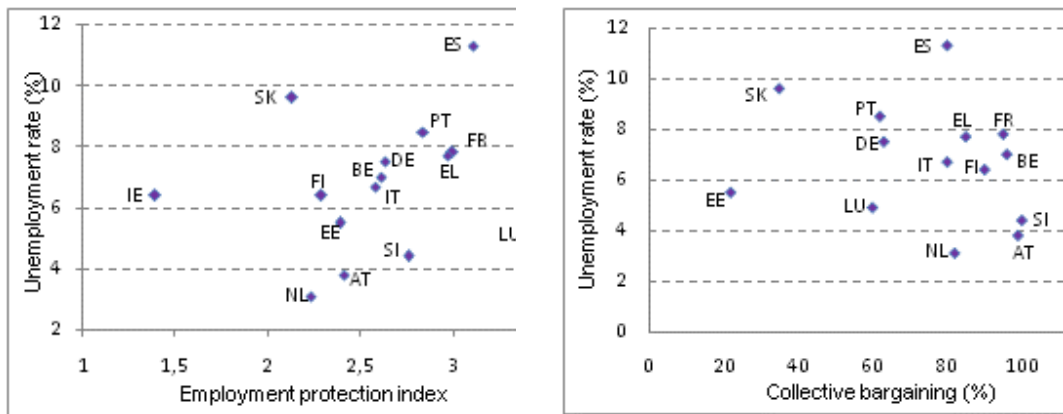
The goal of the labour law or legislation connected to labour market is usually to protect the employees from unfair or discriminatory actions on the part of the employers. The theory associates high

unemployment rates with lower levels of labour market flexibility (or higher rigidity). (Siebert, 1997) Even though there is no direct indicator of labour market flexibility, it can be expressed indirectly, e.g. by indicators of employment protection, power of unions or the share of country's total labour force covered by collective bargaining. It means, the stricter the employment protection is, the less flexible (or more rigid) the labour market would be, creating the inflexible environment with persisting high unemployment rates.

OECD measures rigidity (or flexibility) of labour market by Employment Protection Index (EPI). It comprises indicators such as protection of workers against individual dismissal, regulation of temporary forms of employment and specific requirements for collective dismissal. The overall index of EPI is scaled from 0 to 6, with 0 corresponding to least restrictions and 6 meaning most restrictions. (OECD, 2013)

The following graphs (Fig. 2.10) depict the mutual relationship of market inflexibility (measured by EPI) and unemployment rate (10a) and the relationship of collective bargaining coverage of employees and unemployment rate (10b) for EMU countries.

Figure 2.10a shows that the "latest" EMU members (accessed in 2007 or later) belong to countries with lower EPI (2.0-2.5) while the "original" members indicate stricter protection of employees (2.5-3.0). Combination of high level of employment protection and high level of unemployment rate can be seen in case of Spain and Greece. However, country with the highest EPI, Luxembourg, shows one of the lowest unemployment rates.



Source: Eurostat, Venn (2009)

**Figure 2.10 (a) Employment Protection Index and Unemployment Rate; (b) Employment protection index and collective bargaining - 2 008 (Latest EPI data from 2008, no data available for Ireland)**

Apart from the legislation (labour law), there may be other possibilities assuring protection of employees, such as collective agreement or individual contracts. Power of unions and collective agreement coverage can be various in different countries. According to OECD study it ranges from less than 20.0 % of the workforce in countries such as Japan or United States to 90.0 % or more for some European countries. (Venn, 2009) As for the EMU countries, Fig. 10b shows relationship of collective bargaining coverage and unemployment rate. Here again, we can see lower coverage for new member countries, namely Slovakia and Estonia. However, wide collective bargaining coverage

as a measure of employees' protection (and thus the labour market inflexibility) is not necessarily accompanied with high unemployment. As can be seen for the EMU countries, those having 100 %, or almost 100 %, coverage had at the same time the lowest unemployment rates.

### 2.4.3 Geographic Mobility and Labour Market Barriers

Economic theories suggest that free mobility of production factors improves the allocative efficiency of the particular market. Same can be applied for labour and labour markets. Thus, free circulation of workers between EMU countries should help to offset possible disequilibria, i.e. shortages or surpluses of labour force. For example, Zimmerman sees labour migration as favourable as it leads to better deployment of economic resources and increases production. (Zimmerman, 2009)

As already mentioned, EMU labour markets are characterised by persisting high unemployment as well as significant variation of unemployment rates. These differences in rates exist, sometimes even for the neighbouring states (see Table 1) what would suggest that the cross-border flows are low. According to Bonin's analysis the level of geographical mobility is indeed low in Europe (cross-border flows account for significantly less than 1.0 % of population compared to 2.0-2.5 % in case of United States). Countries showing the highest mobility are Denmark, Netherlands and Sweden (northern countries); the lowest levels of mobility are typical for Italy, Spain or Greece (southern countries). What is more, this type or pattern of behaviour seems to be relatively stable which would make it more difficult to achieve important changes just by promoting geographical mobility by using policy interventions. This study confirms a well-known and interesting European paradox; skill shortages and bottlenecks coexist with areas of persistent high unemployment. (Bonin et al., 2008)

Generally, mobility or migration decisions are basically dependent on both benefits and costs, as perceived by individuals. A person will probably decide to migrate if the expected utility of moving is higher than the expected utility of staying. However, benefits and costs can be viewed differently by each individual. As a result, different individuals in the same country may show different propensity to migrate and even prefer different receiving countries.

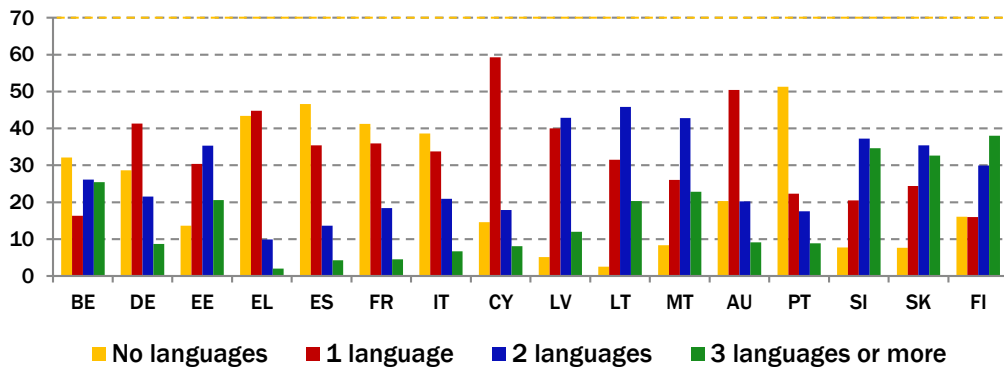
Theories explain migration flows as a result of push factors (at the country of the origin) and pull factors (receiving country). Push factors act as triggers to migration flows. They usually include lack of economic opportunities. Pull factors comprise better economic opportunities with more jobs or better working conditions, cross-country or regional differences in levels of expected income, public transfers and taxes (Bonin et al., 2008), high levels of per capita growth in the receiving country, access to welfare payments or better public services, lower costs of living, as much as cultural or linguistic similarities. (Zimmerman, 2009; European Commission, 2010) However, the impacts of these factors will not be the same for different conditions; they will depend strongly on the geographical, linguistic, and cultural distances between the sending and receiving countries (Kahanec, 2010), as well as on the age, skills and capacity to adjust to the life in the host country. (Bonin et al., 2008; Zimmerman, 2009) These authors especially stress insufficient language skills and cultural differences as one of the greatest obstacles to geographical mobility in case of European Union.



#### 2.4.4 Language Skills in Euro Area Countries

The following figures (Fig. 2.11 and 2.12) present language skills of EMU citizens in 2007 and 2011. Graphs compare percentages of citizens by number of spoken foreign languages (language spoken at the level sufficient for holding a conversation).

As we can see, in 2007 the share of citizens of EMU countries that speak at least one foreign language represented around 70-80 % of population. This share was even higher in small economies (more than 90 % in Baltic countries, Slovakia or Slovenia). These economies also had important shares for 2 or 3 spoken languages (ranged from approximately 15 % to 40 % with the exception of Cyprus and Austria where the percentages were even higher).

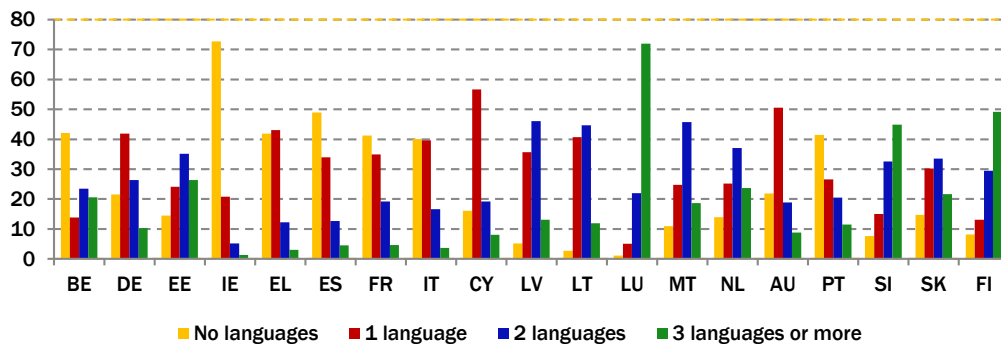


Source: Eurostat

**Figure 2.11 Total Number of Language Known (self-reported) in 2007 (%) (no data available for IE, LU, NL)**

Figure 2.12 with data from 2011 shows there has been a significant improvement in certain categories. While overall share of language skills (knowledge of at least 1 foreign language) did not change significantly in bigger economies, such as Spain, France or Italy, it visibly increased in Portugal (from 50 % in 2007 to 60 % in 2011). As for the shares of 2 and more languages, in some cases there was a visible shift from bilinguals to tri- or more-linguals. It can be observed especially in smaller economies (Finland) and also new EMU members (Slovenia). However, for most of the countries, the shares remained mainly stable.

In general, we can say that smaller countries usually show high percentages in categories of two and more foreign languages. All of these EMU countries are also countries with “minority” languages what may explain the motivation of their citizens for further learning. Except for Slovak Republic and Estonia, these EMU members do not have problems with high unemployment. On the other hand, in big countries like Spain, Greece or Italy, the percentage shares are lower. In this case, weaker language skills coincide with higher unemployment. This would suggest that it can be one of the obstacles holding back the cross-country mobility of these nations. Citizens of the countries, where one of the world languages is spoken as a mother tongue, tend to be less motivated for learning foreign languages and thus less skilled in this area. Figures 2.11 and 2.12 confirm this fact for people living in Ireland, France or Spain (five most widely known languages in EU are English, French, German, Spanish and Russian – European Commission, 2012).



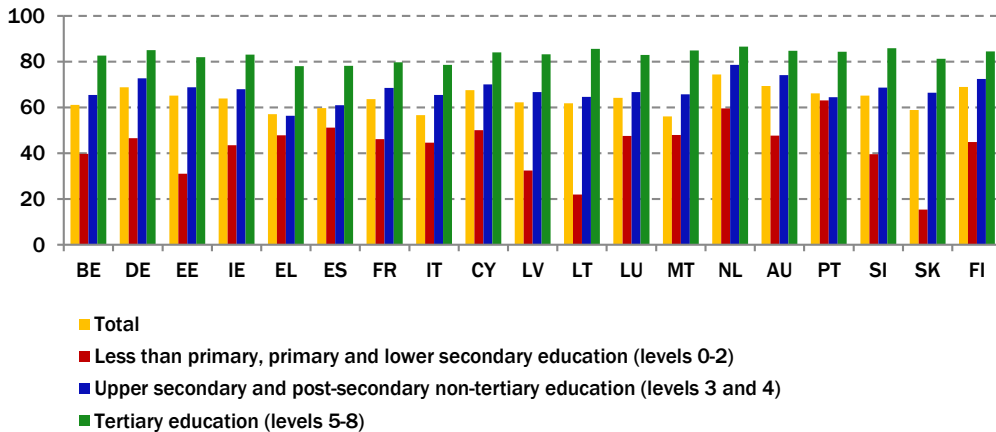
Source: Eurostat

**Figure 2.12 Total Number of Language Known (self-reported) in 2011 (%)**

According to various studies (Bonin et al., 2008; European Commission, 2010), work and income related motivation is one of the strongest, especially in new EU member states. In case of these countries, 60 % of past movers moved for job related reasons. What is more, 80 % claim that work and income related factors would encourage them to move in the future. However, in EU15, only 40 % of past movers mentioned this factor as a past motivation. As for a future move, it was confirmed by 50 % of respondents in this category. (European Commission, 2010) In regard to high unemployment and the fact that work and income seem to be a strong motivation for majority of the European movers, educational attainment can be considered as one of the important factors. Logically, we can expect that higher skills create better potential for finding a job. As a result, countries with higher shares of skilled labour force are likely to have fewer problems linked to labour market. This category of workers is usually able to communicate in one or more foreign languages and may be more inclined to look for job vacancies abroad. Certain groups of low skilled workers may be mobile but they tend to search for temporary or short term vacancies.

Figure 2.13 compares average rates of employment rates by educational attainment in EMU countries over the observed period of 2000-2014. Here we can see that the highest rates of employment are for the level of tertiary education. As for the levels of less than primary and upper secondary education, employment rates are very similar in most of the countries.

When we look more closely at countries with high levels of unemployment (Spain, Greece, and Portugal), it is obvious that employment rates are lower than in e.g. Germany, Austria or Netherlands, i.e. countries with traditionally low unemployment rates. Another interesting finding is that many of the latest EMU members such as Slovakia or Baltic countries have significantly lower employment rates for low skilled labour force (on average 20-25 % for Latvia and Lithuania or less than 20 % in case of Slovakia). This indicates that the important share of unemployed people in these countries would fall in the category of the less than primary to lower secondary education.



Source: Eurostat

**Figure 2.13 Average Employment Rates by Educational Attainment, period 2000- 2014 (%)**

### 2.4.5 Labour Markets Legislative Barriers

Apart from the insufficient language skills, labour mobility in general, as well as in EMU countries, can be held back by other various barriers that are preventing the movements of workers from one country to another. Without these barriers, workers would be able to move between countries, based on their skills, countries' labour shortages or free job vacancies in other regions or states. Existence of barriers also prevents a better synchronisation of national labour markets. As a result, high levels of unemployment persist despite a free movement of citizens guaranteed by EU law. Nevertheless, the reality is still a bit different and the actual mobility is limited mainly by various administrative obstacles and possibly by the countries diversity.

One of the most important mobility hurdles is the lack of system providing for mutual recognition of official documents as well as lack of pension transferability or loss of pension entitlements. The main problem is that pension rights and entitlements are often not portable between schemes or across EU countries' diverse pension systems. Then there are also delays and variation in the level of payments of social security benefits or incomplete transferability of (supplementary) pensions, wide variation in health care systems as well as legal and administrative problems caused by different taxation systems of the Member States. Problematic and lengthy recognition of professional qualification across countries represents another obstacle. Nowadays, an automatic recognition of qualification applies only to 7 out more than 800 professions, namely: architects, doctors, dentists, nurses, midwives, pharmacists and veterinaries (diplomas are recognized without any test or probation period). (Bonin et al., 2008; OECD, 2012)

As for the public sector jobs, they remain mostly closed for non-nationals even though according to European law, EU citizens should have similar access to public sector job as nationals. However, existing regulations close these posts for people from other EU countries and prevent them from accessing some of public sector jobs.

What is more, cross-country information about job vacancies is still scarce and assistance of national employment agencies for unemployed from other EU countries is low. Linguistic diversity, cultural barriers and housing market regulation and taxes on property transactions in some countries add up

to barriers. (OECD, 2012) All of these factors increase the mobility costs for the individuals and reduce migration propensities. With respect to their diversity these factors are not going to be analysed in more details in this section but they are left for future study.

## 2.5 Econometric Model

To estimate the effects of demand shocks we employed SVAR methodology introduced by Clarida and Gali (1994) that implements the long-run identifying restrictions to the unrestricted VAR models. VAR models represent the dynamic systems of equations in which the current level of each variable depends on its past movements as well as all other variables involved in the system.

If  $X_t$  is covariance stationary then an unrestricted form of the VAR model will have the following infinite moving average representation:

$$AX_t = B(L)X_{t-1} + B\varepsilon_t \quad (2.1)$$

where  $X_t = [y_{r,t}, er_{r,t}, er_{n,t}]$  represents  $n \times 1$  a vector of endogenous variables (in our tri-variate model we consider following endogenous variables  $y_{r,t}$  - real output,  $er_{r,t}$  - real exchange rate,  $er_{n,t}$  - nominal exchange rate),  $B(L)$  is a  $n \times n$  polynomial consisting of the matrices of coefficients to be estimated in the lag operator  $L$  representing the relationship among variables on the lagged values, each of  $A$  and  $B$  represent  $n \times n$  matrix which coefficients will be specified later,  $\varepsilon_t$  is  $n \times 1$  vector of identically normally distributed, serially uncorrelated and mutually orthogonal errors (white noise disturbances that represent the unexplained movements in the variables, reflecting the influence of exogenous shocks):

$$E(\varepsilon_t) = 0, \quad E(\varepsilon_t \varepsilon_t') = \Sigma_\varepsilon = I, \quad E(\varepsilon_t \varepsilon_s') = [0] \quad \forall t \neq s \quad (2.2)$$

Residuals of vector  $\varepsilon_t$  represent unexplained movements in variables (the effects of exogenous shocks hitting the model); however as complex functions of structural shocks effects they have no economic interpretation. Structural shocks can be still recovered using a transformation of the true form representation into the reduced-form by imposing a number of identifying restrictions. The applied restrictions should reflect some general assumptions about the underlying structure of the economy and they are obviously derived from the economic theory (Faust and Leeper, 1994). However, the restrictions based on theoretical assumptions should be empirically tested to avoid shocks identification bias and imprecisions associated with the endogenous variables responses to the

shocks. We assume three exogenous shocks that contemporaneously affect endogenous variables - supply shock<sup>1</sup> ( $\varepsilon_{s,t}$ ), demand shock<sup>2</sup> ( $\varepsilon_{d,t}$ ) and nominal shock<sup>3</sup> ( $\varepsilon_{n,t}$ ).

Structural exogenous shocks from equation (1) are not directly observable due to the complexity of information included in true form VAR residuals. As a result, the structural shocks cannot be correctly identified. If  $A$  is invertible, it is necessary to transform the true model into the following reduced form

$$X_t = A^{-1}B(L)X_{t-1} + A^{-1}B\varepsilon_t = C(L)X_{t-1} + e_t \quad (2.3)$$

where  $C(L)$  is the polynomial of matrices with coefficients representing the relationship among variables on lagged values and the disturbance term  $e_t$  is a  $n \times 1$  vector of normally distributed errors (shocks in reduced form) that are serially uncorrelated but not necessarily orthogonal (shocks in the reduced form can be contemporaneously correlated with each other):

$$E(e_t) = 0, \quad \Sigma_u = E(e_t e_t') = A_0 E(e_t e_t') A_0' = A_0 A_0', \quad E(e_t e_s') = [0] \quad \forall t \neq s \quad (2.4)$$

The relationship between reduced-form VAR residuals ( $e_t$ ) and structural shocks ( $\varepsilon_t$ ) can be expressed as follows:

$$e_t = A^{-1}B\varepsilon_t \text{ or } Ae_t = B\varepsilon_t \quad (2.5)$$

SVAR methodology decomposes the series into its permanent and temporary components. The identification scheme of VAR model then affects properties of a matrix  $A$ . The identification of matrix  $A$  requires a definition of  $n^2$  elements. We begin with  $n(n+1)/2$  restrictions imposed on the covariance matrix. We obtain the first three restrictions (summarised in equation (2.2)) from the assumption that each of the shock has a variance - it is nothing but a convenient normalisation (standard deviations of the shocks are normalised to one). Another three restrictions are given by the assumptions that structural shocks are mutually orthogonal (uncorrelated). The last three restrictions come from the long-run neutrality properties. It is expected that the cumulative effect of a particular shock on some endogenous variables is zero. Matrix  $B$  is  $k$ -dimensional identity matrix so that the off-diagonal elements of  $B$  are all zero, implying that we do not allow structural shocks to be mutually correlated.

The framework of our model implies that only a supply shock has permanent effect on all endogenous variables. Demand shock has only temporary impact on the real output. The identification of temporary effects of identified structural shocks on endogenous variables is represented in the model by the following long-run (neutrality) restrictions

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<sup>1</sup> Supply shock is generally represented by e.g. unexpected shifts in productivity, labor market shocks, changes in the prices of key inputs, etc.

<sup>2</sup> Demand shock is generally represented by e.g. unexpected shifts in exports, government expenditures, etc.

<sup>3</sup> Nominal shock, also known as monetary or currency shock is generally represented by e.g. changes in money supply and liquidity preference, velocity of money, risk premium, effects induced by financial liberalization, speculative currency attacks, etc.

$$\sum_{i=0}^{\infty} a_{12i} = 0, \sum_{i=0}^{\infty} a_{13i} = 0, \sum_{i=0}^{\infty} a_{23i} = 0 \quad (2.6)$$

The equation (2.5) can be now rewritten to the following form:

$$\begin{bmatrix} a_{11} & 0 & 0 \\ a_{21} & a_{22} & 0 \\ a_{32} & a_{32} & a_{33} \end{bmatrix} \begin{bmatrix} e_{y_r,t} \\ e_{er_n,t} \\ e_{er_r,t} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_{s,t} \\ \varepsilon_{d,t} \\ \varepsilon_{n,t} \end{bmatrix} \quad (2.7)$$

The system is now just-identified. From estimated SVAR model we compute impulse response functions of real exchange rate to analyse its responsiveness to the underlying supply, demand and nominal shocks in EMU countries.

If the exogenous structural shocks are correctly identified, we might expect the following results

- The positive demand shock increase real output in the short run.
- The effect of a positive supply shock to real output is more efficient in long run making production more efficient thus increasing output.

## 2.6 Data and Results for the Euro Area Countries

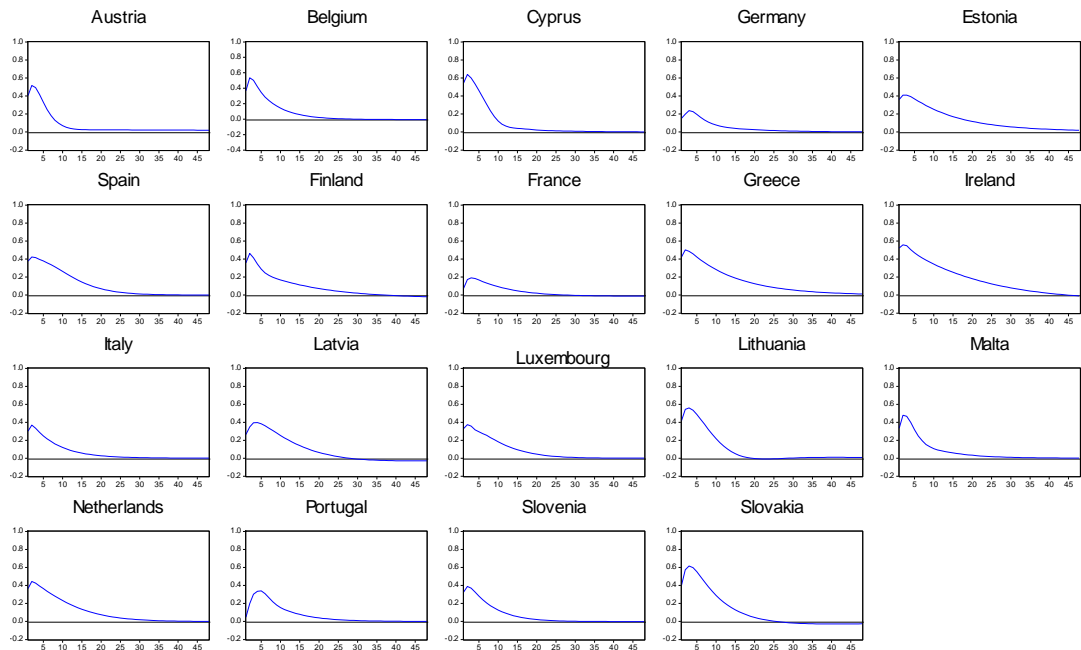
We estimated three-variate SVAR model for EMU countries to estimate the responsiveness of real output to the positive one standard deviation, demand and supply shocks. Monthly data for the period of 2000M1-2007M12 (model A) consisting of 96 observations and for the period of 2000M1-2014M12 (model B) consisting of 180 observations were employed for the following endogenous variable - industrial production<sup>4</sup> (nominal volume of seasonally adjusted industrial production deflated by averaged PPI). Time series for endogenous variable were collected from IMF database (International Financial Statistics, May 2015).

The stationarity of VAR model was checked using the augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. Both tests had indicated that all the variables are non-stationary on the values indicating that the null hypothesis of a unit root presence cannot be rejected for any of time series. Tests of variables in first differences indicate that time series are stationary. We may conclude that variables are I(1). Because all endogenous variables have a unit root it is necessary to test time series for cointegration using the Johansen and Juselius cointegration test. The test for the cointegration was calculated using two lags as recommended by the AIC (Akaike Information Criterion) and SIC (Schwarz Information Criterion). The results of Johansen cointegration tests confirmed our results of unit root tests. Both the trace statistics and maximum eigenvalue statistics (both at 0.05 level) indicate that there is no cointegration among endogenous variables of the model. To test the stability of VAR models we have also employed a number of diagnostic tests. We have found no evidence of serial correlation,

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<sup>4</sup> Time series for monthly industrial production were employed due to absence of data on the same basis for real output (GDP) that is available on quarterly basis only.

heteroskedasticity and autoregressive conditional heteroskedasticity effect in disturbances. The model also passed the Jarque-Bera normality test, meaning errors seem to be normally distributed. Moreover, VAR models seem to be stable as the inverted roots of the model for each country lie inside the unit circle. The detailed results of time series testing procedures are not reported here to save the space. Like any other results, they are available upon request from the authors. Based on the results of the unit root and cointegration tests we have estimated the model using variables in the first differences so that we can calculate impulse-response functions for all EMU countries.



Note: Curves represent responses of real product to the one standard deviation positive demand shocks in each individual country from the EMU group. Time series for monthly industrial production were employed due to absence of data on the same basis for real output (GDP) that is available on quarterly basis only.

Source: Author's calculations.

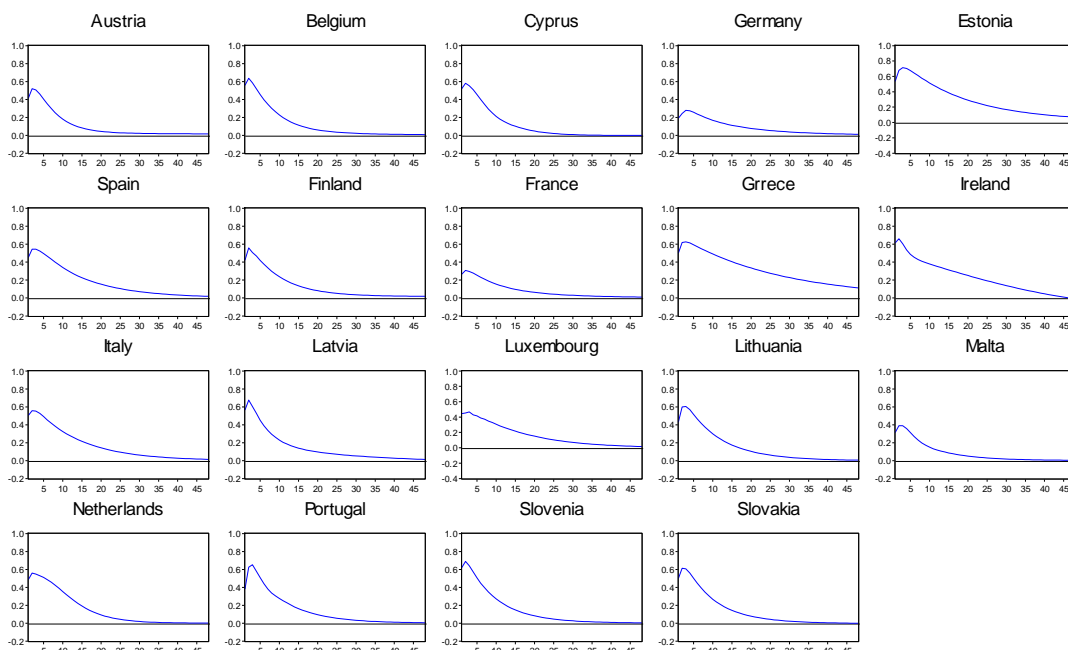
**Figure 2.14 Responses of Real Output to Demand Shock Model A (2000M1-2007M12)**

Following the main objective of this section we discuss the responses of real output to the positive one standard deviation demand and supply shock. In basic Keynesian models, a positive demand and supply shock implies an increase of the real output. We have investigated the effects of demand and supply shocks on different economies in the current circumstances. We also discuss the effects of economic crisis on the real output in EMU countries by comparing the results for models with two different periods - model A (2000M1-2007M12) and model B (2000M1-2014M12). In Figure 2.14 we summarize the estimated responses of real output to the positive one standard deviation demand shock in EMU countries during the pre-crisis period (model A).

Real output increased in all countries after the unexpected *demand shock*. However, the effect of the demand shock seems to be more durable in Estonia, Ireland, Greece or Netherlands. Real output in the countries such as Austria, Belgium, Cyprus and Germany experienced just a short-term vulnerability to the demand shock as the significant part of its effect died out within first year after the

shock. The dynamics of immediate output response to the demand shock in the countries such as Cyprus, Greece, Ireland, Lithuania, Malta, Slovakia, Estonia and Slovenia, was clearly more intense. The overall dynamics and intensity of output response in countries like Germany, France, Italy or Portugal were generally lower.

Estimates of the output responsiveness revealed interesting implications for pre-crisis period. We have observed different intensity of reactions among countries. Demand shock caused a dynamic and strong immediate response of output in countries such as Lithuania, Slovakia, Cyprus, Malta, Ireland and Greece. On the other hand, the results for the core EMU countries (e.g. Germany and France) revealed the overall lower intensity and durability of output responses.



Note: Curves represent responses of real output to the one standard deviation positive demand shocks in each individual country from the EMU group. Time series for monthly industrial production were employed due to absence of data on the same basis for real output (GDP) that is available on quarterly basis only

Source: Author's calculations.

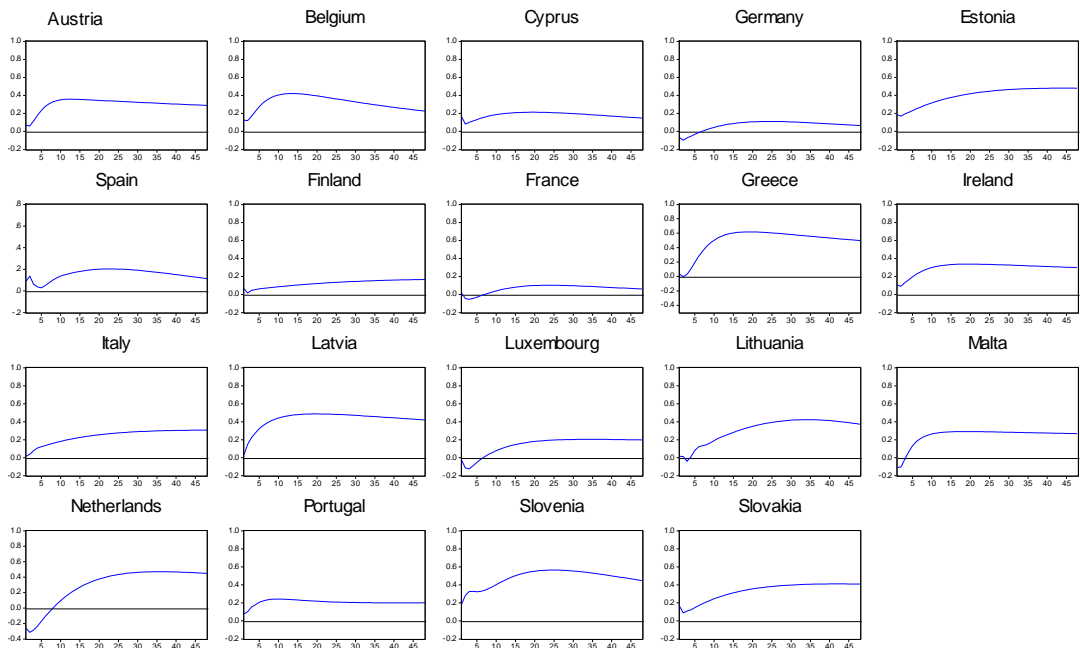
**Figure 2.15 Responses of Real Output to Demand Shock Model B (2000M1-2014M12)**

In Figure 2.15 we summarise the estimated responses of real output to the positive one standard deviation demand shock in EMU countries during the extended period (model B). The positive *demand shock* increased again the output in all countries. Generally it is possible to state that the responses in extended period (with influence of crisis) are more intense. Effects of exogenous shocks on real output were just temporary and thus neutral in the long-run. However, the increased immediate and short-term intensity and durability of the shock is clearly more visible in Estonia, Greece, Ireland, Lithuania, Latvia, Slovenia, Portugal or Belgium. Real output in the countries such as Austria, Belgium, Cyprus, Germany and France experienced a short-term vulnerability to the demand shock as the significant part of its effect died out within two years after the shock.



In “new” member countries (Latvia, Lithuania, Slovakia, Estonia and Slovenia) despite a slight reduction the reactions remain the most dynamic and intense. Responses of GDP in other countries were also affected by the crisis period. The reactions seem to be reduced especially in case of Germany.

Examination of the transition of demand shocks to the consumption and GDP across EMU countries revealed interesting results. We noticed the differences in reactions of “new” member states to the positive demand shock followed by dynamic and strong responses in both observed periods. The responses in other countries (particularly “old” member states) seem to be much less intense and dynamic.



Note: Curves represent responses of real output to the one standard deviation positive supply shocks in each individual country from the EMU group. Time series for monthly industrial production were employed due to absence of data on the same basis for real output (GDP) that is available on quarterly basis only

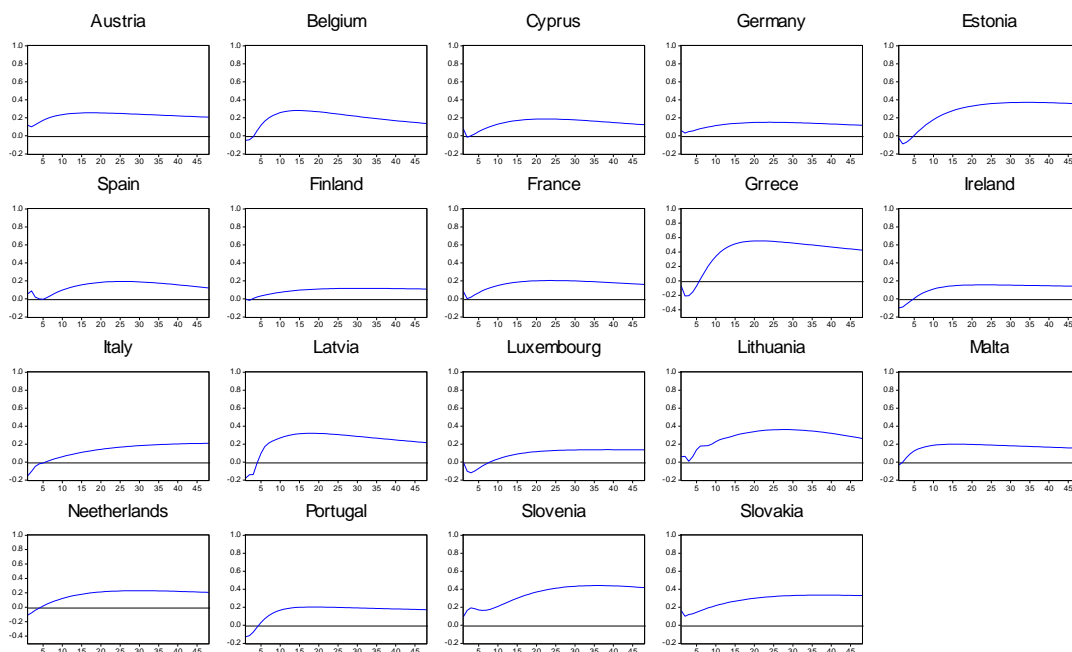
Source: Author’s calculations.

**Figure 2.16 Responses of Real Output to Supply Shock Model A (2000M1-2007M12)**

Supply shock caused real output growth in all EMU countries. While the real output responses correspond to our general expectations, we have observed different patterns in the real output responsiveness to the underlying exogenous shocks in individual countries. Especially, the immediate response of output decrease in countries such as Germany, France, Luxembourg, Netherlands, Malta or Lithuania. The output reaction seems to be sensitive to supply shock just after two months. However, real output in the group of “new” member states were generally more sensitive to the supply shock in the short run (especially in first 12 months). Positive effect of the supply shock was even stronger in small and more opened economies. The overall effect of the supply shock in all countries

was quite durable, though neutral in the long run as its effect died out in all countries in the long-term period.

In Figure 2.17 we summarise the estimated responses of real output to the positive one standard deviation supply shock in EMU countries during the extended period (model B). While the real output responses correspond to our general expectations, we have observed that the responses in extended period (with influence of crisis) are less intense. Crisis period affected the leading path of the real output responses. The positive effect of the shock on the real output was less obvious. As in the previous cases, here again we observed different adjustment in the output responsiveness among countries. Supply shock caused strong and dynamic increase of the output in countries such as Estonia, Greece, Slovenia, Latvia and Lithuania. Responses of the output in “old” member countries (Germany, France, Netherlands, Portugal, Austria, Finland, Spain or Luxembourg) followed moderate and less dynamic increase.



Note: Curves represent responses of real output to the one standard deviation positive supply shocks in each individual country from the EMU group. Time series for monthly industrial production were employed due to absence of data on the same basis for real output (GDP) that is available on quarterly basis only

Source: Author's calculations.

**Figure 2.17 Responses of Real Output to Supply Shock Model B (2000M1-2014M12)**

Summary of overall results showed that the demand and supply shock had remarkable influence on the real output. Our results confirmed the diversity of reactions across EMU countries due to a wide variation in the overall output in EMU countries and this may reflect different stages of economic development as well as growth dynamics over recent years. The responses to the unexpected demand shock were generally more dynamic and intense in “new” member states such as Latvia, Lithuania, Slovakia, Slovenia or Estonia. The results for crisis period revealed persisting dynamism in these countries, contrary to “old” member states such as Germany or France where the reactions seemed

to be less dynamic and intense. However, we had noticed differences in reactions both within the group of “new” member states and the core member countries. The crisis period affected responsiveness of output to demand and supply shock in all countries. The output response to demand shock was generally higher in extended (crisis) period. On the other hand, the positive effect of the supply shock on the real output during extended period was less obvious.

## Conclusion

When the project of monetary union among European countries was being prepared it was not expected that Europe would be hit by such severe crises as occurred few years ago. “Shortcomings” of the euro area were well known even at the beginning, as well as the fact that future EMU countries were far from being the optimum currency area. However, it was not anticipated it would be necessary to address these issues and existing asymmetries in such a short time. Even after more than a decade a position of certain countries, especially of so-called former transition economies can be still described as lagging. What is more, differences and asymmetries can be found also in the group of “founder” countries, or EMU core countries as they are often called. The project of the European Union took away a significant degree of sovereignty from member states and the common currency eliminated the possibility of using an exchange rate as an offsetting tool in case of serious economic fluctuations. That is why a persisting unequal position of individual member countries at the current rate of globalisation and interdependence, together with a restricted scope of country’s economic policy, is still feeding debates of maintaining or improving national competitiveness or managing country’s responses to various shocks in demand or supply. Strict fiscal stance and subsequent forced consolidation of budgets together with reduction of deficits rise also new questions. These issues show the limits of these measures when applied in times of high unemployment and the associated risks of launching a deflationary spiral and worsening the overall macroeconomic situation.

This chapter was focused on the comparison of selected macroeconomic indicators across of EMU member states in order to verify whether we could still talk about similar convergence trends among EMU countries in their economic development due to the crisis. The crisis period clearly revealed the asymmetries between countries. Especially the current situation on labour markets shows that national labour markets remain different. Analysis of relationship for indicators of labour market flexibility and unemployment rate nevertheless confirmed no obvious dependence. Countries having the highest rates show also the worst result for indicators such as language skills, educational attainment and potential of workers for their future move to another country. Insufficient language skills and education (in some countries) act as one of the main factors holding back the mobility of labour force. Unfavourable current situation tells us that countries should be more interested in eliminating existing imbalances and deficiencies that nowadays characterise labour markets in EMU. It would also mean that EMU countries would get more close to a goal of being an optimal currency area.

We looked also at the impact of the demand and supply shock on real output in EMU countries in order to analyse the strength of their individual responses. Such a comparison showed whether a common European policy could have the same impact on macroeconomic variables in such diverse economies. To estimate the effects of shocks we employed SVAR methodology. Economic effects of shocks were evaluated for two periods: pre-crisis (2000Q1-2007Q4) and extended (2000Q1-2014Q12) to reveal crisis effects. Summary of overall results showed that the stimulation measures could have remarkable

influence on the fundamental macroeconomic variables. However, our results confirmed the diversity of reactions across EMU countries. From this point of view we can conclude that the unified fiscal policies or a coordination of national fiscal policies with the goal of similar macroeconomic stimulation would not lead to same results.

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## Chapter 3

### Dual approach to growth accounting in the European Union Member Countries European Countries

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### 3.1 Introduction

Economic theory says that economic policy instruments are used in order to achieve sustainable economic growth in the long term. Forecast of the future economic development would be prepared much easier if economic growth was constant. The reality is, however, not theory. As we can see, the worldwide growth is far from constant. As stated Romer (2012, p.6), "growth has been rising over most of modern history and average growth rate in the industrialized countries were higher in the twentieth century than in the nineteenth". An exception to this scheme of increasing growth is slowdown in productivity growth. The globalization of the world brought strong links between the economies of such trade and financial markets. Such close connection brings the acceleration of positive developments in the economy in "good times", while the same acceleration has signed an acceleration of negative developments in the economy in "bad times". This connection is most pronounced manifested especially during the global economic crisis. The more open an economy is, the more it may undermine global economic crisis. The most important manifestation of the crisis is the sharp decline in gross domestic product. Countries in their production are coming under the level of its potential output and the economy gets into the gap of product. As reported (Huček-Reľovský-Široká, 2010) it is necessary to consider whether this decline is permanent consequences of the crisis or loss in GDP it is possible to catch up in the short term. It is evident that the return of the economy to a state of equilibrium (ie the level of potential output) would require a significant increase in the rate of growth of GDP. This problem is added the conflict in the perception of the cyclical position of the economy and expected price development. (See also Buleca – Andrejovska (2015))

The economic crisis of recent years has opened a space for debate about whether the economy is still capable of economic growth at all, or whether we have reached our ceiling. While Shapiro (2013), in his commentary on the US economy said that economic growth can be achieved through the involvement of more innovations in the production process, reform of immigration policies and the creation of suitable conditions for the creation of new start-ups, on the other hand, de Neufville (2014) combines ecological and economic processes and problems and points out the need to change the current way of functioning of the globalized world. Innovation and investment as a factor of economic growth also described Szabo – Šoltés – Herman (2013), Buleca (2013). To determine the potential of the country to achieve future economic growth is necessary to monitor how the economic growth is



currently set. For this analysis we have chosen growth accounting approach, which consists in the distribution of economic growth on individual shares of individual economic inputs.

Economic growth has become virtually a mantra for politicians and economists from developed economies. The faster the economy is able to grow, the more it is perceived positively. The economic crises of the years 2008-2009 stopped the economic growth of many economies and highlighted the problems associated with the method of financing and the nature of the economic growth of the country. An increasing problem is to find the optimal combination of inputs that would ensure efficiency and sustainable growth in a world of strong limitations of available resources. Experts are trying to find new links between the use of renewable energy and economic growth (eg. Mumtaz et al., 2014). However, the issue is also interaction between economic growth and innovation (eg. Szabo, Šoltés, Herman., 2013; Šoltés, Gavurová, 2014; Buleca, 2013), economic growth and interest rates (eg. Bartóková – Ďurčová, 2013), economic growth and unemployment (eg. Raurich, Sorolla, 2014) and economic growth and capital. As stated in (Sedgley, Elmslie, 2013), „capital is allowed to accumulate and is used, together with other inputs, to produce new knowledge. The stability of the steady state path is found to be determined by the inequality and/or knife-edge restrictions needed to produce steady state growth. The example of the fastest economic growth, called “Asian Miracle”, launched a debate about the importance of the economic growth source of the country. (Senhadji, 1999) Some of the authors (Krugman 1994) are convinced that the “Asian Miracle” is a myth. According to Krugman (1994) “the remarkable record of East Asian growth has been matched by input growth so rapid that Asian economic growth, incredibly, ceases to be a mystery.”(Krugman, 1994, p.76) The question is whether the source of economic growth is or is not essential. When we think about the neoclassical growth model using its main assumption of diminishing returns in physical capital then we shall consider the fact that total factor productivity (also TFP) can sustain long-term growth while capital accumulation cannot. From this point view we can agree with the argumentation that the source of growth can be accepted as the determinant for the long-term perspective of a country. (Senhadji, 1999)

The influence of demand and supply on real product and economic growth is the basic macroeconomic assumption which is documented on many macroeconomics publications. The economic growth and these sources are often studied from view of the aggregate supply factors. Burda Wyplosz (2003) state that essentially four main factors explain economic growth: savings, population grow, resulting in an increased number of workers, technological progress and finally productivity increases. Begg, Fischer, Dornbusch (1999) summarize the various factors of economic growth, like basic models based on growth of production factors, technical progress, innovations but also endogenous growth model built on externalities in human and technical capital formation. Schiller (2004) notes, that the growth rate of total output is equal to the rate of labour growth and productivity growth. There are some authors who show that aggregate demand can have also an effect on economic growth. (see part ..... of these publication) Based on the studies of Optimum currency area and beholding the current situation in EMU the necessity to study the influence and similarity of demand and supply shocks mainly in last accession countries is growing. Mura, Buleca (2012) study the connection between investment and labour market. There is also some interesting connection between investment and labour productivity (Pavliková, Siničáková, 2012). Bartóková (2011) concludes that investments in accession countries

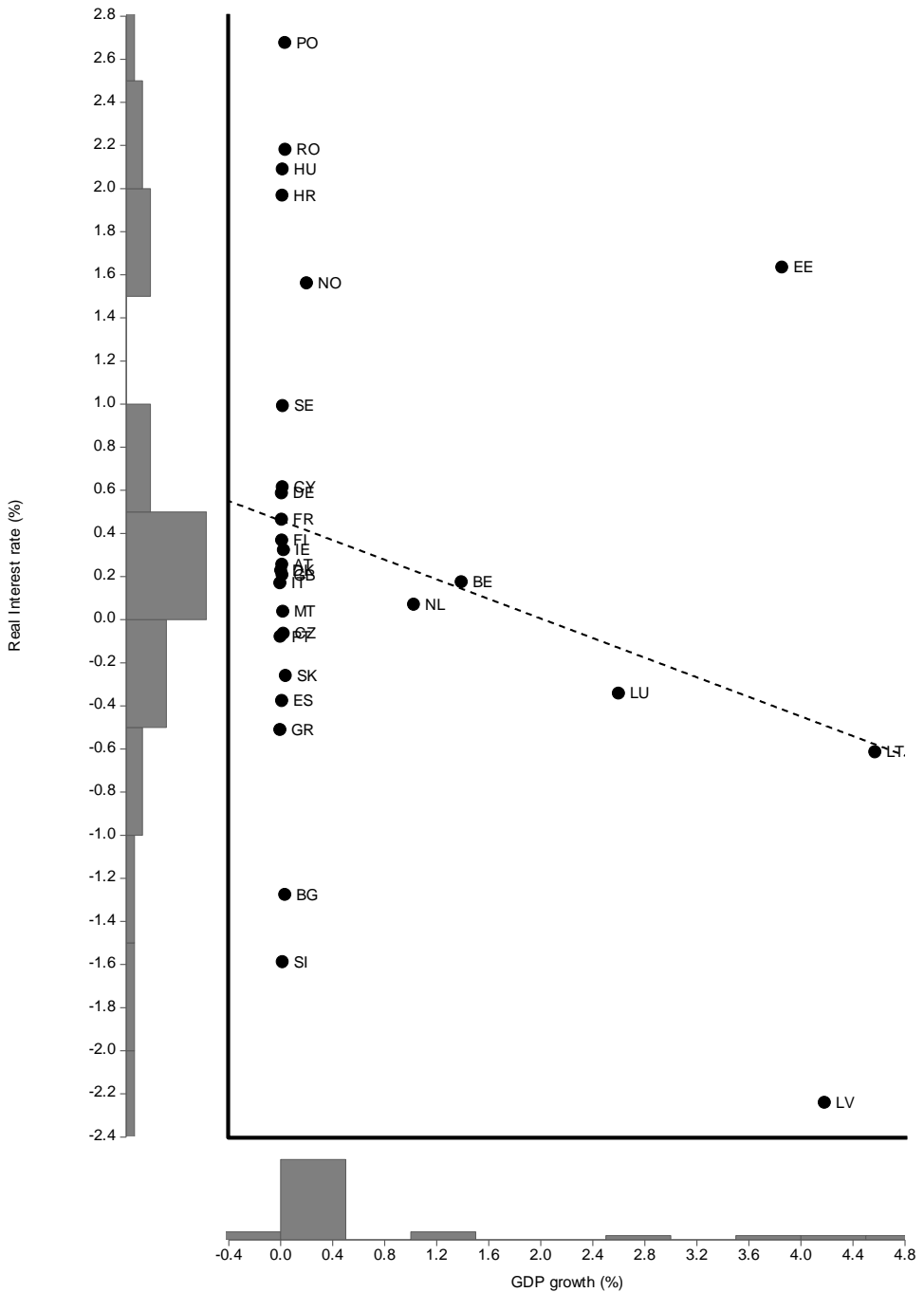
were equally affected by development in western countries, such as lower interest rates or rates of investment returns and attempts of western European investors.

Another problem which mainly affects the countries of the EMU is an effort to set common rules. At the beginning of the new millennium, the countries as a result of continuing problems in the economic field tried to avoid a situation in academic agendas known as an “Eurosclerosis” which was coined to describe a pattern of high unemployment, slow job creation, low participation to the labour force and weakening overall economic growth during the 1980s and most of the 1990s (Bentolila and Saint-Paul (2001)) As a response to the situation was created a document known as the Lisbon Agreement. The Lisbon Agenda is one of the clearest examples of the exogeneity of OCA. It was first adopted by the European Council in Lisbon in March 2000, and sets out a strategy which aims at addressing the issues of low productivity and stagnation of economic growth in the EU over a ten-year period. One of the basic assumptions of the expected common macro-region was that financial integration is not fostering economic divergence and seems to be actually helping to reduce the impact of idiosyncratic shocks. Over time, greater financial integration and modernisation will make it easier for households to insure against idiosyncratic risk through borrowing and lending and cross-country ownership of financial assets, which will allow for more income-smoothing. Furthermore, greater financial integration and modernisation are associated with more sustained economic growth.

Under the rules set by the OCA all participants in the area must have similar business cycles so that economic booms are shared, and the OCA's central bank can offset and diffuse economic recessions by promoting growth and containing inflation. (Mongeli, 2008) In terms of synergy of economic growth and innovation, the question arises: Are real interest rate differentials within the euro area in any case correlated with growth differentials? Standard growth and interest rate theory suggests that there should be, at least at lower frequencies, a positive correlation between real rates and economic growth across different countries. However, this tenet does not apply to a cross-country comparison within the EMU since in a Monetary Union, nominal rates can not reflect anymore differentials in expected inflation. In contrast, one could expect that within a monetary union, real rate differentials are negatively correlated with growth differentials at least over business cycle frequencies if economic growth tends to be higher in countries with higher inflation.

We attempted to verify this claim on our countries surveyed. According to theory the economy with the highest economic growth should have the highest interest rate, and vice versa. Among European countries, however, this theory does not apply. Countries with the highest interest rate (Portugal) reached approximately the same amount of economic growth, as the remaining 20 in the study. On the contrary, the country with the lowest interest rate (LV) achieved greater than average economic growth. The exceptions are the two country groupings - the Benelux and the Baltic countries. Those in the period not only achieved above-average economic growth (compared with other countries), while in their economies there were also changes in real interest rate - so the negative as well as the depository. The most significant developments have taken place in the economy of Estonia, which followed the theory and achieve economic growth along with a rise in real interest rates. Also opposite theory is not in charge. The opposite theory says that the country with the highest rate of economic growth should reach the lowest real interest rate. In this case we are talking about country Lithuania (LT), which was to fulfill theory very close. The real interest rate is very close to 0, but has a negative value.

GDP Growth vs. Real Interest Rate



Source: own calculation

**Figure 3.1 Correlation between Real Interest Rate and GDP growth**

Towards the last years a new phenomenon - negative real interest rates and its connection to economic growth made observations Karlsson (2009). In his view, lower real interest rates in an

economy with a stable money supply, would be the result in a higher willingness to save from the point of households. That will boost investments and so also increase productive capacity. But, if the decline in real interest rates was the result of monetary inflation, then it can too provide a short-term boost to the economy (provided certain assumptions specified in the Austrian business cycle), but under other circumstances, lower real interest rates will not boost the economy even in the short-term. If no entrepreneur is willing to invest despite negative real interest rates, then the decrease in money demand will simply lead to higher prices, money demand will fall further, which in turn leads to yet higher prices in a hyperinflationary spiral. Countries with hyperinflation have strongly negative real interest rates, and are thus the perfect example of what happens if such schemes are initiated.

This will do nothing to boost output even in the short-term and will have disastrous consequences later as there will either be a breakdown of the monetary system through hyperinflation like in Germany in 1923 or a severe contraction when monetary authorities in order to stop the hyperinflationary spiral must initiate a sudden, dramatic monetary contraction. (Karlsson, 2009)

### 3.2 Dual Approach

#### **Methodology**

Given the important role to economic growth in the process of OCA correct formation we have selected the analysis of the evolution of economic growth that the country reached in the pre-crisis, crisis and after crisis period as an objective of the present article. Especially for the analysis of what the economy tends to do in the formation of economic growth - is the economy trying to achieve the desired growth through increasing the productivity of the factors or is it rather the increasing volume of factors entering into production?

In the analysis we used a process by which it is derived the primal and dual Solow residue. The pioneers of this method were Abrahamovitz (1956) and Solow (1957). Solow just came up with the idea to analyze the impact of individual factors on economic growth in the form of a dual approach to growth accounting. The essence of this approach is to adjust production function so that we were able to express so called "*Solow residuals*". The Solow residual is sometimes interpreted as a measure of the contribution of technological progress (Romer, 2012, p.31; Mankiw – Romer – Weil, 1992).

We used approach presented by Hsieh (2002). As a start point was used the basic national accounting identity - national output - presented as:

$$Y = rK + wL \quad (3.1)$$

where "Y" represents aggregate output, or aggregate income, "K" represents capital, "L" is labour, "r" is the real rental price of capital, and "w" is the real wage. After the differentiation of (1) with respect to time and dividing by Y we get:

$$Y' = r'K + rK' + w'L + wL' \quad (3.2a)$$

$$\frac{Y'}{Y} = r' \frac{K}{Y} + \frac{r}{Y} K' + w' \frac{L}{Y} + \frac{w}{Y} L' \quad (3.2b)$$

$$\frac{Y'}{Y} = r \frac{K}{Y} \left( \frac{r'}{r} + \frac{K'}{K} \right) + w \frac{L}{Y} \left( \frac{w'}{w} + \frac{L'}{L} \right) \quad (3.2c)$$

We used substitution in (2c):

$$Y' = s_K (\hat{r} + \hat{K}) + s_L (\hat{w} + \hat{L}) \quad (3.3)$$

where the identities “ $s_K$ ” and “ $s_L$ ” are the factor-income shares. (Hlousek, 2007) In the next step we placed the terms of the growth rates of factor quantities on left-hand side of the equation and the rest we left on the right-hand side. Finally we obtained:

$$Y' - s_K \hat{K} - s_L \hat{L} = s_K \hat{r} + s_L \hat{w} \quad (3.4)$$

The left-hand side of the equation (4) is called the Solow residual primal ( $SR_p$ ) or TFP growth. Decomposition of output growth gives us information about contributions of physical capital, labour and productivity to economic growth. After the removal of the contribution of these essential resources, the remaining part of economic growth, which was not explained by a combination of the growth rates of all production inputs, will be considered as the real value of TFP growth. (Wang – Yao, 2003)

$$SR_p = Y' - s_K \hat{K} - s_L \hat{L} \quad (3.5)$$

The right-hand side of the equation (4) is called the Solow residual dual ( $SR_d$ ) expressed as share-weighted growth in factor prices.

$$SR_d = s_K \hat{r} + s_L \hat{w} \quad (3.6)$$

Under the condition that output equals factor incomes we can talk about the result that the primal and dual measures of the Solow residual are equal. No other assumption about the production function, bias of technological change or relation between factor prices and their marginal products is needed for this result. We do not even need to assume that the data is correct. (Hsieh, 1999)

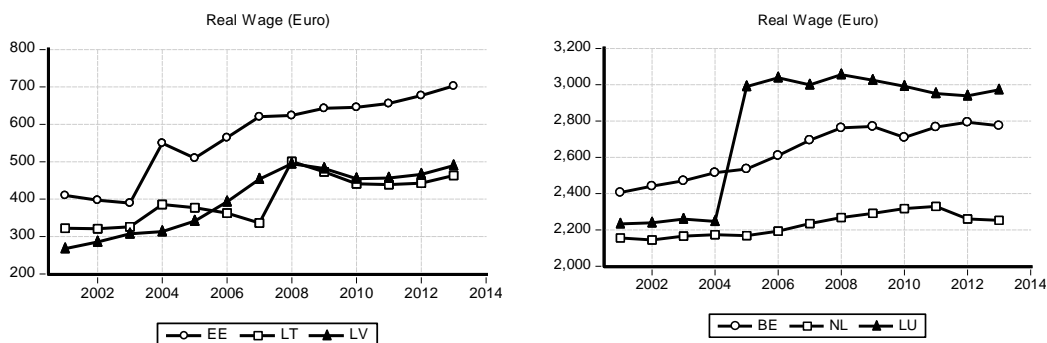
### 3.3 Data

In the analysis, we analyzed the evolution of the variables in the eight groups of countries - the Benelux (BE, NL, LU) and the Baltic countries (EE, LT, LV), the Balkans (BG, HR, RO, SI) and countries of V4 (CZ, HU, PO, SK), the West countries (DE, FR, GB, AT), the Nordic countries (DK, FI, SE, NO), the PIIGS (IE, GR, ES, IT, PT) and small group of countries Malta and Cyprus in the time period 2000 - 2013. Some of the countries are founding countries of the euro area, some countries are later acceding countries and the remaining countries are members of the European Union but do not belong to the Eurozone.

We used the aggregate measures of factor inputs and their prices in this analysis. Data were collected from database of statistical offices of all countries and Eurostat. The frequency of used data was

annual in period 2000 – 2013. We used specific data to the  $SR_p$  calculation such as gross domestic product in constant price of 2010, total hours worked and stock of gross fixed capital in constant price of 2010. The real wage was calculated as a nominal wage-consumer price index ratio (Figure 3.2 – 3.5). The real interest rate was defined by 3 month nominal rates deflated by inflation. (Figure 3.6). As is evident from Figure 3.2, real wages had in all countries tend to grow. Specific development was in Luxemburg, where in 2005 there was a significant increase in the value of real wages. According to the information of OECD the main reason of such a huge change was due to the surge in energy prices as well as increases in excise tax rates. These changes lead to consumer price inflation acceleration and with high level of inflation nonetheless triggered an automatic increase of wage rates and pensions by 2.5% in early-October. (OECD, 2005) This also explains the steepest development of real interest rates in that country.

When comparing the countries of the Balkans and V4 we can see a marked difference in the evolution of real wages among countries. Balkan countries have in the area big differences that reflect the state of the whole economy. It is best for the Slovene, which are in the pre-crisis period as well as during the crisis, has maintained a relatively stable level of real wages. As reported by Banerjee - Vodopivec – Sila (2013), there were several reasons for the gradual growth of real wages: the weakening position and bargaining power of trade unions, agreement deriving from collective bargaining that wage developments will be linked to the evolution of inflation and the subsequent tightening of indexation of wages due to the efforts to adopt the euro as the national currency.

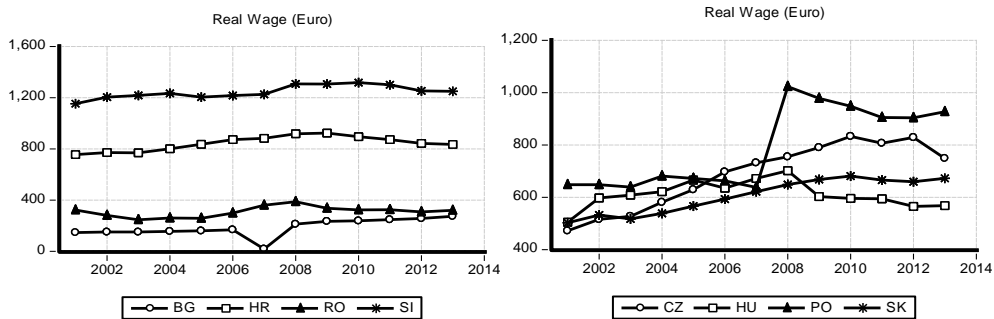


Source: own calculation

**Figure 3.2 Real Wage in the Benelux and the Baltic countries in period 2000 - 2013**

According to this indexation formula were wage increases tied to projected inflation in Slovenia, projected inflation in selected EU member states, and the projected exchange rate of the tolar vis-à-vis the euro. The mechanism also included a safeguard for additional wage increase in the event actual inflation exceeded a specified rate. (Banerjee - Vodopivec – Sila, 2013, p.12) Thus set indexation of wages growth was subsequently modified in 2006 and 2008. Projected inflation was taken into account in the determination of the increase in starting and minimum base wages, though this was not transparent as the agreements proposed increases of a specified percentage each year. Both agreements also included a provision for additional wage increases if inflation exceeded a specified rate. (Banerjee - Vodopivec – Sila, 2013, p.12)

The development of real wages in Croatia was very similar to that in Slovenia, there also made no sharp fluctuations. The level of the real wage remains even above the level of the pre-crisis period. Economists themselves ascribe a slight fluctuation in the fair wage only an economic crisis, which in 2008 broke out in the country. (Orsini – Ostojić, 2015) Now see Romania and Bulgaria - two poorer countries in the region. Despite significantly smaller real wage development in Romania was very similar to the development in Slovenia and Croatia. Specific developments have been in the case of Bulgaria. The Bulgarian economy has been very badly hit by the global economic crisis, which broke out in the country in 2008. During the years 2008-2012 experienced one of the strongest drops in employment in the EU - decline at around 12% in the period. The unemployment rate rose more than doubled - from 5.5% in 2008 to almost 12% in 2012. All these facts may suggest that wages would diminish strongly. However, the opposite was true. Wages fell sharply only in 2007-2008 and subsequently exceeded even the values of the pre-crisis period and maintain a growing trend throughout the crisis. As mentioned Maiväli - Stierle (2013, p.3) if real wages per employee grow in parallel with real productivity, this implies that wage developments are consistent with matching changes in labour demand and supply – provided full employment is maintained. In Bulgaria, wage growth appears to have been broadly in line with productivity prior to the boom-bust cycle. During the crisis, wages seem to have increased excessively, even though productivity growth also appears to have been remarkably strong. Notably, a solid rise in global market shares suggests that rising unit labour costs were compensated for by non-cost factors like quality improvements (Benkovskis and Wörz, 2012) and temporary factors like favourable export price trends in world markets (European Commission, 2012)

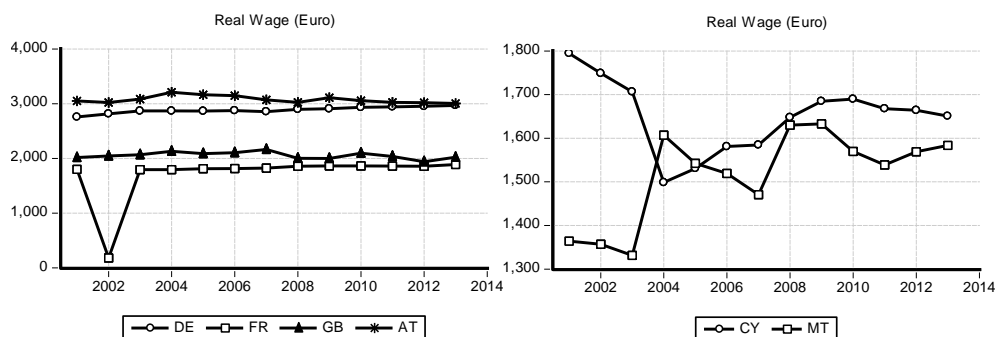


Source: own calculation

**Figure 3.3 Real Wage in the Balkans and V4 countries in period 2000 - 2013**

Different real wage trend is found in the case of the V4 countries. All four countries in 2007 were about the same real wage trend. Its value grew in every country. Subsequently, however, the crisis broke and development in some countries has changed. Slovakia and the Czech continued in the established uptrend. The growth rate has slowed down mainly due to the second wave of economic crisis in the period 2010 - 2012, when there was also a slight decrease values. Slovakia has maintained a positive trend in 2013, but in the case of the Czech Republic there was a relatively sharp decline in the value of real wages. Poland was the only country of the V4 countries which continued economic growth throughout the economic crisis. The country was able to profit from the positive developments in the economy rapid growth in real wages in 2007. In the same year (2007) in the opposite direction issued

Hungary. The crisis in the economy of Hungary demonstrated right from the beginning of 2007, especially in the growth of the unemployment rate and the inflation rate, which have been strongly reflected on the decline in real wages. Hungary has managed to halt this decline in 2013.



Source: own calculation

**Figure 3.4 Real Wage in the West countries, Cyprus and Malta in period 2000 - 2013**

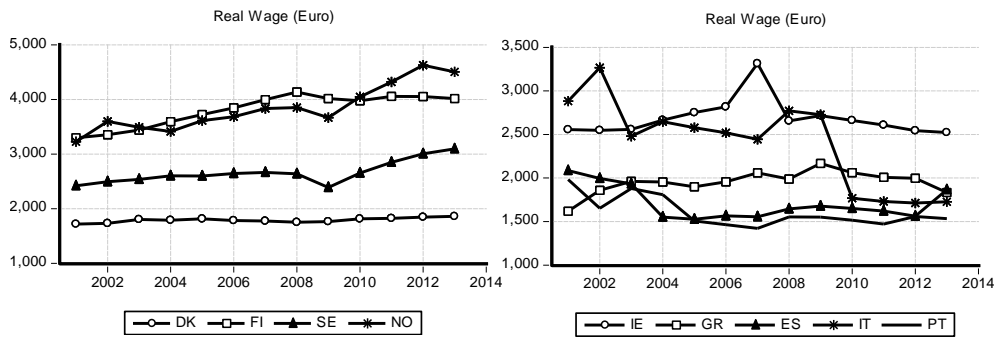
In the case of Austria there were not serious fluctuations in the value of real wages during the entire study period. On the other hand, it is an interesting fact that in comparison with the major economies of Europe Austria achieved the highest value of real wages both in the pre-crisis and in times of crisis. In 2013 it was at the same level as Germany. Germany also by the amount of real wages indicates that is the strongest economy in Europe. Survive the crisis without any fluctuations. Similar situation was also in France and Great Britain, while moving on the lower level. Significant fluctuations we can see in France in 2002. It was coupled with the fact that France at that time went through a significant transformation of the labour market (most significant change occurred in the transition from the 39 hour working week on the 35 hours). This transformation was completed in 2003, when there was a unification of the rules. (Husson – Sommeiller – Vincent, 2012)

For the development of countries Malta and Cyprus were not exceptional period of crisis, but the year in which they entered the EU. Paradoxically, Cyprus has been adapted so that the value of real wages fell, while in Malta increased on the approximately the same level. Both countries have since behaved roughly the same.

The Nordic countries are also showing that they belong to the richest countries in Europe. In particular, research in the field of oil deposits accounted for all of them huge costs on the one hand but on the other hand, production of crude oil delivers exceptional income to countries. It also, in combination with other settings of the economy, it enables such high real wages.

Real wages in the PIIGS countries that are perceived as very problematic among EU countries can be compared with real wages in the economy of the North which have a long-term best score. This is an interesting paradox. If we look at the development itself, the biggest changes can be seen in the case of Italy. This is about a combination of economic and political changes that the economy in the recent period passes.

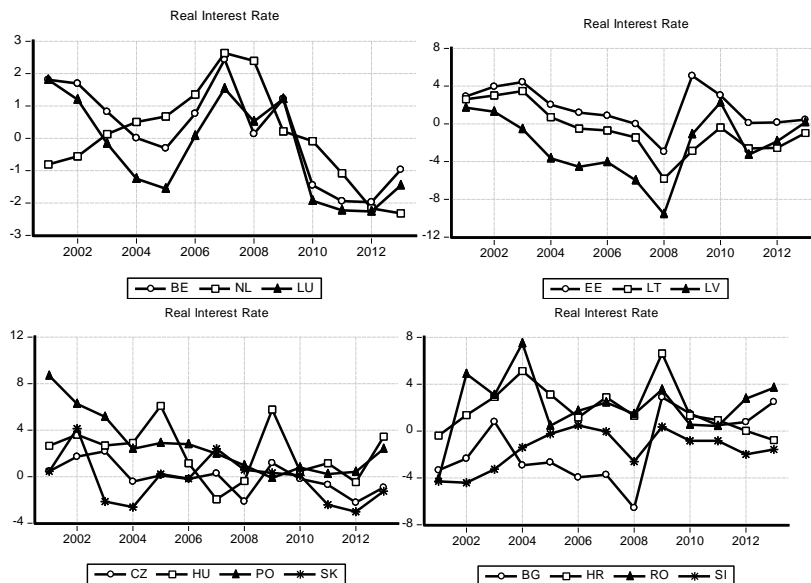


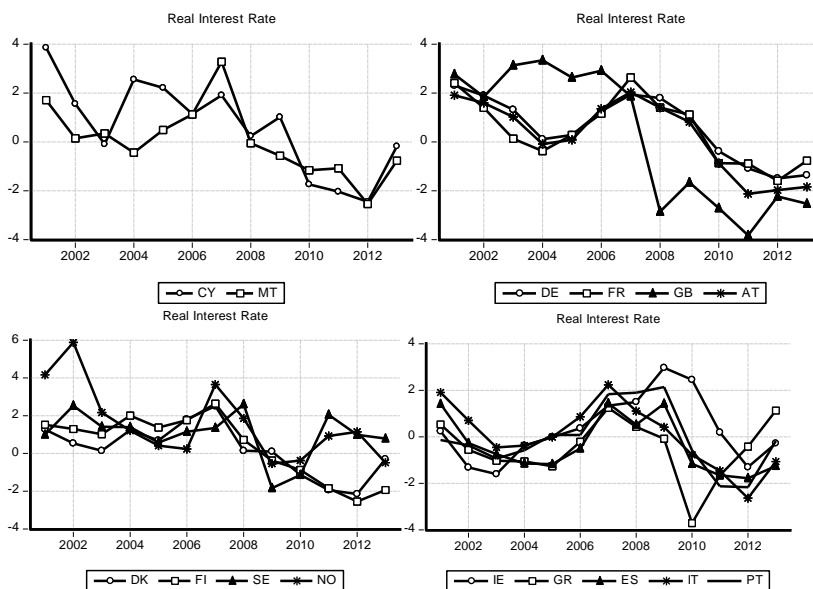


Source: own calculation

**Figure 3.5 Real Wage in the Nordic and the PIIGS countries in period 2000 - 2013**

In 2009, Mankiw (2009) presented the idea of using negativity in favour of economic development by pointing out that most economists are in a situation of rising unemployment and volatile financial system relied on monetary policy. (For euro area countries it is understandable, since monetary policy is part of common policies and common rules.) According to Mankiw (2009), thinking of economists is then directed to handle crisis situations by cutting interest rates. Lower interest rates encourage households and companies in the willingness to borrow and spend. Higher consumption is higher demand for goods and services and that means more jobs in the economy. Recent history has shown that even a reduction in interest rates on a zero limit might not mean rekindle of domestic demand and the economy. Mankiw (2009) thus develop further the idea of using negative for the benefit of the economy mainly through the use of negative interest rates. Negative interest rates can be obtained through inflation. In this case, while nominal interest could remain at zero, real rates could become negative. In this situation “people would have significant incentive to borrow and spend”. (Mankiw, 2009)





Source: own calculation

**Figure 3.6 Real Interest Rate in all countries in period 2000 - 2013**

As can be seen in the following group of graphs, a negative value of real wages was, prior to the crisis, the unknown variable for many countries. Exceptions were the PIIGS countries or other countries that had economic problems long before the crisis broke. Before the crisis, the negative value of the real interest rate can be seen only in the case of two groups of countries of the Eurozone - PIIGS and BENELUX. On the other hand, since the crisis there are very few countries that get into situations where their real interest rate was negative. To this development in Europe helped the ECB policy based on massive the monetary easing. (Randow, 2015)

To obtain factor-income shares we used annual data of gross value added, nominal costs of labour per person and number of employed persons. Our average share of labour ( $S_L$ ) of all countries was 55.69% .It is interesting to observe the distribution of share factors in different countries. There is only one country where the share of the labour can be seen as clearly dominant, since reaching a value of more than 80% (GB). The share of labour is well above 70% in the other five countries, which can still be considered significant. These include countries that are among the economically strongest EU countries - Germany, the Netherlands, Sweden, Denmark and Austria. According to the Trading Economics ratings have all these countries (except Austria) score of 99 points out of 100 and are considered as stable economies. (Trading Economics, 2016) At the opposite end there is only one country in which labour participates in total production in output less than 35 percent (BG). The rating of Bulgaria in The Trading Economics ratings is 52 points out of 100, but is considered as stable economy. (see Table 3.1)

In the calculation we had to consider certain specifics. We already mentioned Cyprus and year 2004. For Belgium, it was 2005. In that year there was a combination of several adverse circumstances for the country. The inflation of the previous years, posted a significant increase in energy prices, which was reflected in the prices of inputs, especially capital. (OECD, 2005)

In 2006, Austria was faced with the consequences of receiving tax reform, as well as structural changes in consumption. In order to comply with fiscal limits in the following year, the economy had to accede to significant reforms in public administration. All these measures have prevented the growth of the fiscal deficit. The same year (2006) was crucial for Italy and Ireland, too. Italy was recovering from a slowdown in the previous year and had to restart the economy anew. Ireland addressed the opposite problem. Massive income growth, which was launched in 2005, provides strong support for activity while monetary conditions remained unchanged. The steady increase in household incomes has turned to higher private consumption and increasing retail sales. Thus created pressure led to the growth of inflation rate as well as to other problems. (OECD, 2006)

**Table 3.1 Share of Labour and Capital**

Country	s <sub>l</sub>	s <sub>k</sub>	Country	s <sub>l</sub>	s <sub>k</sub>	Country	s <sub>l</sub>	s <sub>k</sub>
AT	70.45%	29.55%	FR	66.71%	33.29%	MT	49.79%	50.21%
BE	68.59%	31.41%	GB	82.28%	17.72%	NL	72.63%	27.37%
BG	33.17%	66.83%	GR	54.35%	45.65%	NO	44.55%	55.45%
CY	52.93%	47.07%	HR	56.31%	43.69%	PO	53.96%	46.04%
CZ	41.30%	58.70%	HU	51.26%	48.74%	PT	55.81%	44.19%
DE	74.98%	25.02%	IE	57.48%	42.52%	RO	40.66%	59.34%
DK	72.05%	27.95%	IT	59.53%	40.47%	SE	77.82%	22.18%
EE	45.44%	54.56%	LT	39.98%	60.02%	SI	63.13%	36.87%
ES	51.24%	48.76%	LU	36.63%	63.37%	SK	35.66%	64.34%
FI	68.92%	31.08%	LV	37.46%	62.54%			

Source: own calculations

Year 2007 was primarily a problem for the economies of countries such as Norway, Portugal and the Slovak Republic. Norway after years of strong economic growth reached the peak of its economic cycle. Visible manifestation of this situation was the high inflation, economic slowdown and the tightening of monetary conditions. For Portugal, the year 2007 seemed to be a positive continuation of the trend of the previous year. The global economic crisis has very strongly affected the Portuguese economy, which thus could not continue with fiscal consolidation and this has caused problems for further economic development. A similar problem is also facing the Slovak economy. The economy reached the peak of its economic cycle and threatened its rapid economic decline. There has been a gradual loosening of fiscal policy and the economic crisis broke out. (OECD, 2007) The year 2007 was special for Luxembourg, too. There was a sharp, more than 1% increase in interest rates and short-term decline in inflation. This led to the fact that the cost of capital has seen wild swings in the market. Similarly, significantly below the development of the capital market crisis has also signed on Estonia (2008). Not only was almost 1% increase in interest rates, but at the same time, the inflation rate rose by more than 4%, then that next year there is a significant drop. It was, however, accompanied by a strong decline in interest rates. In view of the peaks in the said period, which may lead to unnecessary distortions of the real development, we have analyzed set of these values diminished. For Slovenia it was 2008. The crisis brought a sharp decline in export performance, resulting in nearly 8% economic

decline. The inflow of cheap credit from abroad grinded to a halt, and the bubbles in the construction and real estate sector burst. The result was more than double the rate of unemployment to which the economy had come about over the next five years. (Furlan, 2014) The main problem of the Czech Republic in 2008 was the overall slowdown in the economy, in particular the weakening of domestic demand and the loss of export markets due to the already ongoing crisis in the partner countries. (OECD, 2008)

The different effects of the crisis were the 2009 and 2010 difficult even for Hungary, Malta and Greece. For Croatia it was 2013. Croatia entered the European Union (EU) on July 1, 2013 as the 28<sup>th</sup> member state. The Croatian government has focused all forces to meet the Maastricht criteria. It also had to cope with the nearly six years long crisis. Another problem was particularly high, nearly 17% unemployment, where 40% of the unemployed amounted to young people aged 15-24 years. Up to 60% of the unemployed represent people who have been out of work for over a year. (WB, 2015)

### **3.4 Analysis**

#### ***Rental price of capital***

The results showed that the indicator rental price of capital reached a positive value only in one third of countries (average value for the whole period). In all other countries the rental price of capital was negative. Its development reflects the diminishing marginal product of capital associated with the growth in the volume of capital.

Changes in real wage were not negligible but the nature of the changes was not as much dynamic as in the case of the capital prices. The value of real wages was the most changed in France. Here, we have already mentioned that France was going through a reform process currently in the labour market and this is reflected in the development of both nominal and real wages.

The costs of capital were changed most significantly in 2004, 2009 and 2011. In June 2004, Estonia entered ERM 2 in preparation for the eventual adoption of the euro. Although the kroon was allowed to fluctuate within a 15% band, Estonia preferred a peg of EEK 15.6466 per euro. This led to lower inflation and lower interest rates. Positive developments in Lithuania in 2003, which was due mainly to the country's preparations for accession to the EU was relieved by a short-term deterioration of the situation in 2004, which according to the IMF was mainly due to the higher excise taxes and energy prices, coupled with strong demand. (IMF Survey, 2005) But this was more of a positive impact of economic and political changes in the economy.

While changes in 2004 we see as a result of positive economic and political changes in the country, negative changes in 2007-2011 are associated with easing of fiscal and monetary policy in the country as well as with onset of the crisis. We admit the possibility that the market might react to the imbalances on the markets already at that time. Strong imbalances in prices of capital in 2011 were clearly associated with a second wave of the crisis. It is the same with real wage developments. According to our opinion, while striking imbalances in the years 2002- 2005 were associated with significant economic changes in economic development, turbulence in 2011 represented a direct result of changes induced by the crisis. Our results are somewhat consistent with the conclusions reached by IMF(2013)

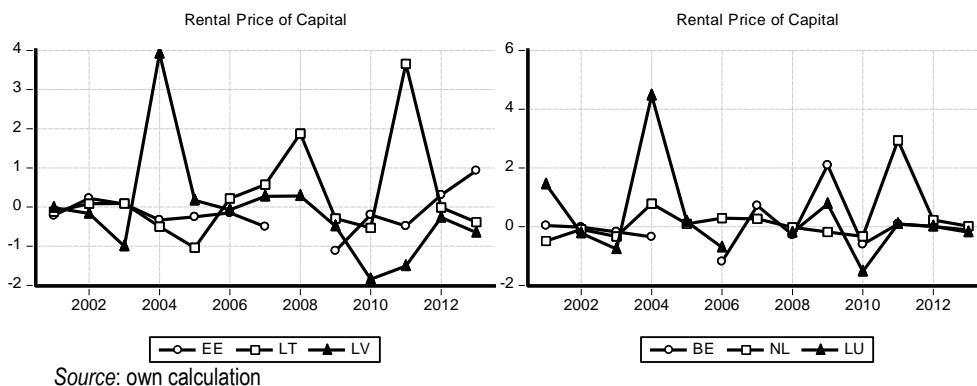
**Table 3.2 Rental Price of Capital and Real Wage for all countries – average in 2001 – 2013**

Country	Rental Price of Capital	Real Wage	Country	Rental Price of Capital	Real Wage
AT	-0,120	0,000	IE	-0,619	0,002
BE	0,016	0,010	IT	-0,153	- 0,016
BG	-0,307	0,274	LT	0,278	0,012
CY	-0,022	0,001	LU	0,257	0,009
CZ	-0,157	0,020	LV	-0,104	0,019
DE	0,082	0,005	MT	0,007	0,004
DK	-0,036	0,006	NL	0,242	0,002
EE	-0,143	0,022	NO	-0,338	0,013
ES	-0,411	0,001	PO	-0,173	0,019
FI	0,039	0,012	PT	0,043	- 0,004
FR	-0,128	0,397	RO	0,253	0,001
GB	-0,043	0,003	SE	-0,071	0,016
GR	-0,623	0,009	SI	-0,268	0,002
HR	-0,068	0,006	SK	0,075	0,010
HU	-0,411	0,015			

Source: own calculations

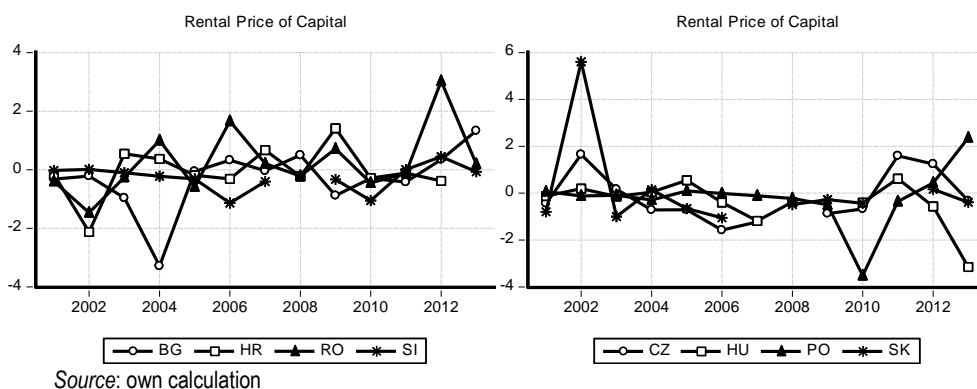
During 2002 – 2004, Bulgaria went through a phase of recovery of financial intermediation which turned into a powerful credit boom. The reason was the country's macroeconomic stability and robust GDP growth (almost 4.5% on average), as well as managing inflation and privatization of banks. The result was that banks provided new products and loans of the private sector grew during the period of almost 6% growth. The sustained decline in real lending rates suggests that demand for credit is still catching up with ample supply. While nominal rates have stabilized in recent months, both short- and long-term real lending rates fell in 2003. (IMF, 2004) In 2011, Romania was located in the middle of the transformation process. The crisis has stopped many reforms and the economy fell into a difficult situation. Limited access to finance resident investment needed to maintain and restore existing capital. The capital thus became temporarily very expensive. The economy, however, quickly returned to their original plan, banks were sufficiently capitalized and investment is gradually restored. (IMF RO, 2012)

In Slovakia, the costs of capital were changed most significantly in 2002, 2007 and 2011. While changes in 2002 we see as a result of positive economic and political changes in the country, changes in 2006-2007 are associated with easing of fiscal and monetary policy in the country as well as with onset of the crisis. We admit the possibility that the market might react to the imbalances on the markets already at that time. A strong decline in prices of capital in 2011 was clearly associated with a second wave of the crisis. Our results are somewhat consistent with the conclusions reached by Haluska, (2012) Poland's economy has benefited in times of crisis of that country's policy since 2008 has been built on a relatively large government investment.



**Figure 3.7 Rental Price of Capital in the Benelux and the Baltic countries in period 2000 - 2013**

The government also did not accept the situation that the household consumption and lending policies out of hand. Due to the fact country entered the crisis as an economically highly resistant country in which the investment has not been significantly compromised. The persistence of the crisis was reflected in the Polish economy as a strong external factor (economic crisis in partner countries, problems of parent banks, ...), which in 2011-2012 led to a reduction in capital availability and economic development has slowed. (IMF PO, 2012)

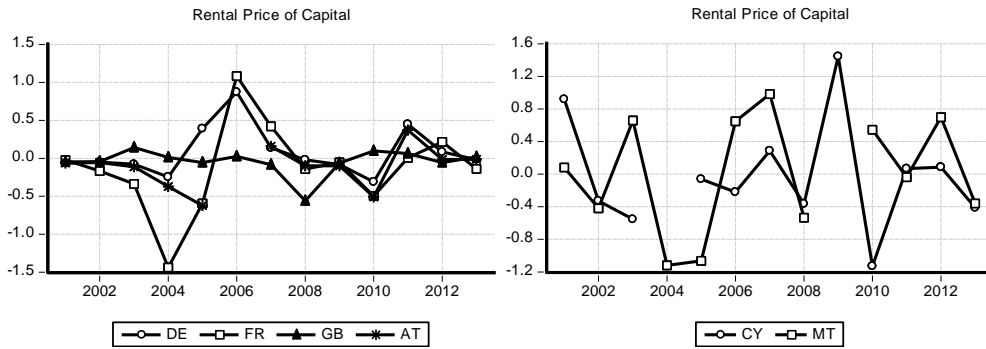


**Figure 3.8 Rental Price of Capital in the Balkan and V4 countries in period 2000 - 2013**

Development in both countries is greatly influenced by the fact that they are small economies. A significant role in their development has played a particularly entry into the EU in 2004. In order to meet the accession criteria was a significant release in various policies, enabling the economy to boot. Available capital flowing from abroad has enabled significant investments. This led to rapid economic growth in both countries. Unstable oil price developments (2004 - 2006), this economic growth, however, slowed down considerably. The openness of economies and their dependence on other countries, causing sudden changes in the rental price of capital, but is an expression of the instability of the economic environment. (IMF MT, 2004)

The Danish economy faced a fall in 2001 and it lasted until 2003-2004, when there was a reinvigoration of the economy. However, the size of the slowdown, both in terms of activity and unemployment, was contained by the low-interest rate environment and the automatic fiscal stabilizers that helped to

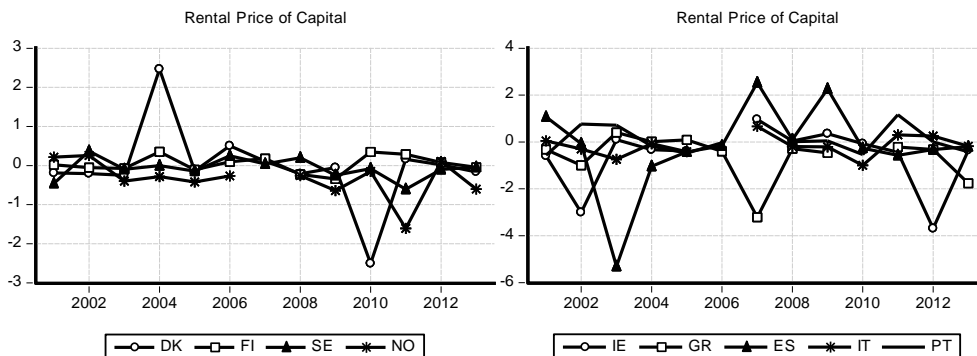
support household income and demand. With a healthy underlying fiscal position, the working of automatic stabilizers did not threaten medium-term fiscal targets. Furthermore, Denmark continued to enjoy high labour force participation rates and low unemployment. Inflation was well under control, and the external current account remained in surplus. The financial system in Denmark has weathered the slowdown well, and is in good position to support an upturn in activity.



Source: own calculation

**Figure 3.9 Rental Price of Capital in the West countries, Malta and Cyprus, 2000 - 2013**

While housing prices continue on an upward trend, the increase has been less than in some other countries and prices do not seem out of line with fundamentals. The increasing use of adjustable rate mortgages amortization and deferred seems to have contributed a small amount to the increase in prices. The mission expects that they will also add to the sensitivity of the economy to changes in short term interest rates. (IMF DK, 2004) Exactly the opposite direction is evolving situation of Denmark from 2009 - 2011. Denmark was badly hit by the double shock - a domestic housing correction and the global recession. Nearly 20% correction in house prices in 2008 triggered a banking crisis. Danske Bank, heavily dependent on wholesale funding, suddenly had to cope with the global crisis. The government, in an effort to stabilize the economy, stabilization has used aggressive methods. Domestic demand and employment were buttressed by counter-cyclical fiscal policy, automatic stabilizers, and easing monetary conditions. However, the measures taken to allow re-growth of investment in the next two years. (IMF DK, 2010)



Source: own calculation

**Figure 3.10 Rental Price of Capital in the Nordic countries and PIIGS in period 2000 - 2013**

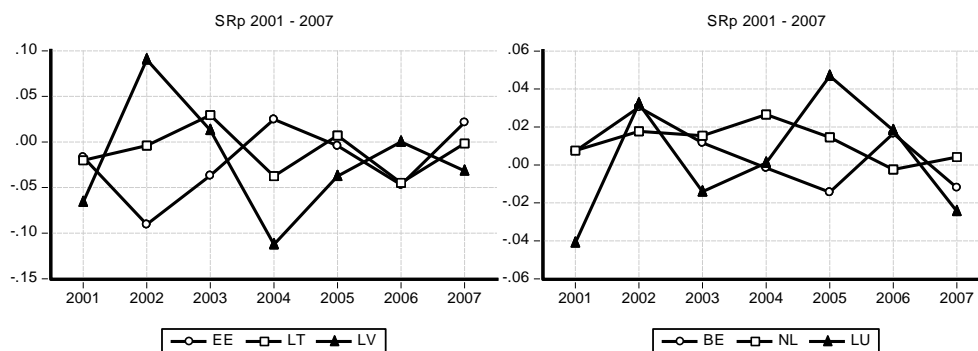
So, like other Western countries also Spain faced economic crisis at the beginning of the new century. However, the economy pulled by domestic demand and investment. Domestic demand held up well, buoyed by private consumption, public infrastructure spending, and booming construction activity. In addition, as labour market flexibility improved, employment continued expanding. Inflation and its margin over the euro area have declined since late 2002. Gains in fiscal consolidation were maintained in 2003, with the general government recording a small surplus (0.3 percent of GDP) and helping to counter very easy monetary conditions. For its part, monetary policy from Spain's perspective was clearly accommodative, with short-term real interest rates in negative territory for over two years. (IMF ES, 2003) The main problems of the Portuguese economy were three areas: the first was low productivity, high indebtedness was second and third was the impact of the global crisis on the banking sector and the economy. Government efforts to stabilize the economy also led to a strong fiscal consolidation in the years 2009 - 2011. The consolidation is focused primarily on reducing public expenditure and consumption as well as capital. Part of the measures for consolidation should be a reform of the tax system, particularly in the field of VAT. (IMF PT, 2010) Ireland had to contend with an interlocking sovereign–banking–real economy crisis. As property prices collapsed, banks' losses on real estate loans mounted and domestic demand fell sharply. We can say that Ireland's economy was depressed about the highest among Eurozone countries. Mainly in 2008. There has been a sharp increase in unemployment rates, the collapse of many firms and the destabilization of the economy as a whole (2009-2010). Nevertheless, with the help of funds from the EU experienced a gradual economic recovery and partial stabilization of the economy, but the country still belongs to the troubled economies of the EU. (IMF IE, 2012)

### **TFP calculation – period 2001 - 2007**

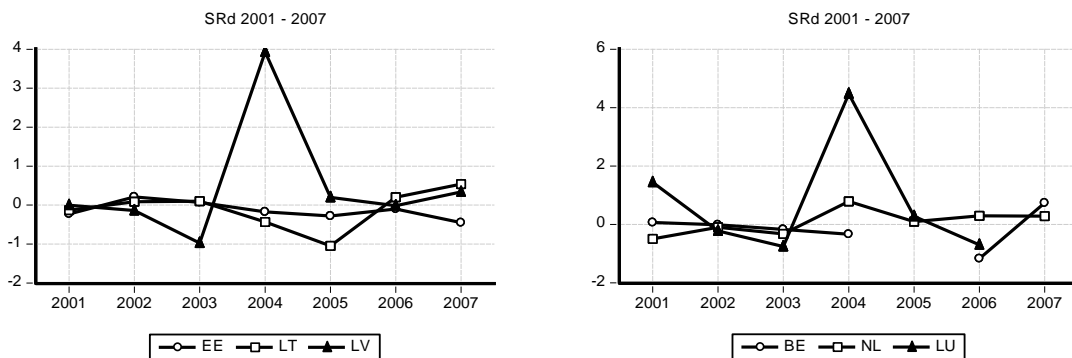
We used Equations 3.6 and 3.5 to calculate the final results. (*The results are in Table 3.3 – 3.6 and graphical results are presented in Figure 3.11 – 3.18*).

However, the calculation of TFP has brought significant differences in results. In case of the Baltic and the Benelux countries, we can speak about approximately the same trend observed for both variables in the pre-crisis period. It should be noted that the rate of change is significantly greater in the case of dual TFP as in the primal TFP. It means that there was a change (the positive and negative) of factors market price and it could affect the overall economic growth in the country.

In the case of the Baltic countries was the most significant year in terms of both indicators in 2004.





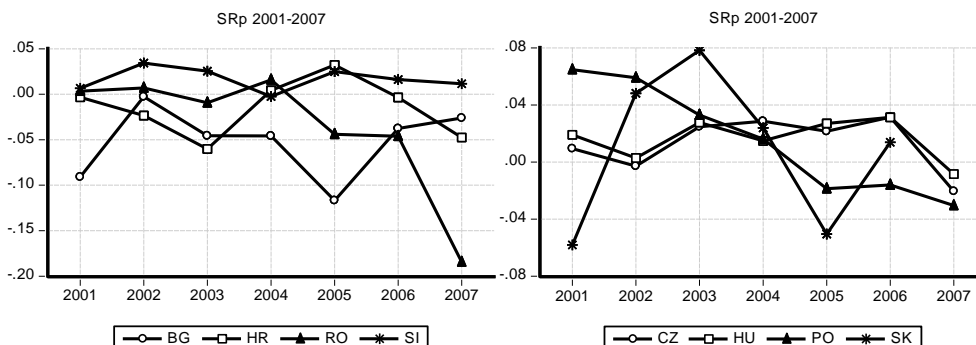


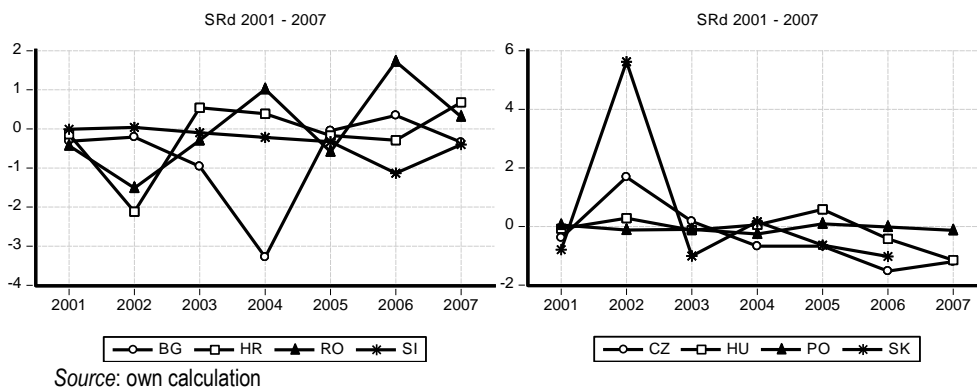
Source: own calculation

**Figure 3.11 Primal and Dual Solow Residual in the Benelux and the Baltic countries in period 2001 - 2007**

The main reason we consider the fact that this year approached these countries to the EU, which resulted in efforts to meet the accession criteria. On the other hand, in this year there was a significant increase in energy prices, which also signed the overall evolution of prices in the market and was reflected mainly in the prices of capital. It's visible in both residues. In the case of the Benelux countries, most significantly stood out Luxembourg which responded to the changing energy prices and wages. Both methods of calculation have pointed out, even though in the primal residues year delay in comparison to the dual. It is evident that the dual residue, as reflected in the market price reflects the change earlier than primal residuum. On the other hand, it may be a very short-term change that represents a momentary blip of the market.

We note that the use of a dual calculation of TFP in the Balkan countries bring about the same results. Interesting are the two countries. The first is Bulgaria. It repeated the situation that we have described already in Luxembourg. While according to the method utilizing the prices of production factors, the contribution of TFP to produce significantly changed already in 2004, according to the method of national accounts it happened until next year. As far as Romania the perception of time changes from the perspective of both procedures are identical, but the difference in value occurs. While the market assesses the contribution of TFP to produce already as negative, according to national accounts, the contribution of TFP decreased, but still only around zero. The difference is not significant, but it can be already seen as a certain deviation in the view. For V4 stands out Slovak Republic (irrespective of the method of calculation).

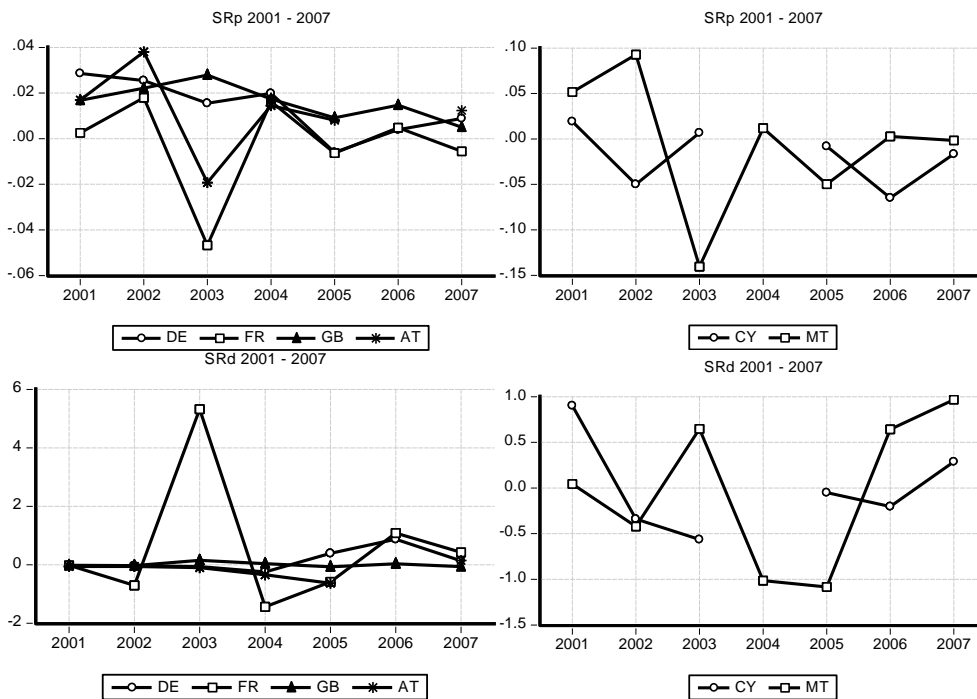




Source: own calculation

**Figure 3.12 Primal and Dual Solow Residual in the Balkan and the V4 countries in period 2001 - 2007**

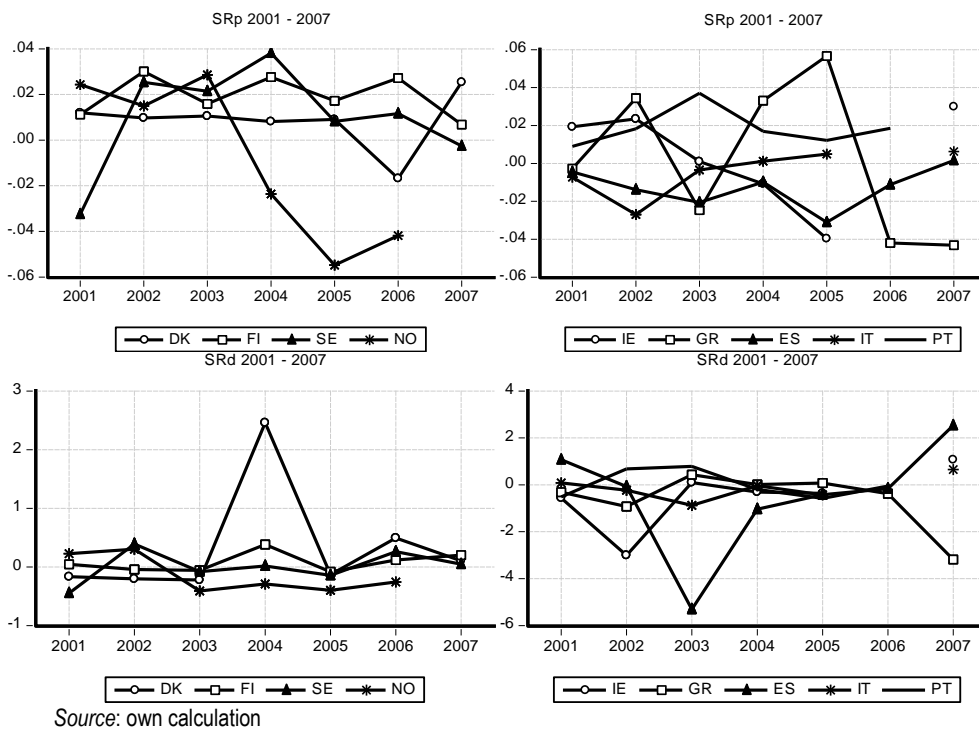
In both cases we are talking mainly about the stage of the years 2001 - 2003, respectively. 2005. This phase is associated with the completion of the transition process of the country and its efforts to meet the accession criteria for EU accession. The development, which is reflected primarily in calculating SRd is also associated with the economic crisis in Western countries and unstable price of oil on international markets, which significantly influenced the price of all other goods and services, particularly the capital.



Source: own calculation

**Figure 3.13 Primal and Dual Solow Residual in the West countries, Malta and Cyprus in period 2001 - 2007**

For the countries of the West, it might seem that no matter what method of calculation we use, the result is about the same. The only exception is France, in its reform period, about which we spoke earlier. For the countries of the West, it might seem that no matter what method of calculation we use, the result is about the same. The only exception is France, in its reform period, about which we spoke earlier. The situation with which we have met already with previous clusters are repeated here. The transformation process affected the results in the case of Malta and Cyprus. The result is inconsistency results. Since 2005, it is immaterial which method was used. The value of TFP share is moving very close to zero. The exception is the year 2007 for Malta. Here, once again demonstrating the mismatch of the data. While under SR there was a positive growth in the share of TFP in the production, according to the system of national accounts continued to be reported value close to zero. This discrepancy attributed to the fact that it was a turning point between rapid economic growth and the onset of the global crisis, which significantly affected Malta.



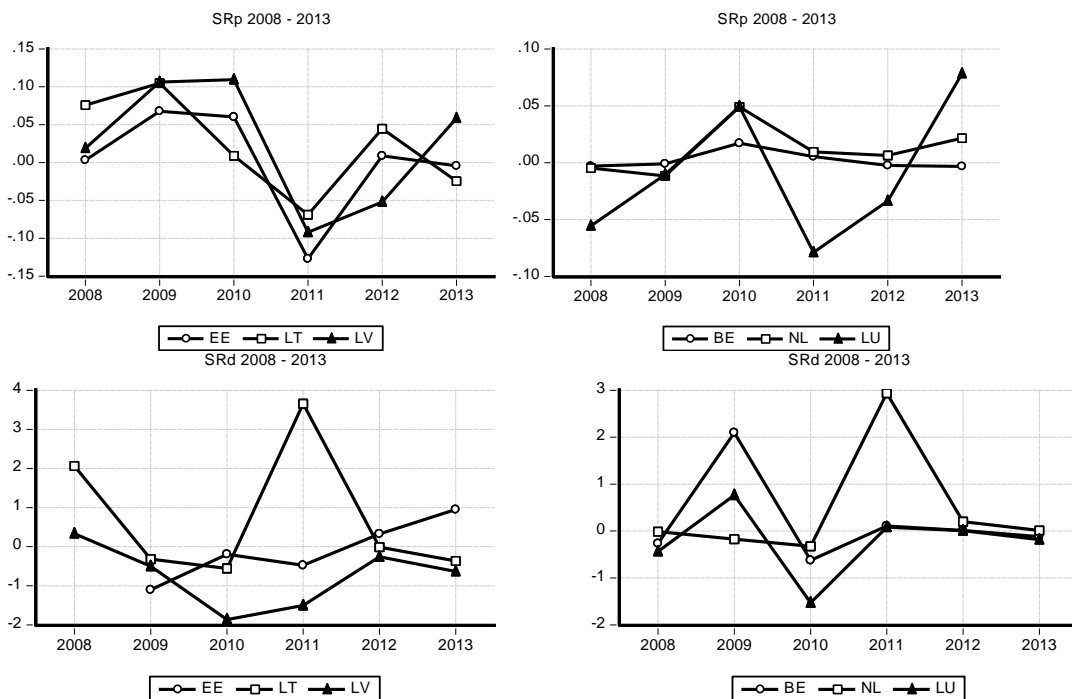
Source: own calculation  
**Figure 3.14 Primal and Dual Solow Residual in the Nordic and the PIIGS countries in period 2001 - 2007**

When comparing results within a grouping of the Nordic countries, we note that deviations are most pronounced here. The results are significantly different. This applies particularly to countries Denmark and Norway. Prices of production factors do not reflect sudden changes in the economy of Norway took place in 2002 (Tight monetary conditions, the strong currency, and sluggish world economic activity caused declines in mainland GDP in Norway in late 2002 and early 2003, leading to negative output gaps and Inflationary pressure reduced. (NO IMF, 2005)). In the system of national accounts, however, these significant changes took effect. The development, which is observed in Denmark and

Spain, we have described earlier. For countries PIIGS are differences in the results rather temporal nature.

**TFP calculation – period 2008 - 2013**

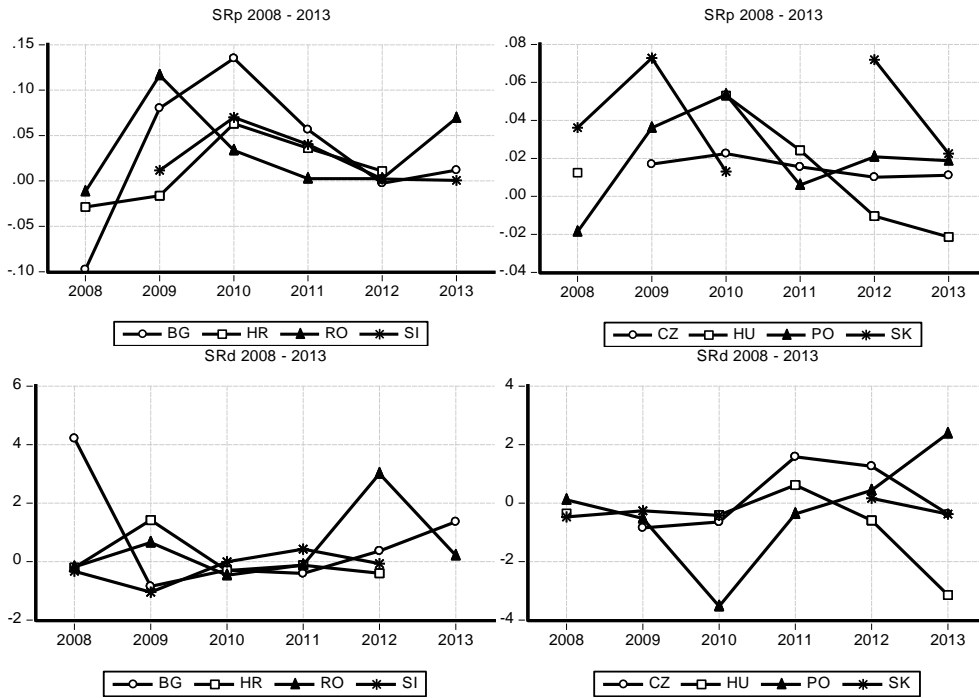
When analyzing the period since the crisis, it is possible to follow the development phase of the economic downturn in 2008, followed by a gradual recovery and improvement in the situation around the level before the crisis. For most of the countries surveyed year 2011 was again year of downturn and worsening indicators. Subsequently, the reinvigoration of the economy lasts until now.



Source: own calculation

**Figure 3.15 Primal and Dual Solow Residual in the Benelux and the Baltic countries in period 2008 - 2013**

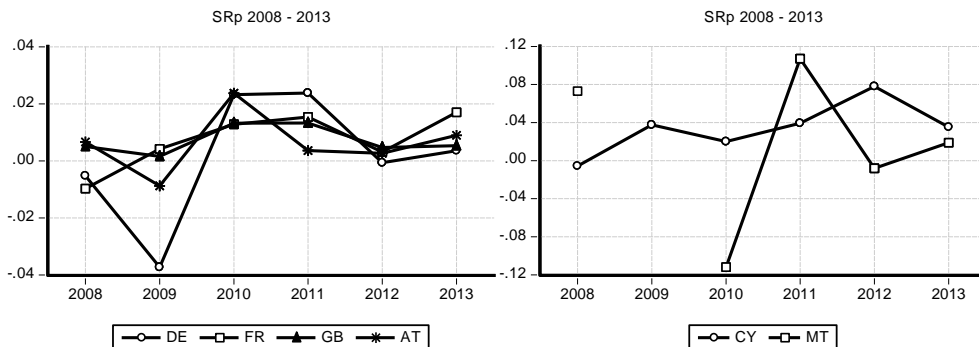
When primal residual points to overall adverse economic developments so dual it refers to volatile price developments in the markets. The situation which was reflected in a sharp one-off deviation in prices in 2011 Latvia was also associated to the markets reacting to early elections, which were in the country at that time made. For the Netherlands it was the response to adverse developments in fuel prices on the markets.

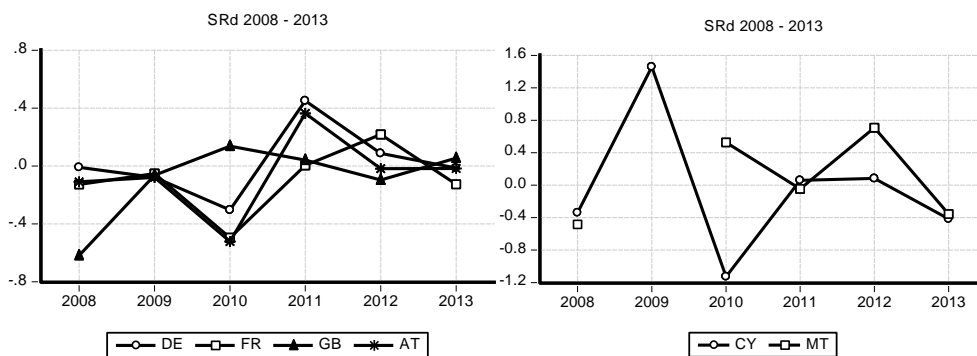


Source: own calculation

**Figure 3.16 Primal and Dual Solow Residual in the Balkan and the V4 countries in period 2008 - 2013**

In times of crisis, we especially take note of the two countries. Bulgaria and Poland. In both cases, the result is that the calculated results are contradictory to each other. According to the "price approach" TFP share significantly decreased in the crisis period. Since 2010, the share of TFP shows a negative value very close to zero until the end of the reporting period. According to the methodology of national accounts, however, the proportion increased, reaching low levels, but until the end of the reporting period does not fall below zero. The same trend can also be observed in the case of Poland.





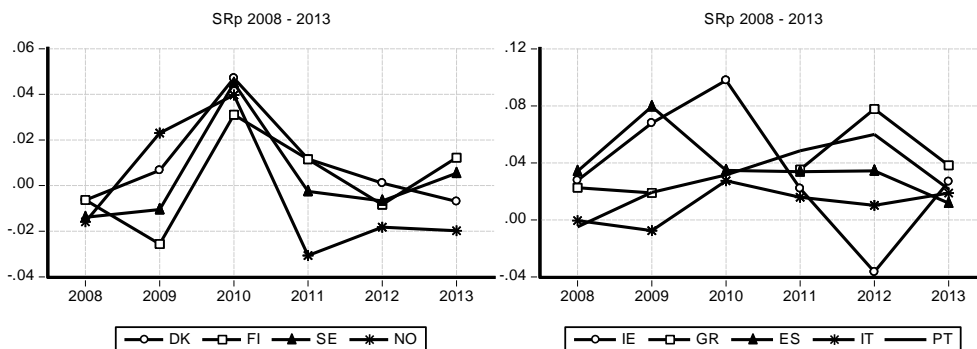
Source: own calculation

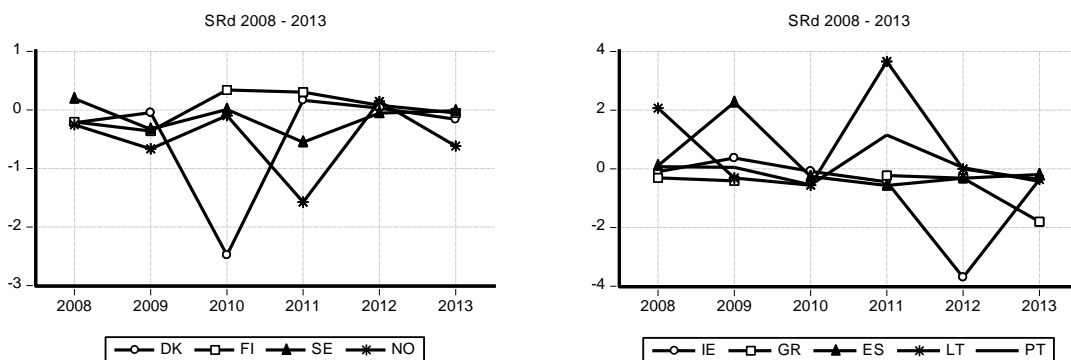
**Figure 3.17 Primal and Dual Solow Residual in the West countries, Malta and Cyprus in period 2008 - 2013**

The situation was repeated, but the perception is adjusted since 2010 and until the end of the reporting period, both methodology give a positive value of the share of TFP. The difference is in the size of that value. In our view, this difference is the result of which values are entered into calculation. While in the case of market prices is a short-term, spot prices of individual inputs when the national accounts are talking about time-shifting and engagement of the factors with a medium to long term prediction. In the case of both countries it showed that after the markets calmed down from the shock in the years 2008 - 2009 both methodologies culminated in the a similar result.

The crisis and its aftermath has been outstanding in the calculation of compliance with both methods, particularly for Western countries. Trend was in both methods, maintaining the same, the results varied in value. Similarly, the situation has evolved even in the calculations relating to Cyprus. The calculations for Malta, however, contradict the results of the methods used. We are attributing it to the instability of the economy that can't optimally estimate the future development of the variables.

The difference can be seen at a glance. Especially in the case of Denmark. Under the system of national accounts is the proportion the TFP in 2010, booming and positive. The value is very close to zero. According to the prices of production factors it is exactly the opposite situation. The value is rapidly declining and quite significantly is distant from the zero level. Such a difference in the results speaks about the problems with the perception of each setting in the economy and is a signal for possible hidden problems in reporting. On the other hand in the case of PIIGS countries, there are differences in value rather than in the description of the development trend.





Source: own calculation

**Figure 3.18 Primal and Dual Solow Residual in the Nordic and PIIGS countries in period 2008 - 2013**

In term of numbers, the calculation of primal and dual Solow residual revealed that the perception of prices on the market factors and the estimates in the national accounts established by the Statistical Office differ significantly.

In all Baltic countries, the volume of invested capital has the largest share of the creation of the product. The share of TFP in production is on the second place. In the case of Latvia is this proportion up to third, respectively we can say that there is no impact.

**Table 3.3 Results of primal and dual Solow residual (growth rates) – the Baltic and Benelux countries**

	Capital	Labour	Output	SRp	SRd	Capital	Labour	Output	SRp	SRd
	<b>Estonia</b>					<b>Belgium</b>				
<b>Annual</b>	0.094	0.002	0.046	(-0.012)	(-0.121)	0.01	0.006	0.013	0.004	0.026
<b>Annual weighted</b>	0.057	0.001	0.046	(-0.012)		0.004	0.005	0.013	0.004	
<b>Contribution</b>	1.235	0.024	1.00	(-0.258)		0.315	0.393	1.00	0.292	
	<b>Latvia</b>					<b>Netherlands</b>				
<b>Annual</b>	0.064	(-0.009)	0.042	0.0003	0.291	(-0.004)	(-0.001)	0.01	0.012	0.244
<b>Annual weighted</b>	0.045	(-0.003)	0.042	0.0003		(-0.001)	(-0.001)	0.01	0.012	
<b>Contribution</b>	1.066	(-0.073)	1.00	0.008		(-0.074)	(-0.073)	1.00	1.147	
	<b>Lithuania</b>					<b>Luxembourg</b>				
<b>Annual</b>	0.071	(-0.004)	0.046	0.005	(-0.085)	0.02	0.018	0.021	(-0.001)	0.266
<b>Annual weighted</b>	0.042	(-0.002)	0.046	0.005		0.014	0.008	0.021	(-0.001)	
<b>Contribution</b>	0.928	(-0.043)	1.00	0.116		0.659	0.37	1.00	(-0.029)	

Source: own calculations

Completely different is the situation in the Benelux. For Belgium, all three variables are involved in the production by almost equal share. For the Netherlands, the share of TFP in the production is almost 90% and in Luxembourg the share of TFP is negligible. The main share has a volume of invested capital. In terms of values calculated by both methods there was consensus in case of Estonia, Latvia, Belgium and the Netherlands. A contrary result was in Luxemburg and Lithuania. The results in all cases differed significantly in value.

When comparing the values for the whole period, we can state the following conclusions: in the case of the Balkan countries, the TFP contributes to the greatest extent in the production of just one country,

in Slovenia. In all other it is mainly the amount of capital entering into production. In the case of V4 countries, we did not find this trend. The share of capital and TFP in the total production is roughly the same in three countries (Slovakia, Hungary, Czech Republic) exception is Hungary. In this country the share of TFP prevails over invested capital. In terms of TFP calculated value it is true that in the two Balkan countries both methods led to the same perception of the evolution of the situation and in two cases it was the opposite perception.

**Table 3.4 Results of primal and dual Solow residual (growth rates) – the Balkan and V4 countries**

	Capital	Labour	Output	SRp	SRd	Capital	Labour	Output	SRp	SRd
	<b>Bulgaria</b>					<b>Czech Republic</b>				
<b>Annual</b>	0.07	0.002	0.037	(-0.014)	(-0.033)	0.021	(-0.003)	0.025	0.014	(-0.137)
<b>Annual weighted</b>	0.050	0.001	0.037	(-0.014)		0.012	(-0.001)	0.025	0.014	
<b>Contribution</b>	1.353	0.03	1.00	(-0.378)		0.497	(-0.054)	1.00	0.559	
	<b>Croatia</b>					<b>Hungary</b>				
<b>Annual</b>	0.037	0.004	0.019	(-0.003)	(-0.062)	0.018	0.001	0.024	0.014	(-0.396)
<b>Annual weighted</b>	0.019	0.003	0.019	(-0.003)		0.001	0.001	0.024	0.014	
<b>Contribution</b>	0.994	0.167	1.00	(-0.161)		0.394	0.022	1.00	0.588	
	<b>Romania</b>					<b>Poland</b>				
<b>Annual</b>	0.078	(-0.015)	0.038	(-0.003)	0.254	0.034	0.006	0.036	0.017	(-0.154)
<b>Annual weighted</b>	0.048	(-0.006)	0.038	(-0.003)		0.016	0.003	0.036	0.017	
<b>Contribution</b>	1.259	(-0.164)	1.00	(-0.092)		0.436	0.09	1.00	0.477	
	<b>Slovenia</b>					<b>Slovak Republic</b>				
<b>Annual</b>	(-0.007)	(-0.004)	0.017	0.02	(-0.266)	0.022	(-0.002)	0.043	0.025	0.085
<b>Annual weighted</b>	(-0.001)	(-0.002)	0.017	0.02		0.018	(-0.001)	0.043	0.025	
<b>Contribution</b>	(-0.063)	(-0.087)	1.00	1.154		0.422	(-0.012)	1.00	0.582	

Source: own calculations

At the same time, however, we have received significantly different calculated values. In the case of the V4 countries we have only one country where the benefit was rated about the same regardless of the approach (Slovakia), in other countries the differences were not only in a positive and a negative contribution, but the differences were in size of the value, too. It is interesting, however, that the value of the indicator 'SRd' is substantially identical for countries HU, CZ and PO and only the value of SK is different.

France is the only country in which the proportion of labour is the greatest. It confirms our previous statement. The second is the capital and the share of the TFP is in third place. Interestingly, in the remaining three countries, the proportion the TFP is in the first place followed by share of labour. In third place is the capital. It should be noted that the difference between the share of labour and capital is not significant. Similarly, and so on for Malta and Cyprus. In the case of Malta, the order is: Capital, Labour and the TFP. In the case of Cyprus, is the order: the TFP, Labour and Capital. At the half of the countries of the group we can talk of conformity in the trend. For Malta, we can say that no matter which methodology we use in the calculation. The values are almost the same.



**Table 3.5 Results of primal and dual Solow residual (growth rates) – the West counties, Malta and Cyprus**

	Capital	Labour	Output	SRp	SRd	Capital	Labour	Output	SRp	SRd
	<b>Germany</b>					<b>Cyprus</b>				
<b>Annual</b>	0.004	0.002	0.0106	0.008	0.087	(-0.004)	0.013	0.015	0.008	(-0.021)
<b>Annual weighted</b>	0.001	0.002	0.011	0.008		(-0.001)	0.008	0.015	0.008	
<b>Contribution</b>	0.092	0.156	1.00	0.755		(-0.067)	0.534	1.00	0.534	
	<b>France</b>					<b>Malta</b>				
<b>Annual</b>	0.011	0.009	0.012	0.002	0.268	0.03	0.012	0.025	0.004	0.011
<b>Annual weighted</b>	0.004	0.006	0.012	0.002		0.016	0.006	0.025	0.004	
<b>Contribution</b>	0.325	0.509	1.00	0.17		0.616	0.233	1.00	0.153	
	<b>Great Britain</b>									
<b>Annual</b>	0.007	0.004	0.017	0.012	(-0.04)					
<b>Annual weighted</b>	0.001	0.003	0.017	0.012						
<b>Contribution</b>	0.084	0.192	1.00	0.726						
	<b>Austria</b>									
<b>Annual</b>	0.004	0.004	0.013	0.009	(-0.12)					
<b>Annual weighted</b>	0.001	0.003	0.013	0.009						
<b>Contribution</b>	0.103	0.222	1.00	0.68						

Source: own calculations

As can be seen, the TFP has the greatest impact on production in the case of Denmark and Finland. In the case of Norway, production relies most on invested capital and in the case of Sweden is the proportion the same for all three variables. The biggest difference in the calculation of the TFP is in the case of Norwegian. We could have seen it in the graphic processing. Finland is a country where it does not matter which method to use, because the result is about the same. For PIIGS countries such country is Portugal. In all other cases there will be no conformity in the calculation. This may reflect the fact that market developments in prices of factors of production in these countries is very distinctive and internal adjustment of the economy is not sufficiently stable and clear.

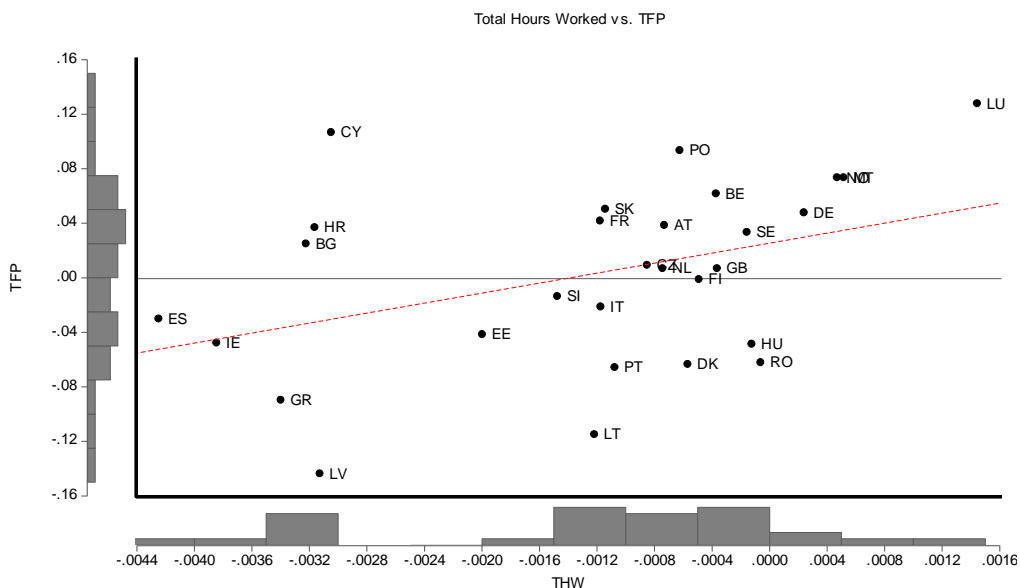
**Table 3.6 Results of primal and dual Solow residual (growth rates) – the Nordic and PIIGS countries**

	Capital	Labour	Output	SRp	SRd	Capital	Labour	Output	SRp	SRd
	<b>Denmark</b>					<b>Ireland</b>				
<b>Annual</b>	0.002	(-0.007)	0.006	0.009	(-0.029)	0.006	0.001	0.027	0.019	(-0.617)
<b>Annual weighted</b>	0.002	(-0.005)	0.006	0.009		0.005	0.003	0.027	0.019	
<b>Contribution</b>	0.359	(-0.902)	1.002	1.545		0.183	0.110	1.003	0.709	
	<b>Finland</b>					<b>Spain</b>				
<b>Annual</b>	0.004	(-0.001)	0.014	0.012	0.051	(-0.001)	0.004	0.013	0.011	(-0.410)
<b>Annual weighted</b>	0.003	(-0.001)	0.014	0.012		(-0.0005)	0.003	0.013	0.011	
<b>Contribution</b>	0.221	(-0.068)	1.005	0.852		(-0.037)	0.227	1.000	0.811	
	<b>Sweden</b>					<b>Italy</b>				
<b>Annual</b>	0.023	0.009	0.019	0.007	(-0.055)	(-0.016)	(-0.001)	(-0.002)	0.003	(-0.169)
<b>Annual weighted</b>	0.006	0.007	0.019	0.007		(-0.005)	(-0.001)	(-0.002)	0.003	
<b>Contribution</b>	0.298	0.362	1.003	0.343		2.14	0.348	1.003	(-1.485)	
	<b>Norway</b>					<b>Greece</b>				
<b>Annual</b>	0.033	0.003	0.015	(-0.006)	(-0.324)	(-0.023)	(-0.010)	0.003	0.019	(-0.614)
<b>Annual weighted</b>	0.019	0.002	0.015	(-0.006)		(-0.010)	(-0.005)	0.003	0.019	
<b>Contribution</b>	1.312	0.116	1.004	(-0.423)		(-2.974)	(-1.502)	1.002	5.478	
						<b>Portugal</b>				
						(-0.044)	(-0.011)	(-0.002)	0.024	0.04
						(-0.019)	(-0.006)	(-0.002)	0.024	
						11.9	3.803	1.002	(-14.702)	

Source: own calculations

### The relationship between TFP and Total hours Worked

One of the biggest problems that brought about the crisis is increasing unemployment. Some countries have had to deal with it even before the crisis, for others it became a problem in 2008. In any case, unemployment affects not only the economic growth of the country, but also affects the production itself. During the calculations we noticed that there was a significant change in the number of hours worked in different economies. It was one of the consequences of changes in employment. We were interested how much of the development in the number of hours worked also affects the TFP itself. In the calculation we used the TFP calculated using the national accounts.



Source: own calculation

**Figure 3.19 TFP vs. Total Hours Worked (growth differentials)**

Figure 3.19 illustrates the relationship between the TFP trend growth rate differentials and total hours worked. In the calculation we used the TFP growth rates differentials calculated as average the TFP trend growth rate in 2008 - 2013 minus average the TFP trend growth rate in 2002 - 2007 and total hours worked calculated as the average of log total hours worked in 2008 - 2013 minus the average log total hours worked in 2002 - 2007. The outcome is slightly positive and significant curves and slight coefficient  $R^2 = 0.39$  suggest that the TFP slowed down more during the crisis in those EU countries in which hours worked fell more. In so far as hours worked and losses are in significant part due to firms' default, we can't claim that these are the less efficient firms that are more likely to default during the crisis and that the cleansing process contributes to a more benign dynamics of the TFP trend during the crisis.

### Conclusion

The economic crisis has highlighted the problems that many countries have long ignored, or did not even know about them. It was also a demonstration of our analysis in which we wanted to prove or disprove the theoretical argument that there should be, at least at lower frequencies, a positive correlation between real rates and economic growth across different countries. This theory has not

been confirmed in the case of the current EU countries. Conditions that economists knew and which governed until 2007 - 2008, no longer exists. The economies must deal with old problems in new ways. But the question remains, what is the new way.

The problem that has always been the yardstick for assessing economic performance, is to achieve economic growth. The subject of our research was to analyse the way in which the 29 European Union countries achieved economic growth over the last 13 years.

According to our results, more than a one third of countries meet its economic growth (but also decrease) mainly through capital accumulation, resp. the accumulation of labour. It was therefore a broadly achieving growth, which requires the creation of new factors. They do not use this method only economically less powerful countries such as Bulgaria, Croatia, Romania, but also countries such as Norway and Estonia who are currently among the highest ranked country economically. The question then is the sustainability of such a system in the long run. In two cases, the share of labour, capital and the TFP on total product was for all three parameters the same. These are the countries Sweden and Belgium. In other cases were used primarily the TFP to promote economic growth, respectively, it was a combination of approximately the same share of the TFP and capital. In one case it was the primary role of labour and in was it the case of France. In our opinion, which is based on the analysis of developments in best rated countries in Europe, it is to achieve long-term economic growth and efficiency issue not question of cumulation of resources. It shows the development in countries such as Finland, Denmark, Austria, Germany and others.

Analysis of calculation "the TFP" we made in a dual manner. We used the Solow residuals. According to our analysis we found also strong differences in results counted by dual approach. Diversity of outcomes has not been reflected on whether the country belonged to the new or old members of the EU, or whether meet other rules. Despite the different results we believe that dual approach is a useful alternative for TFP measuring

European countries has long been dreaming of being part of the so-called perfect Optimum Currency Area. Common rules will serve to the benefit of all and the positive results achieved will be multiplied thanks to the experience of all countries. The crisis, which consequences are still not averted, fully proved that neither common rules that are already in practice have not helped to protect the economies from a severe economic downturn, enormous rise in unemployment, and excessive vibration of the financial system. Icon in the form of economic growth is suddenly very difficult to achieve. On the other hand, it is one of the criteria for accession to EMU and currently protects EMU countries before the influx of other countries. As Krugman says it's time for us instead of living only by positive figures tried to live in the negative. Let's look at the essence of the problem areas and let us through an analysis of their individual parts to find a way to solve a whole.

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## Chapter 4

# Decomposing Euro Area Sovereign Debt Yields into Inflation Expectations and Expected Real Interest Rates

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4.1 Introduction

4.2 Relationship between Interest Rates and Inflation

4.3 Interest Rates Determination in Empirical Literature

4.4 Econometric Model

4.5 Data and Results

Conclusion

References



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## Decomposing Euro Area Sovereign Debt Yields into Inflation Expectations and Expected Real Interest Rates

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### 4.1 Introduction

Risks of deflationary spiral in the Euro Area together with low nominal interest rates policy conducted by European Central Bank (ECB) are drawing attention of increasing number of empirical studies. Changes in the relative importance of inflation expectations and expected real interest rates in determining nominal interest rates are generally induced implications of the zero inflation environment (Labadie, 1994; Evans, 1998; Den Haan, 1995). Moreover, deflationary pressures and tightened financial conditions provided contradictory effects on the determination of long-term interest rates and even emphasized changed market fundamentals during the crisis period (Christensen, Lopez and Rudebusch, 2008).

Recent macroeconomic development in the Euro Area, characterized by persisting deflationary pressures, induces fundamentally different background for the economic policy framework and related institutions experimenting with a convenient policy mix to provide growth incentives and improve growth perspectives in the Euro Area. While governments seek optimum compromise between growth stimulation and consolidation efforts that would provide crucial incentives to boost domestic demand while maintaining conditions for fiscal sustainability of public budgets, European central bank (ECB) conducts another wave of quantitative easing aiming an increase in the rate of inflation (Krishnamurthy and Vissing-Jorgensen, 2011). While increased inflation would reduce persisting risks of deflationary spiral, it should also stimulate an increase in the nominal interest rates from near zero levels nowadays and improve the traditional signaling function of the price of money (Gürkaynak, Sack and Wright, 2007). Moreover, higher nominal interest rates should also help to boost real interest rates that are nowadays occasionally falling to unprecedentedly negative levels (Campbell and Shiller, 1991; Bindseil and Winkler, 2012).

Nominal interest rates in the Euro Area member countries followed generally criticized decreasing and mutually converging trend since the beginning of the Euro Area establishment (Acharya and Steffen, 2015). Introduction of single currency on a very heterogeneous group of countries induced undesirable convergence especially in the long-term interest rates on the government bonds. Reduction of differences among interest rates of the Euro Area member countries resulted from decreased expected risk premium recognized by financial markets being supported by (un)conventional



operations of ECB that many economists criticized and indicated as one of the key design failures of the Euro Area (De Grauwe, 2013).

In the paper we examine influence of inflation expectations and expected real interest rates on the long-term nominal interest rates of government bonds with 10-year maturity in the Euro Area member countries by employing SVAR (structural vector autoregression) methodology. We also decompose nominal interest rates on government bonds into inflation expectations and expected real interest rates components. Our results indicate that both components significantly determined main trends in the development of interest rates on government bonds since 2000. At the same time, the role of both types of shocks in determining sovereign debt yields differs when comparing our results for periphery countries with those of core of the Euro Area.

#### **4.2. Relationship between Interest Rates and Inflation**

Questions associated with fundamental determinants of nominal interest rates are widely discussed in the recent empirical literature. Considering already mentioned deflationary pressures and near zero levels monetary policy conducted by ECB there exist a large number of research studies examining a relative importance of inflation expectations and expected real interest rates in the nominal interest rates determination (Vayanos and Vila, 2009; Christensen, Lopez and Rudebusch, 2012; Haubrich, Pennacchi and Ritchken, 2012). Key characteristics and implications resulted from the relationship between inflation and interest rates provide crucial information for monetary authorities.

Inflation and interest rates are mutually interconnected. Traditional linkage between inflation and interest rates refers the causal (bi-directional) relationship well documented by both theoretical and empirical literature that operates via transmission mechanism. As a result, changes in inflation induce adjustments in interest rates (Crowder and Hoffman, 1996; Rudebusch, 2002). During the periods of high inflation high interest rates may result from the public's anticipation of continued high inflation (Taylor, 1982). Decrease in inflation followed by discretionary policy changes or market-driven shocks is generally followed by a drop in interest rates.

Causal linkage between inflation and interest rates is regularly examined by central banks that preserve price stability and purchasing power of domestic currency by increasing interest rates during the periods of higher inflation following particular monetary policy rule (Fendel, 2009). On the other hand, inflation pressures are not necessarily associated with imbalanced demand driven economic growth where increased interest rates would prevent the economy from overheating. Increased inflation accompanies not just highly performing economies but may be also fueled by internal distortions or external shocks that the economies may experience even during the recession (Emiris, 2006). Deflationary environment provides quite specific fundamental background for the interest rates determination (Peersman, 2011). Near zero levels of nominal interest rates combined with increasing real interest rates induced by decreasing price level reduces maneuverability within existing operational framework of monetary authorities. As a result, central banks tend to employ unconventional instruments to accelerate inflation (Borio and Disyatat, 2009). Low interest rate environment clearly increases the role of management of inflation expectations by central bank (Arouba, 2014). Moreover, monetary economists emphasize the containment of long-term inflation expectations is the most important objective in conducting monetary policy (Tobias and Wu, 2010).

Nominal interest rates are not necessarily determined just by the rate of inflation (Booth and Ciner, 2000). It is due fact that nominal interest rates consists of two components - real value of money and inflation premium. As a result, changes in nominal interest rates may be caused not only by forces determining the rate of inflation, but also by a number of variables affecting real interest rates (expectations of agents included) (Eijffinger, Schaling and Verhagen, 2000; Cochrane and Piazzesi, 2005). Nominal price of money is determined by a wide variety of determinants, that is why it may not seem to be clear, whether the volatility of nominal interest rates is caused by changes in inflation expectations or expected real interest rates (Kim and Orphanides, 2012; Wood, 1983). Correct identification of the sources of the volatility of nominal interest rates is a crucial part of successful monetary policy decision-making (McGough, Rudebusch and Williams, 2005). For example, an increase in the nominal interest rates caused by higher inflation expectations of agents represents a correct signal for monetary policy tightening. Corresponding increase in the rate of interest seems to be well suited decision for reduction of excessive inflation pressures. On the other hand, an increase in the nominal interest rates caused by higher expected real interest rates is usually associated with different monetary policy consequences.

### **4.3. Interest Rates Determination in Empirical Literature**

Gerlach-Kristen and Rudolf (2010) compared three monetary operating procedures by examining optimal policy reaction functions, impulse responses and simulated volatilities of inflation, the output gap and the yield curve to examine volatility of interest rates and other main macroeconomic variables. Their results suggest that volatilities in key variables under different monetary-policy framework (commitment vs. discretion) are strongly dependent on general preconditions (normal times vs. financial distress). Eiffinger, Schaling and Vehagen (2000) analyzed the relevancy of the term structure of interest rates for the transmission process of the monetary policy. Authors identified and empirically tested the long-term interest rates as a crucial indicator for monetary policy discretionary changes. Emiris (2006) decomposed long-term interest rates into term premium and inflation premium to investigate the sources of average premium on 10-year government bonds variability. Author also examined responses of the term premia to the different shocks. Fendel (2009) intended to support the empirical findings on the information content of the term structure of interest rates for monetary policy. Kulish (2007) analyzed two roles (first, as a key determinant in the reaction function of the monetary authority; second, as instruments of policies) that long-term nominal interest rates can play in the conduct of the monetary policy. McGough, Rudebusch and Williams (2005) investigated the problem of short-term versus long-term interest rates suitability to operate as a monetary policy instrument. Authors highlight and discuss a crucial role of inflation expectations and real interest rate for selecting the most appropriate interest rate as a key pillar of a monetary policy framework. Michaud and Upper (2008) identified the origins of interbank interest rates volatility by examining the possible determinants of the risk premium contained in the money market interest rates. Rudebusch, Sack and Swanson (2007) examined the origins and implications of changes in bond term premiums for economic activity to analyze the stability of long-term interest rates. Authors also analyzed empirical relationship between short-term and long-term interest rates.

St-Amant (St-Amant, 1996) employed bivariate SVAR model to analyze the impact of expected inflation and ex-ante real interest rates on the nominal interest rates volatility of government bonds

with maturity one year and ten years in the U.S.A. Following author's results we may conclude that inflation expectations seems to prevailing determinant of nominal interest rate volatility since the beginning of 1970s till the middle of 1980s, whereas shifts in expected real interest rates substantially contributed to the nominal interest rates volatility during the first half of the 1990s. Deacon a Derry (Deacon a Derry, 1994) provided a variety of methods for identification of market interest rate and inflation premium from the interest rates associated with government bonds. Engsted (Engsted, 1995) implemented cointegration analysis and VAR methodology to examine properties of interest rates and inflation time series. Neely and Rapach (Neely and Rapach, 2008) analyzed time series for real interest rates employing growth equilibrium model. Authors dedicated extra effort to investigate a presence of persistence patterns especially in medium and long time period. Ragan (Ragan, 1995) analyzed time structure of nominal interest rates to estimate inflation expectations of agents. Results of his empirical investigation provided interpretation of the real interest rate volatility over time. Crowder a Hoffman (Crowder a Hoffman, 1996) analyzed mutual interconnections between inflation and interest rates. Implemented SVAR methodology helped authors to isolate permanent and temporary sources of volatility for nominal interest rates and inflation time series. Lai (Lai, 2004) examined properties of time series for real interest rates. Author investigated conditions to maintain a time series stationarity under changing length of base period. Garcia and Perron (Garcia and Perron, 1996) analyzed long-run features of time series for real interest rates in the U.S.A. Lanne (Lanne, 2002) verified a validity of Fisher effect following the results of long-run interconnections testing between inflation and nominal interest rates in the U.S.A.

#### 4.4. Econometric Model

VAR models represent dynamic systems of equations in which the current level of each variable depends on past movements of that variable and all other variables involved in the system. Residuals of vector  $\varepsilon_t$  represent unexplained movements in variables (effects of exogenous shocks hitting the model); however as complex functions of structural shocks effects they have no economic interpretation. Structural shocks can be still recovered using transformation of the true form representation into the reduced-form by imposing a number of identifying restrictions. Applied restrictions should reflect some general assumptions about the underlying structure of the economy and they are obviously derived from economic theory.

In the chapter we employ methodology introduced by Blanchard a Quah (Blanchard - Quah, 1988) who estimated bivariate model with two types of exogenous shocks. To identify structural shocks authors implemented identification scheme based on decomposing effects of the shocks into permanent and transitory components. Long-run identifying restrictions were applied on the variance-covariance matrix of reduced form VAR residuals.

Following our objective we estimate a model consisting of the vector of endogenous variables  $X_t$  and the same number of primitive (structural) shocks. Unrestricted true form of the model is represented by the following infinite moving average representation:

$$X_t = A_0\varepsilon_t + A_1\varepsilon_{t-1} + A_2\varepsilon_{t-2} + \dots = \sum_{i=0}^{\infty} A_i\varepsilon_{t-i} = \sum_{i=0}^{\infty} A_iL^i\varepsilon_t \quad (4.1)$$

or

$$\begin{bmatrix} ir_{n,t} \\ p_t \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} \varepsilon_{p^e,t} \\ \varepsilon_{ir^e,t} \end{bmatrix} \quad (4.2)$$

where  $X_t = [ir_{n,t}, p_t]$  is  $n \times 1$  vector of the endogenous macroeconomic variables ( $ir_{n,t}$  - long-term nominal interest rate,  $p_t$  - rate of inflation),  $A(L)$  is a  $n \times n$  polynomial consisting of the matrices of coefficients to be estimated in the lag operator  $L$  representing the relationship among variables on the lagged values,  $\varepsilon_t$  is  $n \times 1$  ( $\varepsilon_t = [\varepsilon_{p^e,t}, \varepsilon_{ir^e,t}]$ ) vector of identically normally distributed, serially uncorrelated and mutually orthogonal errors (white noise disturbances that represent the unexplained movements in the variables, reflecting the influence of exogenous shocks):

$$E(\varepsilon_t) = 0, \quad E(\varepsilon_t \varepsilon_t') = \Sigma_\varepsilon = I, \quad E(\varepsilon_t \varepsilon_s') = [0] \quad \forall t \neq s \quad (4.3)$$

we assume two exogenous shocks that contemporaneously affects endogenous variables - inflation expectations shock ( $\varepsilon_{p^e,t}$ ) and expected real interest rates shock ( $\varepsilon_{ir^e,t}$ ).

Structural exogenous shocks from equation (4.1) are not directly observable due to the complexity of information included in true form VAR residuals. At the same time, the shocks in the reduced form are likely to be correlated so they cannot be considered as true structural shocks. As a result, structural shocks cannot be correctly identified. It is then necessary to transform true model into following reduced form:

$$X_t = u_t + C_1 u_{t-1} + C_2 u_{t-2} + \dots = \sum_{i=0}^{\infty} C_i u_{t-i} = \sum_{i=0}^{\infty} C_i L^i u_t \quad (4.4)$$

or

$$\begin{bmatrix} ir_{n,t} \\ p_t \end{bmatrix} = \begin{bmatrix} C_{11} & C_{12} \\ C_{21} & C_{22} \end{bmatrix} \begin{bmatrix} u_{p^e,t} \\ u_{ir^e,t} \end{bmatrix} \quad (4.5)$$

where  $C(L)$  is a  $n \times n$  polynomial of matrices with coefficients representing the relationship among variables on the lagged values and  $u_t$  is a  $n \times 1$  vector of normally distributed errors (shocks in reduced form) that are serially uncorrelated but not necessarily orthogonal:

$$E(u_t) = 0, \quad \Sigma_u = E(u_t u_t') = A_0 E(u_t u_t') A_0' = A_0 A_0', \quad E(u_t u_s') = [0] \quad \forall t \neq s \quad (4.6)$$

Relationship between reduced-form VAR residuals ( $u_t$ ) and structural shocks ( $\varepsilon_t$ ) can be summarized from equations (4.1) and (4.4) as follows:  $u_t = A_0 \varepsilon_t$ . Matrices  $C_i$  we obtain from estimated equation (4.1). Considering  $A_i = C_i A_0$ , we can now identify matrix  $A_0$ . To estimate coefficient of matrix  $A_0$ , it is necessary to impose four restrictions. Two restrictions are simple

normalizations, which define the variance of the shocks  $\mathcal{E}_{p^e,t}$  and  $\mathcal{E}_{ir,t}$  (it follows the assumption that each of the disturbances has a unit variance,  $\text{var}(\mathcal{E}) = 1$ ). Third restriction comes from an assumption that identified shocks are orthogonal. Normalization together with an assumption of the orthogonality implies  $A_0'A_0 = \Sigma$ , where  $\Sigma$  is the variance covariance matrix of  $\mathcal{E}_{p^e,t}$  and  $\mathcal{E}_{ir,t}$ . SVAR methodology decomposes the series into its permanent and temporary components. The final restriction, which allows the matrix  $C$  to be uniquely defined, represents the long-run identifying restriction providing that a cumulative effect of expected real interest rate shock to the nominal interest rates variability is zero. Long-run identifying restrictions enable us to isolate temporary and permanent sources of nominal interest rates volatility and thus to distinguish effects of both structural shocks on endogenous variables of the model.

The equation (4.2) we can now rewrite to the following form:

$$\begin{bmatrix} ir_{n,t} \\ p_t \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ \cdot & 1 \end{bmatrix} \begin{bmatrix} \mathcal{E}_{i^e,t} \\ \mathcal{E}_{ir^e,t} \end{bmatrix} \quad (4.7)$$

Correctly identified model can be finally estimated employing SVAR methodology as the system is now just-identified. Variance decomposition and impulse-response functions are computed to observe a relative contribution of inflation expectations and expected real interest rates shocks to the nominal interest rates conditional variance as well as the overall responsiveness of nominal long-term interest rates to one standard deviation inflation expectations and expected real interest rates shocks.

#### 4.5. Data and Results

We've estimated bi-variate SVAR model for the individual Euro Area member countries to estimate the responsiveness of their long-term nominal interest rates to the positive one standard deviation inflation expectations and expected real interest rates shocks. Monthly data for the period of 2000M1-2007M12 (model A) consisting of 96 observations and for the period of 2000M1-2015M4 (model B) consisting of 184 observations were employed for the interest rates on government bonds with 10-year maturity and inflation based on consumer prices. Estimation of two models for each individual country should be helpful in examining crisis related effects on calculated results. Time series for inflation were seasonally adjusted. Time series for all endogenous variables were collected from IMF database (International Financial Statistics, September 2015).

#### A. Testing Procedures

Estimation of both models and correct identification of structural shocks affecting both endogenous variables it is necessary to preserve stationarity of the VAR model. To test the stationarity of both models it is necessary to check the time series for unit roots and cointegration. To test the stability of the VAR model we have also applied a number of diagnostic tests of the VAR residuals (normality, serial correlation, heteroskedasticity).

Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were computed to test endogenous variables for the unit roots presence. Both ADF and PP tests indicate that all variables are non-stationary on values. As a result, the null hypothesis of a unit root presence cannot be rejected for any of time series. Testing variables on first differences indicates that time series are stationary. We may conclude that variables are integrated of order 1  $I(1)$ .

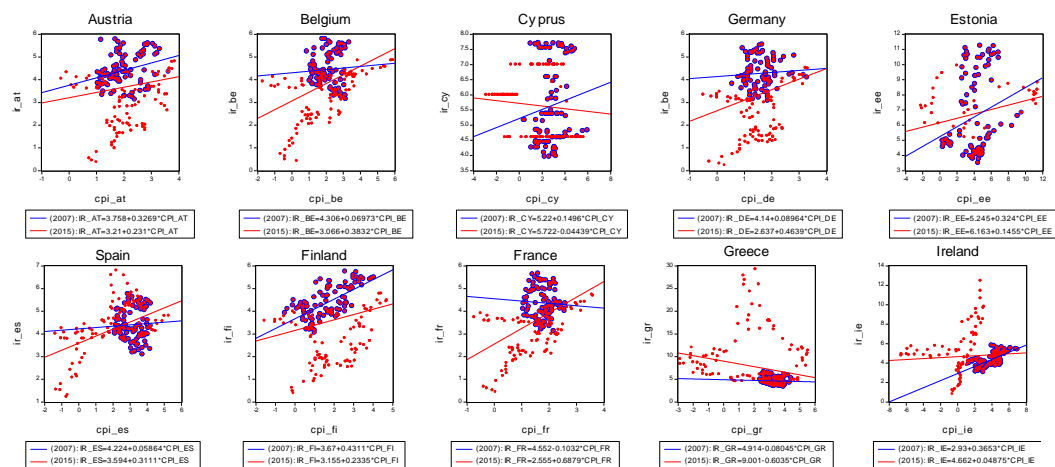
Because all endogenous variables have a unit root it is necessary to test time series for cointegration using the Johansen and Juselius cointegration test. The test for the cointegration was calculated using three lags as recommended by the AIC (Akaike Information Criterion) and SIC (Schwarz Information Criterion).

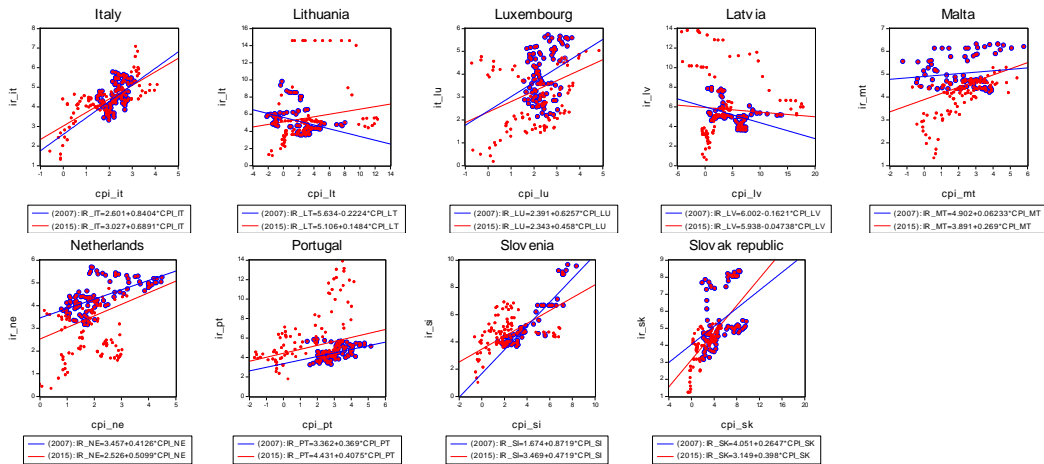
The results of Johansen cointegration tests confirmed our results of unit root tests. Both the trace statistics and maximum eigenvalue statistics (both at 0.05 level) indicate that there is no cointegration among endogenous variables of the model.

To test the stability of VAR models we also employed a number of diagnostic tests. We found no evidence of serial correlation, heteroskedasticity and autoregressive conditional heteroskedasticity effect in disturbances. The model also passes the Jarque-Bera normality test, so that errors seem to be normally distributed. VAR models seem to be stable also because inverted roots of the model for each country lie inside the unit circle. Detailed results of time series testing procedures are not reported here to save space. Like any other results, they are available upon request from the author.

## B. Relationship between Interest Rates and Inflation

Figure 4.1 depicts mutual relationship (simple linear regression) between the price level dynamics and the long-term nominal interest rates on 10-year government bonds in the Euro Area member countries. The results are presented for both per-crisis and extended periods. In most countries higher rates of inflation are associated with higher interest rates. However, mutual relationship between both variables does not provide a clear picture of effects of inflation on long-term interest rates according to the size and performance of the country.





Note: Inflation (CPI) and long-term nominal interest rates (IR) are expressed in percentage. Regression equation 2007 is calculated for the period 2000-2007 and regression equation 2015 for the period 2000-2015. Correlation coefficients between inflation and interest rates:

2000-2007: AT (0.285), BE (0.062), CY (0.122), DE (0.072), EE (0.228), ES (0.049), FI (0.657), FR (-0.061), GR (-0.049), IE (0.662), IT (0.487), LT (-0.360), LU (0.292), LV (-0.414), MT (0.133), NE (0.631), PT (0.421), SI (0.918), SK (0.405).  
2000-2015: AT (0.158), BE (0.441), CY (-0.069), DE (0.248), EE (0.182), ES (0.479), FI (0.242), FR (0.483), GR (-0.219), IE (0.076), IT (0.718), LT (0.171), LU (0.344), LV (-0.078), MT (0.403), NE (0.397), PT (0.278), SI (0.660), SK (0.662).

Source: Author's calculations.

**Figure 4.1 Correlation between Interest Rates and Inflation**

Relatively strong positive relationship between both variables was examined in both smaller (i.e. Austria, Luxembourg, Netherlands) and larger (i.e. Finland) economies from the core as well as the periphery (i.e. Portugal and Italy) of the Euro Area. The same results were obtained for the new Euro Area members from the Central and Eastern Europe (except for Latvia and Lithuania) that operated outside the currency union during the pre-crisis period. In the remaining countries the correlation between interest rates and inflation was generally lower, though in some cases we have also observed a negative correlation between both variables (France and Greece). While generally lower or even negative relationship between both variables indicate reduced role of inflation premium in determining long-term interest rates, examination of possible causal relationship requires a further investigation. Crisis period significantly strengthened the relationship between long-term interest rates and inflation in some countries (i.e. Belgium, Germany, Spain, France and Malta). However, divergent trend was observed in countries that suffered the most during the crisis period (i.e. Cyprus, Greece and Ireland) and few examples of reduced correlations was also identified (i.e. Austria, Finland, Italy, Luxembourg). New Euro Area member countries also provide mixed evidence about the effects of the crisis on the mutual relationship between interest rates and inflation.

Table 4.1 summarizes detailed information on correlation relationship between long-term interest rates and inflation in the Euro Area member countries decomposed into three years long sub-periods.

**Table 4.1 Correlation between Inflation and Interest Rates**

	2000-2002	2003-2005	2006-2008	2009-2011	2012-2014
Austria	0.2019	-0.4750	0.7303	-0.5902	0.6771

Belgium	0.5055	-0.6665	0.5457	0.2313	0.8654
Cyprus	0.0519	-0.0643	0.4877	0.4394	0.8541
Germany	0.0231	-0.2183	0.5790	-0.6271	0.7778
Estonia	0.3424	-0.5284	0.9054	-0.4541	
Spain	0.0824	-0.3351	0.2112	0.7889	0.8938
Finland	0.6124	-0.3054	0.6774	-0.5040	0.6583
France	-0.0981	0.6149	0.3924	-0.5614	0.8315
Greece	-0.3009	-0.4949	0.3010	0.3560	0.8266
Ireland	0.2958	0.0978	0.1760	0.8065	0.9282
Italy	-0.1273	0.6325	0.5472	0.7319	0.9120
Lithuania	0.1963	-0.8343	1.0000	1.0000	0.8942
Luxembourg	0.6316	-0.3415	0.2038	-0.7921	0.6679
Latvia	0.3388	-0.5848	0.5600	-0.4272	0.6823
Malta	0.5320	-0.8068	0.0858	0.2901	0.7399
Netherland	-0.4452	0.0258	0.5790	-0.4265	0.6666
Portugal	-0.5097	0.2965	0.1900	0.8370	0.9125
Slovenia	0.4861	0.9478	0.5955	0.1689	0.8289
Slovakia	0.6982	0.9443	0.3261	0.3914	0.9193
average	0.1851	-0.1103	0.4786	0.0973	0.8076

Note: Data represents coefficients of mutual correlations between inflation (CPI based) and interest rates (10-year government bonds).

Source: Author's calculation.

Early stage (2000-2002) followed by the establishment of the Euro Area indicates positive though generally weak relationship between long-term nominal interest rates on 10-year government bonds and inflation in the group as a whole. This period was characterized by a convergence in long-term interest rates that especially in the periphery and less performing countries of the Euro Area induced decreasing trend in the yields from government bonds. At the same time, most countries experienced a reduced dynamics in the prices (during 2001 and 2002) affected by the recession in European Union during 2000 and 2001 while later new Euro Area members from Central and Eastern Europe were recovering from the end of 1990s recession. As a result, five countries from the group experienced a negative while other five countries strong positive correlation between interest rates and inflation.

Second stage (2003-2005) was characterized by the boost in performance of most countries that induced slight increase in inflation while interest rates on government bonds followed continuously decreasing trend. As a result, correlation between interest rates and inflation decreased in all Euro Area member countries and increased only in Slovak republic and Slovenia operating outside the Euro Area at this stage. During the third period (2006-2008) the correlation between interest rates and inflation significantly strengthened due to increasing trend in the interest rates development and accelerated inflation caused by higher real output dynamics at the end of this sub-period. Early crisis sub-period (2009-2011) revealed a substantial decrease in the mutual relationship between long-term interest rates and inflation due to divergent trajectory in the path of both variables. Recession caused a significant drop in the dynamics of the price level (2009) followed by less dynamic boost (2010) while interest rates on government bonds tend to rise in almost all countries especially in the last year of this sub-period (Cyprus, Spain, Greece, Ireland, Italy, Portugal and Baltic countries as well). The last



sub-period (2012-2014) brought a substantial increase in the mutual relationship between both variables. Disinflation and associated deflationary pressures and the end of this sub-period were associated with a reduction in the rate of interest on government bonds in all countries thought in Cyprus and Greece due to bailout programme.

### C. Variance Decomposition

Instability of the correlation between long-term interest rates and inflation as well as changing patterns in the price level dynamics during the pre-crisis and crisis periods reveals questions associated with a stability of long-term inflations expectations (Chernov and Mueller, 2012). Moreover, the relative importance of inflation expectations in determining long-term interest rates requires rigorous investigation. Increasing importance of this objective is even highlighted considering that near zero inflation environment makes the relative importance of inflation expectations quite ambiguous. Moreover, expected real interest rates do not seem to be the only (though still significant) driver of the nominal interest rates movements during the deflationary periods (Arouba, 2014). However, increased uncertainty on the financial markets, excessive liquidity fueled by the conduction of the unconventional monetary policy and time deformation of the yield curves provide mixed suggestions on the relative importance of expected real interest rates in determining long-term nominal interest rates (Rudebusch and Swanson, 2012).

Table 4.2 summarizes relative contributions of the inflation expectations and expected real interest rates shocks to the conditional variance of long-term nominal interest rates on 10-year government bonds in the Euro Area member countries during pre-crisis (model A) and extended (model B) periods. Variance decomposition enables us to examine the relative importance of both structural shocks in explaining long-term nominal interest rates fluctuations over different time horizons. Because we have employed bi-variate VAR model and employed scheme to identify just two (mutually uncorrelated) structural shocks the sum of both shocks in each particular horizon in both models for all countries is equal to 100 per cent. Moreover, following our identification scheme considering that shock of expected real interest rates is neutral in determining nominal interest rates in the long run, the contribution of this shock to the variance of nominal interest rates gradually approaches zero percent. Our results indicate that expected real interest rate clearly dominates in explaining immediate and short-term fluctuations of the long-term nominal interest rate in models for both pre-crisis and extended period in all countries. However, over increasing time horizon its contribution the variability in nominal interest rate clearly decreases and is equal to zero in long run as we have assumed. It also implies that the role of inflation expectations in explaining short-term movements of nominal interest rate is quite low though their importance continuously raises with increasing time horizon and dominates in the long run.

While the response patterns of the long-term nominal interest rates followed quite similar scenario in all Euro Area member countries we have observed some differences in the relative contributions of both shocks to the nominal interest rates determination in individual countries. Results seem to be also sensitive to the underlying period as the contribution of both shocks to the nominal interest rates determination has slightly changed when comparing models for pre-crisis and extended period. However, differences between both models are less considerable because the model for the extended period includes time series for the pre-crisis period.

**Table 4.2 Variance Decomposition of Long-term Nominal Interest Rates (in per cent)**

Austria				Belgium				Cyprus						
Horizon (months)	Expected interest rates		real inflation		Horizon (months)	Expected interest rates		real inflation		Horizon (months)	Expected interest rates		real inflation	
	A	B	A	B		A	B	A	B		A	B		
1	73.24	71.75	26.76	28.25	1	72.56	70.12	27.44	29.88	1	74.56	70.18	25.44	29.82
6	68.87	65.22	31.13	34.78	6	69.23	66.19	30.77	33.81	6	70.17	64.12	29.83	35.88
12	60.36	57.23	39.64	42.77	12	61.49	59.35	38.51	40.65	12	53.76	51.09	46.24	48.91
24	41.70	36.29	58.30	63.71	24	42.70	40.22	57.30	59.78	24	35.56	34.75	64.44	65.25
48	24.09	22.62	75.91	77.38	48	22.10	21.76	77.90	78.24	48	18.90	21.59	81.10	78.41
long-term	0.00	0.00	100.00	100.00	long-term	0.00	0.00	100.00	100.00	long-term	0.00	0.00	100.00	100.00

Germany				Estonia				Spain						
Horizon (months)	Expected interest rates		real inflation		Horizon (months)	Expected interest rates		real inflation		Horizon (months)	Expected interest rates		real inflation	
	A	B	A	B		A	B	A	B		A	B		
1	76.29	73.53	23.71	26.47	1	78.71	60.03	21.29	39.97	1	70.51	74.29	29.49	25.71
6	73.15	69.36	26.85	30.64	6	69.38	53.56	30.62	46.44	6	65.84	70.41	34.16	29.59
12	65.88	62.28	34.12	37.72	12	59.45	48.21	40.55	51.79	12	52.25	57.14	47.75	42.86
24	45.05	42.45	54.95	57.55	24	40.49	35.69	59.51	64.31	24	33.68	36.27	66.32	63.73
48	24.17	22.16	75.83	77.84	48	21.86	20.54	78.14	79.46	48	16.22	17.42	83.78	82.58
long-term	0.00	0.00	100.00	100.00	long-term	0.00	0.00	100.00	100.00	long-term	0.00	0.00	100.00	100.00

Finland				France				Greece						
Horizon (months)	Expected interest rates		real inflation		Horizon (months)	Expected interest rates		real inflation		Horizon (months)	Expected interest rates		real inflation	
	A	B	A	B		A	B	A	B		A	B		
1	71.33	68.49	28.67	31.51	1	74.21	71.33	25.79	28.67	1	79.08	81.16	20.92	18.84
6	67.09	63.24	32.91	36.76	6	71.18	68.08	28.82	31.92	6	73.22	75.72	26.78	24.28
12	50.14	58.98	49.86	41.02	12	64.23	60.56	35.77	39.44	12	66.90	68.57	33.10	31.43
24	41.77	35.63	58.23	64.37	24	42.32	41.29	57.68	58.71	24	45.47	46.23	54.53	53.77
48	23.32	19.44	76.68	80.56	48	22.89	21.24	77.11	78.76	48	25.04	27.31	74.96	72.69
long-term	0.00	0.00	100.00	100.00	long-term	0.00	0.00	100.00	100.00	long-term	0.00	0.00	100.00	100.00

Ireland				Italy				Luxembourg						
Horizon (months)	Expected interest rates		real inflation		Horizon (months)	Expected interest rates		real inflation		Horizon (months)	Expected interest rates		real inflation	
	A	B	A	B		A	B	A	B		A	B		
1	73.29	76.26	26.71	23.74	1	73.54	75.02	26.46	24.98	1	71.17	68.56	28.83	31.44
6	69.23	71.49	30.77	28.51	6	68.42	71.79	31.58	28.21	6	67.64	62.15	32.36	37.85
12	61.43	64.11	38.57	35.89	12	54.29	60.92	45.71	39.08	12	58.22	56.38	41.78	43.62
24	42.56	45.81	57.44	54.19	24	36.16	41.11	63.84	58.89	24	41.83	38.27	58.17	61.73
48	22.79	23.09	77.21	76.91	48	20.44	22.63	79.56	77.37	48	22.07	20.19	78.93	79.81
long-term	0.00	0.00	100.00	100.00	long-term	0.00	0.00	100.00	100.00	long-term	0.00	0.00	100.00	100.00

Lithuania				Latvia				Malta						
Horizon (months)	Expected interest rates		real inflation		Horizon (months)	Expected interest rates		real inflation		Horizon (months)	Expected interest rates		real inflation	
	A	B	A	B		A	B	A	B		A	B		
1	77.21	64.18	22.79	35.82	1	74.29	67.29	25.71	32.71	1	75.29	70.88	24.71	29.12
6	70.44	60.37	29.56	39.63	6	68.98	59.21	31.02	40.79	6	69.07	66.49	30.93	33.51
12	56.22	45.29	43.78	54.71	12	51.14	48.61	48.86	51.39	12	51.80	54.21	48.20	45.79
24	32.74	31.36	67.26	68.64	24	31.05	29.40	68.95	58.60	24	32.31	37.04	67.69	62.96
48	18.16	16.22	81.84	83.78	48	22.45	23.26	77.55	76.74	48	16.66	20.45	83.34	79.55
long-term	0.00	0.00	100.00	100.00	long-term	0.00	0.00	100.00	100.00	long-term	0.00	0.00	100.00	100.00

Netherlands				Portugal				Slovak republic						
Horizon (months)	Expected interest rates		real inflation		Horizon (months)	Expected interest rates		real inflation		Horizon (months)	Expected interest rates		real inflation	
	A	B	A	B		A	B	A	B		A	B		
1	74.29	70.22	25.71	29.78	1	69.56	72.15	30.44	27.85	1	73.15	71.23	26.85	28.77

6	71.15	66.29	28.85	33.71	6	65.12	69.54	34.88	30.46	6	69.53	65.67	30.47	34.33
12	64.27	61.71	35.73	38.29	12	54.26	60.03	45.74	39.97	12	62.67	56.22	37.33	43.78
24	40.15	38.14	59.85	61.86	24	37.09	42.77	62.91	57.23	24	43.18	38.12	56.82	61.88
48	18.78	18.06	81.22	81.94	48	22.15	23.51	77.85	76.49	48	17.97	16.95	82.03	83.05
long-term	0.00	0.00	100.00	100.00	long-term	0.00	0.00	100.00	100.00	long-term	0.00	0.00	100.00	100.00

Slovenia				
Horizon (months)	Expected real interest rates		Expected inflation	
	A	B	A	B
1	71.49	68.11	28.51	31.89
6	65.24	61.27	34.76	38.73
12	58.56	50.14	41.44	49.86
24	39.16	35.05	60.84	64.95
48	15.17	14.77	84.83	85.23
long-term	0.00	0.00	100.00	100.00

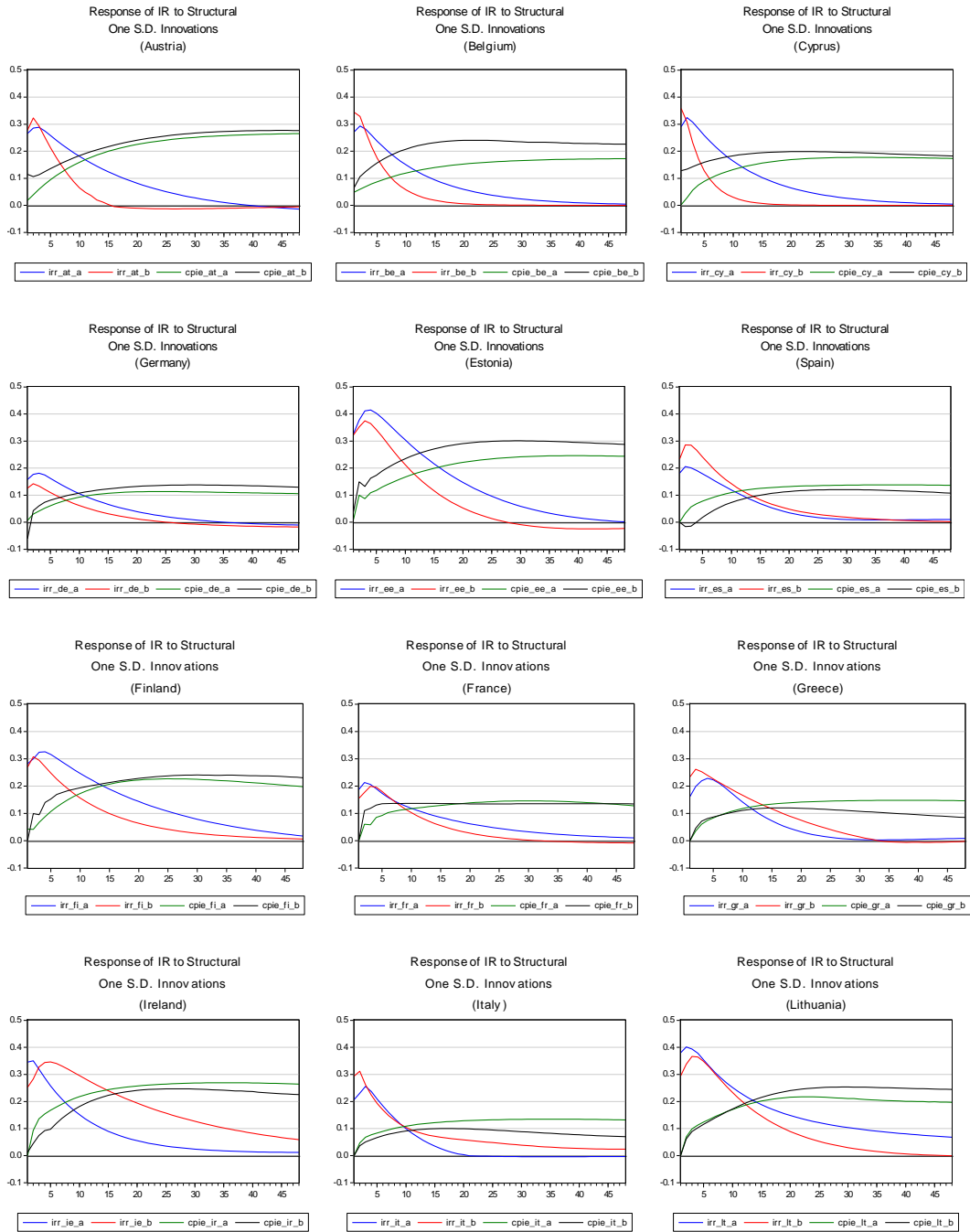
Note: Relative contributions of structural shocks to the conditional variance of long-term nominal interest rates on 10-year government bonds in models A (2000M1-2007M12) and B (2000M1-2015M4).

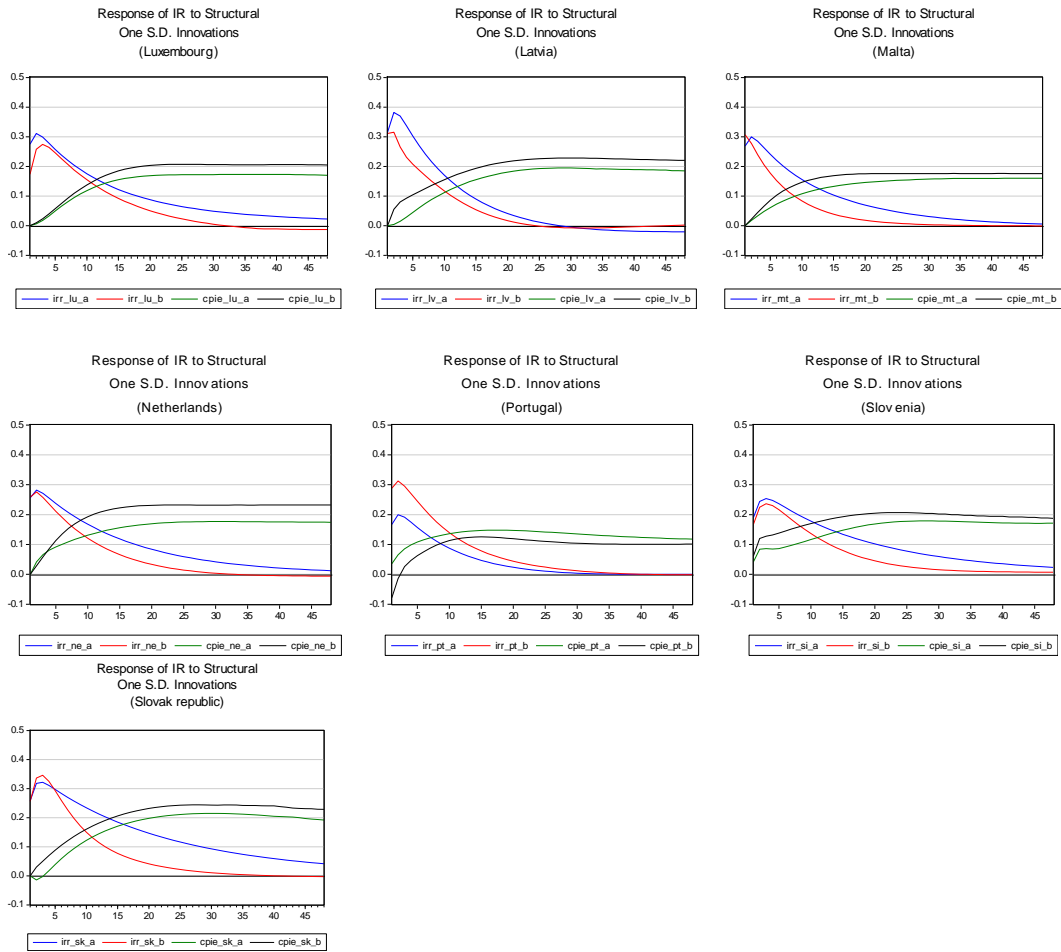
Source: Author's calculations.

Relative importance of expected real interest rates during the first year since the shock in explaining unexpected movements in nominal interest rates clearly dominated during the pre-crisis period in all countries. However, the role of inflation expectations continuously increased and generally dominated since the sixteenth month since the shock. It seems that inflation expectations are more persistent and sudden changes in inflation expectations requires more time to induce changes in the long-term interest rates. While the relative contribution of both shocks to the unexplained fluctuations in the nominal interest rates followed a rather similar pattern in all countries from the group, crisis period brought some changes to the determination of nominal interest rates. Results for the extended period indicate a slight reduction in the relative importance of the expected real interest rates in all countries but periphery economies (Greece, Italy, Portugal, and Spain). We suggest that crisis induced reduction in the role of inflation expectations and increased role of expected real interest rates in the periphery countries reflects well known problems with liquidity (and associated increase in the risk premia) on the markets with their government bonds in the early stage of the crisis period. Second important implication of the effects associated with the crisis period is represented by the more significant increase in the relative importance of inflation expectations in determining long-term nominal interest rate in Baltic countries in comparison with the core countries of the Euro Area. Estonia, Latvia and Lithuania experienced the most significant drop in the dynamics of the price level during the early stage of the crisis period that is why the more significant increase in the more significant increase in the role of inflation expectations seems to be reasonable.

#### D. Impulse-Response Functions

Figure 2 summarizes responses of nominal interest rates on 10-year government bonds to the positive one standard deviation shocks of inflation expectations and expected real interest rates in PIGS countries, Germany and France during pre-crisis (model A) and extended (model B) periods.





Note: Curves represent responses of long-term nominal interest rates (IR) to the positive one standard deviation inflation expectations shock (CPIE) and expected real interest rates shock (IRR) in models A (2000M1-2007M12) and B (2000M1-2015M4).

Source: Author's calculations.

**Figure 4.2 Responses of Long-term Interest Rates to Shocks of Inflation Expectations and Expected Real Interest Rates**

Impulse-response functions of long-term nominal interest rates revealed mostly similar response patterns of interest rates on 10-year government bonds to the underlying shocks across all countries though we have observed some differences between periphery economies (PIGS) and Euro Area core countries. Moreover, differences in the response patterns of nominal interest rates between both groups of countries are reasonable in both models covering both pre-crisis and extended periods. Expected real interest rates dominated in determining long-term interest rates during almost whole first year since the shock in all Euro Area member countries. Nominal interest rates immediately increased after the positive expected real interest rate shock. However, responsiveness of nominal interest rates to the shock of expected real interest rates was slightly higher in the periphery countries. Effect of the shock culminated within first three months and then steadily died out during subsequent

two years since the shock in the whole group of countries. Nominal interest rates in Baltic countries seem to be more responsive to the expected real interest rate shock in comparison with the rest of the group.

Comparison of the results for pre-crisis and extended periods revealed interesting differences between periphery and the core Euro Area member countries. Despite some minor differences, responsiveness of long-term interest rates to the shock of expected real interest rates in periphery countries during the extended period slightly increased (effect is clear especially during first months since the shock), while remaining countries experienced opposite trend. We suggest that investors required higher risk premium (associated with higher expected real interest rates) to hold risky government bonds of PIGS countries considering that these countries were exposed the most to the threat of default during the crises period.

Effects of the expected real interest rates shock on the long-term nominal interest rates gradually decreased with increasing time horizon and completely died out in the horizon of 2 to 4 years since the shock in the respective country. As a result, effect of this shock is neutral in the long run that corresponds to our assumptions in the model specification and structural shocks definition. However, Expected real interest rates remain a significant driver of the long-term nominal interest rates movements in the short run.

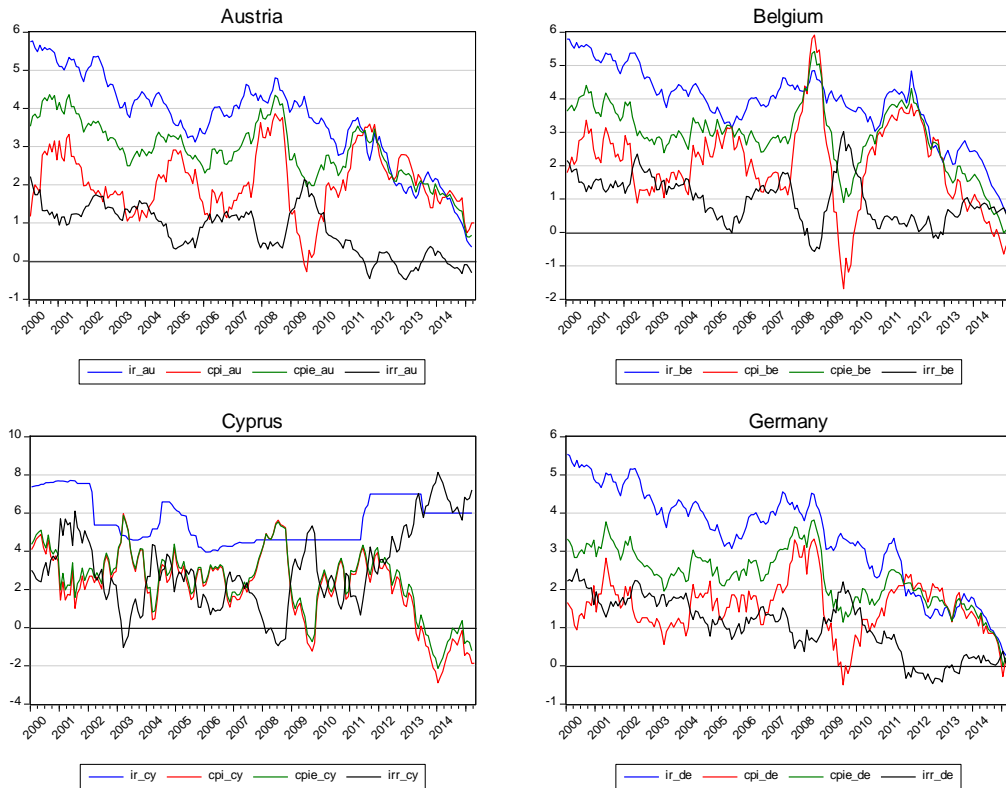
Immediate responsiveness of long-term interest rates to the positive inflation expectations shock was generally negligible (in comparison with expected real interest rates shock) though the intensity of the shock continuously increased over time. As a result, effects of inflation expectations on long-term nominal interest rates are much stable with increasing time horizon in all Euro Area member countries. While short-term (within first twelve months since the shock) response of interest rates to the shock of inflation expectations was generally lower than in case of expected real interest rates, it remained positive and stable with increasing time horizon and even permanent in the long run. Positive effect of the shock culminated till the end of the second year since the shock. The shock of inflation expectations clearly dominated in the medium term in determining long-term nominal interest rates and our results confirm its permanent effect on interest rates in the long run (though with reduced intensity in some countries, i.e. Greece and Italy).

Crises period affected responsiveness of interest rate on 10-year government bonds to the shock of inflations expectations in both groups of countries. While the vulnerability of long-term nominal interest rates to the shock of inflation expectations in periphery countries decreased, the rest of the Euro Area experienced opposite scenario. Economies of GIIPS countries suffered the most during the crisis period. We suggest that the reasonable risk of deflation and deflationary spiral reduced the role of inflation expectations for the nominal interest rates determination.

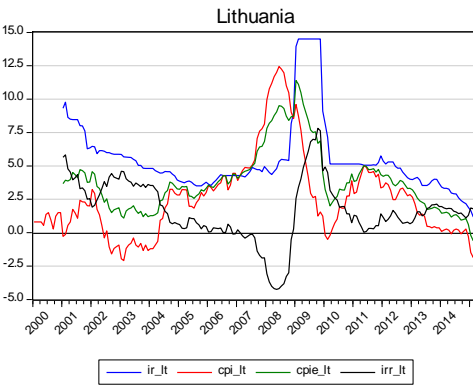
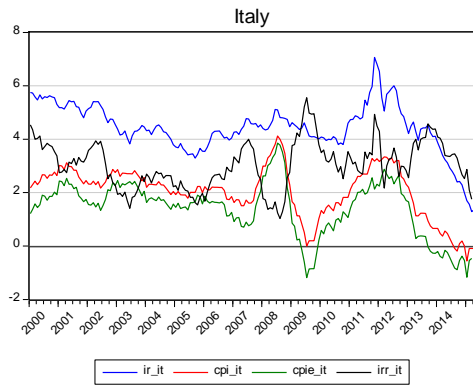
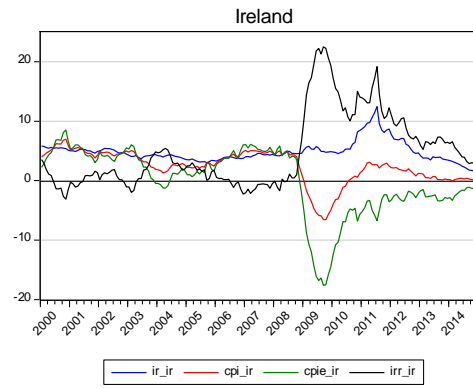
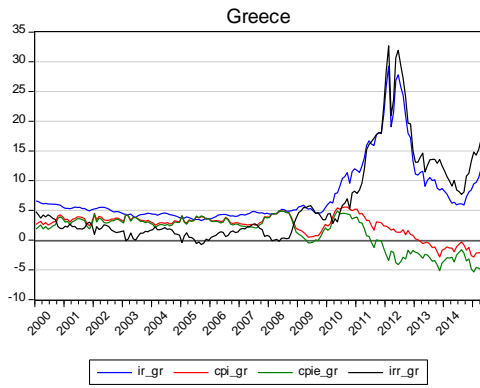
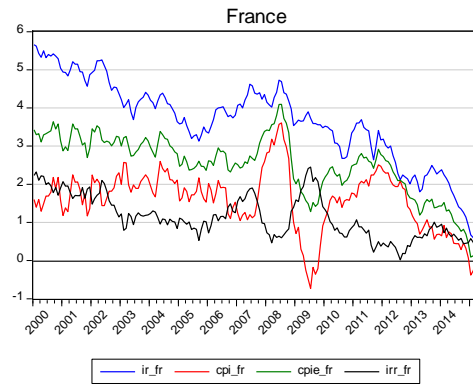
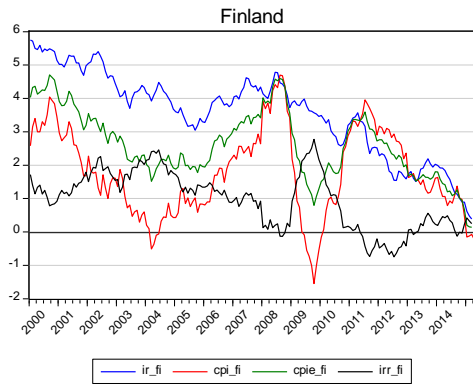
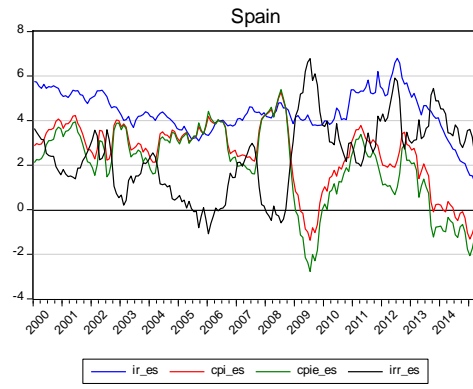
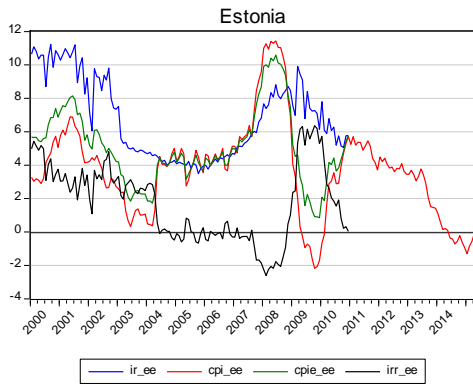
Examined differences in the responsiveness of the long-term interest rates to the inflation expectations shocks between periphery and core countries of the Euro Area reveals many opened questions associated with suitability of monetary policy conducted by ECB in the single currency area consisting of significantly heterogeneous countries. Implications of quantitative easing accompanied by near zero levels of the key interest rates aiming to boost the inflation may be biased due to existing differences in the inflation expectations between North and South of the Euro Area.

### E. Decomposition of Long-term Nominal Interest Rates

In this section we provide decomposition of long-term nominal interest rates into inflation expectations and expected real interest rates components. Stationary and permanent components of the long-term interest rates are calculated by the accumulation of the effect of both structural shocks. Estimation of expected real interest rates is calculated by adding the stationary components to the mean of difference between observed long-term interest rates and contemporaneous rate of inflation<sup>5</sup> (St-Amant, 1996). Estimation of inflation expectations is calculated by subtracting already calculated expected real interest rates from the nominal long-term interest rates.

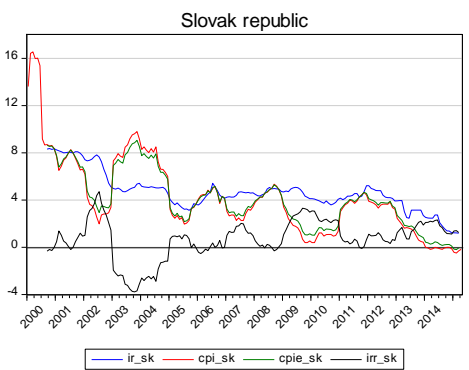
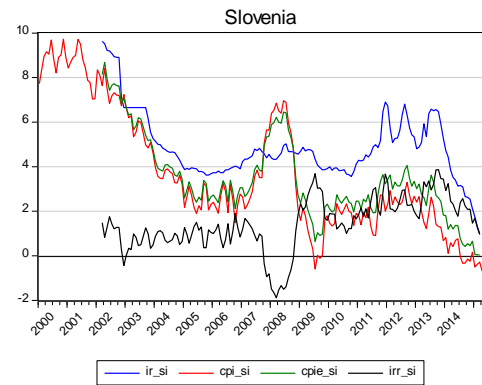
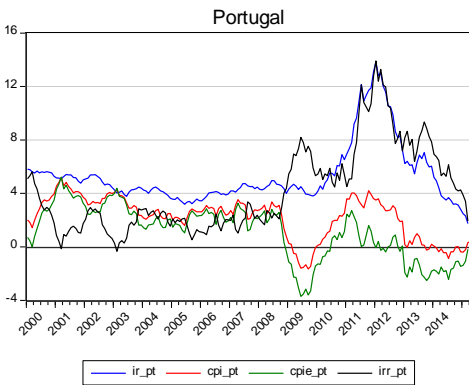
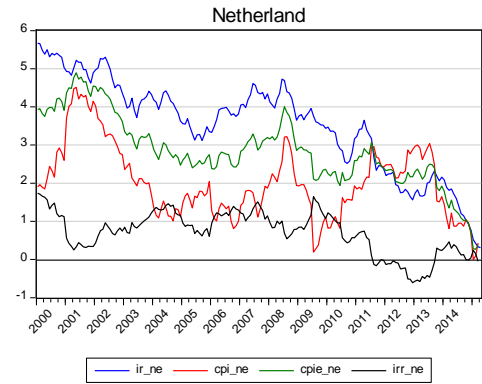
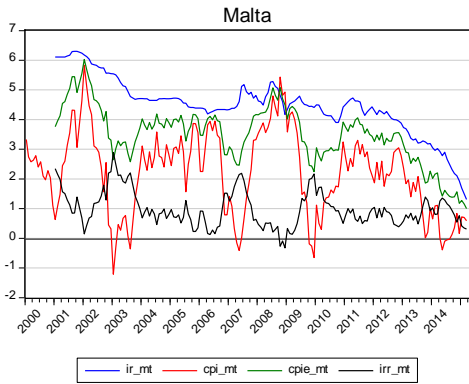
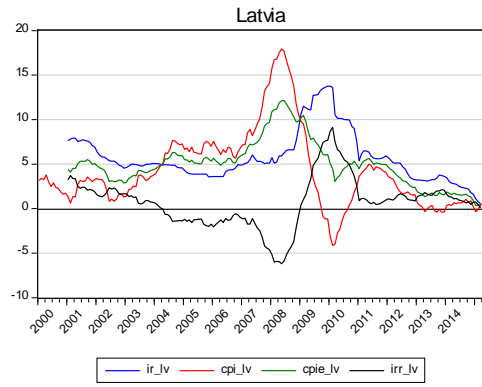
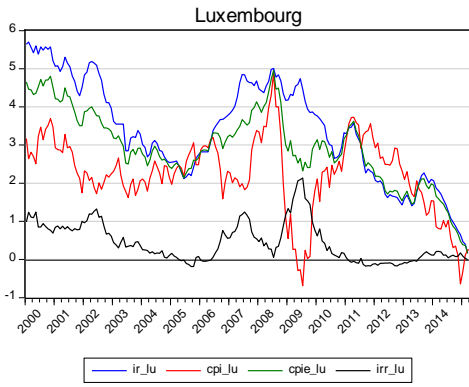


<sup>5</sup> Mean of difference between observed long-term interest rates and contemporaneous rate of inflation: AT (1.636%), BE (1.815%), CY (3.431%), DE (1.815%), EE (3.023%), ES (1.884%), FI (1.783%), FR (2.062%), GR (5.010%), IE (2.465%), IT (2.390%), LT (2.931%), LU (1.141%), LV (1.501%), MT (2.279%), NE (1.516%), PT (3.126%), SI (1.132%), SK (0.473%).





# The Euro Area and the Economic Crisis



*Note:* Curves represent development of nominal interest rate on 10-year government bonds (IRR), inflation measured by CPI (CPI) and estimated components of long-term nominal interest rates represented by inflation expectations (CPIE) and expected real interest rates (IRR).

*Source:* Author's calculations.

### **Figure 4.3 Decomposition of Long-term Interest Rates on Government Bonds<sup>6</sup>**

Decomposition of long-term interest rates on 10-year government bonds in both the periphery and core member countries of the Euro Area revealed interesting differences in the (a) relative contributions of inflation expectations and expected real interest rates into nominal interest rates leading path since the establishment of the Euro Area as well as (b) relationship between inflation rates and inflation expectations in the above mentioned countries (Figure 4.3). Downward trend in long-term interest rates in the Euro Area member countries and related convergence in their development between North and South during the most of the pre-crisis period was associated with drop in inflation expectations while expected real interest rates remained relatively stable at 0-2 per cent corridor on average. However, expected real interest rates were generally higher in Ireland, Italy, Portugal and Spain or more volatile in Cyprus, Baltic countries and Slovakia. At the same time, inflation expectations experienced increasing trend during the last 2-3 years of a pre-crisis period when long-term interest rates tend to increase in most of the Euro Area member countries.

First crucial implication resulted from our estimations is represented by clear differences between inflation and inflation expectations derived from long-term interest rates between periphery economies and the core of the Euro Area. Inflation expectations in GIIPS countries tend to undershoot a trajectory of inflation path during the whole pre-crisis period. Moreover, this trend was even intensified during the crisis period. We suggest that increased uncertainty on the markets together with crisis related problems (recession, risk of default, fiscal unsustainability, etc.) clearly reduced inflation expectations below recent rates of inflation. As a result, risk of deflation during the periods of decreasing inflation expectations that even undershoot low inflation target generally increased. Moreover, low inflation expectations that undershot inflation in periphery countries of the Euro Area induced higher expected real interest rates in comparison with their true levels. Similarly to our results from impulse-response analysis we suggest that undershooting patterns in inflation expectations result from increased fear of deflation and slumping real economy in light of tightening financial conditions that shifted expected real interest rates upward.

Decomposition of interest rates on government bonds in the core of the Euro Area revealed different picture about the relative importance of inflation expectations and expected real interest rates in long-term interest rates determination. Inflation expectations tend to overshoot the long-term path of inflation in both countries during the whole period. This pattern is more significant during the pre-crisis period. Higher inflation expectations than recent inflation that did not induce excessive inflation pressures are good signal for central bank in good times though during periods of persisting deflationary pressures combined with recession it may decrease the chance to boost inflation up and possibly worsen the deflationary spiral. However, mismatch between inflation expectations and recent inflation decreased during the crisis period. On the other hand, lower expected real interest rates, as

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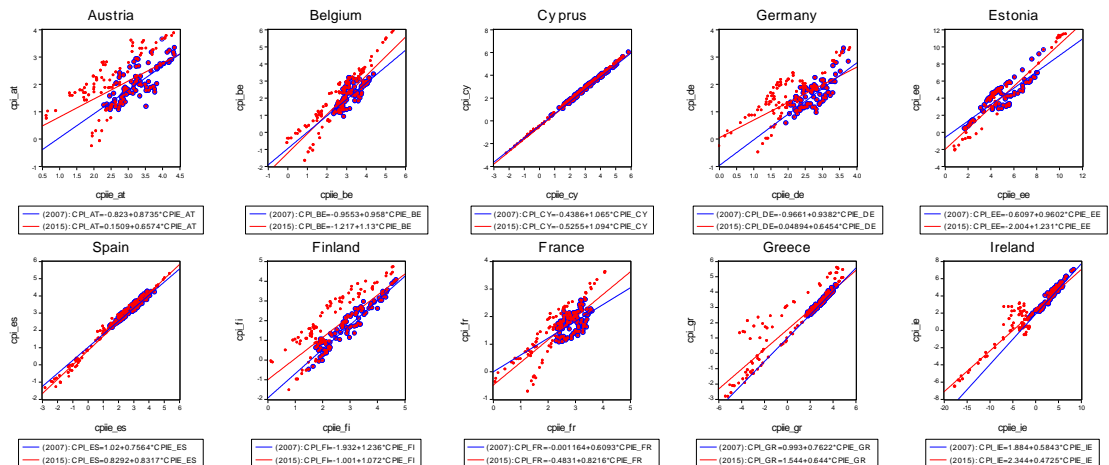
<sup>6</sup> Since 2011 there are no Estonian sovereign debt securities that comply with the definition of long-run interest rates for convergence purposes according to ECB. No suitable proxy indicator has been identified.

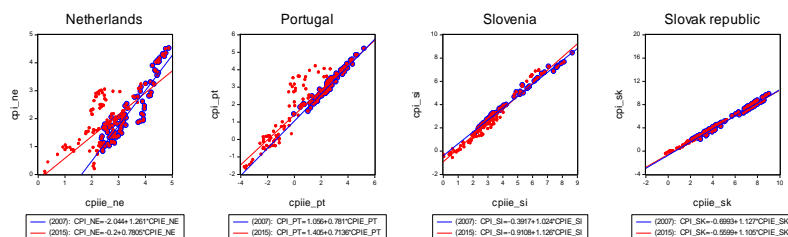
a component of nominal long-term interest rates, may improve liquidity of government bonds in the core of the Euro Area and soften the conditions on their sovereign debt markets.

### F. Relationship between Inflation and Inflation Expectations

Figure 4.4 depicts mutual relationship (simple linear regression) between consumer price inflation and inflation expectations in the Euro Area member countries. The results are presented for both per-crisis and extended periods. In most countries inflation rates and inflation expectations are highly positively correlated. However, we have observed some differences when comparing the results for the North and South of the Euro Area during the pre-crisis and extended period.

Despite examined undershooting patterns in inflation expectations (Section E) in the periphery countries of the Euro Area the correlation between inflation and inflation expectations during the pre-crisis period was generally higher in GIIPS countries (together with Malta and Cyprus) than in the rest of the Euro Area. Similarly high correlation was observed in countries from Central and Eastern Europe that operated outside the Euro Area during the pre-crisis period. Crisis period affected mutual correlation between both variables. While the strength of the relationship between both variables did not significantly change in the periphery countries, the results for the remaining countries are mixed. While in the most countries in the North of the Euro Area the correlation between inflation and inflation expectations decreased, opposite scenario was examined in Belgium, France and Luxembourg.





Note: Inflation (CPI) and inflation expectations (CPIE) are expressed in percentage. Regression equation 2007 is calculated for the period 2000-2007 and regression equation 2015 for the period 2000-2015. Correlation coefficients between inflation and inflation expectations:

2000-2007: AT (0.755), BE (0.739), CY (0.994), DE (0.757), EE (0.865), ES (0.971), FI (0.956), FR (0.554), GR (0.964), IE (0.971), IT (0.931), LT (0.903), LU (0.506), LV (0.930), MT (0.868), NE (0.929), PT (0.975), SI (0.995), SK (0.993).

2000-2015: AT (0.630), BE (0.894), CY (0.998), DE (0.705), EE (0.942), ES (0.992), FI (0.834), FR (0.834), GR (0.924), IE (0.952), IT (0.987), LT (0.880), LU (0.629), LV (0.858), MT (0.858), NE (0.758), PT (0.927), SI (0.988), SK (0.996).

Source: Author's calculations.

**Figure 4.4 Correlation between Inflation and Inflation Expectations**

Table 4.3 summarizes detailed information on correlation relationship between consumer price inflation and inflation expectations in the Euro Area member countries decomposed into three years long sub-periods.

**Table 4.3 Correlation between Inflation and Inflation Expectations**

	2000-2002	2003-2005	2006-2008	2009-2011	2012-2014
Austria	0.8717	0.7094	0.9797	0.9234	0.8942
Belgium	0.9532	0.8319	0.9886	0.9834	0.9831
Cyprus	0.9961	0.9984	0.9999	0.9989	0.9999
Germany	0.9007	0.7761	0.9723	0.9042	0.9746
Estonia	0.9433	0.9808	0.9952	0.9682	
Spain	0.9932	0.9871	0.9974	0.9980	0.9911
Finland	0.9790	0.7596	0.9868	0.9731	0.9679
France	0.7511	0.8903	0.9652	0.9584	0.9700
Greece	0.9882	0.9933	0.9969	0.8795	0.5999
Ireland	0.9758	0.9747	0.9730	0.9648	-0.1646
Italy	0.9706	0.9724	0.9965	0.9900	0.9878
Lithuania	0.8757	0.9831	0.9843	0.7704	0.9878
Luxembourg	0.8851	-0.0369	0.7233	0.5098	0.8116
Latvia	0.8010	0.9735	0.9824	0.6838	0.9117
Malta	0.9865	0.9756	0.9658	0.9759	0.9269
Netherland	0.8892	0.6657	0.9410	0.6945	0.9463
Portugal	0.9965	0.9876	0.9855	0.9560	0.8750
Slovenia	0.9057	0.9976	0.9984	0.9618	0.9826
Slovakia	0.9988	0.9998	0.9973	0.9984	0.9986
average	0.9295	0.8642	0.9700	0.8996	0.8691

Note: Data represents coefficients of mutual correlations between inflation (CPI based) and inflation expectations.

Source: Author's calculation.

Early stage (2000-2002; bad times) followed by the establishment of the Euro Area indicates existence of strong positive correlation between inflation and inflation expectations in all countries. Recession in the European Union (2000-2001) and recovery from the end of 1990s recession in the prospective members of the Euro Area from Central and Eastern Europe was followed by a generally decreasing trend in both inflation and inflation expectations that caused a parallel and highly correlated movement in both variables. Increased dynamics in inflation during the second stage (2003-2005; intermediate times) induced a moderate reduction in the mutual relationship between inflation and inflation expectations in all countries as a whole (except for France). Early pre-crisis period (2006-2008; good times) brought a significant strengthening in the correlation between both variables in all countries. It seems that inflation expectations can adapt to changes in inflation smoothly provided that changes in economic environment are not sudden and associated adjustments in the economic outlook are undergoing over the longer time horizon. Early crisis sub-period (2009-2011) brought a reduction in the strength of correlation between inflation and inflation expectations thought mostly in smaller economies. While the mutual relationship between both variables slightly strengthened in most countries during the last sub-period (2012-2014), significant drop in the correlation coefficients in two countries (Greece and Ireland) caused a moderate drop in the correlation for the group of all countries as a whole.

Even decomposed results of the mutual relationship between inflation and inflation expectations into short sub-periods revealed existence of the significant positive correlation between both variables in GIIPS countries, Cyprus and Malta, and the new Euro Area member countries from Central and Eastern Europe. These results contribute to a growing evidence of a crucial role of inflation expectations in determining inflation especially in countries with imbalanced economic growth. Moreover, substantial role of inflation expectations in reducing the risk of deflationary pressures and associated stimulation of growth incentives even emphasizes the challenging task for ECB to provide a suitable monetary policy framework that would help to boost the performance of the countries in the South of the Euro Area while avoiding scenarios of imbalanced growth at the same time. However, as the recent literature suggest, it is not possible having single monetary policy framework for all Euro Area members countries. As a result, idea of a two-speed Europe may represent a convenient response of authorities to the competitiveness issues and intra-eurozone imbalances (Archick, 2015; Novotný, 2013; von Oндarza, 2013). Moreover, two-speed Europe could also accelerate real convergence not only in the “new” Euro Area members but also among “old” Euro Area member countries (ECB, 2015). However, putting this concept into practice requires further fiscal coordination or integration that is widely unpopular and therefore rather unrealistic.

## **Conclusion**

Examination of the relative importance of inflation expectations and expected real interest rates in determining long-term nominal interest rates on 10-year government bonds in the periphery and core countries of the Euro Area revealed interesting implications of existing economic differences between both groups of countries. Increased contributions of expected real interest rates to the development of long-term nominal interest rates, undershooting patterns in inflation expectations according to the inflation rates together with strong positive correlation between inflation and inflation expectations in

periphery countries of the Euro Area represent clear signal of markets to policy makers and possible scenarios of boosting inflation (ECB) and economic growth (national governments) in the Euro Area. Higher expected real interest rates than actual real interest rates together with increased exposure of holding risky government bonds of periphery countries of the Euro area may force governments to undertake internal devaluation (with all risks associated with deflationary spiral) or to increase nominal interest rates on government bonds (with negative implications on costs of sovereign debt). We suggest that more dynamic convergence of periphery Euro Area member countries to the core countries together with strengthening of fiscal sustainability would help to reduce perceived risk of periphery countries followed by a reduction in expected real interest rates from government bonds.

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## Chapter 5

### Exchange Rate Pass-Through in the Euro Area

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### 5.1 Introduction

Exchange rate pass-through to domestic prices represents one of the most discussed topics in the recent literature dealing with a wide area of effects associated with exchange rate flexibility. The establishment of the Euro Area and introduction of the euro represent a crucial milestone in the ongoing discussions highlighting positive and negative implications of the nominal exchange rate rigidity. On the other hand, we suggest that it is still convenient to analyze the wide spectrum of effects related to the abortion of the relative flexibility of the national exchange rates after the euro adoption (Barhoumi, 2006).

Among many of impulses that the exchange rate transmits from the external environment to the domestic market we highlight price related effects associated with sudden changes in the foreign prices and related responsiveness of the domestic price indexes. The degree of the exchange rate pass-through to domestic prices reveals its role as the external price shocks absorber especially in the situation when the leading path of exchange rates is less vulnerable to the changes in the foreign nominal variables (Campa, Goldberg and González-Mínguez, 2005).

In the chapter we analyze the exchange rate pass-through to domestic prices in the Euro Area member countries. Our motivation follows an idea (Bussière, 2013) of asymmetric exchange rate pass-through to domestic prices across internal price chain. Our methodology consists of two partial stages. In the first stage we examine the responsiveness of nominal effective exchange rates to the exogenous price shock to observe the dynamics (volatility) in the exchange rate leading path followed by the unexpected exogenous oil price shock. By doing so we investigate a capability of exchange rates to transmit or absorb the external inflation pressure to domestic prices (Corsetti, Dedola and Leduc, 2008). In the second stage we investigate effects of the unexpected exchange rate shift to the domestic price indexes (import prices, producer prices, consumer prices) to examine its distribution across the internal pricing chain (Choudhri, Faruqee and Hakura, 2005). Our results contribute to understand the key features of the exchange rate transmission of the inflation pressures initiated by external price shifts and related responses of the domestic price indexes. We employ a vector autoregression (VAR) model. True shocks are identified by the Cholesky decomposition of innovations. From estimated VAR model we compute (1) responses of exchange rates in each individual country to the positive one standard deviation oil price shock and (2) responses of import prices, producer prices and consumer

prices to the positive one standard deviation exchange rate shock. To provide more rigorous insight into the problem of the exchange rate pass-through to domestic prices in we estimate models for each particular country employing monthly data for two subsequent periods 2000-2007 (pre-crisis period) and 2000-2014 (extended period). This approach should be helpful to examine country specific features of the transmission of external inflation pressures to the domestic prices. We suggest that comparison of results for models with different time periods is crucial to understand spurious effects of the economic crisis in both exchange rate responsiveness to the external price shocks as well as associated pass-through effects to domestic price measures.

## 5.2 Exchange Rate Pass-through in the Euro Area

Euro Area member countries are still suffering from lagging recession. While internal devaluation in countries with nominal exchange rate anchor may improve price competitiveness and boost both internal and external demand, risk of deflationary pressures substantially reduce vital growth incentives (Hetzel, 2015). Moreover, ECB by inflating its monetary base fueled by another wave of quantitative easing does not primarily follow idea of economic recovery (Christensen and Gillan, 2015). Low interest rate environment may be followed by euro depreciation improving competitiveness of European producers on the foreign markets. However, as the most of transactions on the EU single market are conducted in euro among its member countries, Euro Area seeks common reasonable automatic mechanisms that would help to improve its internal competitiveness (Peersman, 2011).

There are still many opened issues according to the suitability of the common monetary policy in the Euro Area provided a relative heterogeneity of the single market (Micossi, 2015). Time-varying exchange rate pass-through effects to domestic prices under fixed euro exchange rate perspective represent one of the most challenging implications of the common currency (Bussière, 2013). The problem is even more crucial when examining crisis related redistributive effects associated with relative price changes. The degree of the exchange rate pass-through to domestic prices reveals its role as the external price shocks absorber especially in the situation when the leading path of exchange rates is less vulnerable to the changes in the foreign nominal variables (Campa, Goldberg and González-Mínguez, 2005). Resulted adjustments in domestic prices followed by exchange rate shifts induced by sudden external price shocks are associated with changes in the relative competitiveness among member countries of the currency area (Team of the Working Group on Econometric Modelling of the ESCB, 2012). Moreover, distribution of the exogenous price shock across the internal pricing chain may be biased by country specific conditions and cross-country distortionary effects induced by the recent economic crisis.

Fixed exchange rate environment represented by credible nominal anchor (i.e. sound foreign currency of a country with a low and stable inflation) or common currency in the currency union provides very efficient tool in fighting high inflation while helping to stabilize inflation expectations (Calvo and Reinhart, 2002). As a result, countries with fixed exchange rate benefit from disinflationary periods provided that a decision to adopt fixed exchange rate originated from high inflation pressures in the past. On the other hand, countries in the common currency area obviously experience intensified price level convergence due to higher price transparency that may result in the increased inflation rates over the medium-term period. However, stable inflation expectations anchored by fixed exchange rate and common monetary policy following explicit inflation target obviously induces price stability (Wehinger,

2000). On the other hand, increased volatility of exchange rate of the common currency may cause domestic price level to adjust accordingly in the short period, though persisting inflation or disinflation pressures are not expected. It is especially due to positive effects of stable inflation expectations that (we suggest) do not seem to be affected for longer period of time.

Quite specific seems to be a situation in countries with common currency that serves as a local or global currency widely used in foreign transactions. Price effects of increased volatility in such a common currency may be reduced provided that a large number of trading partners are also participating on the common currency. Even when the large portion of mutual foreign transactions in member countries of the common currency area are immune to the exchange rate volatility, remaining transactions are still exposed to the unexpected shifts in the common currency exchange rate against other currencies (Hahn, 2003). On the other hand, sudden shifts in the real exchange rate are not exclusively caused by the nominal exchange rate volatility. Increased intensity of price adjustments associated with crisis related effects on real output are usually followed by accelerated deviations of real exchange rates from their equilibrium leading path especially in the short period. This scenario is even more biased provided that crisis period induced diverse effects on the price level dynamics in the heterogeneous group of countries (Choudhri and Hakura, 2012).

### 5.3 Overview of the Literature

Vulnerability of the exchange rates to the exogenous shocks came to the center of an academic discussion shortly after a break-down of a Bretton Woods system of fixed exchange rates at the beginning of the 1970s. Uncertainty on the foreign exchange markets together with higher volatility of exchange rates increased a sensitivity of domestic economies to the foreign partners' economic development as well as to the world leading economies' exchange rate movements. Exchange rate pass-through as the relationship between exchange rate movement and price adjustments of traded goods came to the center in academic and policy circles (Lian, 2007). Toshitaka (2006) estimated exchange rate pass-through of six major industrial countries using a time-varying parameter with stochastic volatility model. Author divided an analysis into impacts of exchange rate fluctuations to import prices and those of import price movements to consumer prices. Takatoshi et al. (2005) examined the pass-through effects of exchange rate changes on the domestic prices among the East Asian countries using the conventional pass-through equation and a VAR analysis. In order to identify the VAR model authors used a Cholesky decomposition to identify structural shocks and to examine the pass-through of the exchange rate shock to the domestic price inflation. They conclude that while the degree of exchange rate pass-through to import prices is quite high in the crisis-hit countries, the pass-through to CPI is generally low. Takatoshi and Kiyotaka (2006) estimated five and seven variable VAR model (including all three price variables to check the robustness and to investigate directly the pass-through effect across the prices.) in order to examine the pass-through effects of exchange rate changes on the domestic prices. Cortinhas (2007) also tested the sensitivity of results from the VAR models using several alternative ordering of the variables with mixed results. Ca' Zorzi et al. (2007) on the sample 12 emerging markets in Asia, Latin America, and Central and Eastern Europe investigated that exchange rate pass-through declines across the pricing chain, i.e. it is lower on consumer prices than on import prices. Choudhri and Hakura (2012) analyzed exchange rate pass-through to import prices and export prices employing both regression- and VAR-based estimates

considering local currency pricing and producer currency pricing assumptions. Authors suggest that exchange rate pass-through to import prices for a large number of countries is incomplete and larger than the pass-through to export prices. McCarthy (2007) investigated the impact of exchange rates and import prices on the domestic PPI and CPI in selected industrialized economies by employing VAR model. His Impulse-response analysis indicates that exchange rates have a modest effect on domestic price inflation while import prices have a stronger effect. He suggests that pass-through is larger in countries with a larger import share and more persistent exchange rates and import prices. Bussière and Peltonen (2008) estimated export and import price equations for a large number of countries. Their results indicate, *inter alia*, that exchange rate pass-through to import prices in advanced countries is falling over time indicating the increased role of emerging economies in the world economy. Campa, Goldberg and González-Mínguez (2005) analyzed the transmission rates from exchange rates movements to import prices, across countries and product categories, in the Euro Area during 1990s. Their results show that the transmission of exchange rate changes to import prices in the short run is high, although incomplete, and that it differs across industries and countries; in the long run, exchange rate pass-through is higher and close to one. Anderton (2003) employed both time series and panel estimation techniques to investigate exchange rate pass-through for euro. His results points to the relatively high degree of the pass-through changes in the effective exchange rate of the euro to the price of extra-Euro Area imports of manufacturers. Bergin and Feenstra (2007) studied how a rise in China's share of U.S. imports could lower pass-through of exchange rates to U.S. import prices. Barhouni (2006) investigated exchange rate pass-through into import prices in a sample of 24 developing countries over the period from 1980 to 2003. His analysis revealed differences in exchange rate pass-through in his sample of developing countries explained by three macroeconomics determinants: exchange rate regimes, trade distortions and inflation regimes. Shambaugh (2008) examined the relationship between exchange rates and prices. He employed long-run restrictions VAR to identify shocks and explore the way domestic prices, import prices and exchange rates react to a variety of shocks. He suggests that consumer price pass-through is nearly complete in response to some shocks, but low in response to others. Alternatively, import prices and exchange rates typically respond in the same direction, and pass-through seems quick.

#### 5.4 Econometric Model

VAR models represent dynamic systems of equations in which the current level of each variable depends on past movements of that variable and all other variables involved in the system. Residuals of vector  $\varepsilon_t$  represent unexplained movements in variables (effects of exogenous shocks hitting the model); however as complex functions of structural shocks effects they have no economic interpretation. Structural shocks can be still recovered using transformation of the true form representation into the reduced-form by imposing a number of identifying restrictions. Applied restrictions should reflect some general assumptions about the underlying structure of the economy and they are obviously derived from economic theory. There are two general (most used) approaches to identify VAR models. (I) Cholesky decomposition of innovations implies the contemporaneous interactions between exogenous shocks and the endogenous variables are characterized by a Wald causal chain. Ordering of endogenous variables then reflects expected particular economy structure following general economic theory assumptions. However, the lack of reasonable guidance for

appropriate ordering led to the development of more sophisticated and flexible identification methods - (II) structural VAR (SVAR) models. Identifying restrictions implemented in SVAR models reflect theoretical assumptions about the economy structure more precisely. However, restrictions based on the theoretical assumptions employed in both identifying schemes should be empirically tested to avoid shocks identification bias and imprecisions associated with endogenous variables responses to the shocks.

We employ a VAR methodology to investigate the exchange rate pass-through to domestic prices in the Euro Area member countries. Cholesky decomposition of variance-covariance matrix of reduced-form VAR residuals is implemented to examine responsiveness of (1) exchange rate to the unexpected oil price shock followed by (2) investigation of responses of different domestic price indexes to the unexpected exchange rate shock (Takatoshi and Kiyotaka, 2006).

First stage in exchange rate pass-through reveals ability of exchange rate to absorb or accelerate the transmission of external price shock (positive one standard deviation oil price shock). The overall dynamics in the exchange rates response patterns provide crucial information about the exposure of exchange rate to the price related external shock in each particular country from the group (McCarthy, 2007). At the same time it reveals vital features of the exchange rate leading path toward pre-shock equilibrium and associated volatility patterns followed by the initial exogenous price shock.

Second stage in exchange rate pass-through highlights effects of the unexpected exchange rate shifts (positive one standard deviation exchange rate shock) on domestic price indexes and thus reveals the responsiveness of prices at different stages of the pricing chain (import prices, producer prices, consumer prices). At the same time it allows to investigate a distribution channel of the external price shock along the internal pricing chain. This approach is helpful for understanding the responsiveness patterns of domestic price indexes following principles of the pricing chain mechanism across different price measures.

Examination of the two stage exchange rate pass-through employing a multivariate VAR for each individual country from the group of the Euro Area member countries follows the side objective of the paper to investigate possible implications of different exchange rate arrangements on estimated results and thus to contribute to the fixed versus flexible exchange rates dilemma from the prospective of the transmission of the external inflation pressures to the domestic price inflation associated with the exchange rate conditional variability.

True model is represented by the following infinite moving average representation:

$$X_t = A_0\varepsilon_t + A_1\varepsilon_{t-1} + A_2\varepsilon_{t-2} + \dots = \sum_{i=0}^{\infty} A_i\varepsilon_{t-i} = \sum_{i=0}^{\infty} A_iL^i\varepsilon_t = A(L)\varepsilon_t \quad (5.1)$$

where  $X_t$  represents  $n \times 1$  a vector including endogenous variables of the model,  $A(L)$  is a  $n \times n$  polynomial consisting of the matrices of coefficients to be estimated in the lag operator  $L$  representing the relationship among variables on the lagged values,  $\varepsilon_t$  is  $n \times 1$  vector of identically normally distributed, serially uncorrelated and mutually orthogonal errors (white noise disturbances that represent the unexplained movements in the variables, reflecting the influence of exogenous shocks):

$$E(\varepsilon_t) = 0, \quad E(\varepsilon_t \varepsilon_t') = \Sigma_\varepsilon = I, \quad E(\varepsilon_t \varepsilon_s') = [0] \quad \forall t \neq s \quad (5.2)$$

Vector  $X_t$  in our baseline model similar to those by Takatoshi and Liyotaka (2006) consists of five endogenous variables - oil prices ( $p_{oil,t}$ ), nominal exchange rate ( $er_{n,t}$ ), money supply ( $m_t$ ), real output ( $y_{r,t}$ ), domestic price index ( $p_t$ ). In the five-variable VAR model ( $X_t = [p_{oil,t}, er_{n,t}, m_t, y_{r,t}, p_t]$ ) we assume five exogenous shocks that contemporaneously affect endogenous variables - external (oil) price shock ( $\varepsilon_{p_{oil,t}}$ ), nominal exchange rate shock ( $\varepsilon_{er_{n,t}}$ ), liquidity shock ( $\varepsilon_{m,t}$ ), demand shock ( $\varepsilon_{y_{d,t}}$ ) and internal price shock ( $\varepsilon_{p,t}$ ).

Structural exogenous shocks from equation (5.1) are not directly observable due to the complexity of information included in true form VAR residuals. As a result, structural shocks cannot be correctly identified. It is then necessary to transform true model into following reduced form

$$X_t = C(L)X_{t-1} + e_t \quad (5.3)$$

where  $C(L)$  is the polynomial of matrices with coefficients representing the relationship among variables on lagged values and  $e_t$  is a  $n \times 1$  vector of normally distributed errors (shocks in reduced form) that are serially uncorrelated but not necessarily orthogonal (shocks in the reduced form can be contemporaneously correlated with each other):

$$E(e_t) = 0, \quad \Sigma_u = E(e_t e_t') = A_0 E(e_t e_t') A_0' = A_0 A_0', \quad E(e_t e_s') = [0] \quad \forall t \neq s \quad (5.4)$$

Relationship between reduced-form VAR residuals ( $e_t$ ) and structural shocks ( $\varepsilon_t$ ) can be expressed as follows:

$$e_t = A_0 \varepsilon_t \quad (5.5)$$

As we have already noted at the beginning of the section we implement a Cholesky identification scheme to correctly identify structural shocks. In order to identify our model there must be exactly  $n^2 - [(n^2 - n) / 2]$  relationships among endogenous variables of the model, where  $n$  represents a number of variables. We have to impose  $(n^2 - n) / 2$  restrictions on the matrix  $A_0$  based on the Cholesky decomposition of the reduced-form VAR residual matrix that define matrix  $A_0$  as a lower triangular matrix. The lower triangularity of  $A_0$  (all elements above the diagonal are zero) implies a recursive scheme (structural shocks are identified through the reduced-form VAR residuals) among variables (the Wald chain scheme) that has clear economic implications and has to be empirically tested as any other relationship. Identification scheme of the matrix  $A_0$  implies that particular

contemporaneous interactions between some exogenous shocks and some endogenous variables are restricted reflecting causal (distribution) chain of interaction transmission. It is clear that the Wald causal chain is incorporated via convenient ordering of variables.

Considering lower triangularity of a matrix  $A_0$  the equation (5.5) can be rewritten as follows:

$$\begin{bmatrix} e_{p_{oit},t} \\ e_{er_n,t} \\ e_{m,t} \\ e_{y_r,t} \\ e_{p,t} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 \end{bmatrix} \begin{bmatrix} \mathcal{E}_{p_{oit},t} \\ \mathcal{E}_{er_n,t} \\ \mathcal{E}_{m,t} \\ \mathcal{E}_{y_r,t} \\ \mathcal{E}_{p,t} \end{bmatrix} \quad (5.6)$$

Correct identification of exogenous structural shocks reflecting Cholesky ordering of variables denotes following assumptions:

- Oil prices do not contemporaneously respond to the shock from any other endogenous variable of the model.
- Exchange rate doesn't contemporaneously respond to liquidity, demand and internal price shocks, while it is contemporaneously affected only by the external price shock.
- Money supply doesn't contemporaneously respond to demand and internal price shocks, while it is contemporaneously affected by external price and exchange rate shocks.
- Real output doesn't contemporaneously respond to the internal price shock, while it is contemporaneously affected by external price, exchange rate and liquidity shocks.
- Domestic price index is contemporaneously affected by the shocks from all of the endogenous variables of the model.

After initial period endogenous variables may interact freely without any restrictions.

Ordering of variables is crucial not only for a correct identification of structural shocks but also to reveal a convenient transmission mechanism of the external price shock into the domestic price level as well as a suitable distribution chain of the price effect across various domestic price indexes. However, the overall accuracy and robustness of the empirical results may be tested by examining the effects of the changed ordering of endogenous variables to exchange rate pass-through to the domestic prices.

To investigate the pass-through effect of the exchange rate shock to domestic price indexes at particular stages of distribution we include three different types of domestic prices (import prices, producer prices, consumer prices). All three types of internal price indexes are included in one model to examine a distribution channel of the external price shock along the internal pricing chain. As a result, the equation (5.6) is rewritten as follows:



$$\begin{bmatrix} e_{p_{oil},t} \\ e_{er_n,t} \\ e_{m,t} \\ e_{y_r,t} \\ e_{p_{imp},t} \\ e_{p_{ppi},t} \\ e_{p_{cpi},t} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & 0 & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1 & 0 \\ a_{71} & a_{72} & a_{73} & a_{74} & a_{75} & a_{76} & 1 \end{bmatrix} \begin{bmatrix} \mathcal{E}_{p_{oil},t} \\ \mathcal{E}_{er_n,t} \\ \mathcal{E}_{m,t} \\ \mathcal{E}_{y_r,t} \\ \mathcal{E}_{p_{imp},t} \\ \mathcal{E}_{p_{ppi},t} \\ \mathcal{E}_{p_{cpi},t} \end{bmatrix} \quad (5.7)$$

Following theoretical assumptions as well as empirical results we expect that the highest degree of exchange rate pass-through would be identified for import prices and lowest for consumer prices. We suggest that the initial effect of the external price shock will be reduced during its transmission along the internal price distribution channel.

Estimated VAR model is employed to compute impulse response functions to analyze (1) the responses of the exchange rate to the positive one standard deviation external (oil) price shock and (2) responses of particular internal price indexes to the positive one standard deviation exchange rate shock in the Euro Area member countries (Lian and Wang, 2012). To check the robustness of empirical results we estimate the model considering different ordering of the endogenous variables in models and thus employing different identifying restrictions resulting from the recursive Cholesky decomposition of the reduced form VAR residuals:

- model A1, B1 ( $X_t = [p_{oil,t}, er_{n,t}, m_t, y_{r,t}, p_{imp,t}, p_{ppi,t}, p_{cpi,t}]$ )
- model A2, B2 ( $X_t = [p_{oil,t}, m_t, er_{n,t}, y_{r,t}, p_{imp,t}, p_{ppi,t}, p_{cpi,t}]$ )
- model A3, B3 ( $X_t = [p_{oil,t}, y_{r,t}, er_{n,t}, m_t, p_{imp,t}, p_{ppi,t}, p_{cpi,t}]$ )

Different ordering of variables enables us to examine exchange rate pass-through via alternative distribution channels of external inflation pressures transmission to the domestic prices assuming that different ordering of variables follows the economic logic of the chain of pricing and the structure of the economy. It also allows us to compare results with those of other studies. Additionally, if estimated results from the impulse-response analysis confirm the model is not very sensitive to the endogenous variables ordering than the Cholesky decomposition of the reduced-form VAR residuals with the initial ordering of variables provides significant and robust results.

Following the main objective of the paper we also estimate VAR models employing time series for two different periods (pre-crisis period (model A, 2000M1-2007M12) and extended period (model B, 2000M1-2014M12)) to examine effects of the crisis period on the exchange rate pass-through to import prices, producer prices and consumer prices in the Euro Area member countries.

Investigation of the exchange rate responsiveness to the unexpected exogenous price shock in countries with de-facto fixed exchange rates reveals substantial implications of exchange rate rigidity according to the absorption capabilities of exchange rates (Hahn, 2003). We expect that limited

exchange rate volatility in terms of its vulnerability to the country specific determinants should reduce exchange rate exposure to the external price shock while it should simplify its transmission to the domestic prices.

## 5.5 Data and Results

To investigate the exchange rate pass-through to domestic prices in the Euro Area member countries we employed monthly data for period 2000M1-2007M12 (model A) consisting of 96 observations and for period 2000M1-2014M12 (model B) consisting of 168 observations for the following endogenous variables - oil prices, nominal exchange rate (nominal effective exchange rate), money supply (monetary aggregate M2), industrial production (nominal volume of the industrial product deflated by averaged PPI) and inflation (import prices index, producer prices index, consumer prices index).

### A. Testing Procedures

Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were computed to test endogenous variables for the unit roots presence. Both ADF and PP tests indicate that most of variables are non-stationary on values so that the null hypothesis of a unit root presence cannot be rejected for any of time series. Testing variables on first differences indicates that time series are stationary. We may conclude that variables are integrated of order 1  $I(1)$ .

Because there are endogenous variables with a unit root on values it is necessary to test time series for cointegration using the Johansen and Juselius cointegration test (we found reasonable to include variables  $I(0)$  for testing purposes following economic logic of expected results). The test for the cointegration was computed using three lags as recommended by the AIC (Akaike Information Criterion) and SIC (Schwarz Information Criterion).

Results of Johansen cointegration tests confirmed our results of unit root tests. Both trace statistics and maximum eigenvalue statistics (both at 0.05 level) indicate that there is no cointegration among endogenous variables of the model.

To test the stability of VAR models we also employed a number of diagnostic tests. We found no evidence of serial correlation, heteroskedasticity and autoregressive conditional heteroskedasticity effect in disturbances. The model also passes the Jarque-Bera normality test, so that errors seem to be normally distributed. VAR models seem to be stable also because inverted roots of the model for each country lie inside the unit circle. Detailed results of time series testing procedures are not reported here to save space. Like any other results, they are available upon request from the author.

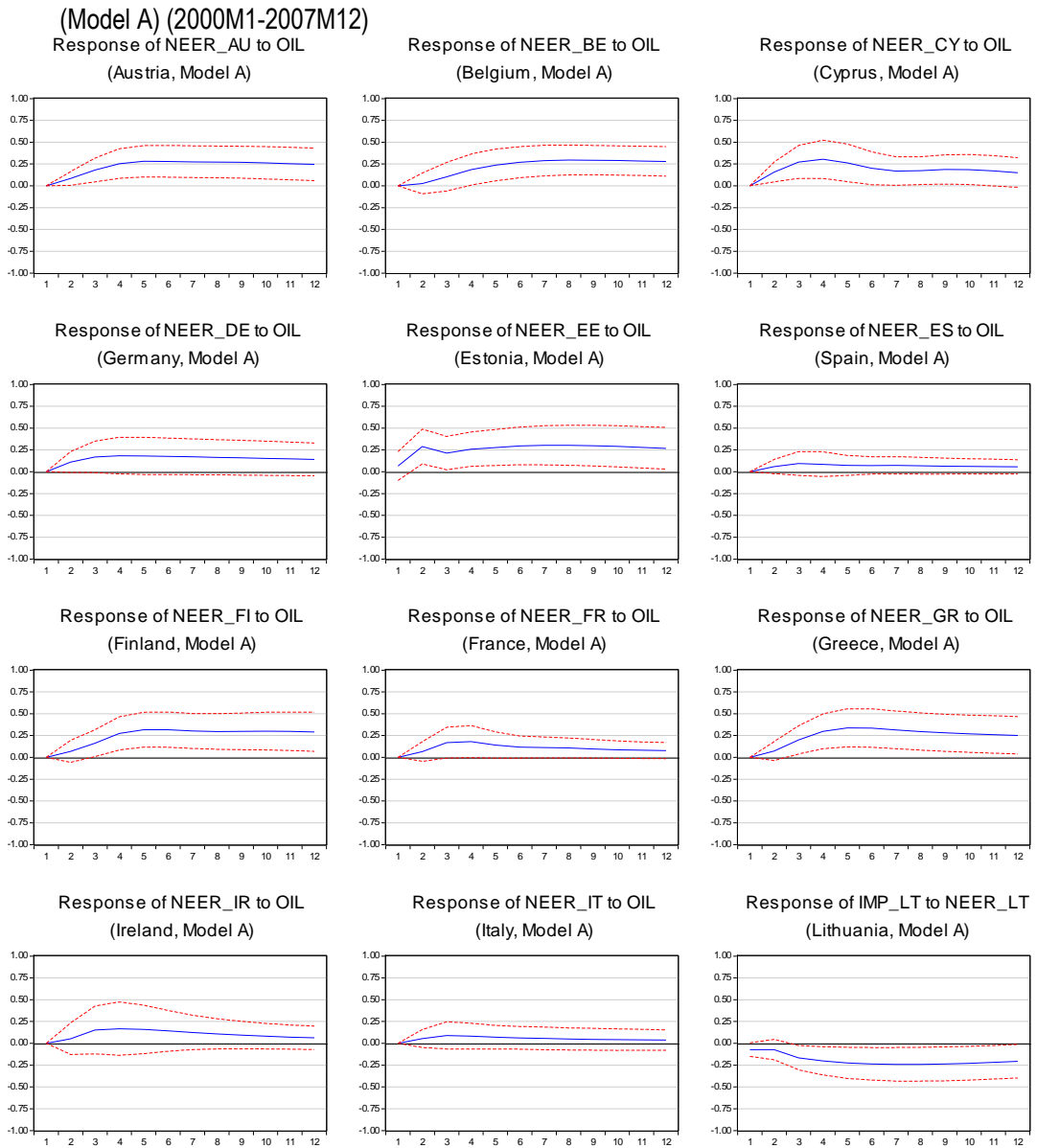
Following results of the unit root and cointegration tests we estimated the model using variables in first differences so that we can calculate impulse-response functions for all nineteen Euro Area member countries. Following the main objective of the paper we focus on interpretation of responses of the (1) exchange rate to the positive one standard deviation oil price shock and (2) domestic price indexes (import prices, producer prices and consumer prices) to the positive one standard deviation exchange rate shock.

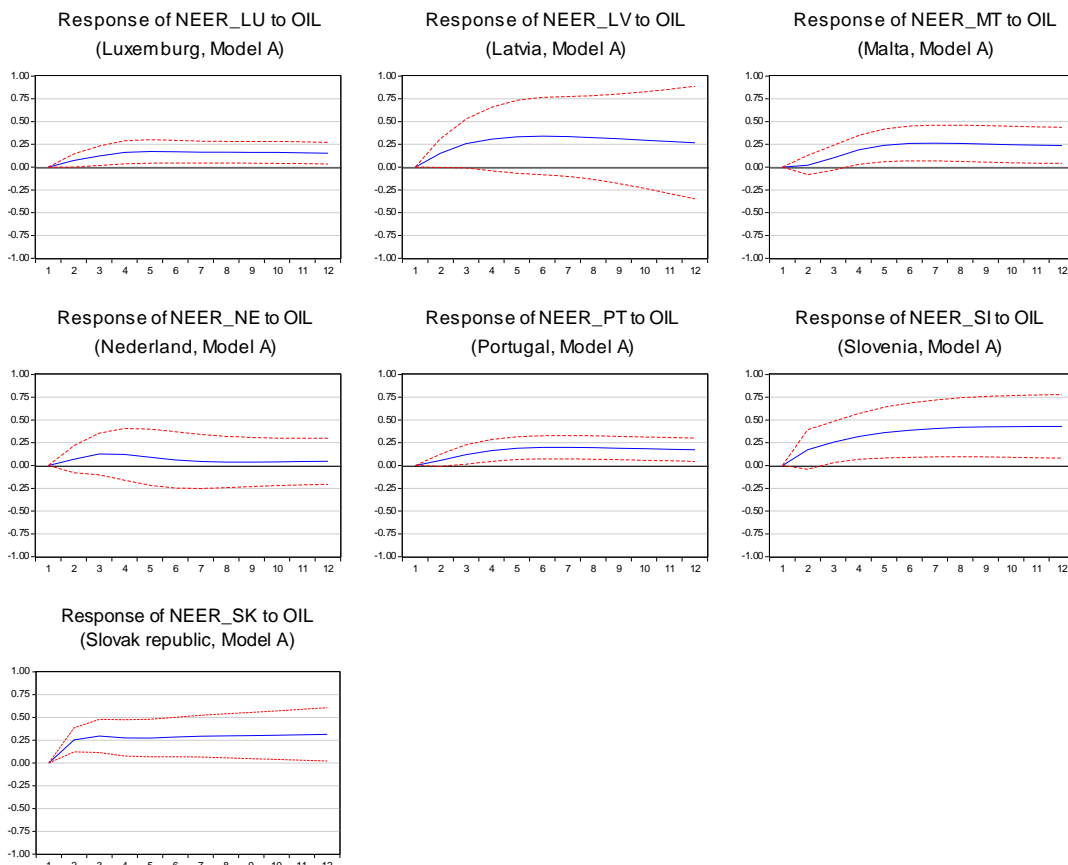
We also observe effects of the crisis period on the both exchange rate responses to oil price shock and domestic prices responses to the exchange rate shock in the Euro Area member countries by comparing results for estimated models using time series for two different periods - model A (2000M1-2007M12) and model B (2000M1-2014M12). Changed ordering of variables didn't seem to affect

results of the analysis. Considering that impulse-response functions are not very sensitive to the ordering of endogenous variables we present results of both models (model A1 and B1) with default ordering of endogenous variables (detailed results for models A2, A3, B2, B3 are available upon request from the author).

### B. Impulse-Response Functions

Examination of the first stage in the exchange rate pass-through includes estimation of exchange rates responses to the positive one standard deviation oil price shock employing monthly data for two subsequent periods 2000-2007 (model A) and 2000-2014 (model B).





**Note:** Curves represent responses of exchange rates (NEER) to the positive one standard deviation oil price (OIL) shock in each country from the group of the Euro Area member countries.

**Source:** Author's calculations.

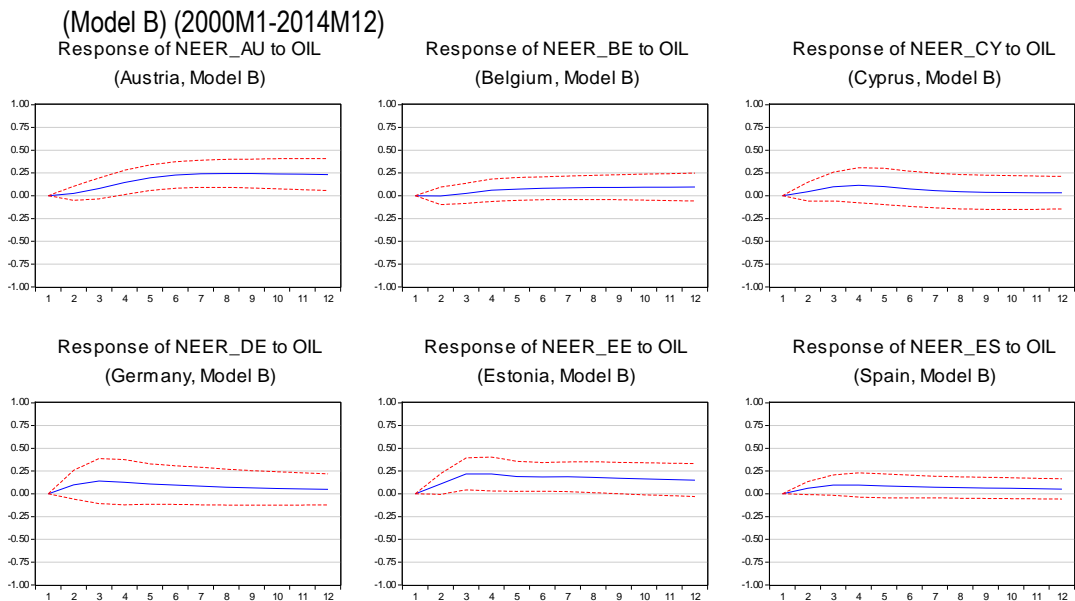
**Figure 5.1 Responses of Exchange Rates to Oil Price Shock**

In the Figure 5.1 we summarize results of impulse-response functions of exchange rates to the positive (increase in) oil price shocks in both models in Euro Area member countries. Estimations of the exchange rates responsiveness to the Cholesky positive one standard deviation oil price shocks revealed interesting implications of the relative heterogeneity of the Euro Area. Unexpected increase in the oil price was followed by the exchange rate appreciation in all countries from the group. However, we have observed different patterns in the exchange rate responsiveness among individual countries. Oil price shock caused a moderate and less dynamic increase in the exchange rate in large economies (Germany, Spain, France, Italy), countries of Benelux (except for Belgium) and Portugal. Exchange rate responsiveness to the external price (oil) shock in countries with large and less opened economies seems be to less dynamic in comparison with the rest of countries from the Euro Area. Reduced responsiveness of NEER in sizeable economies corresponds with theoretical assumptions about low exposure of exchange rates to exogenous shocks in less opened economies. In Luxemburg, Nederland and Portugal our results indicate reduced absorption capabilities associated with price related effects of unexpected oil price shock.

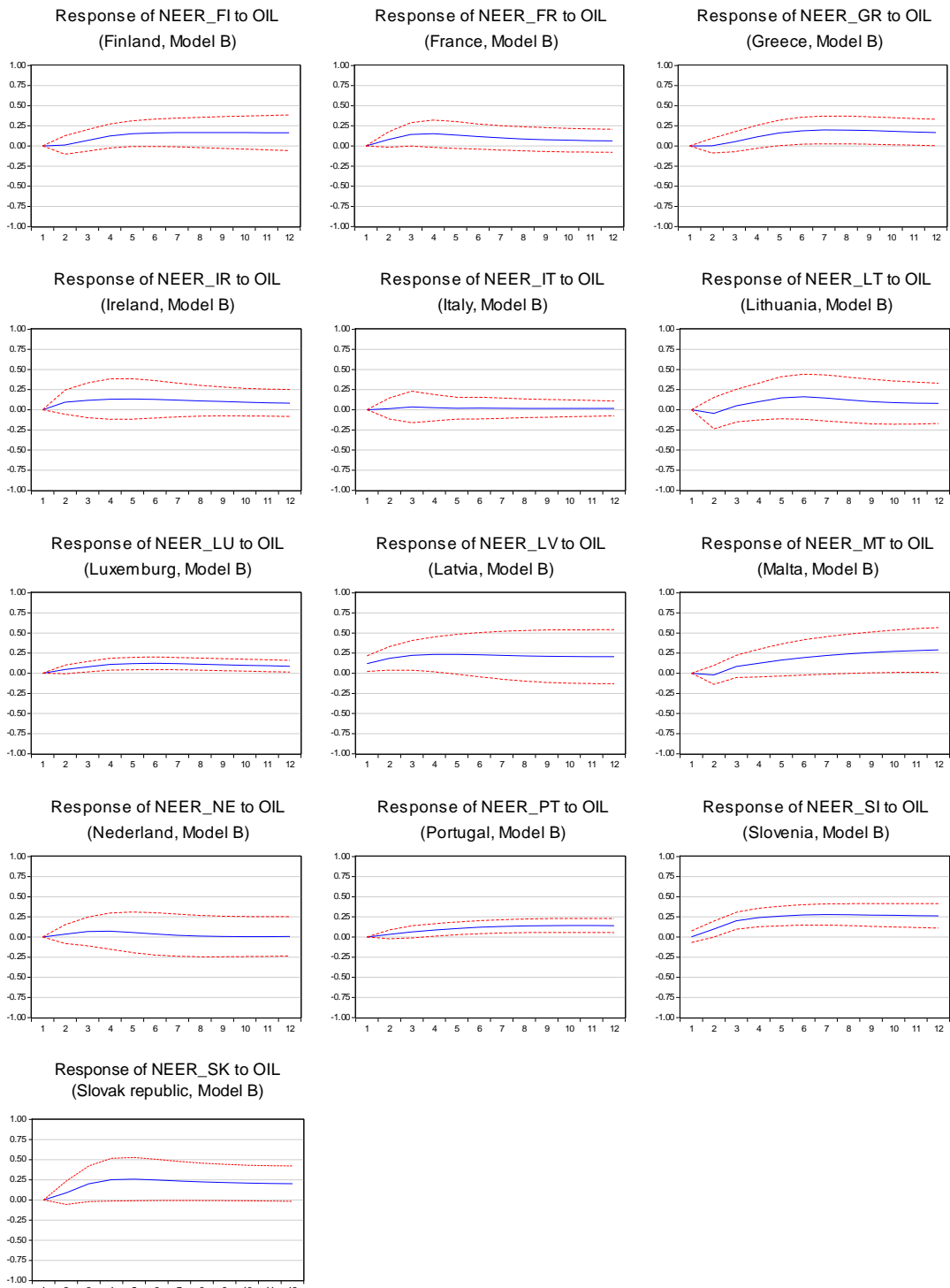
In the rest of countries we observed more dynamic initial response of NEER to the positive oil price shock. Higher absorption capability of exchange rates in these countries reduces inflation pressures associated with external price shock and its transmission to domestic prices.

Our results also indicate different durability of the effect of the external price shock on NEER in the Euro Area member countries. In large economies and Euro Area outliers the overall positive effect of the oil price shock clearly died out earlier in comparison with the rest of countries from the group. While generally temporary in most of countries, NEER appreciation seems to be permanent in just three economies (Finland, Slovenia and Slovak republic<sup>7</sup>).

Low exposure of the exchange rate to the oil price shock reduces its absorption capabilities. We expect that this feature of exchange rates will be crucial consideration in examining the second stage in the exchange rate pass-through. Reduced exchange rate responsiveness to the external price shocks increases the transmission of the price effect to the domestic prices. Imported inflation is clear implication of the exchange rate rigidity in such cases and it is also a contrary example to the traditional views emphasizing positive effects of the (fixed) exchange rate based stabilization economic policies. On the other hand, higher and durable responsiveness of exchange rates to the oil price shock in the second group of countries reduces the transmission of the price effect to domestic prices and thus contributes to offset the expected inflation pressures originated in the negative external price shock. As a result, exchange rates in these countries operate more as an external price shock absorber. Assumptions about expected transmission or absorption capabilities of exchange rates in both groups of countries will be comprehensively evaluated by assessing the second stage in the exchange rate pass-through to import prices, producer prices and consumer prices.



<sup>7</sup> It is necessary to note that Slovenia and Slovakia operated during the most of the pre-crisis period outside the Eurozone.



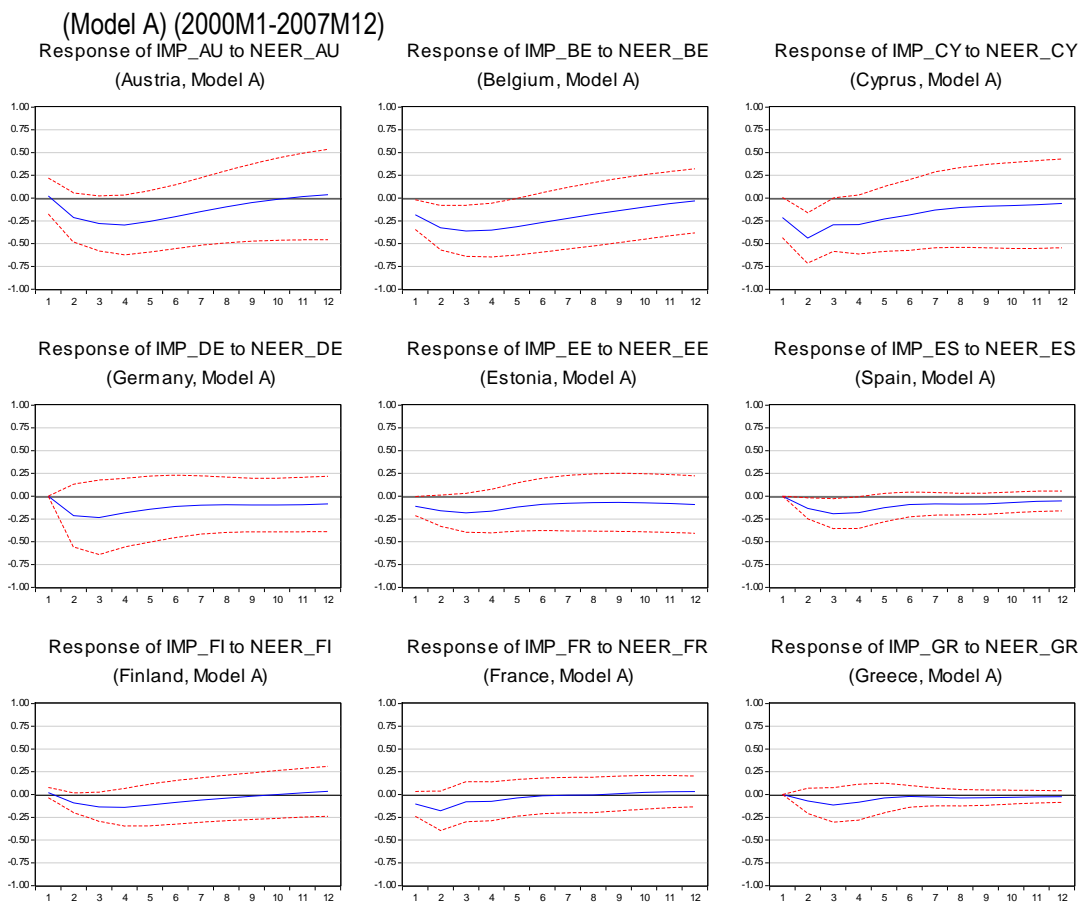
Note: Curves represent responses of exchange rates (NEER) to the positive one standard deviation oil price (OIL) shock in each country from the group of the Euro Area member countries.

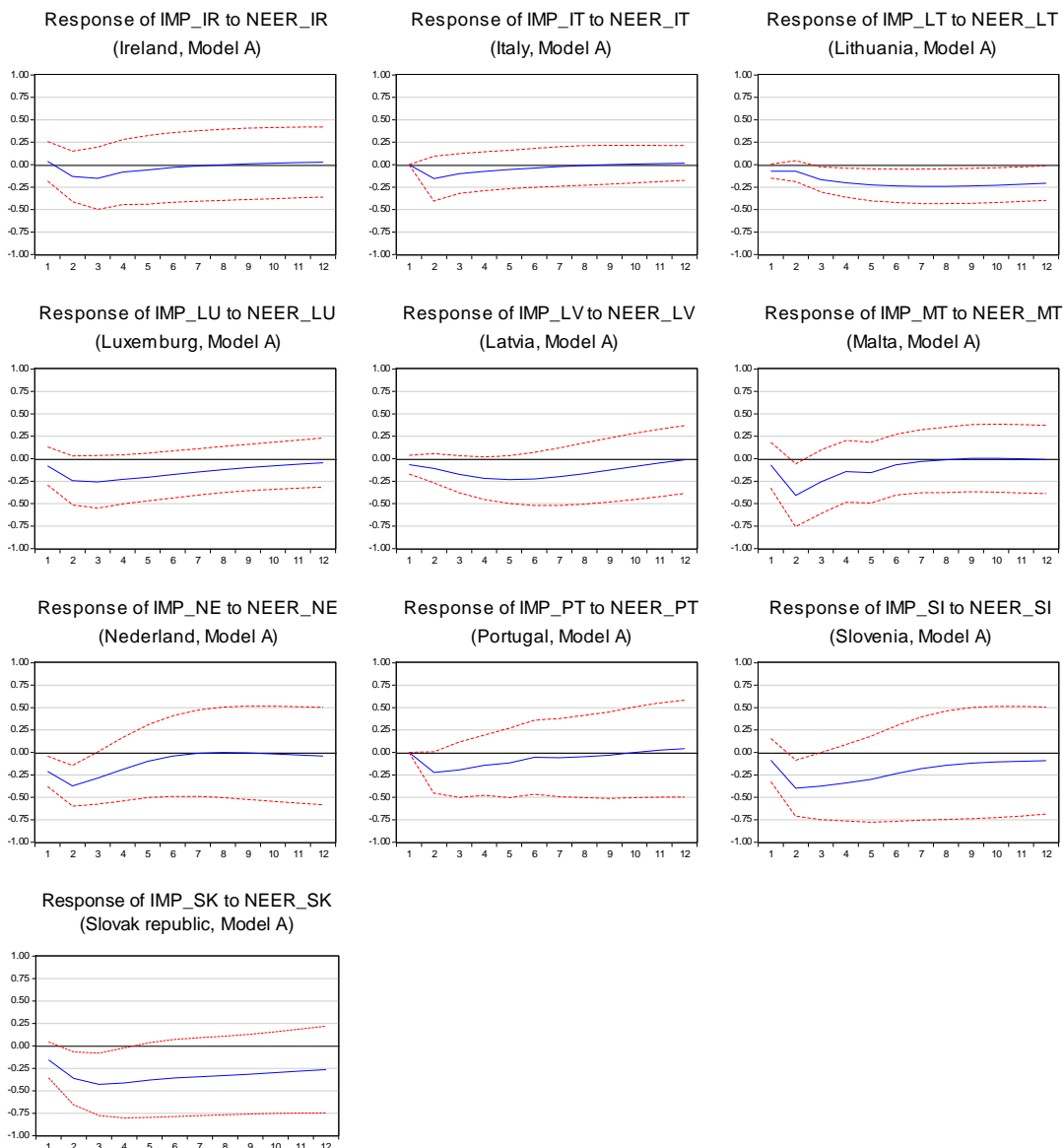
Source: Author's calculations.

**Figure 5.2 Responses of Exchange Rates to Oil Price Shock**

Crisis period affected short-term responsiveness of exchange rates to the positive one standard deviation oil price shock in all Euro Area member countries (Figure 5.2). In general, the NEER response during the extended period followed slightly lagged, less intensive and less durable path toward its long-run pre-shock equilibrium in all countries. Permanent feature in the NEER response was preserved in Slovenia and Slovak republic. Generally lower responsiveness of NEER to the exogenous price shocks during the extended period indicates reduced absorption capabilities of exchange rate due to crisis related effects. As a result, the crisis period increased the overall vulnerability of the Euro Area member countries to the external price shocks.

Examination of the second stage in the exchange rate pass-through includes estimation of the import prices, producer prices and consumer prices responses to the positive one standard deviation exchange rate shock (unexpected exchange rate appreciation) employing monthly data for two subsequent periods 2000-2007 (model A) and 2000-2014 (model B).





Note: Curves represent responses of import prices (IMP) to the positive one standard deviation exchange rate (NEER) shock in each country from the group of the Euro Area member countries

Source: Author's calculation.

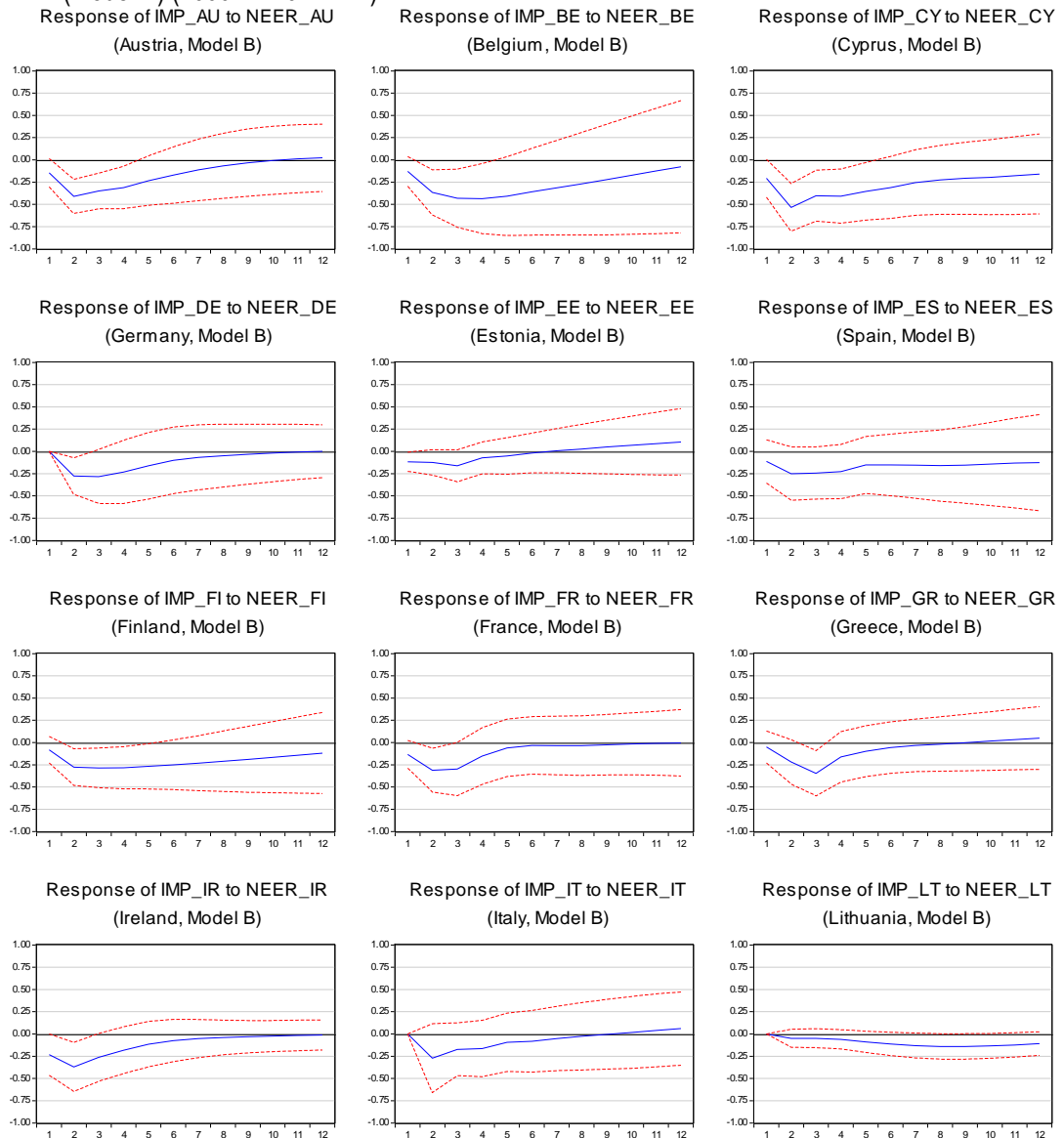
**Figure 5.3 Responses of Import Prices to Exchange Rate Shock**

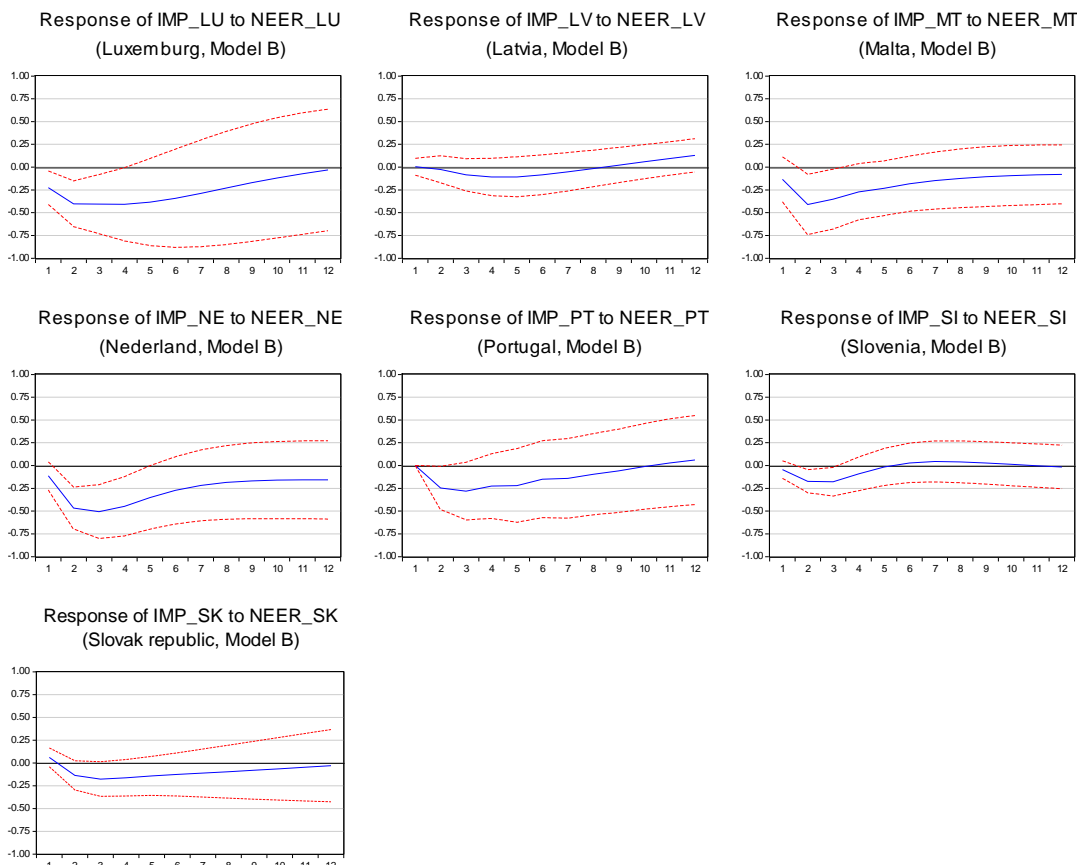
In the figure 5.3 we summarize results of impulse-response functions of the import prices to the positive (increase in) exchange rate shocks in both models in the Euro Area member countries. While we observed some similar patterns in the import prices responsiveness in the whole group of countries there are still some differences than need to be discussed. Most of the initial effect of the exchange rate shock affected import prices in all countries within first 2-3 months and then steadily decreased. Only exception we observed in Latvia and Lithuania where import prices decreased with a reduced intensity. Effect of the exchange rate shock on import prices seems to be neutral in the long run in all countries. Moreover, smaller and more opened economies experienced more dynamic initial decrease



in import prices followed by the exchange rate shock. Increased vulnerability of import prices contributed to higher absorption capabilities of NEER in these countries. Moreover, import prices, as the first element in the internal price chain, initiated impulse that will spread across remaining two price indexes (producer prices and import prices). Responsiveness of the latest two indexes to the unexpected exchange rate shock may provide crucial information about efficiency of the transmission mechanism of the external price shock across internal price chain in individual countries.

(Model B) (2000M1-2014M12)





Note: Curves represent responses of import prices (IMP) to the positive one standard deviation exchange rate (NEER) shock in each country from the group of the Euro Area member countries

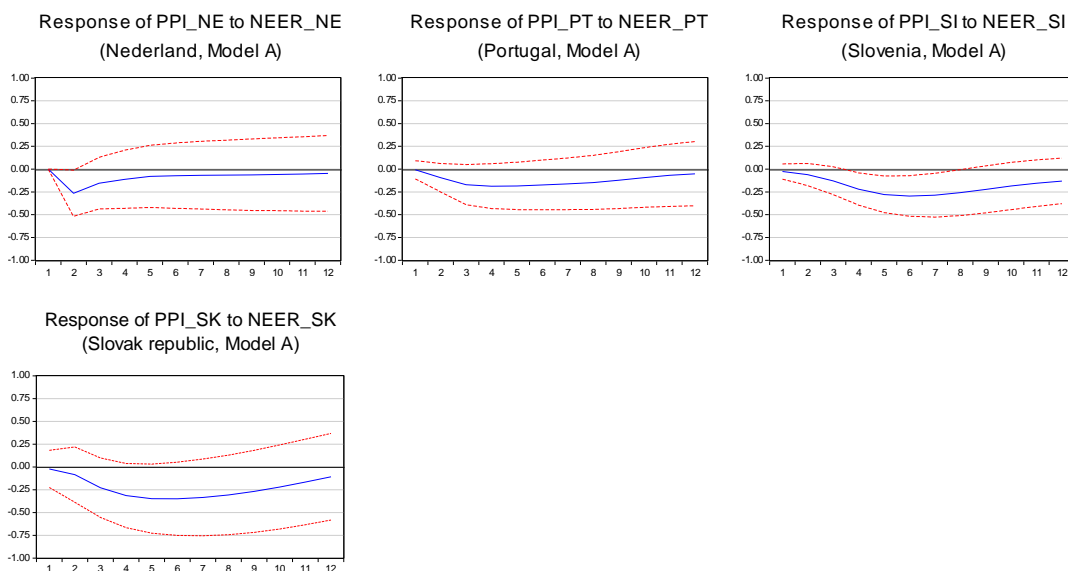
Source: Author's calculation.

**Figure 5.4 Responses of Import Prices to Exchange Rate Shock**

Crisis period affected responsiveness of import prices to the positive one standard deviation exchange rate shock in the Euro Area member countries though we observed some differences that need to be discussed (Figure 5.4). In general, all Euro Area member countries except for new members (Baltic countries, Slovakia and Slovenia) experienced increased short term vulnerability of import price to the unexpected NEER shock. Similarly to the results for the pre-crisis period, negative effect (decrease in prices) of the shock culminated within first three months (except for Lithuania) and was neutral in the long run as its effect completely died out mostly within one year since the shock. Higher short-term sensitivity of the import prices to the exchange rate shock induces increased absorption capabilities of NEER in most of the Euro Area member countries. However, our results for producer prices and consumer prices did not confirm the idea of the transmission of the exchange rate absorption capabilities across the internal price chain.

(Model A) (2000M1-2007M12)





*Note:* Curves represent responses of producer prices (PPI) to the positive one standard deviation exchange rate (NEER) shock in each country from the group of the Euro Area member countries.

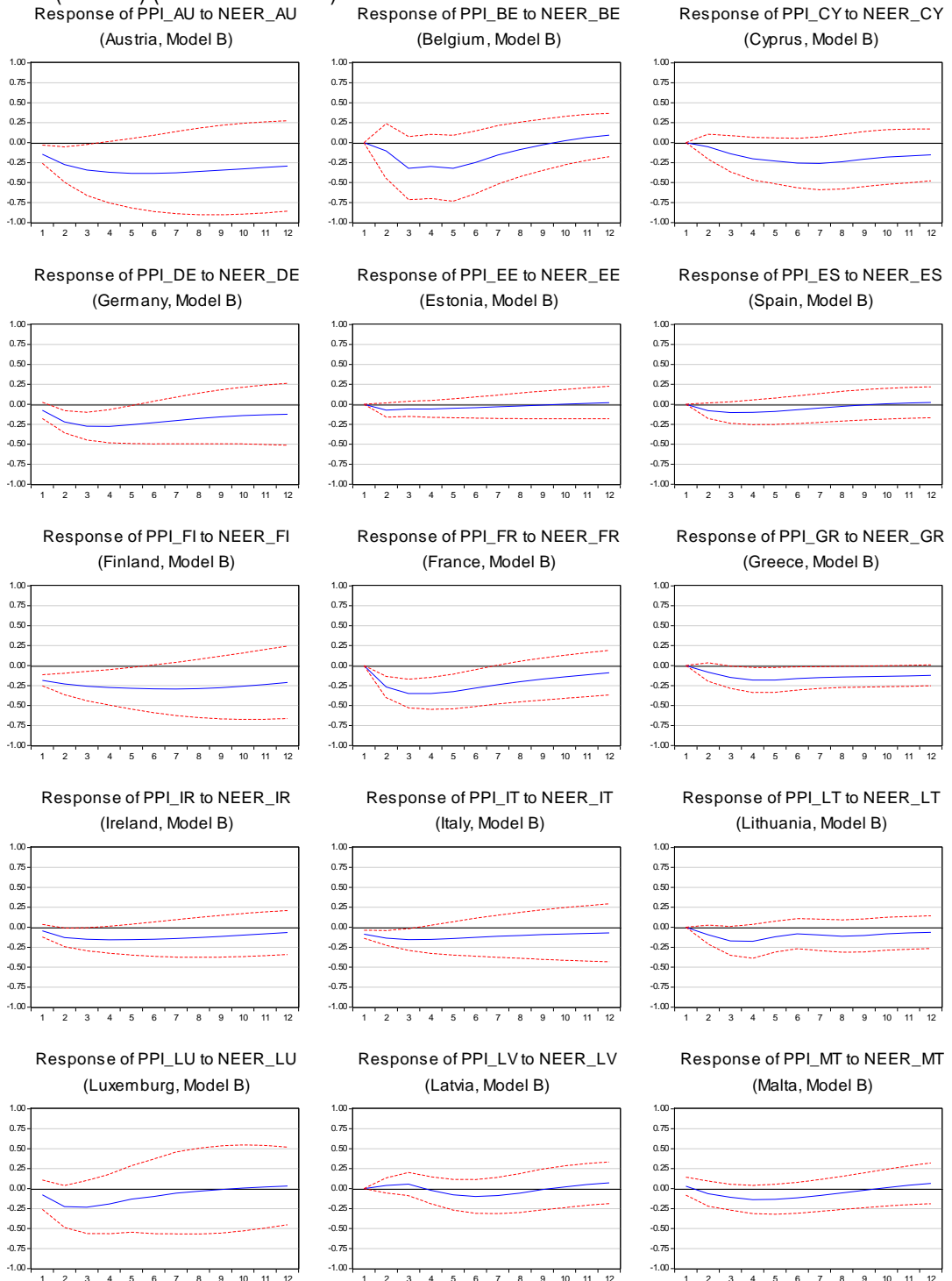
*Source:* Author's calculation.

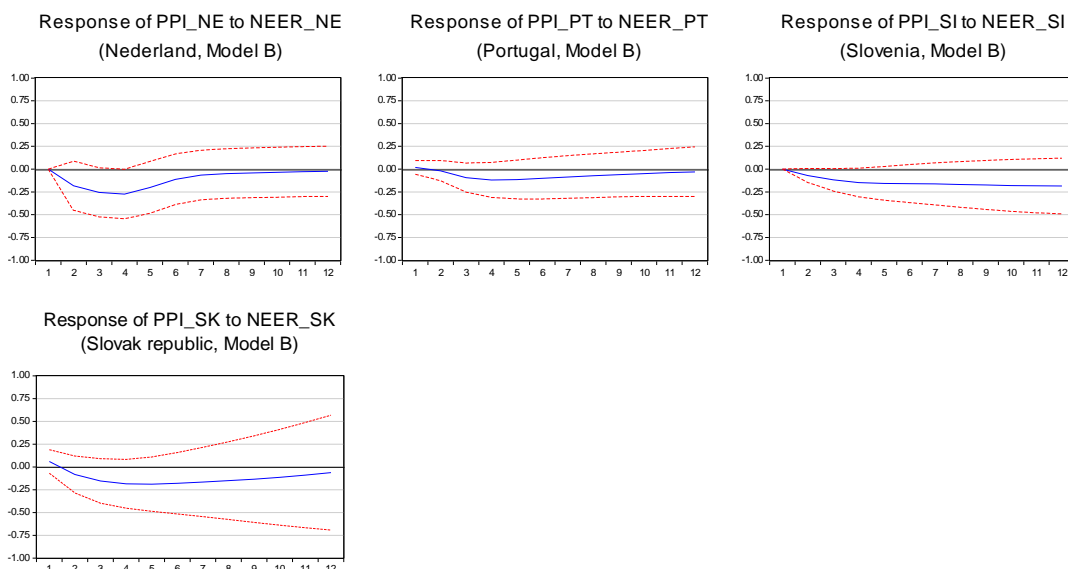
**Figure 5.5 Responses of Producer Prices to Exchange Rate Shock**

In the Figure 5.5 we summarize results of impulse-response functions of the producer prices to the positive (increase in) exchange rate shocks in both models in the Euro Area member countries. Exchange rate appreciation, in models with time series for the pre-crisis period, was followed by a drop in producer prices in all nineteen economies. However, while the positive effect of the shock culminated within first six months, the response pattern of producer prices in individual countries followed unique leading path to its pre-shock equilibrium. New Euro Area member countries from past Eastern bloc (except for Estonia) experienced more dynamic and more lagged decrease in producer prices in comparison with the rest of the Euro Area. Similar response patterns (more dynamic and durable) were observed in Cyprus and Greece. In remaining countries we observed mostly less dynamic and less durable responsiveness of producer prices. Overall effect of the shock in all countries seems to be just a temporary and thus neutral in the long run. Finally, in most of the less performing countries (mostly periphery economies) we observed higher dynamics in the responsiveness pattern of producer prices in comparison with responsiveness of import prices. Overreaction of producer prices combined with low responsiveness of NEER to the external price shock may refer to reduced efficiency of the transmission mechanism across the internal price chain. Examination of the exchange rate pass-through to producer prices revealed interesting differences in the absorption capabilities of the common currency among member countries of the Euro Area. Generally higher responsiveness of producer prices in the new Euro Area member countries from the past Eastern bloc (together with Cyprus and Greece) indicates better transmission of the asymmetric effect of the external price shock from exchange rate (appreciation) to producer prices (decrease) in the short-run period. As a result, higher flexibility of the exchange rate pass-through in these countries reduces their vulnerability to the exogenous price shocks. At the same time, less dynamic response

of producer prices in the most of the Euro Area member countries increase their exposure to the unexpected external price shocks.

(Model B) (2000M1-2014M12)





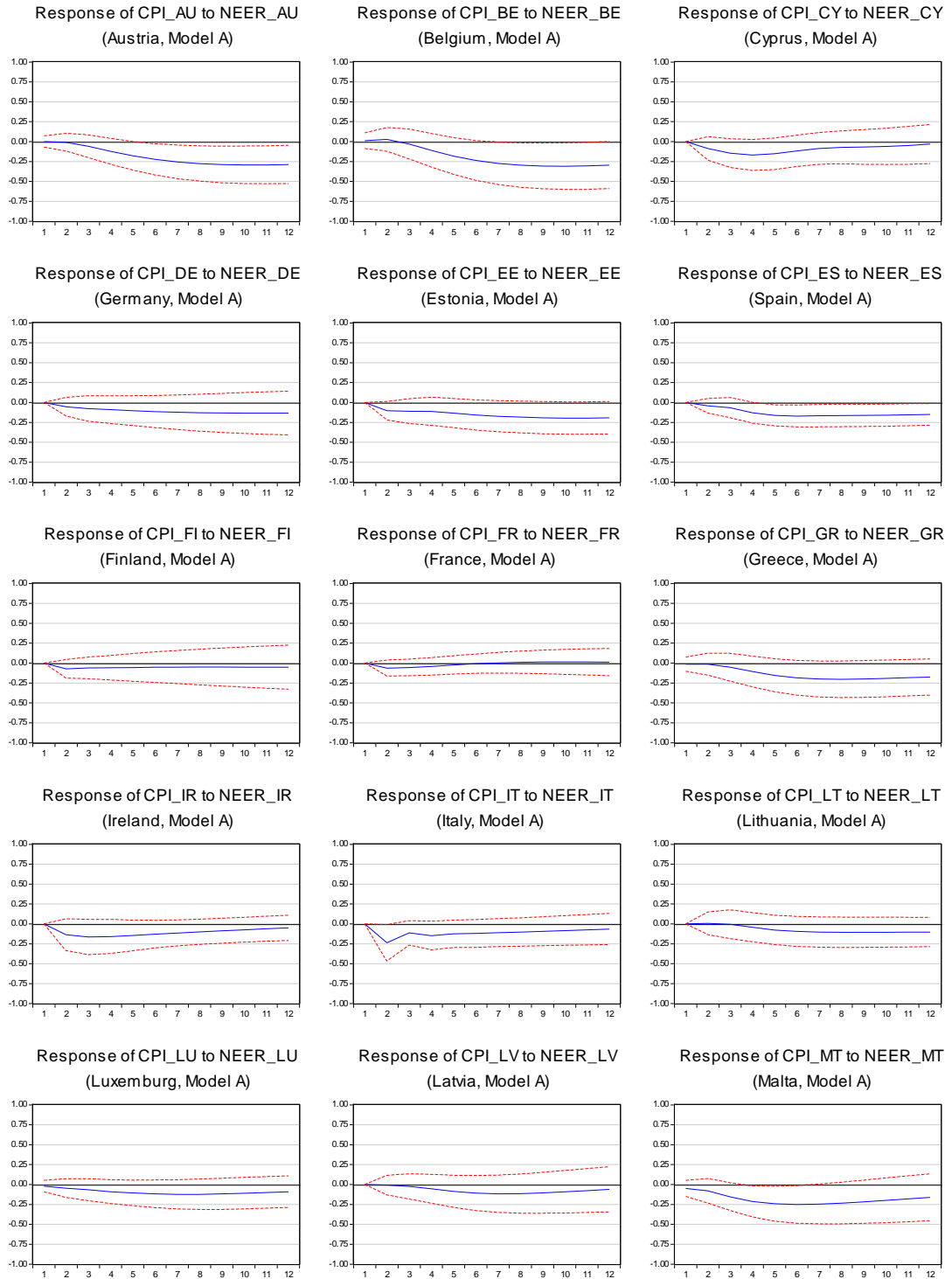
*Note:* Curves represent responses of producer prices (PPI) to the positive one standard deviation exchange rate (NEER) shock in each country from the group of the Euro Area member countries

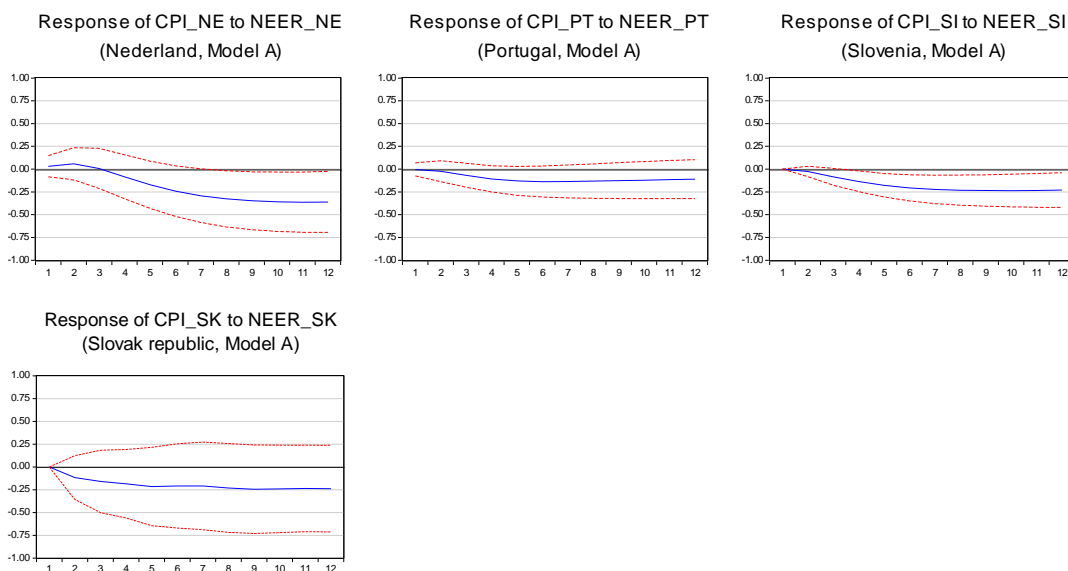
*Source:* Author's calculation.

**Figure 5.6 Responses of Producer Prices to Exchange Rate Shock**

Crisis period affected responsiveness of producer prices to the positive one standard deviation exchange rate shock in our group of countries though we have recognized some differences that need to be discussed (Figure 5.6). NEER appreciation was followed by general decrease in producer prices. However, crisis period reduced responsiveness of producer prices (mostly in terms of dynamics and in some cases also in the speed of adjustment) to the unexpected exchange rate shock in group consisting of the new Euro Area member countries (Baltic countries, Slovakia and Slovenia) and the less performing core Euro Area members represented by periphery countries (PIGS), Cyprus, Ireland and Malta. We suggest that these countries experienced a reduction in efficiency of the exchange rate pass-through to producer prices that increased their vulnerability to external price shocks due to reduced absorption capabilities of their NEER. Moreover, remaining countries from the core of the Euro Area experienced an increased dynamics in the response pattern of their producer prices to the unexpected exchange rate shock. It seems that generally better macroeconomic conditions in these countries resulted in the overall improvement of the exchange rate pass-through to producer prices. As a result, absorption capabilities of NEER in the core countries were improved and the vulnerability and exposure of the core countries to the external price shocks was generally reduced. We suggest that less performing economies of the Euro Area seem to be more vulnerable to the external price shocks and thus more prone to deflationary pressures driven by external shocks.

(Model A) (2000M1-2007M12)





*Note:* Curves represent responses of consumer prices (CPI) to the positive one standard deviation exchange rate (NEER) shock in each country from the group of the Euro Area member countries.

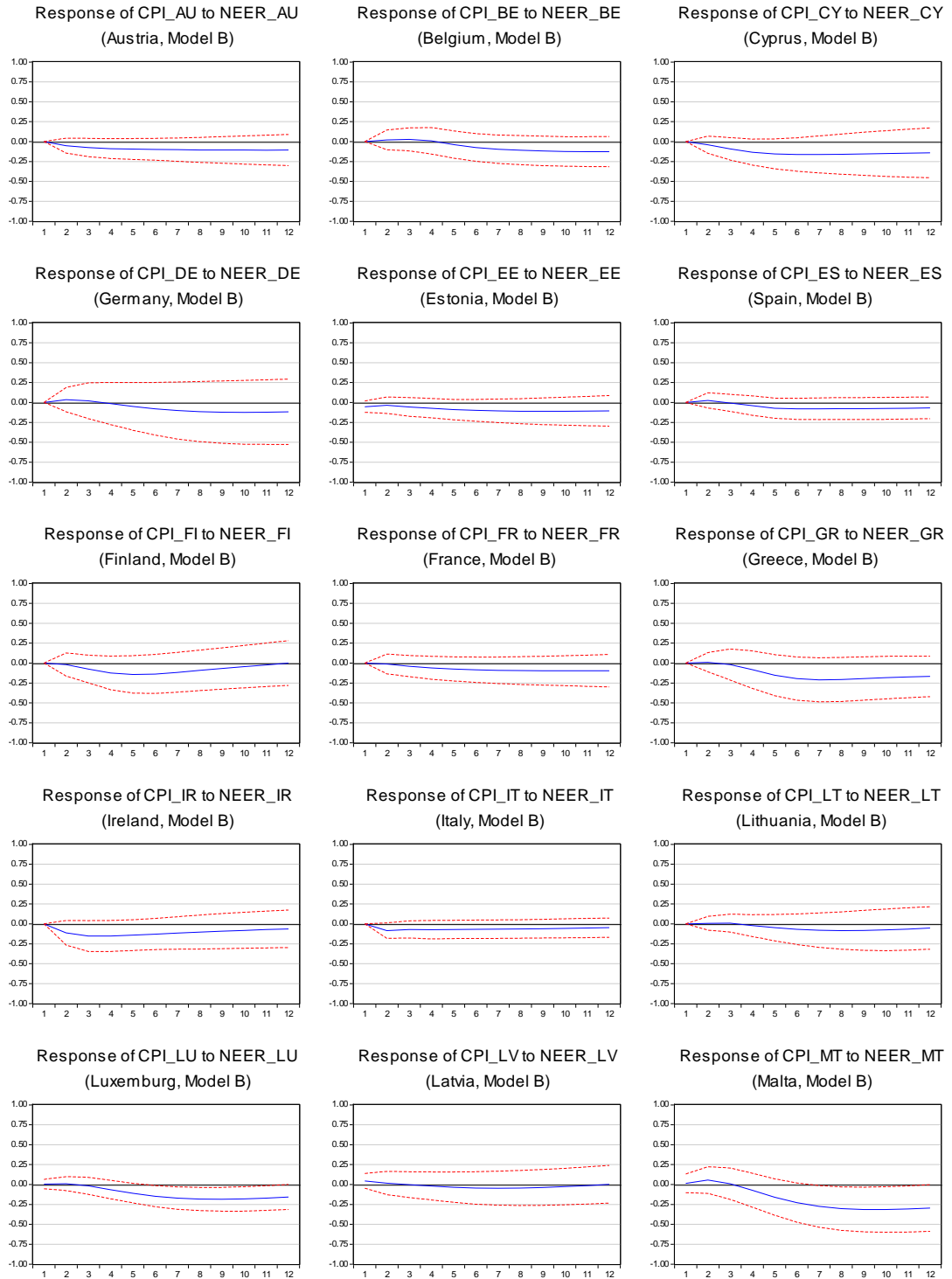
*Source:* Author's calculation.

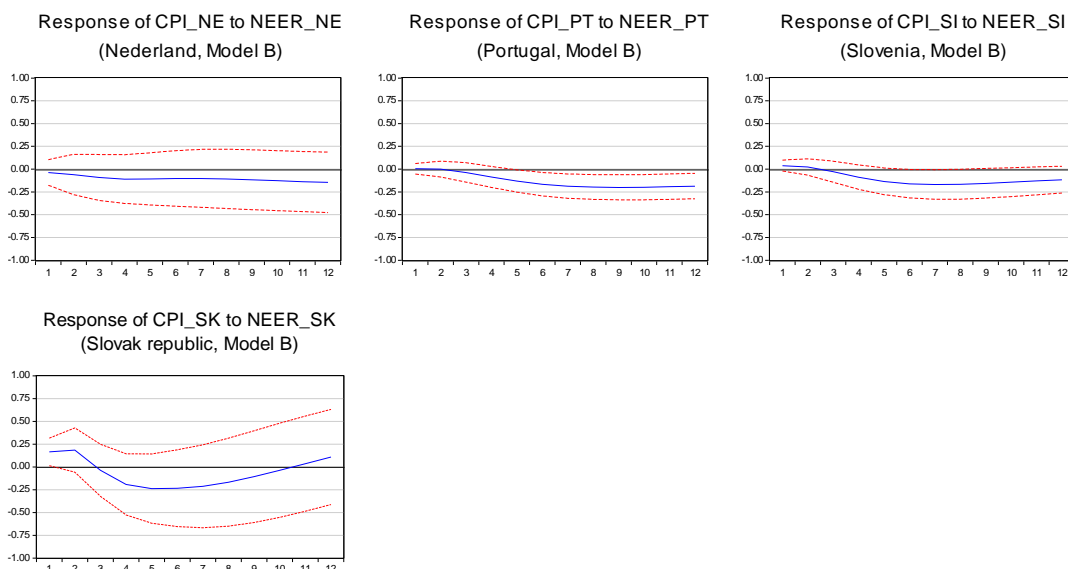
**Figure 5.7 Responses of Consumer Prices to Exchange Rate Shock**

In the Figure 5.7 we summarize results of impulse-response functions of the consumer prices to the positive (increase in) exchange rate shocks in both models in the Euro Area member countries. We observed that unexpected exchange rate appreciation was followed by a decrease in consumer prices in all countries though we observed some differences in the response patterns of domestic prices. Large economies and most of outliers experienced lagged and moderate decrease in consumer prices followed by the positive NEER shock. Effect of the shock in this group of countries seems to be just a temporary and gradually died out in the long run. Cyprus, Finland and Ireland experienced only small and short-term decrease in consumer prices. The rest of countries experienced lagged though more dynamic decrease in consumer prices followed by the exchange rate shock. Effect of the shock seems to be just a temporary and thus neutral in the long run in all countries but Estonia and Slovenia. Finally, in some economies (Belgium, Estonia, Spain, Ireland, Italy, Malta, and Nederland) we observed increased dynamics in the responsiveness pattern of consumer prices in comparison with responsiveness of producer prices. Overreaction of producer prices combined with low responsiveness of import prices to the NEER shock indicates reduced efficiency of the transmission mechanism across the internal price chain.

(Model B) (2000M1-2014M12)







*Note:* Curves represent responses of consumer prices (CPI) to the positive one standard deviation exchange rate (NEER) shock in each country from the group of the Euro Area member countries.

*Source:* Author's calculation.

**Figure 5.8 Responses of Consumer Prices to Exchange Rate Shock**

Crisis period affected responsiveness of consumer prices to the positive one standard deviation exchange rate shock in the Euro Area member countries though we observed some differences that need to be discussed (Figure 8). In general, the overall short-term decrease in consumer prices seems to be reduced and slightly lagged in the most of countries. Higher medium term dynamic in the consumer prices response pattern was observed in Cyprus, France, Luxemburg, Malta and Portugal.

## Conclusion

Investigation of the first stage in the exchange rate pass-through revealed reduced absorption capabilities of NEER in large economies (Germany, Spain, France, Italy), countries of Benelux (except for Belgium) and Portugal in comparison with the rest of countries from the Euro Area. Reduced exchange rate responsiveness to the external price shocks increases the transmission of the price effect to the domestic prices.

While the examination of the first stage in the exchange rate pass-through during the pre-crisis period generally confirmed higher absorption capabilities of NEER in countries from the past Eastern bloc (due to more dynamic responsiveness of producer prices to the exchange rate shock), reduced absorption capabilities of NEER in Portugal, Italy and Spain indicates increased vulnerability of less performing periphery members of the Euro Area to the external price shocks. Moreover, reduced absorption capabilities of NEER in all countries during the crisis period just highlighted higher exposure of all Euro Area members operating under common currency to the external price shocks. Most of the countries from the core of the Euro Area experienced more dynamic NEER response to the oil price shock. As a result, fixed exchange rate operated more as the external price shock absorber reducing effect of so called imported inflation (or deflation) in these countries.

Second stage of the exchange rate pass-through revealed interesting differences in the absorption capabilities of NEER among the Eurozone member countries. Exchange rate shock was followed by immediate decrease in import prices (within first three months) in all countries but Latvia and Lithuania. As a result, initial effect of the exchange rate shock (followed by oil price shock that appreciated NEER) was adequately transmitted to the import prices. Import prices, as the first element in the internal price chain, initiated impulse that will spread across remaining two price indexes (producer prices and import prices). Crises period generally increased short-term responsiveness of import prices to the exchange rate shock except for Baltic countries, Slovakia and Slovenia. However, our results for producer prices and consumer prices did not confirm the idea of the transmission of the exchange rate absorption capabilities across the internal price chain.

Higher responsiveness of producer prices in the new Eurozone member countries from the past Eastern bloc (together with Cyprus and Greece) indicates better transmission of the asymmetric effect of the external price shock from exchange rate (appreciation) to producer prices (decrease) in the short-run period. As a result, higher flexibility of the exchange rate pass-through in these countries reduces their vulnerability to the exogenous price shocks. At the same time, less dynamic response of producer prices in the most of the Eurozone member countries increase their exposure to the unexpected external price shocks. Crisis period clearly reduced absorption capabilities of NEER in PIGS countries, Cyprus, Ireland and Malta due to reduced responsiveness of their producer prices to the unexpected exchange rate shock. As a result, these countries experienced increased vulnerability to external price shocks due to reduced absorption capabilities of their NEER while absorption capabilities of NEER in the core countries generally improved and thus reduced their vulnerability to the external price shocks.

Summary of the response patterns to the unexpected positive NEER shock for the last component in the internal price chain, consumer prices, revealed mixed results. Most of the countries experienced lagged and moderate decrease in consumer prices followed by the exchange rate shock. However, combination of low NEER exposure to oil price shock and reduced responsiveness of consumer prices to the NEER shock mostly in less performing economies of the Euro Area intensifies the transmission of the external inflation pressures to domestic prices. As a result, negative external price shocks in the time of crises may operate as a vehicle of imported deflation and contribute to the domestic demand driven deflationary pressures in bad times. On the other hand, most of the remaining countries experiencing more dynamic NEER response to the oil price shock that together with increased responsiveness of consumer prices to the NEER shock reduced the effect of the exchange rate pass-through to domestic prices. Crisis period reduced vulnerability of both NEER and consumer prices to above mentioned unexpected structural shocks. As a result, exchange rate pass-through to domestic prices was intensified due to crisis related effects reducing external price related absorption capabilities of NEER in the most of the Euro Area member countries.

Finally, analysis of the transmission of the price impulse initiated by the external price shock across the internal price chain revealed interesting implications of the heterogeneity problem in the Euro Area. In most of the Euro Area periphery and less performing countries we examined the pattern of small dynamics in import prices, higher dynamics in producer prices and even higher responsiveness of consumer prices followed by the positive NEER shock. Some sort of overreaction in the internal price chain indicates competitiveness issues in the less performing group of Euro Area member countries.

However, while the crisis period mostly reduced the effect of overreaction across the internal price chain (except for the response patterns in import prices), reduced vulnerability of producer prices and consumer prices to the unexpected positive NEER shock clearly reduced absorption capabilities of the exchange rates mostly in the weaker part of the Euro Area resulting in their higher vulnerability to the external price shocks. At the same time, increased differences in response patterns between a) import prices (overreaction) and b) producer prices (reduced responsiveness) and consumer prices (reduced responsiveness) indicates distortionary effects of the crisis period on the price transmission mechanism across internal price chain.

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## Chapter 6

### Real Exchange Rates, Current Accounts and Competitiveness Issues in the Euro Area

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6.1 Introduction

6.2 Overview of the Literature

6.3 Main Trends in Current Account Imbalances in the Euro Area

6.4 Econometric Model

6.5 Data and Results

Conclusions

References



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## Real Exchange Rates, Current Accounts and Competitiveness Issues in the Euro Area

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### 6.1 Introduction

Euro Area member countries are still suffering from negative effects of the crisis period. Increasing economic imbalances have become obvious in the Euro Area since the start of the monetary union. Differentials in productivity, inflation and unit labor costs were indeed very persistent (Comunale and Hessel, 2014). Economic and debt crisis highlighted their existence and inappropriate economic policy mix has even intensified their negative implications. Economic imbalances are obvious not only among different countries (e.g. rising disparities between core and periphery) but also within particular member countries of the Euro Area (Gruber and Kamin, 2005). In addition, we can observe clear contagion effect among the European Union member countries. Disturbances and distortions are fairly transmitted on both intra-country and cross-country levels (Berger and Nitsch, 2010).

Exposure of countries to negative implications of exchange rate volatility (Stavárek, 2011) represents one of areas of empirical investigations related to the fixed versus flexible exchange rate dilemma (Calvo and Reinhart, 2002). Analysis of various aspects of exchange rate shift and its influence on macroeconomic performance provides information on cross-country expenditure shifting/switching effects. The lack of nominal exchange rate flexibility in the monetary union induces the growing divergence of trade performance among the member countries with different income levels per capita (Chen, Milesi-Ferretti and Tressel, 2012). Fixed nominal exchange rate triggers real exchange rate adjustments through relative price and unit labor costs levels alone, which can be difficult in the presence of rigidities in national goods and services markets (Berger and Nitsch, 2010).

Investigation of relative changes in real exchange rates and associated adjustments in current accounts reveals causal relationship between real exchange rate and international competitiveness (Rusek, 2013). Shifts in competitiveness associated with real exchange rate movements correspond to changes in relative prices and unit labor costs. Real exchange rate appreciation makes domestic goods less competitive because their prices increase more than foreign prices. As a result, real exchange rate appreciation and subsequent decrease in foreign competitiveness of domestic goods on foreign as well as domestic markets shifts expenditures from domestic goods to goods produced abroad (Mirdala, 2013a). Negative effect of the real exchange rate appreciation on the current account is significantly determined not only by a shift in demand preferences but also by the ability of domestic



economy to shift unused production capacities to more perspective areas with high growth perspectives (Chinn, 2005).

The establishment of the Euro Area and introduction of the euro represent a crucial milestone in the ongoing discussions highlighting positive and negative implications of the nominal exchange rate inflexibility (Bayoumi, Harmsen and Turunen, 2011). Although the contemporary evidence on empirical validity of causal relationship between the real exchange rate and the current account seems to be limited (Arghyrou and Chortareas, 2008), we emphasize challenges addressed to the phenomenon of internal devaluation (Armingeon and Baccaro, 2012) and wide range of its direct and indirect effects in the Euro Area member countries.

While internal devaluation in countries with nominal exchange rate anchor may improve price competitiveness and boost both internal and external demand, risk of deflationary pressures substantially reduce vital growth incentives (Hetzl, 2015). Moreover, ECB (European Central Bank) by inflating its monetary base fueled by another wave of quantitative easing does not primarily follow idea of economic recovery (Christensen and Gillan, 2015). Low interest rate environment may be followed by euro depreciation improving competitiveness of European producers on the foreign markets. However, as the most of transactions on the EU single market are conducted in euro among its member countries, Euro Area seeks common reasonable automatic mechanisms that would help to improve its internal competitiveness (Peersman, 2011).

Economic crisis intensified demand driven redistributive effects that induced diverse and spurious effects on current account adjustments. While current accounts temporarily deteriorated (with quite different intensity in each particular economy) at the beginning of the crisis period (Kang and Shambaugh, 2013), at the later stages we have observed a positive trend (either improvement or stable outlook) in almost all Euro area member countries reflecting intensified redistributive effects of the crisis on the cross-country expenditure shifting (Gaulier and Vicard, 2012). However, existing nexus between surpluses in the core with deficits in the periphery addresses issues in both trade and financial linkages (Hobza and Zeugner, 2014). While current accounts between North and South of the Euro Area do not necessarily have to be balanced, existence of large and persisting bilateral current account imbalances may induce policy tensions or rigidities (Berger and Nitsch, 2012). Euro area is in a vicious circle and economic policy of European Union faces a real challenge.

Intra-Eurozone current account imbalances among countries with different income levels per capita fuel discussions on competitiveness channels under common currency (Belke and Dreger, 2011). Disinflation followed by deflationary pressures induced shifts in competitiveness associated with real exchange rate adjustments through relative price levels. While external imbalances in countries on the periphery of the Euro Area were mainly driven by domestic demand boom fueled by increasing financial integration (Chen, Milesi-Ferretti and Tressel, 2012), the role of changes in the competitiveness of the Euro Area core countries may be disputable. As a result, limited effectiveness of internal devaluation in reducing current account imbalances in the Euro Area could be expected (Sanchez and Varoudakis, 2013). However, asynchronous current account trends between North and South of the Euro Area were accompanied by significant appreciations of real exchange rate in the periphery economies originating in the strong shifts in consumer prices and unit labor costs in these countries relative to the countries of the Euro Area core (Holinski, Kool and Muysken, 2012). As a

result, the issue is whether the real exchange rate is a significant driver of persisting current account imbalances in the Euro Area (Lane and Milesi-Ferretti, 2002).

In the chapter we examine competitiveness issues associated with current account development in the Euro Area member countries. Our main objective is to examine effects of the unexpected shifts in real effective exchange rates (REER) and overall demand and associated current account adjustments in the core and periphery of the Euro Area. We employ VAR methodology to analyze responsiveness of current account to the real exchange rate (REER calculated on CPI and ULC base) and demand shocks as well as the relative contribution of both shocks in explaining adjustments in current accounts. Possible implications of the crisis period will be considered by the comparison of estimated results for two models estimated for each individual country for two subsequent periods 2000-2007 (pre-crisis period) and 2000-2014 (extended period). In both models for each country we alternate both CPI and ULC based REER. We suggest that a comparison of the results for models with different time period is crucial to understand redistributive effects and competitiveness issues associated with real exchange rates shifts (induced by different dynamics in the consumer prices and unit labor costs movements between the core and periphery of the Euro Area) and overall demand shifts.

Following the introduction, we provide brief overview of theoretical concepts referring to the relationship between the real exchange rate dynamics and current account adjustments in Section 6.2. In Section 6.3 we provide an overview of the empirical evidence about current account imbalances in the Euro area member countries. While the recent empirical literature provides lot of evidence about the effects of real exchange rates shifts on current accounts, conclusion are quite different according to the relative importance of changes in competitiveness and its role in triggering intra-Eurozone current account imbalances. In Section 6.4 we observe main trends in the current account development in the Euro area member countries and highlight some stylized facts about common implications resulted from its determination. In Section 6.5 we provide a brief overview of the VAR model (recursive Cholesky decomposition is employed to identify structural shocks) that was employed to examine responsiveness of current accounts to the positive one standard deviation real exchange rate and demand shocks in the Euro Area member countries as well as the relative importance of both shocks in explaining adjustments in current accounts. In Section 6 we discuss the main results.

## 6.2 Overview of the Literature

Bussiere, Fratzscher and Muller (2004) analyzed the current account determination in 33 countries employing an intertemporal approach via regression analysis considering effects of fiscal stance of government as well as real exchange rate deviations. Authors suggest that current account balances of countries included in the model are close to their structural current account positions confirming a validity of the intertemporal approach. Arghyrou and Chortareas (2008) investigated dynamics of current account adjustments and the role of real exchange rates in the current account determination in the EMU. Despite a limited evidence of most theoretical models in explaining causal relationship between real exchange rates and the current account, authors confirmed above relationship with significant validity and subject to non-linear effects. Lee and Chinn (2006) analyzed implications of real exchange rate fluctuations on the current account development in 7 most developed industrial countries. Authors suggest that while the variation in the current account is mostly determined by temporary shocks, permanent shocks seem to be much more crucial in explaining the variation in the

real exchange rate. At the same time, their results confirmed validity of the intertemporal opened economy model. Sek a Chuah (2011) explored causality between the exchange rate changes and the current account adjustments in 6 Asian countries. Authors surprisingly conclude that the current account did not change much expected after the crisis. They suggest it is due to adjustments that authorities made in countries' financial policies to reduce the excessive exchange rates volatility. Obstfeld and Rogoff (2005) focused their investigation on estimation of effects of global current account imbalances reduction on exchange rates (USD, EUR and Asian currencies) equilibrium path in the model with alternative scenarios. Gruber and Kamin (2005) examined the global pattern of current account imbalances by estimating panel regression models for 61 countries over the period 1982-2003. Authors suggest that traditional determinants do not provide a comprehensive explanation of large current account imbalances for the U.S. economy and Asian countries emphasizing an increased importance of role of financial crises itself. Mendoza (1995) examined the relationship between terms of trade, trade balances and business cycles using a three-sector intertemporal equilibrium model and a large multi-country database. His results indicate that terms of trade shocks associated with sudden real exchange rate shifts account for nearly  $\frac{1}{2}$  of actual total output variability.

Bayoumi, Harmsen and Turunen (2011) examined competitiveness issues within the Euro Area. Authors estimated responsiveness of both intra and extra Euro Area export volumes to changes in competitiveness using panel data. Their results suggest that long-term price elasticities for intra-Euro Area exports are at least double those for extra-Euro Area exports, so traditional real effective exchange rate indexes may overstate the effectiveness of euro depreciation in restoring exports growth in the Euro Area periphery. Belke and Dreger (2011) traced current account imbalances according to the catching up and competitiveness factors using paneconometric techniques. Their results are in line with intertemporal approach confirming the existence of asymmetric imbalances between rich and poor countries. Moreover, real exchange rate movements are associated with changing patterns in current accounts that is why authors provide a rich evidence about the changes in competitiveness associated with unit labor costs adjustments. Chen, Milesi-Ferretti and Tressel (2012) examined origins of the current account imbalances within the Euro Area countries in terms of the relative importance of intra-Euro Area factors and external trade shocks. While generally confirming the traditional explanations for the rising imbalances, authors highlighted a large impact of competitiveness issues and asymmetric trade developments vis-à-vis China, Central and Eastern Europe and oil exporters. Comunale and Hessel (2014) aimed to investigate the relative role of price competitiveness and domestic demand as drivers of the current account imbalances in the Euro Area by employing panel error correction models for exports, imports and the trade balance. Their results indicate that although differences in price competitiveness have an influence, differences in domestic demand are more important than is often realized. Gaulier and Vicard (2012) analyzed design patterns of current account imbalances in the Euro Area. Authors investigated that while current account dynamics are correlated with unit labor costs (ULC) and imports, they are not correlated with exports. Losses in cost competitiveness do not appear to have been the cause of deficits, but rather a symptom of a demand shock leading to price-level drift in the non-tradable sector. Holinski, Kool and Muysken (2012) documented a growing divergence between current account imbalances in northern and southern euro area countries from 1992 to 2007. Authors suggest that systematic monitoring of external imbalances and implementation of better coordinated policies to prevent the emergence of

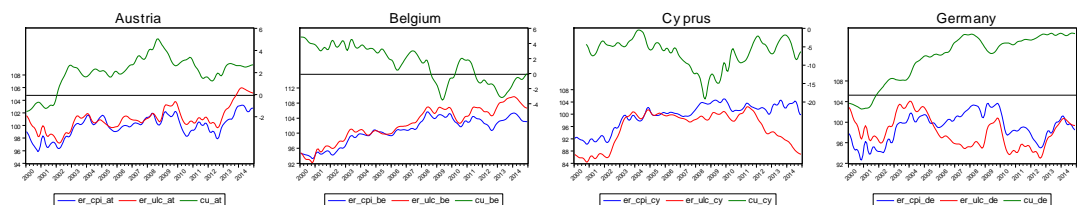
unsustainably large imbalances in the euro area is advisable. Rusek (2013) analyzed the long-term dynamics of the competitiveness in the individual Eurozone countries by estimating both external (current account) and internal (fiscal stance and credit dynamics) positions. Author suggest that changes in competitiveness associated with real effective

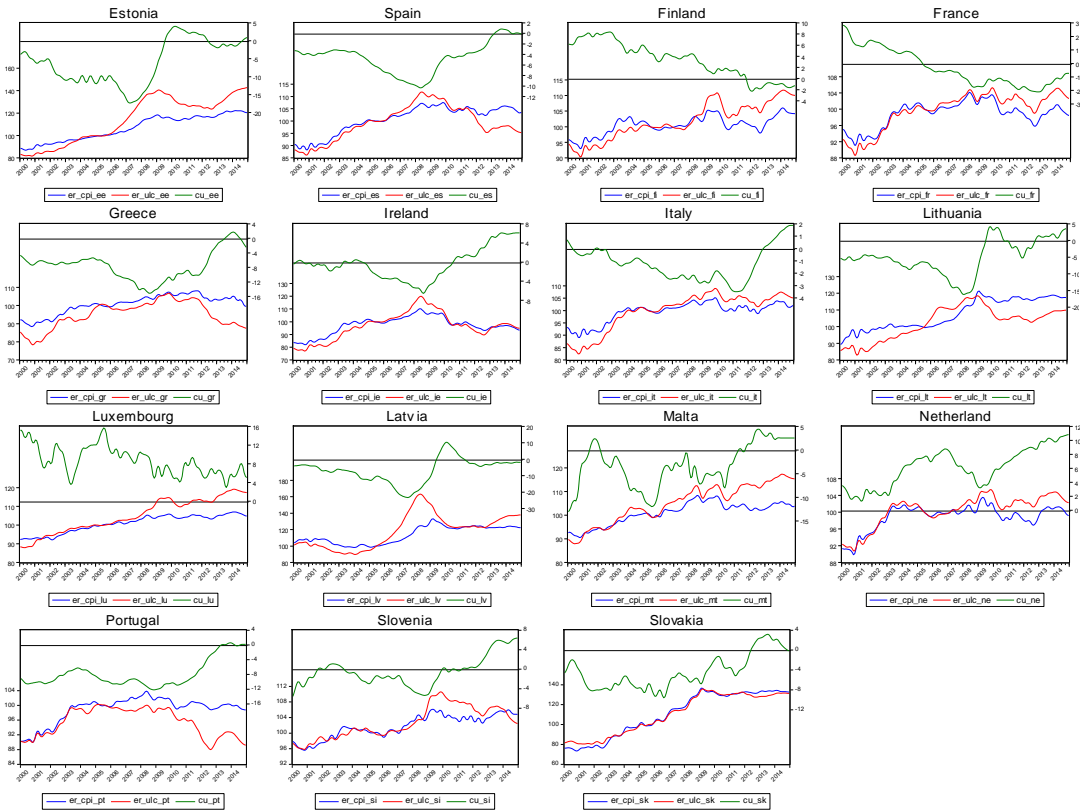
Berger and Nitsch (2010) studied bilateral trade balances for 18 European countries during the period 1948-2008. Following their results it seems that the introduction of the euro was followed by a considerable widening in trade imbalances among Euro Area members, even after allowing for permanent asymmetries in trade competitiveness within pairs of countries or in the overall trade competitiveness of individual countries. Real exchange rates and growth differentials significantly determined the direction of imbalances. In their later study (Berger and Nitsch, 2012) authors examined association between trade and financial linkages on the same sample of the countries. Hobza and Zeugner (2014) explored the role of financial links in the accumulation and then adjustment of current account imbalances in the Euro Area. Their results indicate that the geography of financial flows can differ quite markedly from trade flow patterns and suggest that the nexus between surpluses in the 'core' with deficits in the periphery went along financial rather than trade interlinkages. Lane and Milesi-Ferretti (2002) examined the link between the net foreign position, the trade balance and the real exchange rate. Authors shown that the relation between external wealth and the trade balance within and across countries is related to the rates of return on external assets and liabilities and the rate of output growth.

### 6.3 Main Trends in Current Account Imbalances in the Euro Area

Asymmetric external imbalances have become obvious since the establishment of the Euro Area. Increasing divergence in the current account balances between North and South of the Euro Area revealed bottlenecks in the architecture of the single monetary union. Recent economic crisis even increased heterogeneity within the Euro Area. Moreover, credibility of the single currency and low interest rate policy encouraged a significant capital flows from North to South of the Euro Area and contributed to the debt accumulation by both private and public sectors.

Large current account deficits fueled by real exchange rate appreciation and strong domestic demand indicates a significant loss of competitiveness in the periphery countries. Figure 1 provides a brief overview of main trends in real exchange rates and current accounts in the Euro Area member countries.





Note: CPI based real effective exchange rate (REER\_CPI) and ULC based real effective exchange rate (REER\_ULC) are expressed as indexes (left axis in figures) (2005 = 100). Current account is expressed as percentage share on GDP (CU) (right axes in figures).

Source: Compiled by author based on data taken from IMF - International Financial Statistics (November 2015). Time series for CPI and ULC based REER we drawn from Eurostat (November 2015).

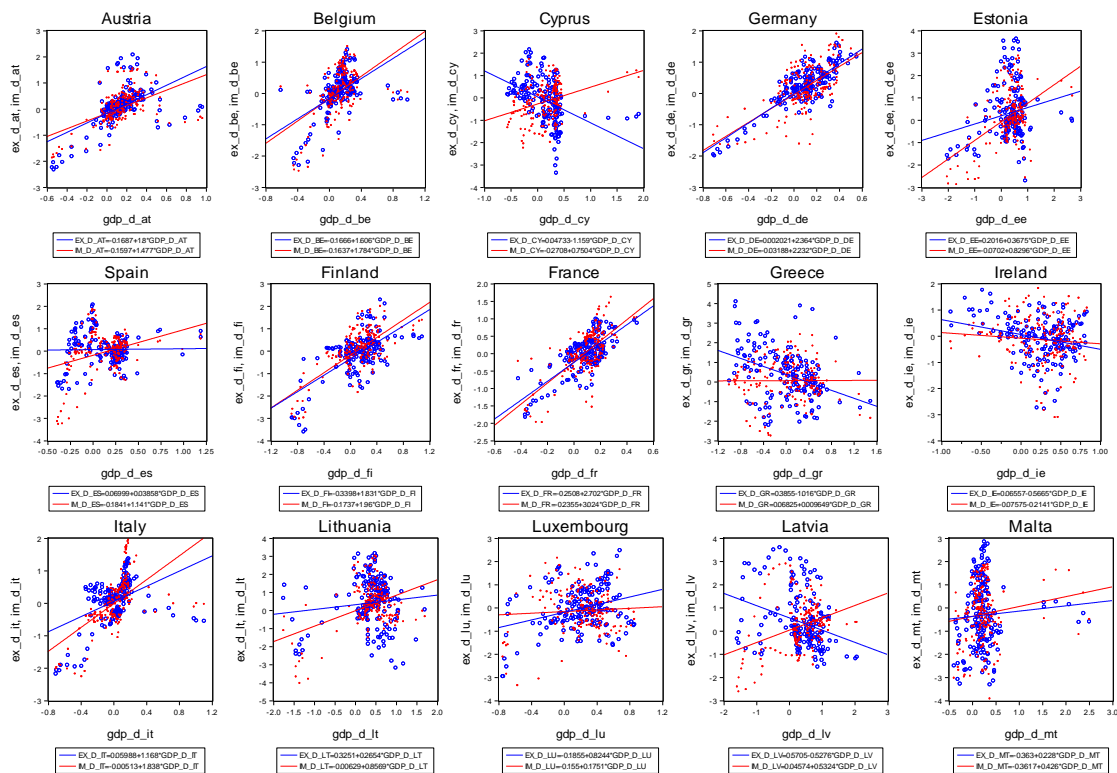
**Figure 6.1 Real Effective Exchange Rates and Current Accounts (2000M1-2014M12)**

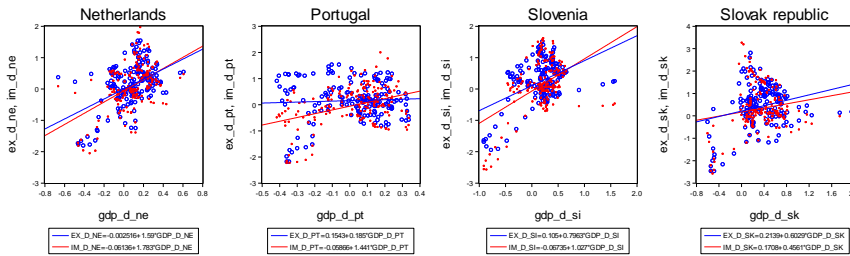
While all countries from the group experienced real exchange rate appreciation (based on both consumer prices and unit labor costs) during the whole pre-crisis period since the birth of the Euro, this trend is clearly the strongest in the periphery countries. However, similar trend is also present in Baltic countries<sup>8</sup> and Slovakia which suffered from large current account deficits too. However, the loss in competitiveness is more significant considering costs (unit labor costs) rather than prices (consumer prices) that provides supportive evidence about another convenient channel of demand driven current account imbalances. Large current consumption and associated accumulation of private and public debt even emphasize generally expected implications of intertemporal choice in countries represented weaker part of the common currency area. As a result, significant trend in consumer prices and unit labor costs based real exchange rates discrepancies in the most countries indicates asynchronous effects of processes that determine internally caused changes in the relative external competitiveness.

<sup>8</sup> Estonia, Latvia and Lithuania operated in the pegged exchange rate regime during the whole pre-crisis period outside the Euro Area.

Figure 6.1 also indicate sudden break at the end of the pre-crisis trend in both current accounts and real exchange rates in all countries that even emphasize distortionary effects of the crisis period. Most deficit countries experienced almost immediate sharp though temporary improvement in the current account balances accompanied by the real exchange rate depreciation induced by a drop in consumer prices and unit labor costs (that decreased even more). Economic crisis and associated recession clearly reduced demand incentives that even contributed to the reduction in current account deficits that is why the net effect of the price and costs related boost in the competitiveness on the external imbalances is the subject of the recent empirical research.

Figure 6.2 depicts mutual relationship (simple linear regression) between the dynamics of real output and the dynamics of exports and imports in the Euro Area member countries. In most countries economics growth seems to have positive effect on export performance. However, the situation seems to be different in almost all deficit countries. Growth rates of the real output are negatively associated with export performance in Cyprus, Greece, Ireland and Latvia while in Spain and Portugal we have observed just a negligible positive relationship between real output and export dynamics. Results for all six countries indicate competitiveness issues in good times, though good news in bad times. The problem is even more significant (in good times) in small open economies like Ireland and Latvia. On the other, all above mentioned countries experienced significant decrease in real exchange rates (with higher dynamics in unit labor costs based real exchange rate) that boosted their export performance, putting exports into the role of a significant driver of their post-crisis economic recovery.





Note: Dynamics of export share (EX\_D) and import (IM\_D) shares on GDP are expressed as the relative change in the monthly percentage share of export and imports of goods on GDP. Real output dynamics (GDP\_D) is expressed as monthly percentage change of the seasonally adjusted real output. Both variables are seasonally adjusted.

Source: Compiled by author based on data taken from IMF - International Financial Statistics (November 2015).

**Figure 6.2 Dynamics of Export and Import Shares on GDP and Dynamics of Real Output (2000M1-2014M12)**

More comprehensive picture about the competitiveness issues revealed a comparison of the mutual relationship between the dynamics of export and import shares. Asymmetric dynamics of exports and imports shares in Cyprus and Latvia indicates risks of negative current account development in good times. As a result, periods of economic growth during the pre-crisis era resulted in persisting and excessive current account deficits in these countries. Asymmetric dynamics of both exports and import shares was also observed in Greece though the results for imports are clearly affected by the crisis period (the results for the pre-crisis period indicates strong positive correlation between real output and import shares dynamics). All remaining countries experienced symmetric dynamics of both export and import shares. Moreover, comparison of the correlation relationship between dynamics of export and import share and dynamics of real output for most of the core countries in the North of Euro Area for the pre-crisis and extended period (not presented here) indicates significant increase in the intensity of this relationship during the extended period (this result is confirmed by decomposed results presented in Tables 6.1 and 6.2).

The size and openness of individual countries does not seem to be a significant determinant of export and import shares on total output. However, differences between correlations of total output dynamics and dynamics of exports and imports shares in countries with persisting current account deficits is mostly significant. Finally, crisis period affected dynamics of export and import shares in all countries emphasizing its redistributive effects, cross-country expenditure shifting and related competitiveness issues that is why more comprehensive investigation of the effects of the overall demand dynamics and current account balances in both surplus and deficit countries is necessary.

Table 6.1 summarizes correlation relationships between export shares and real output dynamics in the Euro Area member countries decomposed into three years long sub-periods. Detailed results revealed important implications for deficit and surplus countries for both pre-crisis and crisis periods.

**Table 6.1 Dynamics of Export Share on GDP and Dynamics of Real Output (2000M1-2014M12)**

	2000-2002	2003-2005	2006-2008	2009-2011	2012-2014
Austria	-0.2709	0.7017	0.8889	0.8450	0.5520
Belgium	0.1019	0.6329	0.7152	0.8929	0.4172
Cyprus	-0.0981	0.5334	-0.0877	0.3270	0.3784
Germany	0.1819	0.7781	0.9389	0.9819	0.2102
Estonia	-0.1600	-0.6676	0.0710	0.8453	-0.1524

Spain	0.7391	0.1283	0.6633	0.9462	-0.3995
Finland	0.5577	0.1690	0.5532	0.8718	-0.2185
France	0.6611	0.7466	0.5735	0.9777	0.2422
Greece	-0.0117	-0.7009	-0.0024	-0.4746	-0.3474
Ireland	0.6990	0.2075	-0.5981	-0.6234	0.1243
Italy	-0.1141	0.7905	0.9497	0.9641	-0.4165
Lithuania	-0.2726	-0.1163	-0.3489	0.6761	0.2090
Luxembourg	-0.0895	0.6815	-0.5514	0.8430	-0.1197
Latvia	-0.4574	-0.2649	-0.5230	-0.4040	-0.1444
Malta	0.1067	-0.2979	-0.4251	0.7431	-0.1535
Netherland	0.0609	0.6877	0.8119	0.9398	-0.7091
Portugal	-0.2533	-0.0302	0.5762	0.5722	-0.6118
Slovenia	0.0529	0.5010	0.7670	0.9603	-0.5101
Slovakia	-0.3063	-0.6525	0.5855	0.8337	-0.4010
<b>average</b>	<b>0.0593</b>	<b>0.2015</b>	<b>0.2925</b>	<b>0.6378</b>	<b>-0.1027</b>

Note: Data represents coefficients of mutual correlations between dynamics of export share on GDP and dynamics of real output.

Source: Author's calculation.

Early stage (2000-2002) followed by the establishment of the Euro Area indicates weak relationship between dynamics of export performance and total output (except for Finland, France, Ireland and Spain). Low dynamics of total output in Western Europe was affected by recession in European Union during 2000 and 2001 while later new Euro Area members from Eastern Europe were recovering from the end of 1990s recession. As a result, most countries experienced diverse dynamics of total output and exports. Second stage (2003-2005) was characterized by the boost in performance and the most of countries experienced a significant strengthening in the correlation between total output and export dynamics. However, Baltic countries, Greece, Malta and Portugal still suffered for low dynamics in export performance and Slovak republic experienced significant boost in export performance (correlation still negative). During the third period (2006-2008) the correlation of total output and export performance even strengthened, though it remained still negative for Greece, Latvia, Lithuania and Malta (correlation even weakened). The results for Cyprus and Luxembourg was affected by reduced export performance due to higher real output dynamics and at the end of this sub-period the correlation already captured asynchronous trend caused by the negative effect of the arising crisis on the total output dynamics. Early crisis sub-period (2009-2011) revealed a substantial increase in the mutual relationship between total output and export performance dynamics in almost all countries (significant deterioration followed by improvement in both variables with increased sensitivity of export shares indicating higher dynamics in external demand in both directions). However, we also have observed a strengthening in the asynchronous trend in Greece, Ireland and Latvia caused the boost of the export performance. While export driven recovery helped all three countries to improve their overall performance, highly volatile export dynamics and lagged real output improvements caused deepening in the negative correlation between real output and export share performance. The last sub-period (2012-2014) brought a substantial decrease in the mutual relationship between both variables. It refers to changed patterns of the economic recovery during the later stages of the post-crisis period based on increased dynamics of domestic components of aggregate demand.



Table 6.2 summarizes correlation relationships between import shares and real output dynamics in the Euro Area member countries decomposed into three years long sub-periods. Detailed results revealed important implications for deficit and surplus countries for both pre-crisis and crisis periods.

**Table 6.2 Dynamics of Import Shares on GDP and Dynamics of Real Output (2000M1-2014M12)**

	2000-2002	2003-2005	2006-2008	2009-2011	2012-2014
Austria	-0.0669	0.4907	0.5603	0.8501	0.6046
Belgium	0.1808	0.6644	0.4012	0.8793	0.4459
Cyprus	0.3200	0.7310	0.3023	0.8274	0.5353
Germany	0.3679	0.4244	0.4810	0.9287	0.6183
Estonia	0.3178	-0.7703	0.3956	0.9004	0.3448
Spain	0.6082	0.1381	0.9125	0.9459	0.7884
Finland	0.6967	-0.1733	0.5497	0.9335	-0.0236
France	0.3860	0.5120	0.5643	0.9724	0.0590
Greece	-0.3028	-0.1348	0.1061	-0.1407	0.3515
Ireland	0.5755	0.3644	0.1220	-0.2632	-0.2127
Italy	0.3649	0.6596	0.7723	0.9434	0.6630
Lithuania	-0.4451	-0.4396	0.0579	0.8035	0.4421
Luxembourg	-0.6321	-0.3481	-0.5081	0.7550	-0.1637
Latvia	-0.0219	-0.1499	0.7192	0.6789	0.4460
Malta	0.3587	-0.2064	-0.4140	0.6414	-0.1475
Netherlands	0.0843	0.7164	0.7577	0.9371	-0.5563
Portugal	-0.0334	0.5985	0.3883	0.7924	0.4843
Slovenia	-0.2399	0.2727	0.8701	0.9798	-0.2767
Slovakia	-0.4229	-0.5601	0.4263	0.8445	-0.2210
<b>Average</b>	<b>0.1103</b>	<b>0.1468</b>	<b>0.3929</b>	<b>0.7479</b>	<b>0.2201</b>

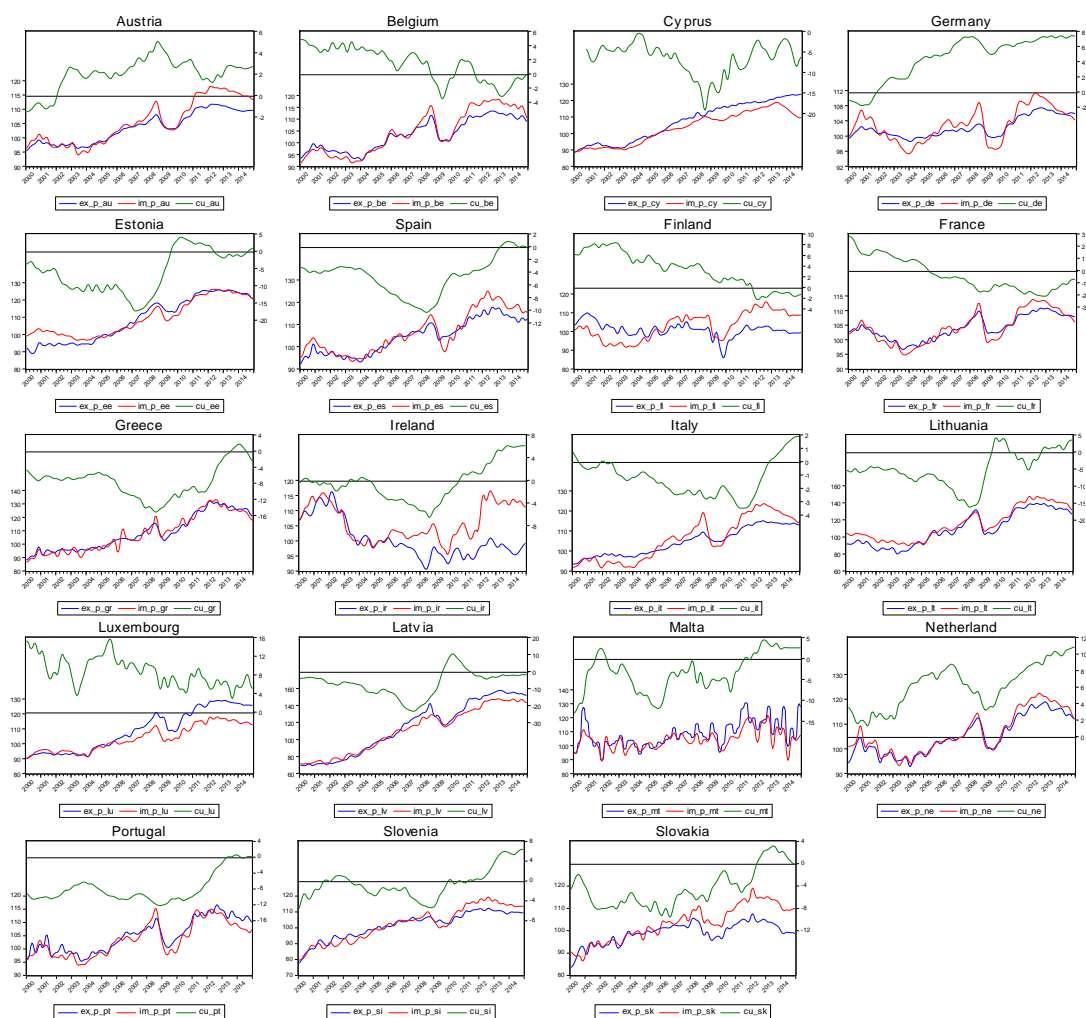
Note: Data represents coefficients of mutual correlations between dynamics of import share on GDP and dynamics of real output.

Source: Author's calculation.

Similarly to the results from the Table 1, early stage (2000-2002) indicates generally weak relationship between dynamics of import shares and total output for the whole group of countries. However, this time the results indicate more diverse trends in individual countries (strong positive correlation in eight countries and strong negative correlation in four-five countries). Negative development in countries at the beginning of the period was thus associated with diverse effects on demand for both domestic and foreign goods. Next sub-period (2003-2005) brought a minor increase in the correlation of both variables. Still persisting negative correlations experienced mostly smaller, more opened and/or weak performing economies due to higher volatility in the dynamics of import shares. During the third period (2006-2008) most of countries experienced improvement in the relationship between dynamics of total output and import shares. The only exception with negative correlations remained just two countries - Luxembourg and Malta in which the design of the growth pattern induced a reduction in the shares if imports on the total output. Early crisis sub-period (2009-2011) was associated with a significant increase in the correlation between total output and import performance dynamics in almost all countries. Only exceptions are Greece (with suppressed positive imports dynamics since the beginning of the crisis period) and Ireland (with less depressed imports during the initial stage of the crisis period). The last sub-period (2012-2014) brought a substantial decrease in the mutual relationship between both variables. Similarly to the results from the Table 6.1 our results refers to

changed patterns of the economic recovery during the later stages of the post-crisis period based on increased dynamics of domestic components of aggregate demand associated with less dynamics of demand for foreign goods though we have observed some exceptions (Cyprus, Greece, Portugal, Spain).

Figure 6.3 provides a brief overview of main trends in export prices, import prices and current accounts in the Euro Area member countries. An increase in terms of trade (prices of exports-to-prices of import ratio) is usually associated with the current account improvement provided low price elasticity of exports and imports. However, persisting increase in terms of trade (due to exchange rate or domestic prices shifts) is obviously followed by deterioration in international competitiveness especially with increasing lag. Single currency and fixed nominal exchange rate environment in the common currency area allows adjustments in the term of trade only via domestic prices. As a result, demand and costs related channels of domestic prices dynamics represent crucial determinants of external competitiveness of individual Euro Area member countries.



Note: Export prices (EX\_P) and import prices (IM\_P) are expressed as indexes (left axis in figures) (2005 = 100). Current account (CU) is expressed as percentage share in GDP (CU) (right axes in figures).

Source: Compiled by author based on data taken from IMF - International Financial Statistics (November 2015). Time series for CPI and ULC based REER we drawn from Eurostat (November 2015).

### Figure 6.3 Export Prices, Import Prices and Current Account (2000M1-2014M12)

Prices of exports and imports in individual Euro area member countries did not follow common trend. Most of the countries experienced increasing trend in the development of export and import prices since 2000-2003 (as direct effect of the recession in European Union during 2000 and 2001). However, there is still enough room to recognize some different patterns in this general trend. Countries from past Eastern bloc (Baltic countries, Slovak republic and Slovenia) that operated outside the Euro Area during the whole pre-crisis period experienced almost continuous increase in the prices of exports and imports due to generally lower national price levels and price level convergence fueled by strong territorial orientation of their foreign trade toward Western European countries. Most of old EU member countries operated within the Euro Area experienced more dynamic increase in import prices (narrowly followed by the dynamics of export prices) (especially during last 3 years before the crises) fueled by strong domestic demand accelerated by low interest rate policy conducted by ECB. Crisis period changed this trend in several ways. First, the overall dynamics of export and import prices during the early stages of the crisis period decreased due to drop in demand incentives. Second, overall dynamics of export prices decreased more significantly due to higher decrease in external demand (in comparison with domestic demand). Third, asynchronous dynamics in prices of exports and imports affected mainly small and opened economies. Forth, increased dynamics in import prices since 2010 till 2012 was fueled by early wave of economic recovery fueled by low interest rate environment heavily managed by activities of ECB.

More detailed information on averaged export-to-import prices ratios (terms of trade) in the Euro Area member countries provides Table 6.3. Most countries experienced improvement in the terms of trade between two initial sub-periods. Recovery from early 2000 crisis generally did not provide negative effect on the terms of trade in the whole group of countries. Moderate decrease in term of trade experienced Belgium, Finland, Greece, Ireland, Malta, and Portugal. Newcomers from past Eastern bloc still experienced unfavorable terms of trade fueling negative current account development though keeping foreign exports more competitive.

Substantial decrease in demand for both foreign exports and domestic imports during early stages of the crisis period resulted in decrease in terms of trade and thus slightly improved price competitiveness of international trade in the whole group of countries. However, some countries (i.e. Cyprus, Estonia, Spain, Greece, Ireland, Lithuania, Latvia, Malta, Netherlands, Slovak republic) did not experience a drop in terms of trade and suffered from relative reduction in the price competitiveness at the early stage of the crisis period though deficit countries experienced a significant improvement in the current account balances. Early recovery period during the economic crisis (2009-2011) brought a significant improvement in terms of trade in the whole group of countries though most of deficit countries experienced an opposite trend that was i.e. in Baltic countries and Slovak republic associated with another moderate deterioration in the current account balances. During the last sub-period terms of trade moderately decreased in the whole sample of countries though Cyprus, Greece, Luxembourg, Latvia, Malta, and Portugal experienced an opposite trend.

**Table 6.3 Terms of Trade (2000M1-2014M12)**

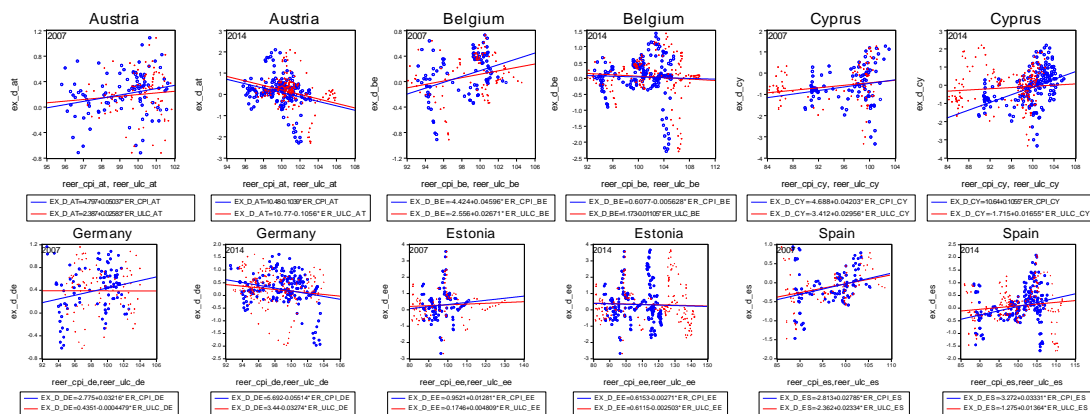
	2000-2002	2003-2005	2006-2008	2009-2011	2012-2014
Austria	99.34	100.71	98.41	97.89	95.09
Belgium	101.98	100.73	98.67	97.66	96.15
Cyprus	101.38	101.59	103.24	105.52	105.72
Germany	98.71	101.51	97.79	100.10	98.65
Estonia	92.48	98.45	102.26	102.41	100.05
Spain	97.77	99.76	99.21	99.53	95.72
Finland	107.82	104.24	95.33	93.35	90.47
France	100.43	100.91	99.35	100.23	98.72
Greece	101.86	100.73	100.52	98.10	100.86
Ireland	112.96	110.52	113.63	95.50	89.78
Italy	102.58	102.97	96.09	98.08	95.17
Lithuania	90.34	95.72	97.95	95.66	95.03
Luxembourg	98.50	100.14	105.87	108.71	110.30
Latvia	97.01	99.33	104.32	104.94	105.73
Malta	102.91	101.59	103.37	106.62	108.17
Netherland	97.83	99.97	99.83	98.80	97.65
Portugal	101.49	101.14	100.12	101.86	102.39
Slovenia	101.56	102.12	99.37	98.56	95.43
Slovakia	99.89	99.84	96.73	93.36	90.62
<b>Average</b>	<b>100.36</b>	<b>101.16</b>	<b>95.90</b>	<b>99.84</b>	<b>98.51</b>

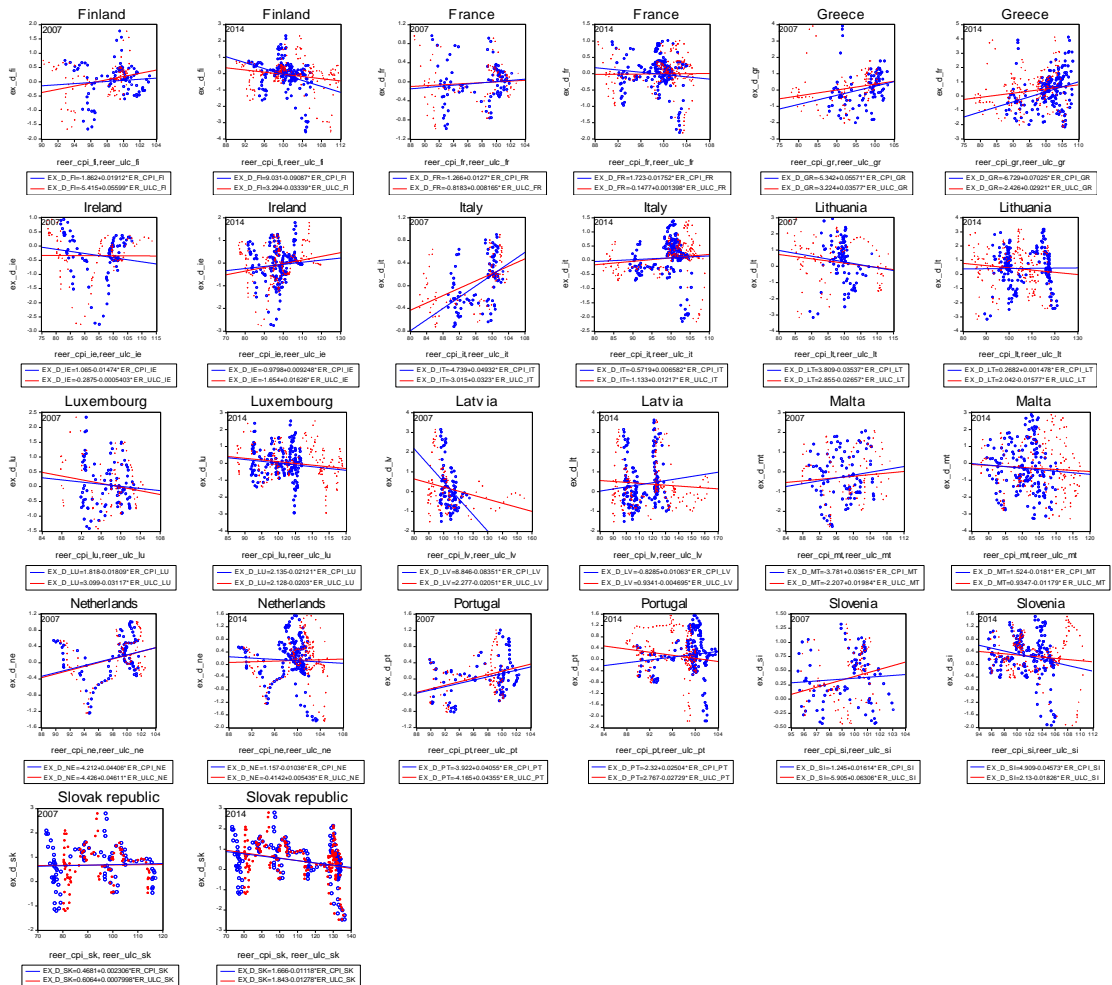
Note: Data represents averaged ratios of export-to-import price index.

Source: Author's calculation.

While the general trend in the development of terms of trade provide reasonable facts about exports and imports dynamics for North and South of the Euro Area as well as new Euro Area member countries from the past Eastern bloc, more comprehensive insight into current account determination is necessary.

Figure 6.4 reveals mutual relationships (simple linear regression) between exports shares on GDP and REER based on both CPI and ULC in the Euro Area member countries. Results indicates mixed conclusions about the effects of changes in prices and costs related competitiveness and associated dynamics in the exports shares.





Note: Dynamics of exports share on GDP (EX\_D) is expressed as the relative change in the percentage share of exports of goods on GDP\_ CPI based real effective exchange rate (REER\_CPI) and ULC based real effective exchange rate (REER\_ULC) is expressed as index (2005 = 100). Year 2007 in figures means period 2000-2007 while year 2014 in figures means period 2000-2014.

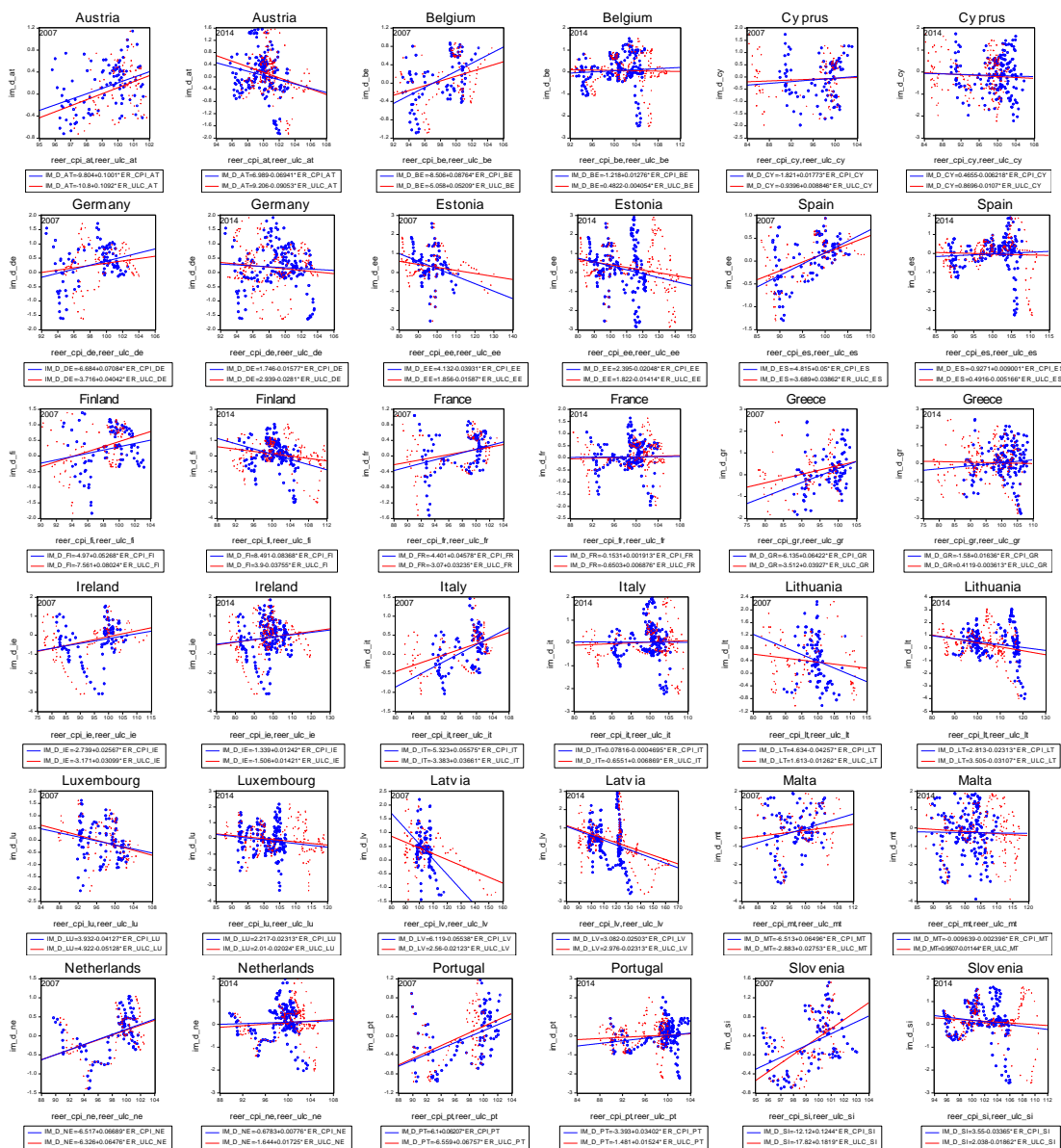
Source: Author's calculation.

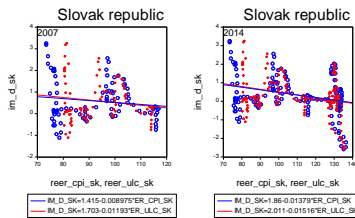
**Figure 6.4 Dynamics of Exports Shares on GDP and Real Exchange Rates (CPI and ULC based) Dynamics (2000M1-2014M12)**

An increase in REER indicates a reduction in the competitiveness that is why reduction in the dynamics of exports share or negative relationship is generally expected. Surprisingly, export dynamics in most of the Euro Area member countries was associated with increasing trend (appreciation) in both CPI and ULC based REER indicating reduced importance of price and costs related effects on export performance though generally low dynamics of exports in the periphery countries of the Euro Area indicates the negative role of the loss in external prices and costs related competitiveness (Gaulier and Vicard, 2012; Chen, Milesi-Ferretti and Tressel, 2012; Sanchez and Varoudakis, 2013). Minor exceptions were examined in case of Germany (ULC), France (both CPI and ULC), Ireland (both CPI and ULC) Luxembourg (both CPI and ULC) and most of new Euro Area member countries. However, crisis period clearly changed this picture making export performance of almost Euro Area members

much more sensitive to the changes in external competitiveness based on both CPI and ULC. Significant decrease in external demand during the crisis period increased the role of prices and costs related determinants of export performance.

Figure 6.5 reveals mutual relationships (simple linear regression) between import shares on GDP and REER based on both CPI and ULC in the Euro Area member countries. Results indicates mixed conclusions about the effects of changes in prices and costs related competitiveness and associated dynamics in the import shares. However, key conclusions about the relative importance of the prices and costs related determinants of imports for the pre-crisis and extended periods are completely different in comparison with exports.





Note: Dynamics of imports share on GDP (IM\_D) is expressed as the relative change in the percentage share of imports of goods on GDP\_ CPI based real effective exchange rate (REER\_CPI) and ULC based real effective exchange rate (REER\_ULC) is expressed as index (2005 = 100). Year 2007 in figures means period 2000-2007 while year 2014 in figures means period 2000-2014.

Source: Author's calculation.

**Figure 6.5 Dynamics of Imports Share on GDP and Real Exchange Rate (CPI and ULC based) Dynamics (2000M1-2014M12)**

Dynamics of import shares on GDP was positively correlated with appreciation of both CPI and ULC based REER in almost all countries but the new Euro Area member countries. Putting together results of Figures 6.4 and 6.5 we suggest that price and costs related determinants of external competitiveness had reduced role in determining the external current account imbalances making domestic and foreign demand drivers much more important in these five countries from the Central and Eastern Europe. In all remaining Euro Area member countries real exchange rate appreciation had a positive effect on import dynamics. As a result, imports and its price and costs related determinants represented more significant driver of trends in current account balances than exports exogenously determined by the dynamics in foreign demand leaving less room to prices and costs related determinants. Effects of the crisis period are also presented in Figure 5 and reflects reduced role of REER shifts in determining external positions of both North and South of the Euro Area.

#### 6.4. Econometric Model

VAR models represent dynamic systems of equations in which the current level of each variable depends on past movements of that variable and all other variables involved in the system. Residuals of vector  $\varepsilon_t$  represent unexplained movements in variables (effects of exogenous shocks hitting the model); however as complex functions of structural shocks effects they have no economic interpretation. Structural shocks can be still recovered using transformation of the true form representation into the reduced-form by imposing a number of identifying restrictions. Applied restrictions should reflect some general assumptions about the underlying structure of the economy and they are obviously derived from economic theory. There are two general (most used) approaches to identify VAR models. (I) Cholesky decomposition of innovations implies the contemporaneous interactions between exogenous shocks and the endogenous variables are characterized by a Wald causal chain. Ordering of endogenous variables then reflects expected particular economy structure following general economic theory assumptions. However, the lack of reasonable guidance for appropriate ordering led to the development of more sophisticated and flexible identification methods - (II) structural VAR (SVAR) models. Identifying restrictions implemented in SVAR models reflect theoretical assumptions about the economy structure more precisely.

We employ a VAR methodology to analyze effects of unexpected real exchange rate and demand shifts on current account adjustments in the Euro Area member countries. Cholesky decomposition of variance-covariance matrix of reduced-form VAR residuals is implemented to estimate effects of real exchange rate appreciation and increase in overall demand on the current accounts deterioration. True model is represented by the following infinite moving average representation:

$$AX_t = B(L)X_{t-1} + B\varepsilon_t \quad (6.1)$$

where  $X_t$  represents  $n \times 1$  a vector including endogenous variables of the model,  $B(L)$  is a  $n \times n$  polynomial consisting of the matrices of coefficients to be estimated in the lag operator  $L$  representing the relationship among variables on the lagged values, each of  $A$  and  $B$  represent  $n \times n$  matrices which coefficients will be specified later,  $\varepsilon_t$  is  $n \times 1$  vector of identically normally distributed, serially uncorrelated and mutually orthogonal errors (white noise disturbances that represent the unexplained movements in the variables, reflecting the influence of exogenous shocks):

$$E(\varepsilon_t) = 0, \quad E(\varepsilon_t \varepsilon_t') = \Sigma_\varepsilon = I, \quad E(\varepsilon_t \varepsilon_s') = [0] \quad \forall t \neq s \quad (6.2)$$

Vector  $X_t$  consists of six endogenous variables - real output ( $y_{r,t}$ ), money supply ( $m_t$ ), core inflation ( $p_t$ ), short-term nominal interest rates ( $ir_{n,t}$ ), real exchange rate ( $er_{r,t}$ ) and current account ( $cu_t$ ). In the six-variable VAR model ( $X_t = [y_{r,t}, m_t, p_t, ir_{n,t}, er_{r,t}, cu_t, ]$ ) we assume six exogenous shocks that contemporaneously affects endogenous variables - demand shock ( $\varepsilon_{y,t}$ ), nominal shock ( $\varepsilon_{m,t}$ ), inflation shock ( $\varepsilon_{p,t}$ ), monetary policy shock ( $\varepsilon_{ir_{n,t}}$ ), exchange rate shock ( $\varepsilon_{er_{r,t}}$ ) and current account shock ( $\varepsilon_{cu_{n,t}}$ ).

Structural exogenous shocks from equation (1) are not directly recoverable due to the complexity of information included in true form VAR residuals. As a result, structural shocks cannot be correctly identified. It is then necessary to transform true model into following reduced form

$$X_t = A^{-1}B(L)X_{t-1} + A^{-1}B\varepsilon_t = C(L)X_{t-1} + e_t \quad (6.3)$$

where  $C(L)$  is the polynomial of matrices with coefficients representing the relationship among variables on lagged values and  $e_t$  is a  $n \times 1$  vector of normally distributed errors (shocks in reduced form) that are serially uncorrelated but not necessarily orthogonal:

$$E(e_t) = 0, \quad \Sigma_e = E(e_t e_t') = A_0 E(\varepsilon_t \varepsilon_t') A_0' = A_0 A_0', \quad E(e_t e_s') = [0] \quad \forall t \neq s \quad (6.4)$$



Relationship between reduced-form VAR residuals ( $e_t$ ) and structural shocks ( $\varepsilon_t$ ) can be expressed as follows:

$$e_t = A^{-1}B\varepsilon_t \text{ or } Ae_t = B\varepsilon_t \quad (6.5)$$

As we have already noted at the beginning of the section we implement a Cholesky identification scheme to correctly identify structural shocks. In order to identify our model there must be exactly  $n^2 - [(n^2 - n) / 2]$  relationships among endogenous variables of the model, where  $n$  represents a number of variables. We have to impose  $(n^2 - n) / 2$  restrictions on the matrix  $A_0$  based on the Cholesky decomposition of the reduced-form VAR residual matrix that define matrix  $A_0$  as a lower triangular matrix. The lower triangularity of  $A_0$  (all elements above the diagonal are zero) implies a recursive scheme (structural shocks are identified through reduced-form VAR residuals) among variables (the Wald chain scheme) that has clear economic implications and has to be empirically tested as any other relationship. Identification scheme of the matrix  $A_0$  implies that particular contemporaneous interactions between some exogenous shocks and some endogenous variables are restricted reflecting causal (distribution) chain of interaction transmission. It is clear that the Wald causal chain is incorporated via convenient ordering of variables.

Considering lower triangularity of a matrix  $A_0$  the equation (5) can be rewritten as follows:

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1 \end{bmatrix} \begin{bmatrix} e_{y,t} \\ e_{m,t} \\ e_{p,t} \\ e_{ir,t} \\ e_{er,t} \\ e_{cu,t} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_{y,t} \\ \varepsilon_{m,t} \\ \varepsilon_{p,t} \\ \varepsilon_{ir,t} \\ \varepsilon_{er,t} \\ \varepsilon_{cu,t} \end{bmatrix} \quad (6.6)$$

Correct identification of exogenous structural shocks reflecting Cholesky ordering of variables denotes following assumptions:

- Real output doesn't contemporaneously respond to the shock from any other endogenous variable of the model.
- Money supply doesn't contemporaneously respond to inflation, interest rates, exchange rate and current account shocks, while it is contemporaneously affected only by the real output shock.
- Inflation doesn't contemporaneously respond to interest rates, exchange rate and current account shocks, while it is contemporaneously affected by real output and money supply shocks.
- Interest rates don't contemporaneously respond to exchange rate and current account shocks, while it is contemporaneously affected by real output, money supply and inflation shocks.

- Exchange rate doesn't contemporaneously respond to the current account shock, while it is contemporaneously affected by real output, money supply, inflation and interest rates shocks.
- Current account is contemporaneously affected by shocks from all of endogenous variables of the model.

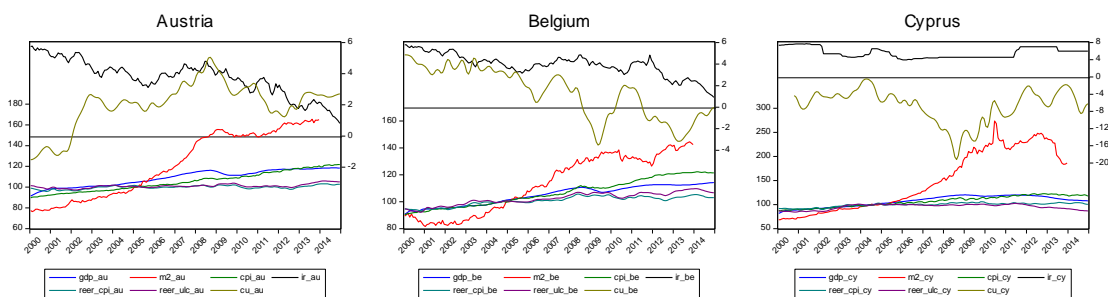
After initial period endogenous variables may interact freely without any restrictions.

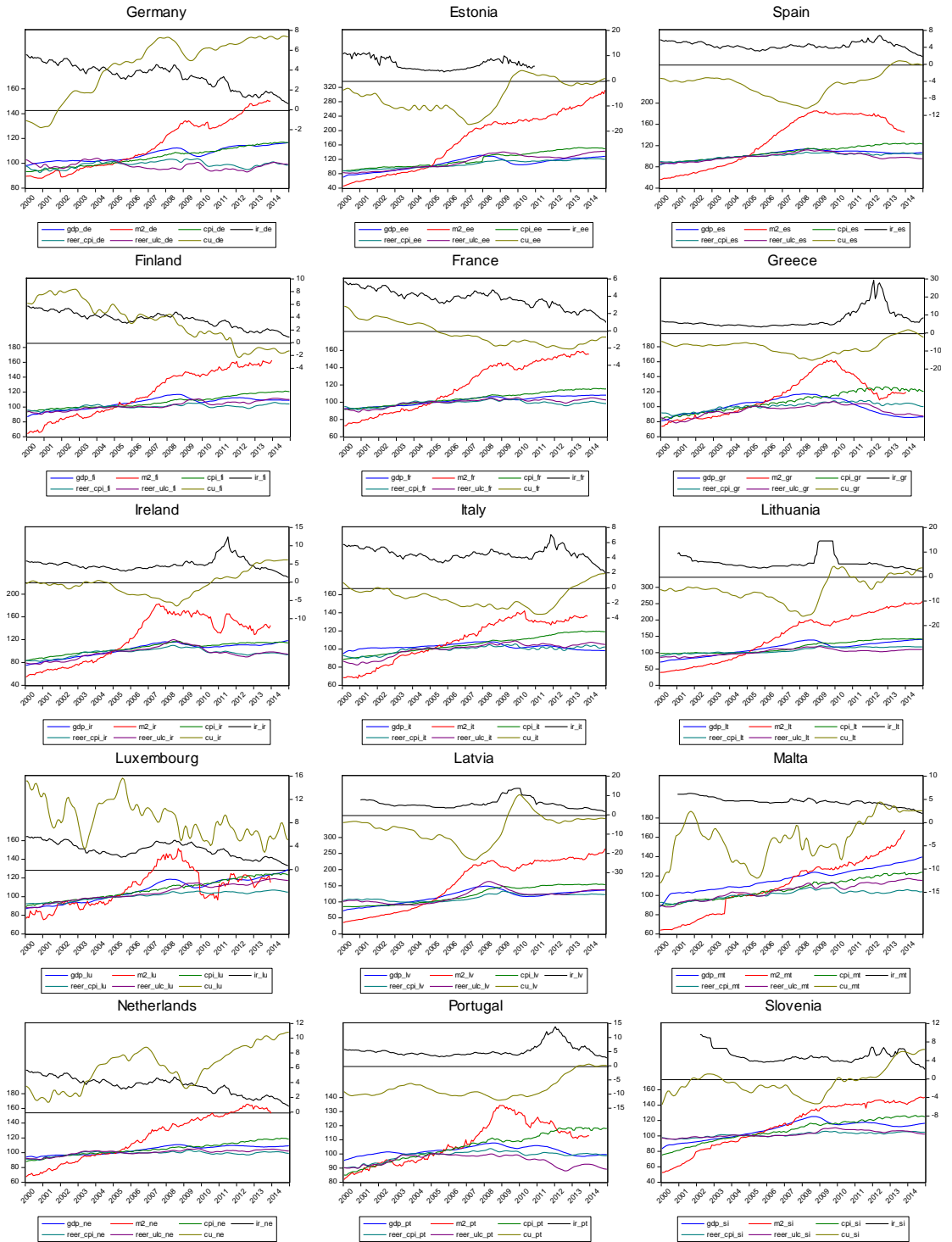
Estimated VAR model is used to compute impulse response functions to analyze responses of the current account to the positive one standard deviation real exchange rate and demand shocks in the Euro Area member countries as well as the relative contribution of both shocks in explaining adjustments in current accounts. To check the robustness of empirical results we estimate the model considering different ordering of the endogenous variables in models with time series for two different periods (pre-crisis period - model A (2000M1-2007M12) and extended period - model B (2000M1-2014M12)):

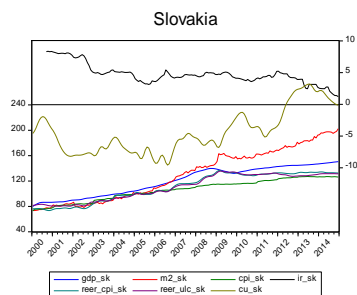
- model 1 ( $X_t = [y_{r,t}, m_t, p_t, ir_{n,t}, er_{r,t}, cu_t]$ )
- model 2 ( $X_t = [y_{r,t}, er_{r,t}, m_t, ir_{n,t}, p_t, cu_t]$ )
- model 3 ( $X_t = [y_{r,t}, p_t, m_t, ir_{n,t}, er_{r,t}, cu_t]$ )

## 6.5. Data and Results

To estimate effects of the unexpected real exchange rate and demand shifts on current account adjustments in the Euro Area member countries we employ monthly data for period 2000M1-2007M12 (model A) consisting of 96 observations and for period 2000M1-2014M12 (model B) consisting of 180 observations for the following endogenous variables - real output (nominal industrial production deflated by GDP deflator), money supply (monetary aggregate M2), inflation (core inflation), long-term interest rates (long-term nominal interest rates of government bonds with ten years maturity), real exchange rate (both CPI and ULC deflated nominal effective exchange rate) and current account of the balance of payment (Figure 6.6).







Note: Endogenous variables - real output (GDP), money supply (M2), inflation (CPI) and CPI/ULC based real effective exchange rate (REER\_CPI, REER\_ULC) are expressed as indexes (left axis in figures) (2005 = 100). Interest rates (IR) and current account (CU) are expressed in percentage (right axis in figures).

Source: Compiled by author based on data taken from IMF - International Financial Statistics (November 2015). Time series for CPI and ULC based REER we drawn from Eurostat (November 2015).

**Figure 6.6 Real Output, Money Supply, Inflation, Interest Rates, Real Effective Exchange Rates (CPI and ULC based) and Current Account (2000M1-2014M12)**

Estimation of two models is in line with the primary objective of the paper to reveal a relationship between the dynamics of real exchange rate and overall demand and current account adjustments considering possible implications of the crisis period on estimated results. Time series for real output, money supply, inflation, interest rates and current account were drawn from IMF database (International Financial Statistics, November 2015). Time series for CPI and ULC based REER we drawn from Eurostat (November 2015). Time series for real output, money supply, inflation and current account were seasonally adjusted.

To correctly identify exogenous shocks hitting the model as well as to compute impulse-response functions it is necessary VAR model to be stationary. To check stationarity of the model it is necessary to test the time series for unit roots and cointegration.

### A. Testing Procedures

Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were computed to test endogenous variables for the unit roots presence. Both ADF and PP tests indicate that most of variables are non-stationary on values so that the null hypothesis of a unit root presence cannot be rejected for any of time series. Testing variables on first differences indicates that time series are stationary. We may conclude that variables are integrated of order 1  $I(1)$ .

Because there are endogenous variables with a unit root on values it is necessary to test time series for cointegration using the Johansen and Juselius cointegration test (we found reasonable to include variables  $I(0)$  for testing purposes following economic logic of expected results). The test for the cointegration was computed using two lags as recommended by the AIC (Akaike Information Criterion) and SIC (Schwarz Information Criterion).

Results of Johansen cointegration tests confirmed our results of unit root tests. Both trace statistics and maximum eigenvalue statistics (both at 0.05 level) indicate that there is no cointegration among endogenous variables of the model.

To test the stability of VAR models we also employed a number of diagnostic tests. We found no evidence of serial correlation, heteroskedasticity and autoregressive conditional heteroskedasticity

effect in disturbances. The model also passes the Jarque-Bera normality test, so that errors seem to be normally distributed. VAR models seem to be stable also because inverted roots of the model for each country lie inside the unit circle. Detailed results of time series testing procedures are not reported here to save space. Like any other results, they are available upon request from the author.

Following results of the unit root and cointegration tests we estimated the model using variables in first differences so that we can calculate impulse-response functions and variance decomposition for all nineteen Euro Area member countries. Following the main objective of the paper we focus on interpretation of responses of the current account to the positive one standard deviation real exchange rate (increase in REER) and demand shocks and the relative contribution of both shocks in explaining adjustments in current accounts. To observe effects of changes in relative competitiveness associated with sudden shifts REER and overall demand on current account adjustments we estimate models with CPI and ULC based REER separately.

We also observe effects of the crisis period on the current account determination in Euro Area member countries by comparing the results for estimated models using time series for two different periods - model A (2000Q1-2007Q4) and model B (2000Q1-2014Q4). Changed ordering of variables didn't seem to affect results of the analysis. Considering that impulse-response functions are not very sensitive to the ordering of endogenous variables we present results of both models (model A and B) with default ordering of endogenous variables (detailed results for two models different ordering of variables are available upon request from the author).

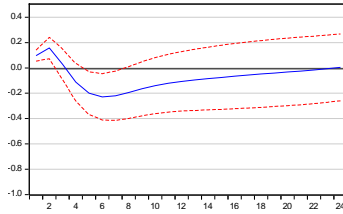
## **B. Impulse-Response Functions**

Effects of real exchange rates and demand shifts on current account adjustments in the Euro Area member countries are examined from estimated responsiveness of current accounts to the positive (appreciation) one standard deviation real exchange rate and demand shock employing monthly data for two subsequent periods 2000-2007 (model A) and 2000-2014 (model B). Results seem to be sensitive to overall performance of the countries considering differences in the response patterns of the current accounts between core and periphery of the Euro Area.

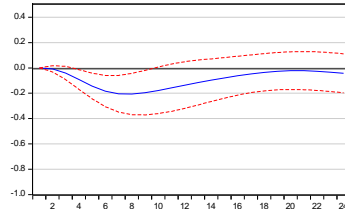
While current accounts in the group of periphery countries seem to be more responsive to the REER shocks revealing more dynamic cross-country expenditure shifting effects, current accounts in the core countries seem to be less vulnerable to the shifts in competitiveness associated with real exchange rate appreciation.

In the Figure 6.7 we summarize results of impulse-response functions of current accounts to positive (appreciation) real effective exchange rate (CPI based) shocks in the model with time series for the pre-crisis period (model A1) in the Euro Area member countries.

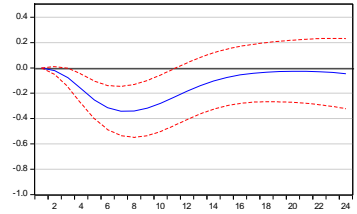
Response of CU\_AT to Cholesky  
One S.D. ER\_CPI\_AT Innovations  $\pm 2$  S.E.  
(Austria, Model A)



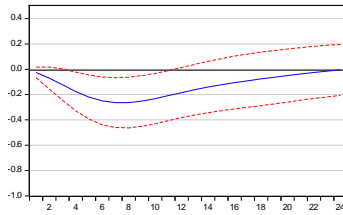
Response of CU\_BE to Cholesky  
One S.D. ER\_CPI\_BE Innovations  $\pm 2$  S.E.  
(Belgium, Model A)



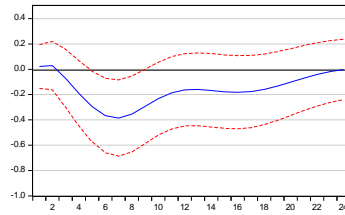
Response of CU\_CY to Cholesky  
One S.D. ER\_CPI\_CY Innovations  $\pm 2$  S.E.  
(Cyprus, Model A)



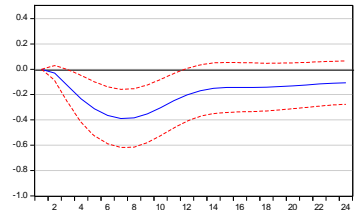
Response of CU\_DE to Cholesky  
One S.D. ER\_CPI\_DE Innovations  $\pm 2$  S.E.  
(Germany, Model A)



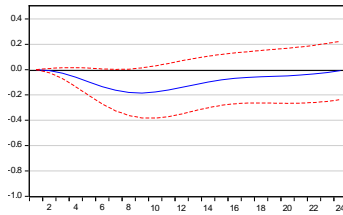
Response of CU\_EE to Cholesky  
One S.D. ER\_CPI\_EE Innovations  $\pm 2$  S.E.  
(Estonia, Model A)



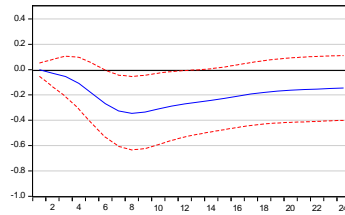
Response of CU\_ES to Cholesky  
One S.D. ER\_CPI\_ES Innovations  $\pm 2$  S.E.  
(Spain, Model A)



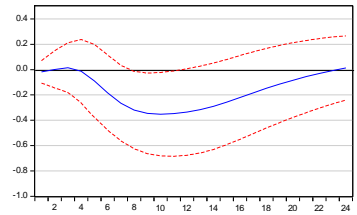
Response of CU\_FI to Cholesky  
One S.D. ER\_CPI\_FI Innovations  $\pm 2$  S.E.  
(Finland, Model A)



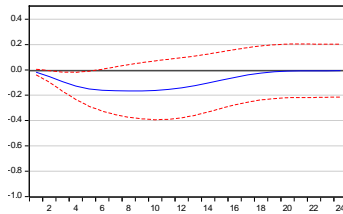
Response of CU\_FR to Cholesky  
One S.D. ER\_CPI\_FR Innovations  $\pm 2$  S.E.  
(France, Model A)



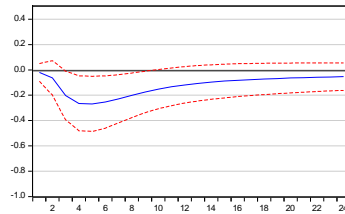
Response of CU\_GR to Cholesky  
One S.D. ER\_CPI\_GR Innovations  $\pm 2$  S.E.  
(Greece, Model A)



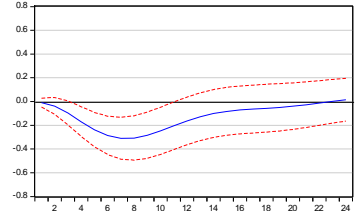
Response of CU\_IE to Cholesky  
One S.D. ER\_CPI\_IE Innovations  $\pm 2$  S.E.  
(Ireland, Model A)



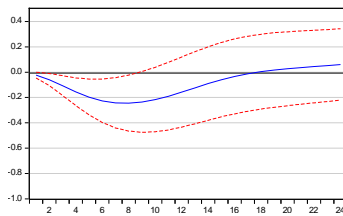
Response of CU\_IT to Cholesky  
One S.D. ER\_CPI\_IT Innovations  $\pm 2$  S.E.  
(Italy, Model A)



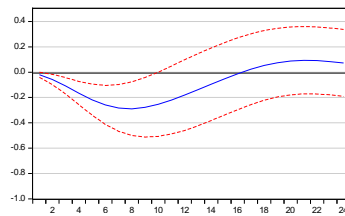
Response of CU\_LT to Cholesky  
One S.D. ER\_CPI\_LT Innovations  $\pm 2$  S.E.  
(Lithuania, Model A)



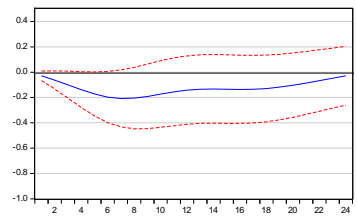
Response of CU\_LU to Cholesky  
One S.D. ER\_CPI\_LU Innovations  $\pm 2$  S.E.  
(Luxembourg, Model A)

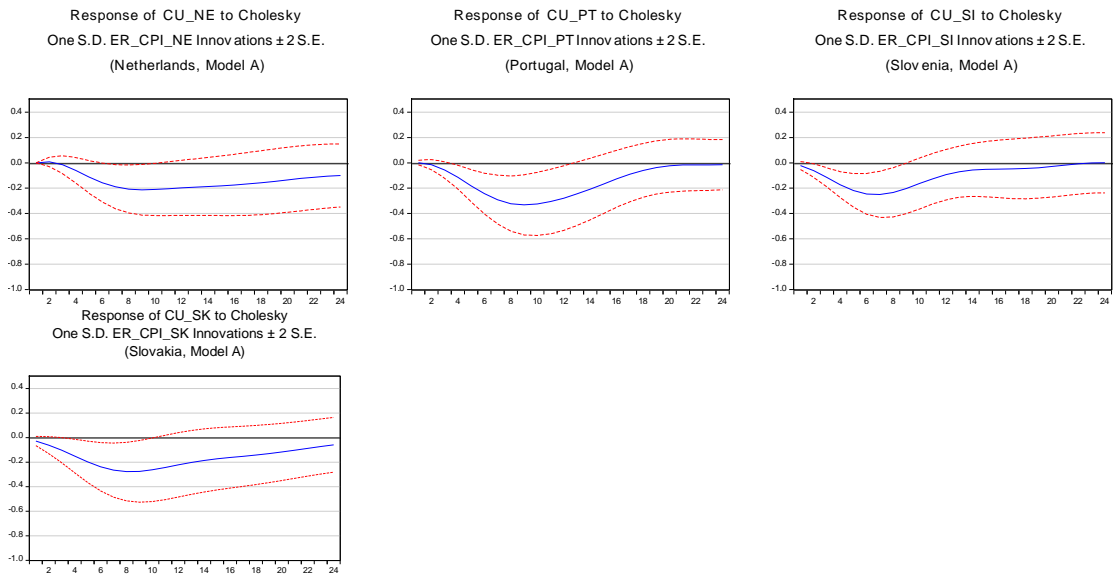


Response of CU\_LV to Cholesky  
One S.D. ER\_CPI\_LV Innovations  $\pm 2$  S.E.  
(Latvia, Model A)



Response of CU\_MT to Cholesky  
One S.D. ER\_CPI\_MT Innovations  $\pm 2$  S.E.  
(Malta, Model A)





Note: Curves represent responses of current account (CU) to the positive (appreciation) one standard deviation real effective exchange rate (CPI based) shock in each of the Euro Area member countries.

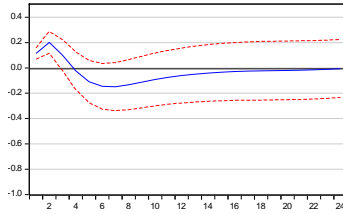
Source: Author's calculation.

**Figure 6.7 Responses of Current Account to REER (CPI based) Shocks (2000M1-2007M12) (Model A1)**

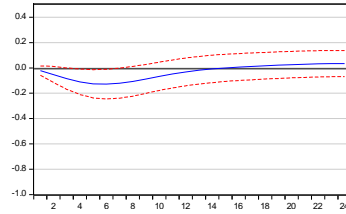
Estimated responsiveness of current accounts to the Cholesky positive one standard deviation REER shock (appreciation of the CPI based real exchange rate) revealed interesting implications of a reduced price-determined competitiveness in the Euro Area member countries during the pre-crisis period. Unexpected shift (increase) in REER was followed by the current account deterioration in each individual country. Negative effect of the shock culminated within the sixth and twelfth month since the shock followed by a converging trend in the current account to its pre-shock equilibrium. Exchange rate shock seems to be neutral in the long run and its effect on the current account was just temporary. Moreover, we have examined just minor differences in the response pattern of current accounts between the core and periphery of the Euro Area. We suggest that generally higher dynamics in the price level in the South of the Euro Area contributed to the reduction in the competitiveness of the periphery countries. However, similarity of the responsiveness of current accounts between core and periphery countries indicates that changes in competitiveness measured by real exchange rates (CPI based) played a less important role in explaining considerable asynchronous trend in current accounts between North and South of the Euro Area. Responsiveness of current accounts to the positive CPI based real exchange rate shock in the new Euro Area member countries (from Central and Eastern Europe) that operated outside the Euro Area during the pre-crisis period was generally more dynamic though not the highest from the whole group. It generally followed expected adjustment of the current account in the small opened economies.

In the Figure 6.8 we summarize results of impulse-response functions of current accounts to positive (appreciation) real effective exchange rate (CPI based) shocks in the model with time series for the extended period (model B1) in the Euro Area member countries.

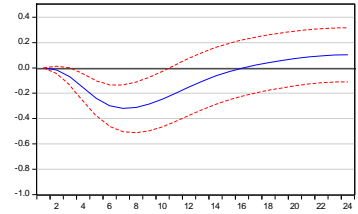
Response of CU\_AT to Cholesky  
One S.D. ER\_CPI\_AT Innovations  $\pm 2$  S.E.  
(Austria, Model B)



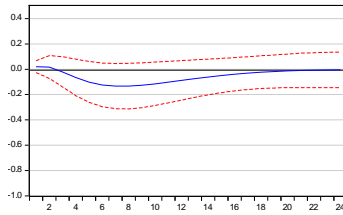
Response of CU\_BE to Cholesky  
One S.D. ER\_CPI\_BE Innovations  $\pm 2$  S.E.  
(Belgium, Model B)



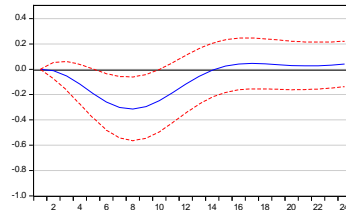
Response of CU\_CY to Cholesky  
One S.D. ER\_CPI\_CY Innovations  $\pm 2$  S.E.  
(Cyprus, Model B)



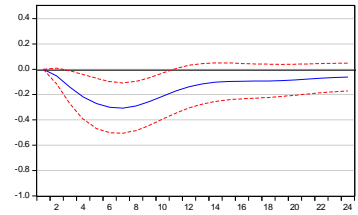
Response of CU\_DE to Cholesky  
One S.D. ER\_CPI\_DE Innovations  $\pm 2$  S.E.  
(Germany, Model B)



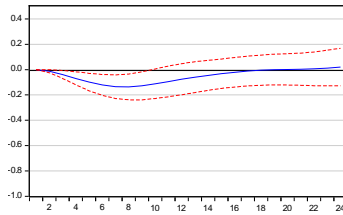
Response of CU\_EE to Cholesky  
One S.D. ER\_CPI\_EE Innovations  $\pm 2$  S.E.  
(Estonia, Model B)



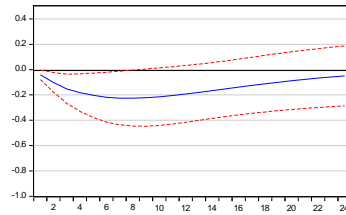
Response of CU\_ES to Cholesky  
One S.D. ER\_CPI\_ES Innovations  $\pm 2$  S.E.  
(Spain, Model B)



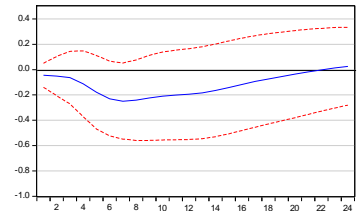
Response of CU\_FI to Cholesky  
One S.D. ER\_CPI\_FI Innovations  $\pm 2$  S.E.  
(Finland, Model B)



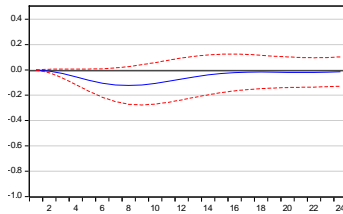
Response of CU\_FR to Cholesky  
One S.D. ER\_CPI\_FR Innovations  $\pm 2$  S.E.  
(France, Model B)



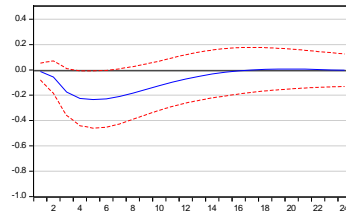
Response of CU\_GR to Cholesky  
One S.D. ER\_CPI\_GR Innovations  $\pm 2$  S.E.  
(Greece, Model B)



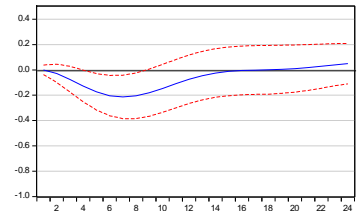
Response of CU\_IE to Cholesky  
One S.D. ER\_CPI\_IE Innovations  $\pm 2$  S.E.  
(Ireland, Model B)



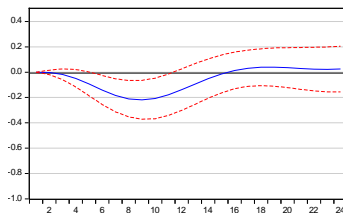
Response of CU\_IT to Cholesky  
One S.D. ER\_CPI\_IT Innovations  $\pm 2$  S.E.  
(Italy, Model B)



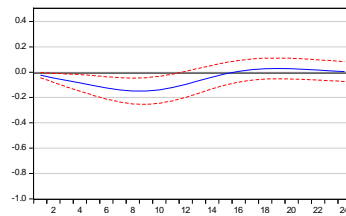
Response of CU\_LT to Cholesky  
One S.D. ER\_CPI\_LT Innovations  $\pm 2$  S.E.  
(Lithuania, Model B)



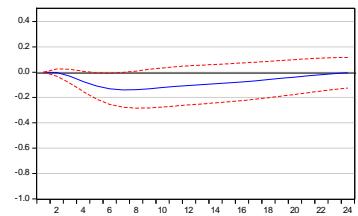
Response of CU\_LU to Cholesky  
One S.D. ER\_CPI\_LU Innovations  $\pm 2$  S.E.  
(Luxembourg, Model B)



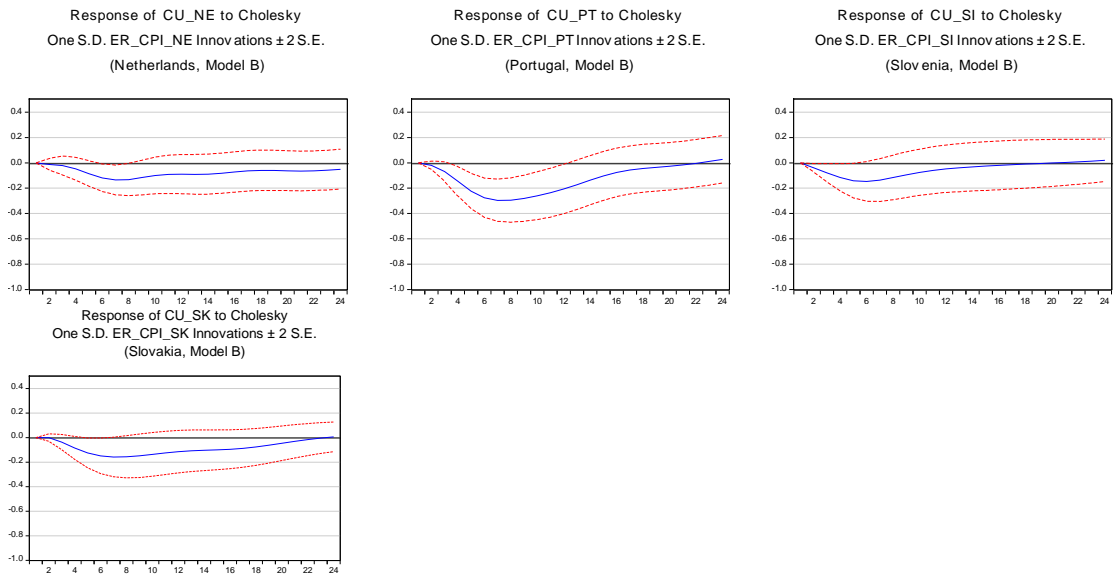
Response of CU\_LV to Cholesky  
One S.D. ER\_CPI\_LV Innovations  $\pm 2$  S.E.  
(Latvia, Model B)



Response of CU\_MT to Cholesky  
One S.D. ER\_CPI\_MT Innovations  $\pm 2$  S.E.  
(Malta, Model B)







Note: Curves represent responses of current account (CU) to the positive (appreciation) one standard deviation real effective exchange rate (CPI based) shock in each of the Euro Area member countries.

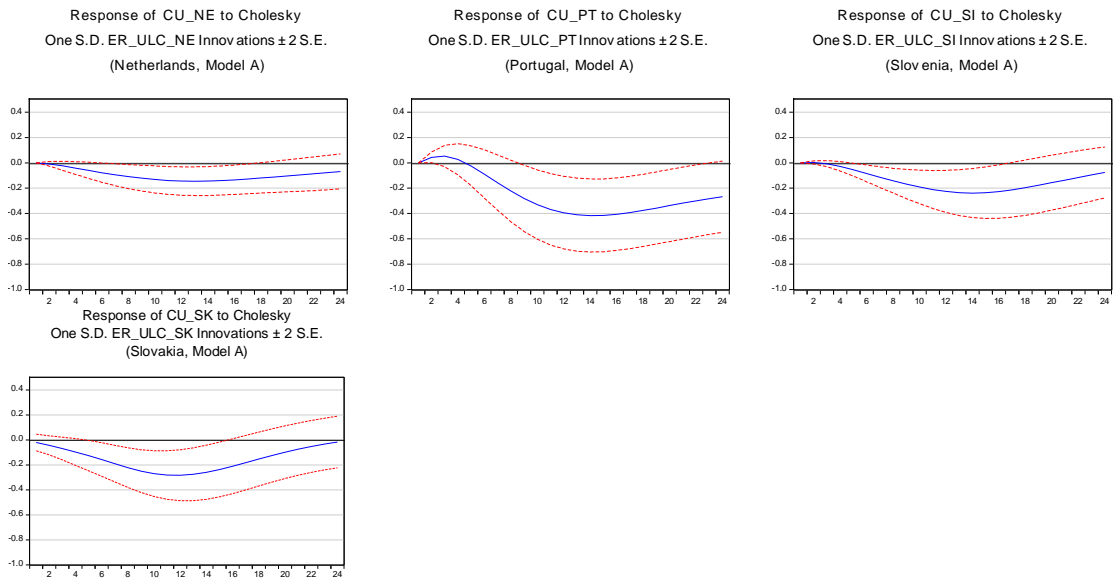
Source: Author's calculation.

**Figure 6.8 Responses of Current Account to REER (CPI based) Shocks (2000M1-2014M12) (Model B1)**

Crisis period affected responsiveness of current accounts to the positive real exchange rate (CPI based) shock in both groups of countries as it has revealed some differences in its key characteristics. While the loading phase of the current account responses to the real exchange rate (CPI based) shock was quite similar to the results from the pre-crisis period (effect of the shock culminated within one year since the shock), the overall durability and intensity of the current account deterioration seems to be reduced in all countries. As a result, the overall exposure of current accounts to the exchange rate shock decreased in both core and periphery countries of the Euro Area. Similar pattern in the current account responsiveness was also investigated in the new Euro Area member countries. We suggest that the core countries experienced less dynamic deterioration in their current accounts that makes them less vulnerable to the price related drop in competitiveness induced by real exchange rate appreciation.

In the Figure 6.9 we summarize results of impulse-response functions of current accounts to positive (appreciation) real effective exchange rate (ULC based) shocks in the model with time series for the pre-crisis period (model A2) in the Euro Area member countries.





Note: Curves represent responses of current account (CU) to the positive (appreciation) one standard deviation real effective exchange rate (ULC based) shock in each of the Euro Area member countries.

Source: Author's calculation.

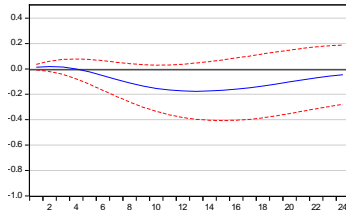
**Figure 6.9 Responses of Current Account to REER (ULC based) Shocks (2000M1-2007M12) (Model A2)**

Estimated responsiveness of current accounts to the Cholesky positive one standard deviation REER shock (appreciation of the ULC based real exchange rate) revealed interesting implications of a reduced labor costs-determined competitiveness in the Euro Area member countries during the pre-crisis period. Unexpected shift (increase) in REER was followed by the current account deterioration in all countries. However, our results indicate significant differences in the current account response patterns between the core and periphery of the Euro Area (as well as considering our results for CPI based real exchange rate shocks). Loading phase of the drop in the current accounts in the periphery countries increased that is why the negative effect of the shock culminated within ninth and eighteenth month since the shock. The overall dynamics as well as durability in the current account responsiveness also increased in this group of countries. On the other hand, the core countries seems to be less vulnerable to the drop in labor costs-determined competitiveness as their current account deteriorated with clearly reduced dynamics after the positive real exchange rate shock. The overall durability of the current account convergence to its pre shock equilibrium was also much reduced in the core of the Euro Area. Exchange rate shock seems to be neutral in the long run and its effect on the current account was just temporary.

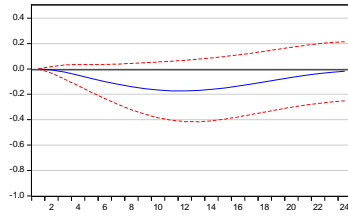
Responsiveness of current accounts to the positive ULC based real exchange rate shock in the new Euro Area member countries that operated outside the Euro Area during the pre-crisis period was generally less dynamic in Baltic countries than in Slovak republic and Slovenia.

In the Figure 6.10 we summarize results of impulse-response functions of current accounts to positive (appreciation) real effective exchange rate (ULC based) shocks in the model with time series for the pre-crisis period (model B2) in the Euro Area member countries.

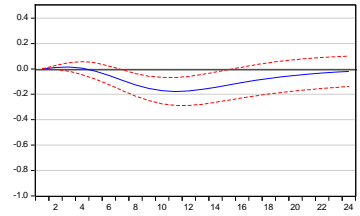
Response of CU\_AT to Cholesky  
One S.D. ER\_ULC\_AT Innovations  $\pm 2$  S.E.  
(Austria, Model B)



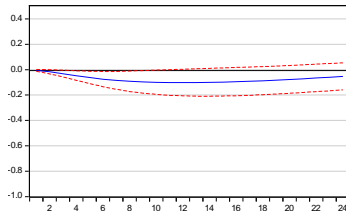
Response of CU\_BE to Cholesky  
One S.D. ER\_ULC\_BE Innovations  $\pm 2$  S.E.  
(Belgium, Model B)



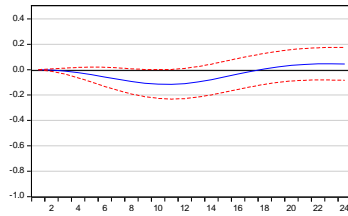
Response of CU\_CY to Cholesky  
One S.D. ER\_ULC\_CY Innovations  $\pm 2$  S.E.  
(Cyprus, Model B)



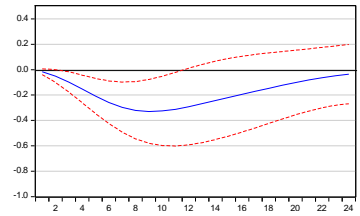
Response of CU\_DE to Cholesky  
One S.D. ER\_ULC\_DE Innovations  $\pm 2$  S.E.  
(Germany, Model B)



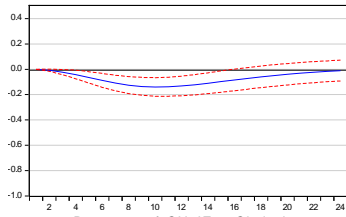
Response of CU\_EE to Cholesky  
One S.D. ER\_ULC\_EE Innovations  $\pm 2$  S.E.  
(Estonia, Model B)



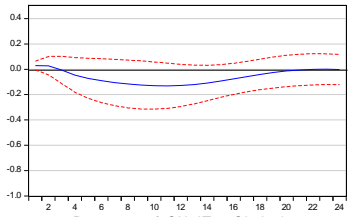
Response of CU\_ES to Cholesky  
One S.D. ER\_ULC\_ES Innovations  $\pm 2$  S.E.  
(Spain, Model B)



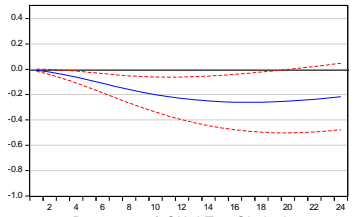
Response of CU\_FI to Cholesky  
One S.D. ER\_ULC\_FI Innovations  $\pm 2$  S.E.  
(Finland, Model B)



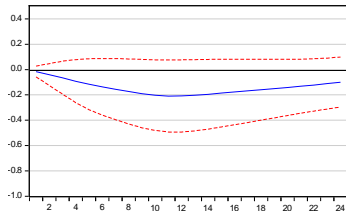
Response of CU\_FR to Cholesky  
One S.D. ER\_ULC\_FR Innovations  $\pm 2$  S.E.  
(France, Model B)



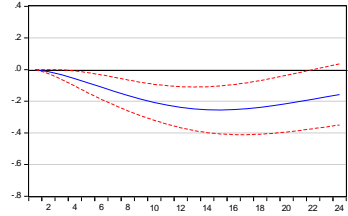
Response of CU\_GR to Cholesky  
One S.D. ER\_ULC\_GR Innovations  $\pm 2$  S.E.  
(Greece, Model B)



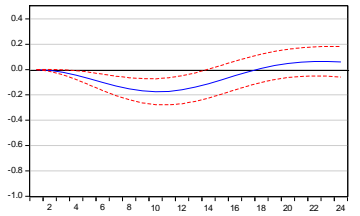
Response of CU\_IE to Cholesky  
One S.D. ER\_ULC\_IE Innovations  $\pm 2$  S.E.  
(Ireland, Model B)



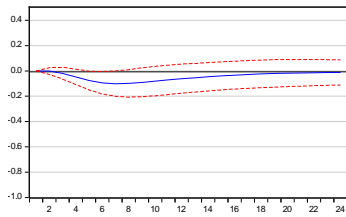
Response of CU\_IT to Cholesky  
One S.D. ER\_ULC\_IT Innovations  $\pm 2$  S.E.  
(Italy, Model B)



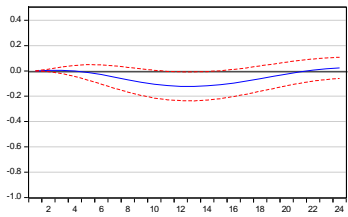
Response of CU\_LT to Cholesky  
One S.D. ER\_ULC\_LT Innovations  $\pm 2$  S.E.  
(Lithuania, Model B)



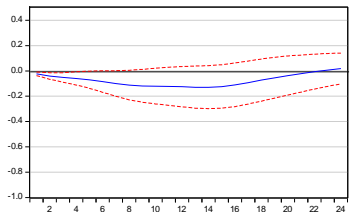
Response of CU\_LU to Cholesky  
One S.D. ER\_ULC\_LU Innovations  $\pm 2$  S.E.  
(Luxembourg, Model B)

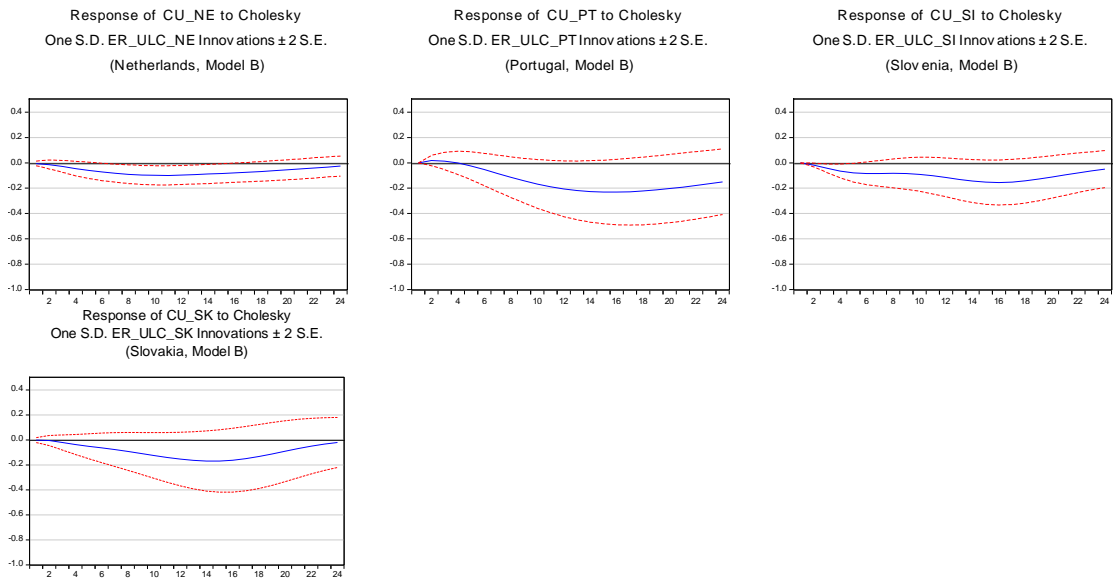


Response of CU\_LV to Cholesky  
One S.D. ER\_ULC\_LV Innovations  $\pm 2$  S.E.  
(Latvia, Model B)



Response of CU\_MT to Cholesky  
One S.D. ER\_ULC\_MT Innovations  $\pm 2$  S.E.  
(Malta, Model B)





*Note:* Curves represent responses of current account (CU) to the positive (appreciation) one standard deviation real effective exchange rate (ULC based) shock in each of the Euro Area member countries.

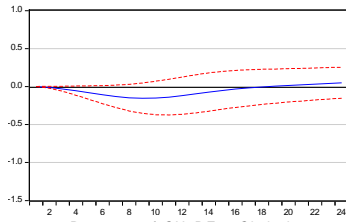
*Source:* Author's calculation.

**Figure 6.10 Responses of Current Account to REER (ULC based) Shocks (2000M1-2014M12) (Model B2)**

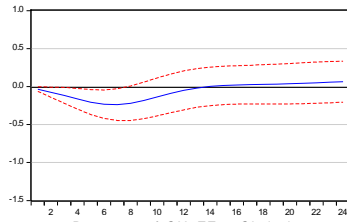
Crisis period affected responsiveness of current accounts to the positive exchange rate (ULC based) shock in both core and periphery of countries. Generally, the overall vulnerability of current accounts to the drop in labor costs-determined competitiveness decreased in all Euro Area countries. Reduced dynamics and durability of the current account deterioration in both groups of countries indicate less important role of the labor costs related determinants of competitiveness especially in countries that experienced just a minor improvement in their external imbalances (Italy). Similar pattern in the current account responsiveness was also investigated in the new Euro Area member countries. However, reduced vulnerability of current accounts to the labor costs-determined competitiveness in countries that experienced a significant improvement in their external imbalances (Portugal, Greece and Spain) indicates that internal (labor costs-driven) devaluation and related improvement in competitiveness does not represent a convenient vehicle for reducing their external imbalances.

In the Figure 6.11 we summarize results of impulse-response functions of current accounts to positive (appreciation) demand shocks in the model with time series for the pre-crisis period (model A3) in the Euro Area member countries.

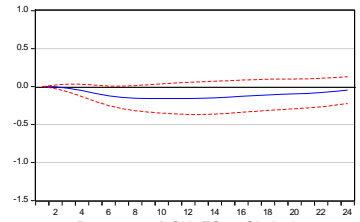
Response of CU\_AT to Cholesky  
One S.D. GDP\_AT Innovations  $\pm 2$  S.E.  
(Austria, Model A)



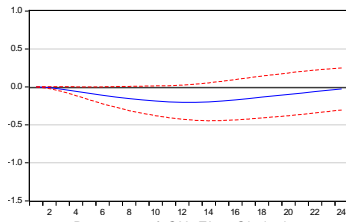
Response of CU\_BE to Cholesky  
One S.D. GDP\_BE Innovations  $\pm 2$  S.E.  
(Belgium, Model A)



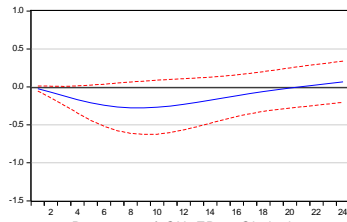
Response of CU\_CY to Cholesky  
One S.D. GDP\_CY Innovations  $\pm 2$  S.E.  
(Cyprus, Model A)



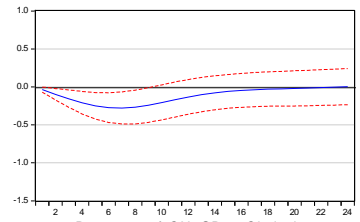
Response of CU\_DE to Cholesky  
One S.D. GDP\_DE Innovations  $\pm 2$  S.E.  
(Germany, Model A)



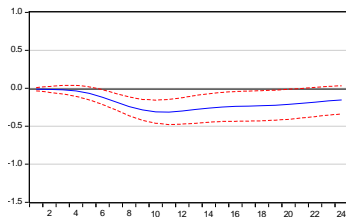
Response of CU\_EE to Cholesky  
One S.D. GDP\_EE Innovations  $\pm 2$  S.E.  
(Estonia, Model A)



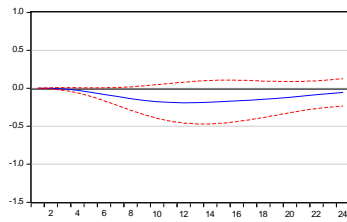
Response of CU\_ES to Cholesky  
One S.D. GDP\_ES Innovations  $\pm 2$  S.E.  
(Spain, Model A)



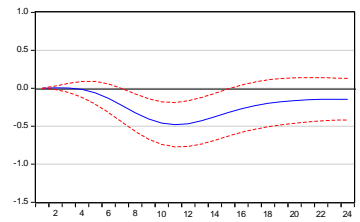
Response of CU\_FI to Cholesky  
One S.D. GDP\_FI Innovations  $\pm 2$  S.E.  
(Finland, Model A)



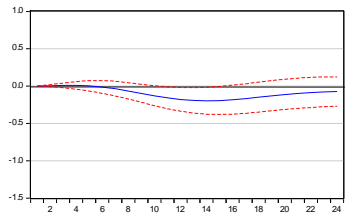
Response of CU\_FR to Cholesky  
One S.D. GDP\_FR Innovations  $\pm 2$  S.E.  
(France, Model A)



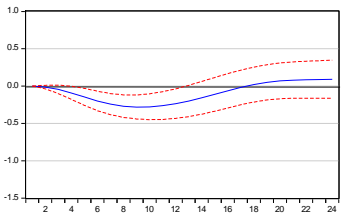
Response of CU\_GR to Cholesky  
One S.D. GDP\_GR Innovations  $\pm 2$  S.E.  
(Greece, Model A)



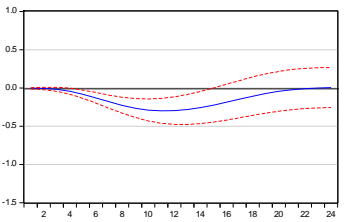
Response of CU\_IE to Cholesky  
One S.D. GDP\_IE Innovations  $\pm 2$  S.E.  
(Ireland, Model A)



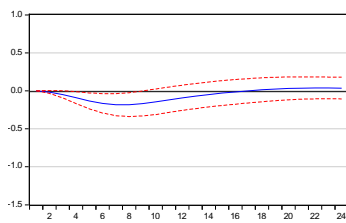
Response of CU\_IT to Cholesky  
One S.D. GDP\_IT Innovations  $\pm 2$  S.E.  
(Italy, Model A)



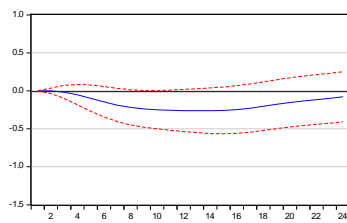
Response of CU\_LT to Cholesky  
One S.D. GDP\_LT Innovations  $\pm 2$  S.E.  
(Lithuania, Model A)



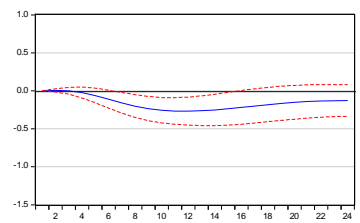
Response of CU\_LU to Cholesky  
One S.D. GDP\_LU Innovations  $\pm 2$  S.E.  
(Luxembourg, Model A)

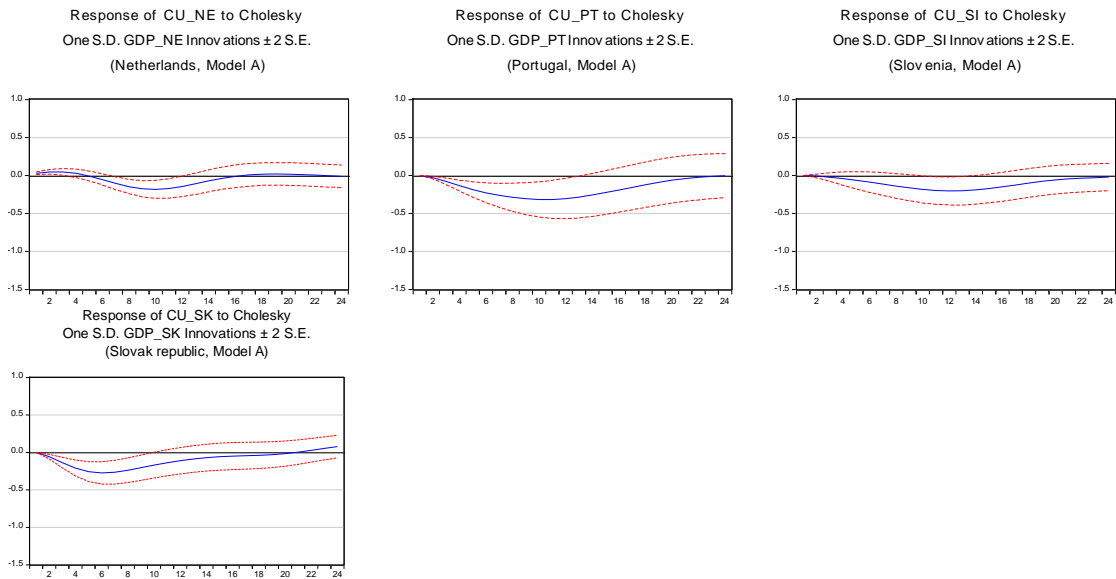


Response of CU\_LV to Cholesky  
One S.D. GDP\_LV Innovations  $\pm 2$  S.E.  
(Latvia, Model A)



Response of CU\_MT to Cholesky  
One S.D. GDP\_MT Innovations  $\pm 2$  S.E.  
(Malta, Model A)





*Note:* Curves represent responses of current account (CU) to the positive (appreciation) one standard deviation real effective exchange rate (ULC based) shock in each of the Euro Area member countries.

*Source:* Author's calculation.

**Figure 6.11 Responses of Current Account to Demand Shock (2000M1-2007M12) (Model A3)**

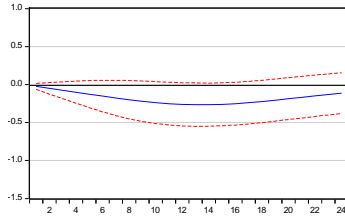
Estimated responsiveness of current accounts to the Cholesky positive one standard deviation demand shock revealed interesting implications of a demand driven external imbalances in the Euro Area member countries during the pre-crisis period. Unexpected shift (increase) in demand was followed by the current account deterioration in all countries. However, our results indicate significant differences in the current account response patterns not only between the core and periphery of the Euro Area but also within both sub-groups of countries. Together with different dynamics in the initial current account deterioration (generally higher in the periphery and all new Euro Area member countries but Slovenia; though countries operated outside the Euro Area during the pre-crisis period) we have also examined quite different length of the initial loading phase of the effect of the shock on the current account deterioration. Effect of the shock in the periphery countries had shorter durability (except for Greece and Portugal), culminated with reduced lag length and was followed by generally more dynamic current account deterioration. Demand shock seems to be neutral in the long run and its effect on the current account was just temporary in all countries.

Responsiveness of current accounts to the positive demand shock in the new Euro Area member countries that operated outside the Euro Area during the pre-crisis period was generally more durable though we have examined some differences in the length of the initial loading phase of the shock.

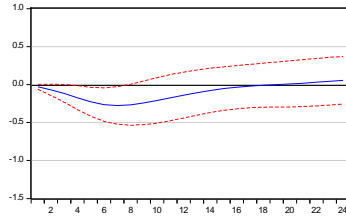
It seems that demand shocks contributed more to the current account imbalances in the periphery of the Euro Area (considering large current account deficits in the pre-crisis period) than in the core countries as suggested by Sanchez and Varoudakis (2013).

In the Figure 6.12 we summarize results of impulse-response functions of current accounts to positive (appreciation) demand shocks in the model with time series for the pre-crisis period (model B3) in the Euro Area member countries.

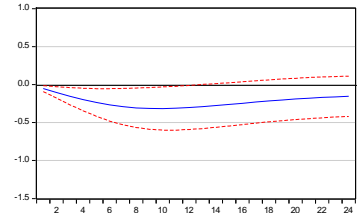
Response of CU\_AT to Cholesky  
One S.D. GDP\_AT Innovations  $\pm 2$  S.E.  
(Austria, Model B)



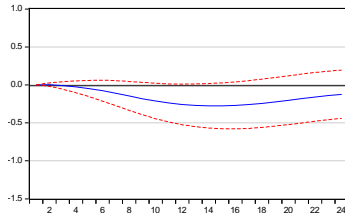
Response of CU\_BE to Cholesky  
One S.D. GDP\_BE Innovations  $\pm 2$  S.E.  
(Belgium, Model B)



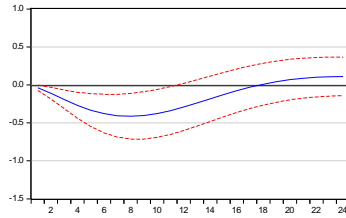
Response of CU\_CY to Cholesky  
One S.D. GDP\_CY Innovations  $\pm 2$  S.E.  
(Cyprus, Model B)



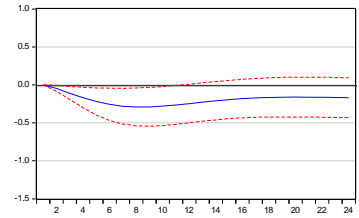
Response of CU\_DE to Cholesky  
One S.D. GDP\_DE Innovations  $\pm 2$  S.E.  
(Germany, Model B)



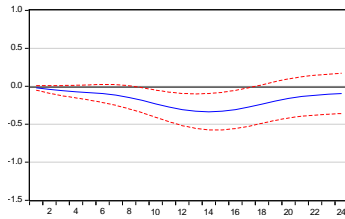
Response of CU\_EE to Cholesky  
One S.D. GDP\_EE Innovations  $\pm 2$  S.E.  
(Estonia, Model B)



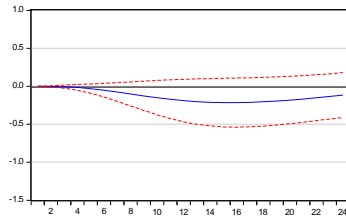
Response of CU\_ES to Cholesky  
One S.D. GDP\_ES Innovations  $\pm 2$  S.E.  
(Spain, Model B)



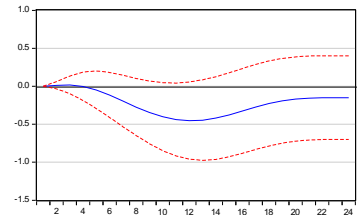
Response of CU\_FI to Cholesky  
One S.D. GDP\_FI Innovations  $\pm 2$  S.E.  
(Finland, Model B)



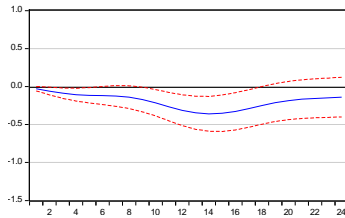
Response of CU\_FR to Cholesky  
One S.D. GDP\_FR Innovations  $\pm 2$  S.E.  
(France, Model B)



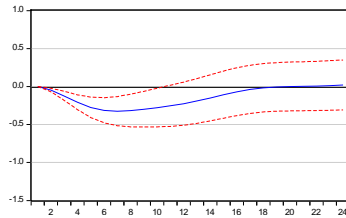
Response of CU\_GR to Cholesky  
One S.D. GDP\_GR Innovations  $\pm 2$  S.E.  
(Greece, Model B)



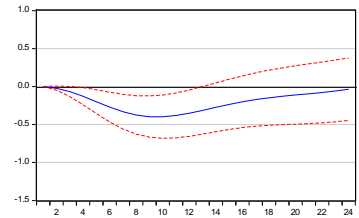
Response of CU\_IE to Cholesky  
One S.D. GDP\_IE Innovations  $\pm 2$  S.E.  
(Ireland, Model B)



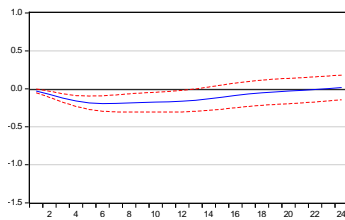
Response of CU\_IT to Cholesky  
One S.D. GDP\_IT Innovations  $\pm 2$  S.E.  
(Italy, Model B)



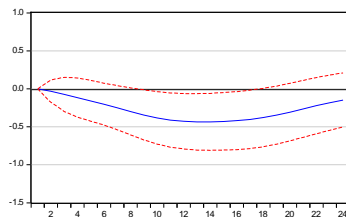
Response of CU\_LT to Cholesky  
One S.D. GDP\_LT Innovations  $\pm 2$  S.E.  
(Lithuania, Model B)



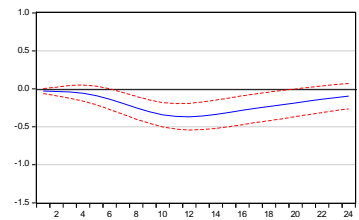
Response of CU\_LU to Cholesky  
One S.D. GDP\_LU Innovations  $\pm 2$  S.E.  
(Luxembourg, Model B)



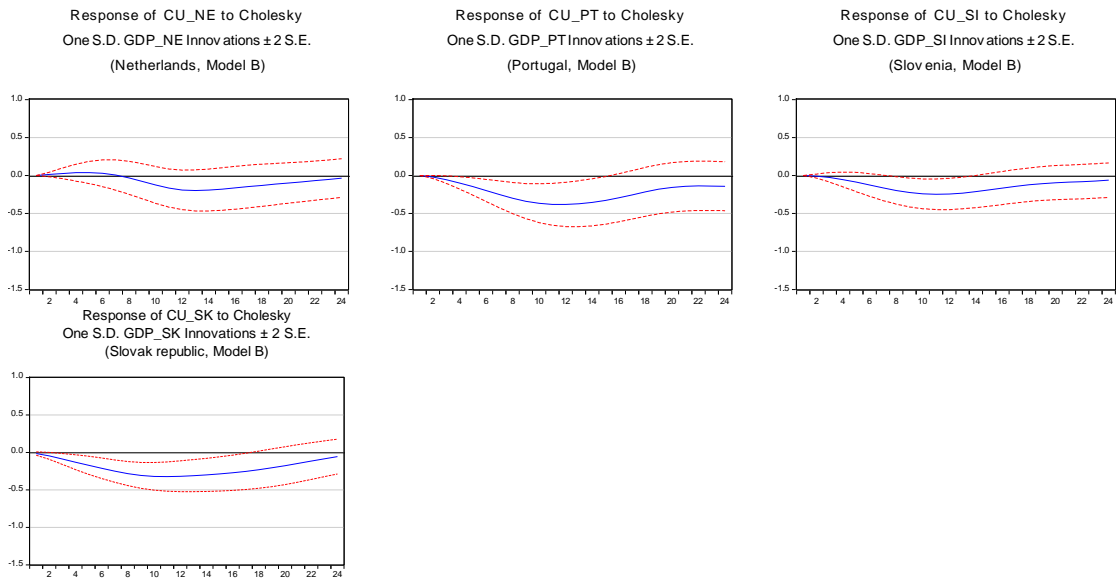
Response of CU\_LV to Cholesky  
One S.D. GDP\_LV Innovations  $\pm 2$  S.E.  
(Latvia, Model B)



Response of CU\_MT to Cholesky  
One S.D. GDP\_MT Innovations  $\pm 2$  S.E.  
(Malta, Model B)







Note: Curves represent responses of current account (CU) to the positive (appreciation) one standard deviation real effective exchange rate (ULC based) shock in each of the Euro Area member countries.

Source: Author's calculation.

**Figure 6.12 Responses of Current Account to Demand Shock (2000M1-2014M12) (Model B3)**

Crisis period affected responsiveness of current accounts to the positive demand shock in both core and periphery of countries. Contrary to our results for real exchange rates (both CPI and ULC based), current account responsiveness to the unexpected demand shock increased in both groups of countries during the crisis period. We have observed more dynamic and durable current account deterioration also in new Euro Area member countries.

We suggest that crisis period intensified demand driven redistributive effects that seems to have more important role on the current account determination that changes in price and cost related competitiveness. Significant reduction in demand during the initial stage of the crisis period contributed to general improvement in the current account imbalances between North and South of the Euro Area and as a result, in the Euro Area as a whole.

### C. Variance Decomposition

Table 6.4 summarizes relative contributions of the CPI based REER shock, ULC based REER shock and demand shock to the conditional variance of current accounts in the Euro Area member countries during pre-crisis (model A) and extended (model B) periods.

**Table 6.4 Variance Decomposition of Current Accounts (in per cent)**

Horizon (months)	Austria						Belgium						Cyprus							
	REER Shock (CPI)		REER Shock (ULC)		Demand Shock		Horizon (months)	REER Shock (CPI)		REER Shock (ULC)		Demand Shock		Horizon (months)	REER Shock (CPI)		REER Shock (ULC)		Demand Shock	
	A	B	A	B	A	B		A	B	A	B	A	B		A	B	A	B	A	B
1	0.23	1.89	0.00	0.00	0.06	0.31	1	0.00	0.00	0.12	0.00	0.00	0.00	1	1.61	2.12	0.00	0.00	0.00	0.03
6	8.56	7.93	8.03	6.19	0.99	1.40	6	9.98	8.05	8.96	10.48	1.33	1.58	6	11.36	10.01	9.61	8.81	0.96	1.47
12	14.63	12.48	17.24	12.56	9.74	9.82	12	13.94	9.56	12.40	15.00	8.67	10.32	12	14.73	13.09	14.28	13.60	13.10	14.90
24	18.36	16.38	20.32	17.46	18.39	24.27	24	12.78	9.48	13.60	12.87	16.61	21.54	24	18.37	15.12	19.77	18.91	18.75	24.05

Germany							Estonia							Spain						
Horizon (months)	REER Shock (CPI)		REER Shock (ULC)		Demand Shock		Horizon (months)	REER Shock (CPI)		REER Shock (ULC)		Demand Shock		Horizon (months)	REER Shock (CPI)		REER Shock (ULC)		Demand Shock	
	A	B	A	B	A	B		A	B	A	B	A	B		A	B	A	B	A	B
1	0.00	0.00	0.00	0.31	0.00	0.28	1	0.00	0.00	0.00	0.00	0.00	0.00	1	0.00	0.24	0.00	0.18	0.00	0.21
6	4.15	3.90	5.89	6.39	0.53	1.58	6	5.27	6.85	4.20	3.20	0.75	1.27	6	8.35	6.39	7.42	6.74	1.14	1.80
12	14.88	12.28	15.79	13.78	13.92	14.47	12	15.83	14.32	13.83	12.06	6.17	7.39	12	13.17	12.18	14.96	13.08	12.98	14.61
24	20.77	16.89	17.93	12.64	17.89	20.29	24	21.13	20.23	21.42	20.68	14.46	19.43	24	18.69	16.55	21.56	17.43	19.23	21.78

Finland							France							Greece						
Horizon (months)	REER Shock (CPI)		REER Shock (ULC)		Demand Shock		Horizon (months)	REER Shock (CPI)		REER Shock (ULC)		Demand Shock		Horizon (months)	REER Shock (CPI)		REER Shock (ULC)		Demand Shock	
	A	B	A	B	A	B		A	B	A	B	A	B		A	B	A	B	A	B
1	0.00	0.14	0.00	0.32	0.00	0.00	1	0.03	0.00	0.00	0.26	0.12	0.15	1	0.12	0.00	0.00	0.13	0.32	0.25
6	7.26	6.28	5.87	5.06	1.19	2.06	6	7.14	7.03	6.38	6.06	1.77	2.07	6	7.29	6.58	7.15	7.02	2.04	1.96
12	13.27	11.34	13.67	11.44	12.08	13.17	12	15.25	13.87	14.19	13.48	11.36	13.08	12	12.54	11.36	13.06	12.58	13.47	14.02
24	17.96	16.79	18.29	16.29	19.05	24.57	24	19.32	18.32	20.87	19.28	18.25	19.54	24	19.38	18.52	20.27	19.35	20.21	25.61

Ireland							Italy							Lithuania						
Horizon (months)	REER Shock (CPI)		REER Shock (ULC)		Demand Shock		Horizon (months)	REER Shock (CPI)		REER Shock (ULC)		Demand Shock		Horizon (months)	REER Shock (CPI)		REER Shock (ULC)		Demand Shock	
	A	B	A	B	A	B		A	B	A	B	A	B		A	B	A	B	A	B
1	0.00	0.18	0.00	0.14	0.21	0.28	1	0.00	0.00	0.00	0.00	0.17	0.14	1	0.15	0.00	0.00	0.00	0.27	0.15
6	6.83	5.91	6.04	5.87	1.36	1.27	6	7.27	7.01	6.31	6.22	1.94	2.04	6	4.24	4.15	4.01	3.76	1.78	2.08
12	12.17	11.64	11.63	10.39	11.14	12.75	12	14.84	13.35	13.84	13.05	9.65	11.38	12	15.85	14.87	14.73	14.35	7.48	7.89
24	17.46	16.30	16.49	16.09	18.53	22.43	24	17.28	16.43	16.39	15.89	17.45	19.51	24	22.14	21.53	20.51	19.59	16.39	19.99

Luxembourg							Latvia							Malta						
Horizon (months)	REER Shock (CPI)		REER Shock (ULC)		Demand Shock		Horizon (months)	REER Shock (CPI)		REER Shock (ULC)		Demand Shock		Horizon (months)	REER Shock (CPI)		REER Shock (ULC)		Demand Shock	
	A	B	A	B	A	B		A	B	A	B	A	B		A	B	A	B	A	B
1	0.00	0.00	0.14	0.18	0.00	0.00	1	0.00	0.00	0.14	0.11	0.00	0.00	1	0.00	0.27	0.00	0.31	0.00	0.00
6	5.21	5.16	5.49	5.27	1.17	1.65	6	5.44	5.02	6.22	6.07	1.78	1.94	6	8.75	8.23	7.33	7.10	1.11	1.39
12	13.84	13.22	14.38	14.75	9.14	9.49	12	12.78	12.43	14.52	14.80	8.45	8.76	12	13.89	13.47	12.76	12.25	10.38	11.23
24	17.89	16.43	18.49	17.94	14.76	18.54	24	19.58	19.04	20.14	19.32	17.59	21.48	24	19.51	17.39	19.36	18.24	17.31	20.56

Netherlands							Portugal							Slovenia						
Horizon (months)	REER Shock (CPI)		REER Shock (ULC)		Demand Shock		Horizon (months)	REER Shock (CPI)		REER Shock (ULC)		Demand Shock		Horizon (months)	REER Shock (CPI)		REER Shock (ULC)		Demand Shock	
	A	B	A	B	A	B		A	B	A	B	A	B		A	B	A	B	A	B
1	0.00	0.00	0.00	0.00	0.17	0.21	1	0.24	0.21	0.00	0.00	0.16	0.19	1	0.00	0.12	0.00	0.14	0.00	0.00
6	7.57	7.08	7.47	6.50	1.78	1.95	6	6.88	6.03	6.56	6.24	2.12	2.27	6	5.32	5.25	5.07	4.33	1.19	1.54
12	12.14	12.07	14.15	13.66	11.36	13.23	12	14.18	13.75	15.06	14.55	14.77	15.56	12	13.39	13.65	11.29	11.16	9.66	10.12
24	13.78	12.99	15.38	15.00	15.27	19.41	24	17.97	16.99	19.27	18.38	21.20	23.94	24	18.42	17.96	17.38	17.32	18.77	22.30

Slovak republic						
Horizon (months)	REER Shock (CPI)		REER Shock (ULC)		Demand Shock	
	A	B	A	B	A	B
1	0.31	0.25	0.00	0.00	0.15	0.19
6	7.43	7.14	6.34	5.21	1.17	1.88
12	12.39	11.87	11.84	11.25	12.23	13.15
24	19.58	19.32	17.38	17.04	19.77	23.27

*Note:* Relative contributions of structural shocks to the conditional variance of current accounts in models A (2000M1-2007M12) and B (2000M1-2014M12).

*Source:* Author's calculations.

Decomposition of conditional variance of current accounts in the Euro Area member countries revealed information about the relative importance of real effective exchange rate and demand shocks in determining external balances in the North and South of the euro Area.

First, during first six months since the shocks both CPI and ULC based REER shocks contributed into the adjustments of the current accounts with higher intensity (between 5 to 10 percent) than demand shocks in all countries. While the relative importance of both shocks slightly increased over time, their contribution steadily diminished in the long run. We did not observe any clear determination pattern that would enable us to make any reasonable differences between North and South of the Euro Area. Current accounts in the new Euro Area member countries were generally more vulnerable to the real exchange rate shocks than the average of the Euro Area.

Second, the relative contribution of the demand shock during first six month since the shock was generally negligible and did not determine current account adjustments with any significant magnitude. However, its importance significantly increased during the second half of the year since the shock in most countries. The relative importance of the demand shock became comparable to the real exchange rate shocks during the second year since shock and even dominated in some countries (Finland, Italy, Netherlands, Portugal, Slovenia and Slovak republic). Its importance even increased over longer period of time.

Third, crisis period slightly reduced the relative importance of prices and costs related determinants of external competitiveness in favor demand of drivers in all Euro Area member countries. As a result, the relative importance of both CPI and ULC based REER shocks moderately decreased over the whole observed period since shock (2 years). At the same time the relative importance of demand shock clearly increased in all countries though with higher intensity in smaller and more opened economies (new Euro Area members included).

## **Conclusion**

Examination of the effects associated with changes in price and costs-determined competitiveness on current account deficits in the Euro Area member countries revealed interesting implications of existing differences in performance between the core and periphery on the external intra-Eurozone imbalances. Our results indicate that current accounts in the periphery countries was more vulnerable the exchange rate (both CPI and ULC based) shocks than in the core countries. However, differences are more significant in case of costs-determined changes in competitiveness induced by unexpected real exchange rate shifts.

Current accounts in the periphery countries of the Euro Area were also more vulnerable to the demand shocks in terms of both intensity and durability of the effect associated with the current account adjustments. Moreover, while the relative importance of the real exchange rate shocks dominated just within first six months since the shock, increased vulnerability to the demand shock over longer period of time reduces well expected benefits of the prices and costs related boost in competitiveness and associated reduction in the current account deficits. This idea is even more reasonable provided that

crisis period generally reduced vulnerability of current accounts in the all Euro Area member countries to the real exchange rates shocks and increased their responsiveness to the demand shocks. Higher relative importance of demand shocks in explaining conditional variability of current accounts in the whole Euro Area during the crisis period even emphasizes these conclusions.

While competitiveness issues (higher dynamics of prices and labor costs) in the periphery countries can explain a significant deterioration in the external imbalances of the periphery countries during the pre-crisis period, decreased vulnerability of current accounts to the real exchange rate shocks during the crisis period reduces applicability of internal devaluation as a convenient vehicle for a reduction in external imbalances in these countries.

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## Chapter 7

### Effects of Fiscal Policy Shocks in the Euro Area (Lessons Learned from Fiscal Consolidation)

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7.1 Introduction

7.2 Overview of Fiscal Stance

7.3 Overview of the Literature

7.4 Fiscal Consolidation

7.5 Fiscal Policy Shocks

Conclusions

References



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### 7.1 Introduction

European Union member countries are currently exposed to negative implications of the economic and debt crisis. Questions associated with disputable implications of fiscal incentives seem to be contrary to the crucial need of the effective fiscal consolidation that is necessary to reduce excessive fiscal deficits and high sovereign debts. As a result, governments tend to reduce public expenditures and raise taxes during the periods lagging recession and thus cooling down economies. However, an appropriate composition of fiscal incentives without direct negative effect on the public budget and its revenue and expenditure sides may help to reduce negative budgetary pressures through increased tax capacity of the economy followed by stronger growth of real output.

While challenges addressed to the fiscal policy and its anti-cyclical potential rose steadily but not desperately since the beginning of the economic crisis, the call for fiscal consolidation became urgent almost immediately and this need significantly strengthen after the debt crisis contagion flooded Europe.

The overall success of the fiscal consolidation may seem to differ across countries reflecting the overall burden of sovereign debt and associated costs of debt service. Significant reduction in primary budget deficit (aiming to primary surplus during a reasonable period) is the only way to reduce a negative impact of sovereign debt on economic growth. While the need to reduce a fiscal imbalance is clear, the composition (expenditure versus revenues based consolidation) and nature (gradual or sharp consolidation) of fiscal consolidation, together with the role played by accompanied policies (quantitative monetary easing, exchange rate internal versus external devaluation, reforms of fiscal institutions, etc.), seems to be quite disputable (Barrios, Langedijk and Penc 2010).

In the paper we provide an overview of main trends in public budgets and sovereign debts in the Euro Area member countries during last two decades. We identify episodes of successful and unsuccessful (cold showers versus gradual) fiscal (expenditure versus revenue based) consolidations by analyzing effects of improvements in cyclically adjusted primary balance on the sovereign debt ratio reduction. We also estimate VAR model to analyze effects of fiscal shocks (based on one standard deviation (fall) in total expenditure and (rise) in direct and indirect taxes) to real output. It is expected that responses of real output to the different types of (consolidating) fiscal shocks may vary and thus provide more precise ideas about a feasibility (i.e. side effects on the macroeconomic performance)

of expenditure versus revenue based fiscal consolidation episodes. Economic effects of fiscal consolidating adjustments are evaluated for two periods (pre-crisis and extended) to reveal crisis effects on fiscal consolidation efforts.

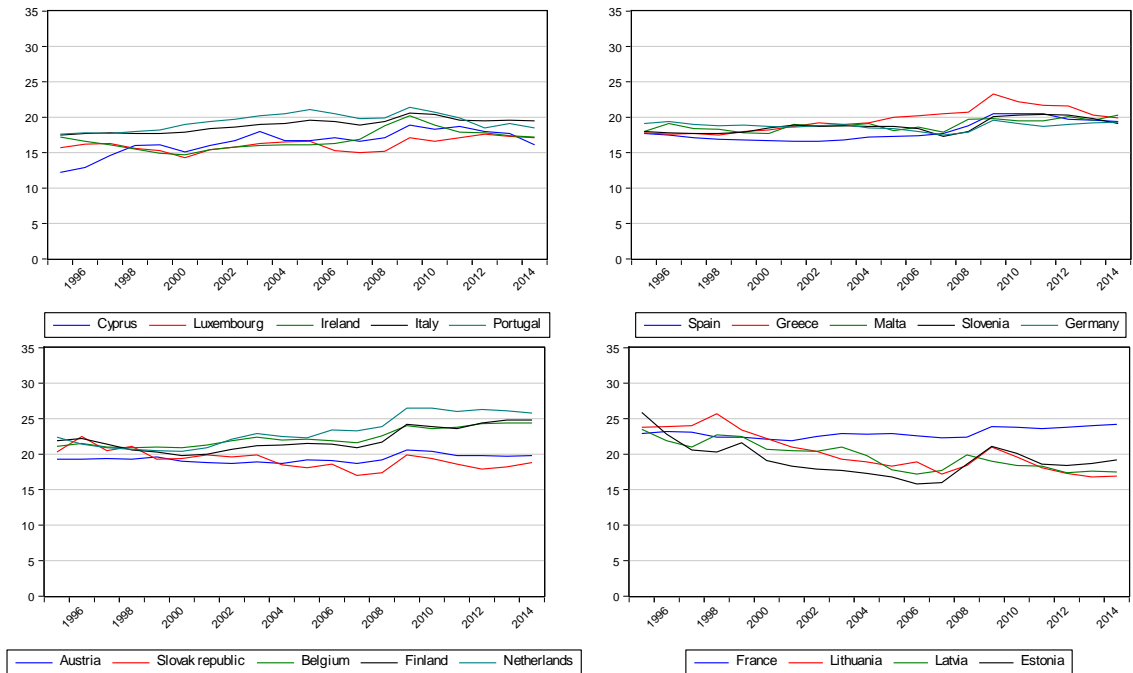
Following the introduction, we provide some stylized facts about fiscal stance in the Euro Area member countries over the period of last two decades. We emphasize main trends in the evolution of government consumption, rate of secondary redistribution, total expenditures and total revenues, fiscal deficit and sovereign debt. In the third section we provide an overview of current empirical evidence about fiscal consolidation and fiscal policy shocks. Wide range of causal effects and implications of expenditure and tax revenue based fiscal adjustments as well as their size and durability seem to be well documented in papers published in last two decades. Fourth section begins with some methodological remarks to fiscal consolidation and cyclically adjusted primary balance. Subsequent analysis of fiscal consolidation episodes provides an in-depth insight into the degree of success of expenditure and tax revenue based fiscal adjustments in the view of a sustainable sovereign debt reduction in the Euro Area member countries. In section five we deal with fiscal policy shocks trying to provide some alternative guideline for evaluation of side economic effects related to expenditure and tax based fiscal adjustments on the real output performance.

## **7.2. Overview of Fiscal Stance**

Budgetary development in the Euro Area member countries did not follow the same trend, though some common patterns seem to be present. In general, relative share of total government consumption on overall aggregate expenditures seems to be quite low during last two decades (Figure 7.1).

However, there seem to be notable differences among countries especially if we emphasize a relative importance as well as the overall trend in the development of the general government consumption. Despite generally low differences in the relative share of government consumption on total output among the countries at the beginning of the period we have observed increased diverging trend since the establishment of the Euro Area. Dynamic increase in the government consumption is present especially in the periphery countries like Cyprus, Greece, Italy, Portugal though this trend is also obvious in Belgium, Finland and Netherlands. The overall share the general government consumption on the total output remained quite different even at the end of the observed period though it seems that effects of economic crisis contributed to slight reduction in this gap in the whole group of countries. At the same time we emphasize a relatively persistent decreasing trend in the Baltic countries and the Slovak republic.



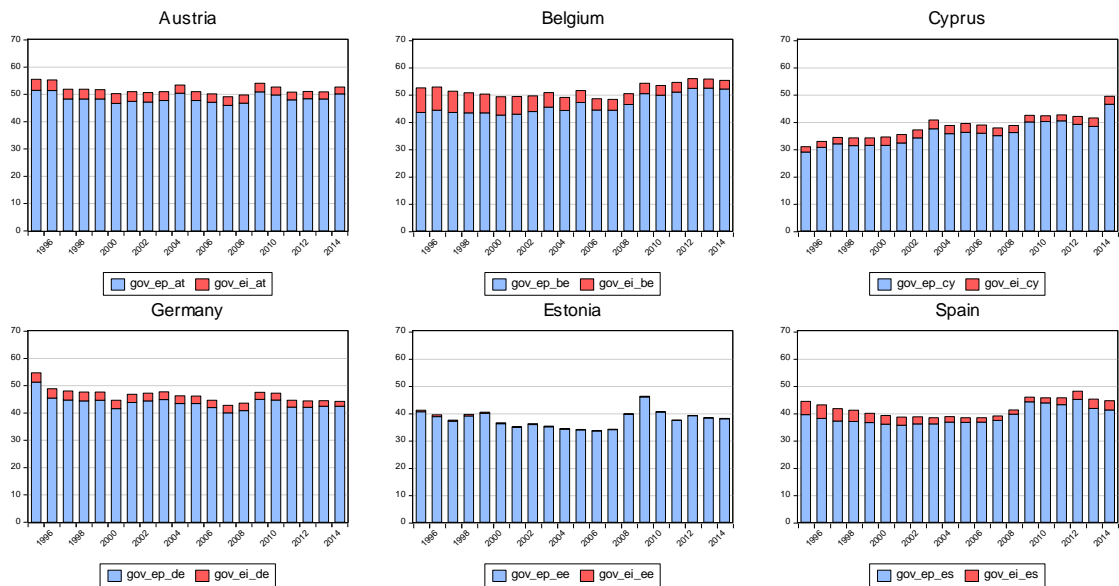


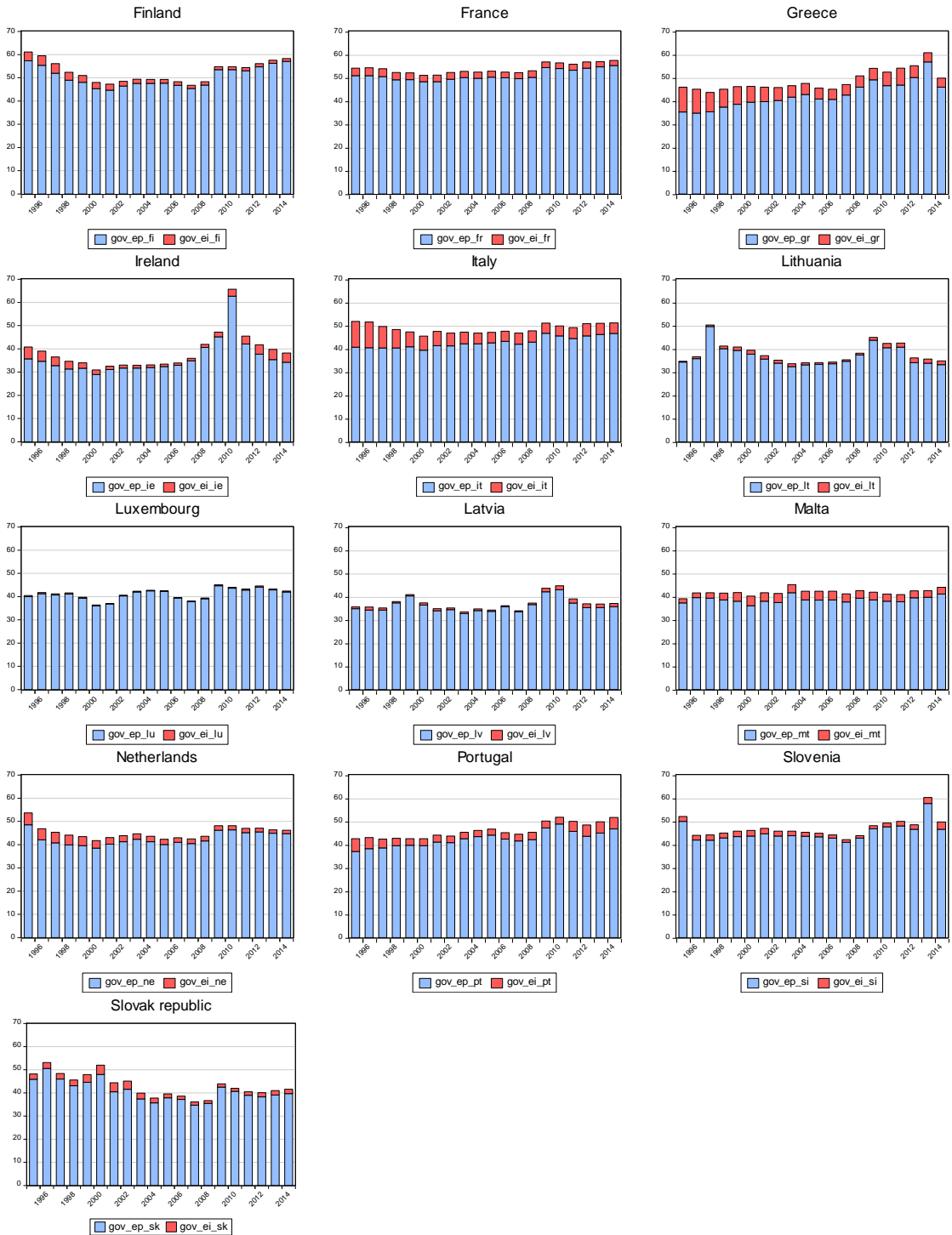
**Note:** General government consumption is expressed as a percentage shares on GDP.

**Source:** Compiled by author based on data taken from Eurostat - Government Finance Statistics (November 2015) and IMF - International Financial Statistics (November 2015).

**Figure 7.1 General Government Consumption (1995-2014)**

Rate of the secondary income redistribution represents one of the most crucial indicators of the government size (Figure 7.2). It is also convenient to emphasize the size of payable interests to calculate primary government expenditures to express a structural fiscal stance of the government.





Note: Variables - primary government expenditures (GOV\_EP) and payable interests (GOV\_EI) are expressed as percentage share on GDP.

Source: Compiled by author based on data taken from Eurostat - Government Finance Statistics (November 2015) and IMF - International Financial Statistics (November 2015).

**Figure 7.2 Size of Government - Rate of Secondary Income Redistribution (1995-2014)**

The size of the government in the Euro Area member countries seems to be quite stable in the core countries of the Euro Area, however, countries like Cyprus, Greece and Portugal experienced opposite trend (pre-crisis period). Moreover, increasing indebtedness of periphery countries affected the relative share of associated interest costs that was clearly higher than in the rest of the Euro area in general, though it generally followed decreasing trend due to reduced interest rates on government bonds due to undesirable convergence in the long-term interest rates in the whole Euro Area.

**Table 7.1 Total Government Expenditures and Revenues (1995-2014)**

	Total expenditures					Total Revenues				
	1995-1998	1999-2002	2003-2006	2007-2010	2011-2014	1995-1998	1999-2002	2003-2006	2007-2010	2011-2014
Austria	53.650	50.925	51.400	51.425	51.375	49.700	49.275	48.525	48.300	49.200
Belgium	51.725	49.475	49.850	51.475	55.225	48.825	49.375	48.850	48.900	51.650
Cyprus	32.975	35.200	39.325	40.200	43.775	29.900	32.125	36.100	38.675	37.450
Germany	49.850	46.650	46.250	45.325	44.475	45.225	44.675	43.000	43.425	44.300
Estonia	39.300	36.950	34.275	40.100	38.200	39.850	36.250	36.325	39.625	38.550
Spain	42.475	39.025	38.400	42.850	45.800	37.675	38.200	39.125	37.150	37.625
Finland	57.275	48.700	49.075	51.175	56.600	55.075	53.100	51.875	52.150	54.300
France	53.675	51.675	52.675	54.600	56.800	49.925	49.875	49.450	49.675	52.325
Greece	44.975	46.075	46.225	51.125	55.025	37.425	40.725	39.050	40.300	46.250
Ireland	37.725	32.600	33.325	47.675	41.300	37.975	34.600	34.900	34.450	33.800
Italy	50.325	46.775	47.175	48.900	59.525	45.350	44.375	43.525	45.450	47.425
Lithuania	40.675	38.100	34.000	40.150	37.250	35.725	35.275	33.150	35.150	33.375
Luxembourg	41.275	38.450	41.775	41.650	43.400	44.050	42.850	42.075	43.250	44.075
Latvia	36.025	37.025	34.600	39.850	37.450	35.950	34.325	33.725	34.275	35.800
Malta	40.975	41.275	43.025	41.700	42.500	34.125	35.350	38.325	38.450	39.775
Netherland	47.500	43.075	43.400	45.625	46.675	44.400	43.000	42.225	43.100	43.450
Portugal	42.700	43.250	45.825	47.950	50.025	38.200	39.650	40.550	41.025	43.775
Slovenia	46.325	46.175	45.050	45.900	52.175	42.850	42.950	43.300	42.625	44.475
Slovakia	48.825	47.350	38.975	39.675	40.800	42.725	38.925	36.100	34.775	37.425
<b>average</b>	<b>45.171</b>	<b>43.092</b>	<b>42.875</b>	<b>45.650</b>	<b>47.283</b>	<b>41.839</b>	<b>41.311</b>	<b>41.062</b>	<b>41.618</b>	<b>42.896</b>

Note: Fiscal indicators are expressed as percentage shares on GDP.

Source: Compiled by author based on data taken from Eurostat - Government Finance Statistics (November 2015) and IMF - International Financial Statistics (November 2015).

Table 7.1 provides more detailed information on the relative shares of government expenditures and government revenues in the Euro Area member countries during the years 1995-2014 divided into short-term sub-periods.

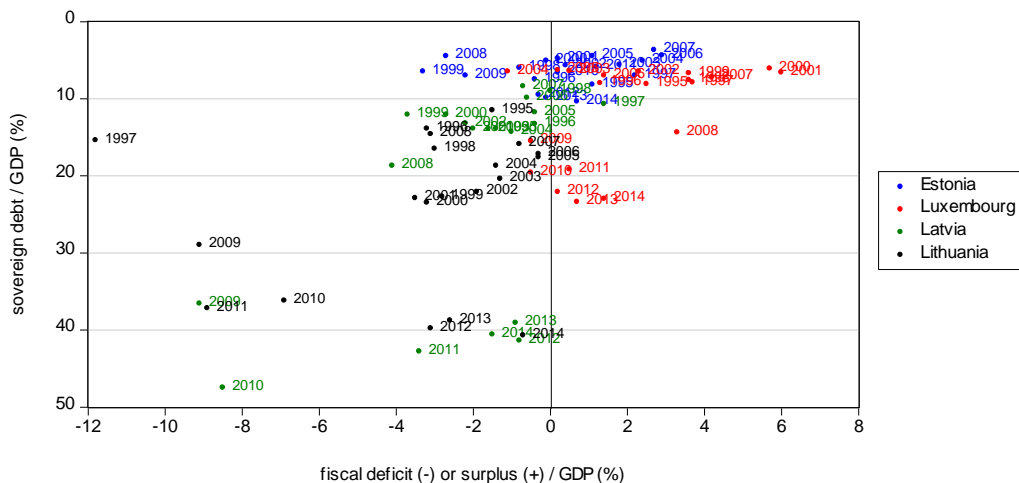
Overview of the relative shares of government expenditures and revenues even emphasized the differences in the size of the government in individual Euro Area member countries. Generally lower shares of government expenditures on the total output in the periphery countries at the beginning of the period and improved conditions on the financial markets since the establishment of the Euro Area were followed by more dynamic increase in the government expenditures in these countries in comparison with the rest of the Euro Area. Moreover, increasing share in government expenditures together with less dynamic increase in government expenditures clearly indicates deterioration in fiscal discipline especially in the south of the Euro Area.

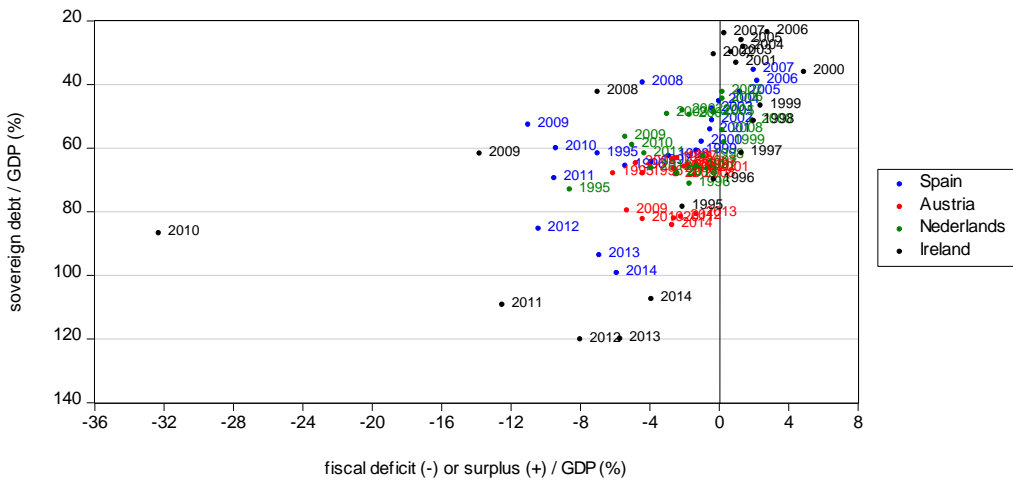
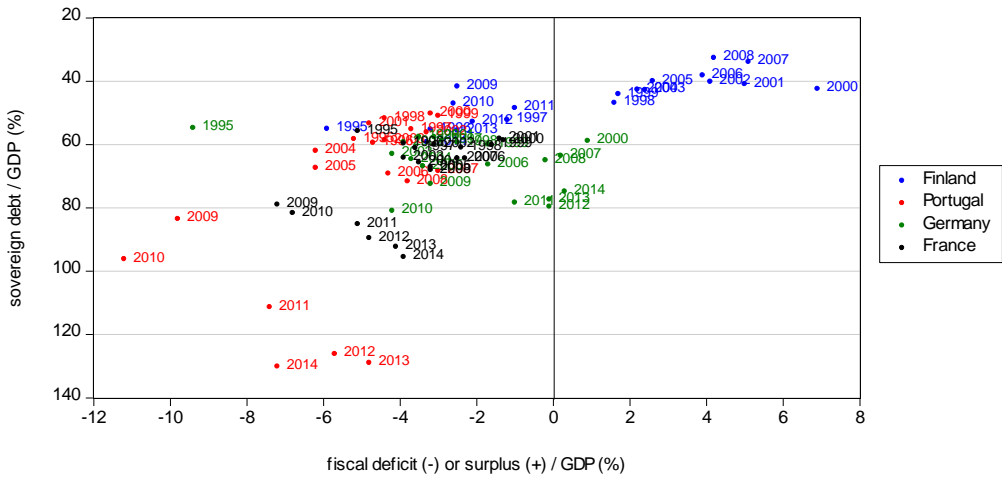
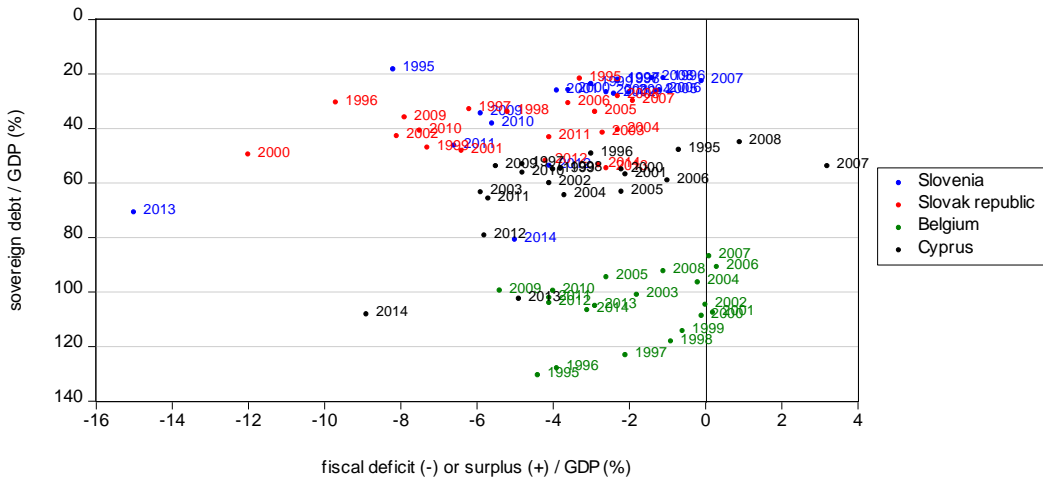
As a one the most crucial aspects representing key features of the overview in the general government financial stance we emphasize risks of increasing sovereign debt burden associate with persistent fiscal deficits that periphery countries of the Euro Area experienced during the most of the period of last two decades (Figure 7.3). Moreover, crisis period significantly reduced fiscal sustainability in the periphery countries of the Euro Area (similar trend was observed in Baltic countries) that made calls for fiscal consolidation urgent.

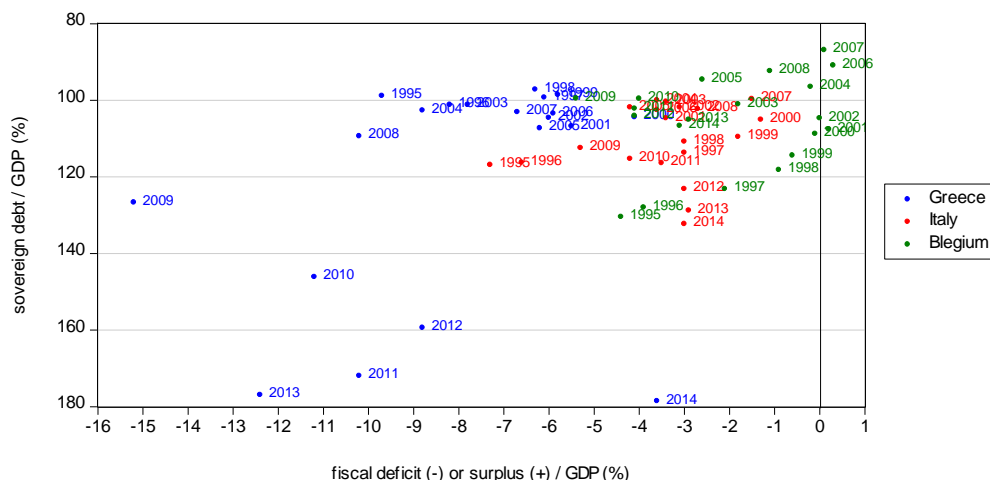
However, more comprehensive analysis of the budgetary stance is needed to identify the overall potential as well as effectiveness of a fiscal consolidation to successfully reduce a sovereign debt burden provided that debt constraints strengthened during the crisis period.

Fiscal implications of the economic crisis vary across Euro Area member countries considering existing differences in the financial discipline of fiscal authorities (levels of fiscal budget balance and sovereign debt), overall macroeconomic performance and high level of heterogeneity of individual markets that in altogether affects the overall costs of fiscal consolidation (European Commission, 2012).

The problem of say about a permanent deficiency of general government budgets stresses many “old” (Austria, France, Greece, Germany, Great Britain, Italy, Portugal) as well as “new” (Croatia, Cyprus, Czech republic, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovak republic, Slovenia) European Union member countries (of course we consider the period before the economic crisis put a stress on revenue and expenditures sides of national fiscal budgets). Lack of fiscal discipline in many European Union member countries revealed a crucial need of a fiscal consolidation during the crisis period due to a sharp acceleration in sovereign debt burden.



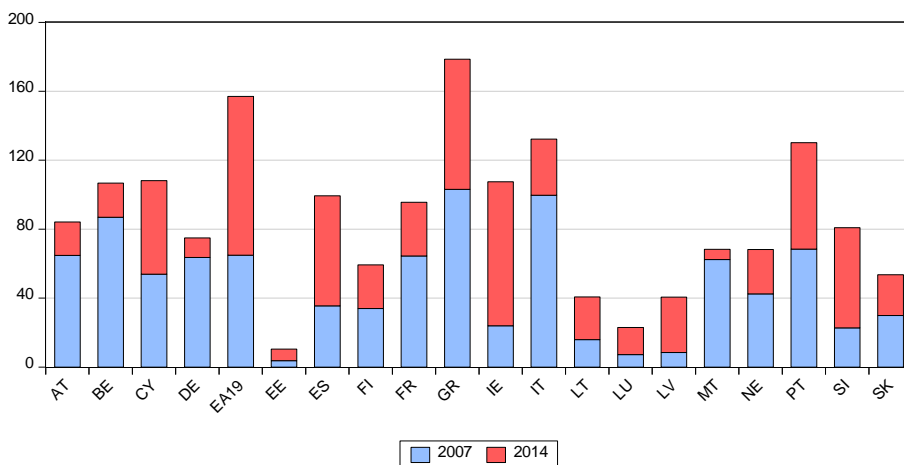




Note: All fiscal indicators are expressed as percentage shares on GDP.  
 Source: Compiled by author based on data taken from Eurostat - Government Finance Statistics (November 2015) and IMF - International Financial Statistics (November 2015).

**Figure 7.3 Fiscal Deficit and Sovereign Debt (1995-2014)**

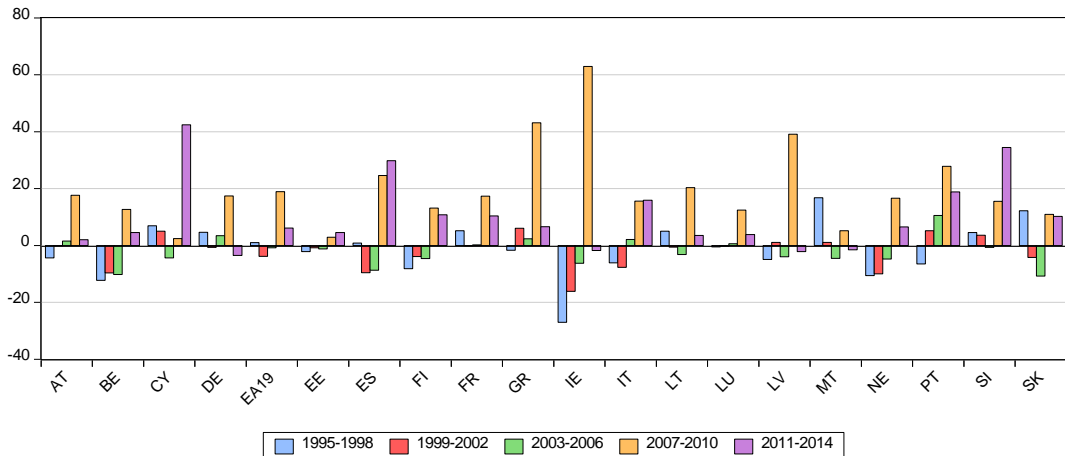
Figure 7.4 provides brief overview of the dynamic in the sovereign debt accumulation in individual Euro Area member countries comparing debt burden in 2007 and 2014. Results clearly demonstrate significant accumulation of sovereign debts in the periphery countries of the Euro Area and even stressed the risks of fiscal unsustainability especially in GIIPS countries.



Note: Changes in sovereign debt ratio between 2007 and 2014 (as a percentage to GDP).  
 Source: Compiled by author based on data taken from Eurostat - Government Finance Statistics (November 2015) and IMF - International Financial Statistics (November 2015).

**Figure 7.4 Changes in Sovereign Debt Ratio (as a percentage to GDP)  
 (changes between 2007 and 2014)**

Figure 7.5 provides overview of changes in the accumulation of sovereign debts in the Euro Area member countries during the years 1995-2014 divided into short-term sub-periods. While the negative trend of the significant increase in the sovereign debt experienced mostly countries from the periphery of the Euro Area during the crisis period, significant debt accumulation was also examined during the initial stage after the establishment of the Euro Area.



*Note:* Changes in sovereign debt ratio (as a percentage to GDP) during a particular sub-period. Positive change represents an increase and negative change a decrease in sovereign debt burden.

*Source:* Compiled by author based on data taken from Eurostat - Government Finance Statistics (November 2015) and IMF - International Financial Statistics (November 2015).

**Figure 7.5 Changes in Sovereign Debt Ratio (as a percentage to GDP) (1995-2014)**

However, our results indicate that all Euro Area member countries experienced a considerable increase in public debt burden during the crisis period. As a result, improvements in the fiscal stance, fiscal sustainability and reduction the risk of default required flexible responses of governments to the negative pressures on the both expenditure and revenue sides of their budgets.

However, while sudden changes in the fiscal policy framework accompanied by large adjustments in the budgetary components generally help to improve fiscal discipline and reduces occurrence of excessive fiscal deficits, both theoretical and empirical literature provide lot of evidence about negative (contractionary) effects of fiscal consolidation or in fact, fiscal restriction. As a result, effects of fiscal policy shocks and proper composition of fiscal consolidation are still subject of rigorous academic and political discussions.

### 7.3. Overview of the Literature

Fiscal consolidation based on tax increases and expenditures cuts is well documented in empirical literature. Tsibouris, Horton, Flanagan and Maliszewski (2006) provided an overview of the experience of countries that have challenged large fiscal adjustments in the last three decades. By identifying periods of successful and unsuccessful fiscal consolidations authors provide operational guidance to policymakers related to various aspects of fiscal adjustments, including common policy approaches, institutional arrangements and causal implications of various fiscal decisions. Barrios, Langedijk and Pench (2010) from estimated econometric models revealed determinants of successful fiscal

consolidation while considering large scale of preconditions, including impacts of financial crisis, debt and deficit levels, real exchange rate adjustments, effects on economic growth as well as types of fiscal consolidation. Alesina and Perotti (1997) analyzed how the composition of fiscal adjustments (gradual versus sharp consolidation, expenditures versus tax revenues based consolidation) influences their likelihood of success in the view of long lasting deficit reduction, and their macroeconomic consequences. Overall success of fiscal consolidation is also evaluated concerning initial fiscal stance. Briotti (2002) analyzed the fiscal consolidation process in EU countries over the 1990s. From observed periods of fiscal adjustments authors highlight that revenue based adjustments have generally preceded expenditure based adjustments. Alesina and Ardagna (2009) examined the evidence of fiscal stimuli and fiscal adjustments episodes in OECD countries from 1970 to 2007. Authors discuss effects of adjustments on the spending and revenues sides concluding that tax cuts seem to have higher expansionary potential than spending increases while spending cuts associated with fiscal adjustments are more appropriate for stabilizing the sovereign debt than tax increases while having less deteriorating effect of the real output performance.

Implications and expected success of fiscal consolidation is largely dependent on effects of tax (revenue) and expenditure based adjustments in the government budget on the overall macroeconomic performance. Contribution of fiscal policy shocks to i.e. slowdown in real output growth rates may provide useful information about contrary effects of fiscal consolidation and thus a convenient prospect about more feasible composition of fiscal policy arrangements.

Effects of fiscal policy shocks are also well documented especially on a sample of developed countries. Blanchard and Perotti (Blanchard and Perotti, 1999) used mixed structural VAR/event study approach to identify the automatic responses of taxes and government spending to economic activity. They also argued that positive government spending shocks have a positive effect on output, and positive tax shocks have a negative effect, while the multipliers for both spending and tax shocks are typically small.

Perotti (Perotti, 2002) implemented SVAR approach in order to analyze the effect of fiscal policy on GDP, prices and interest rates in five OECD countries. The results we may conclude as follows: 1) The effects of fiscal policy on GDP and its components have become substantially weaker in the last 20 years; 2) The tax multipliers tend to be negative but small; 3) Once plausible values of the price elasticity of governments spending are imposed, the negative effects of government spending on prices that have been frequently estimated become positive, although usually small and not always significant; 4) Government spending shocks have significant effects on the real short-term interest rate, but uncertain signs; 5) Net tax shocks have very small effects on prices; 6) The U.S. is an outlier in many dimensions; U.S. responses to fiscal shocks are often not representative of the average OECD country included in this sample.

Giuliodori and Beetsma (Giuliodori and Beetsma, 2004) also implemented few identifications schemes using VAR methodology to analyze the (spill-over) effects of fiscal policy shocks in European economies. Their analysis is focused on the indirect channel of transmitting the fiscal policy shocks that affect an import of the country. They also emphasized a necessity of enhanced fiscal coordination at the macroeconomic level.

Romer and Romer (Romer and Romer, 2007) analyze the causes and consequences in the level of taxation in the postwar U.S. Their results indicate that tax changes have very large effects on output.



At the same time output effects are very persistent. Authors argue it is due to the strong response of investments to the tax burden decrease.

Caldara and Camps (Caldara and Camps, 2008) provide an empirical evidence on the response of key macroeconomic variables to government spending and tax revenue shocks for the U.S. over the period 1955-2006. Authors implemented four approaches (the recursive approach, the Blanchard-Perotti approach, the sign-restrictions approach and the event-study approach) to identify their system based on the VAR methodology. While there is the empirical evidence that the positive responses of private consumption and the real wage are very persistent, authors argued that the most current-generation DSGE models consistent with an increase in these variables predict that the responses turn negative already about one year after the government spending shock occurs. They also find strongly diverging results as regards the effects of tax shocks depending on the identification approach used, with the estimated effects of unanticipated tax increases ranging from non-distortionary to strongly distortionary.

## **7.4. Fiscal Consolidation**

### **7.4.1 Methodological Notes to Fiscal Consolidation**

Fiscal consolidation is usually addressed to the set of fiscal arrangements on the side of revenues and/or expenditures of the government budget in order to reduce a burden of sovereign debt via improved fiscal stance. As a result, crucial fiscal adjustments are employed relying primarily on expenditures cuts (especially in the area of government consumption and social security transfers) and much lower portion is based on tax increases (Alesina and Perotti, 1997). Another type of fiscal adjustments rely especially on the tax and social contributions increases. While the first type of fiscal adjustments is expansionary and usually has longer durability, second type of fiscal adjustments is restrictive, having contractionary effects on the economy and thus representing risks associated with future reductions in the tax capacity of the country.

There seems to be several approaches to measure fiscal consolidation and to evaluate a success of fiscal consolidation episode. For example, Alesina and Ardagna (2009) identify three types of fiscal adjustment episodes. For the purpose of our study we employ two of these measures slightly revised by Barrios, Langedijk and Pench (2010): (1) Fiscal consolidation is the year at which CAPB improves by at least 1.5 percent of GDP (so called *cold shower*) or (2) takes the place over three years provided CAPB will not deteriorate by more than 0.5 percent of GDP (so called *gradual consolidation*). Considering both definitions, cold showers (consolidations during one year) are recognized as full episodes of fiscal consolidation and each year of gradual consolidation are considered as episodes on their own. The last measure reflects the overall success of fiscal consolidation. Fiscal adjustments are evaluated according to their effects on sovereign debt and fiscal CAPB ratios to GDP and real output performance. (3) Fiscal consolidation is revealed as successful provided it helps to reduce sovereign debt to GDP ratio by 5 percent during three subsequent years after we have recognized an initiation of the fiscal episode. At the same time, successful fiscal consolidation is considered to be an effective only if it is able to bring down a debt ratio while not having deteriorating effect on real output.

### **7.4.2 Cyclically Adjusted Primary Balance**

To assess detailed overview of fiscal consolidation effects it is necessary to estimate an influence of fiscal adjustments based on tax and/or expenditures changes on fiscal balance. However, it seems to be necessary to reveal changes on revenues and expenditures sides of government balance associated with automatic effects induced by changes in macroeconomic environment and effects of discretionary fiscal policy actions. In first case, i.e. a cool-down of real output growth may be followed by a cut in government revenues (due to reduced tax capacity of an economy in the time of crisis) and an increase in government expenditures (i.e. due higher unemployment benefits). As a result, deterioration of a fiscal balance will occur. At the same time, similar effects on the fiscal balance will be followed by discretionary taxes cuts or expenditures increases. A fiscal stance of a government budget may thus reflect mixed effects of automatic changes in budgetary revenues and expenditures associated with business cycle fluctuations as well as discrete changes on both sides of government budgets associated with discrete fiscal policy actions.

To eliminate effects of a business cycle to the fiscal stance of a government budget it is necessary to eliminate influence of cyclical movements of fiscal variables. As a result of filtered business cycle impacts, together with some other adjustments (i.e. exclusion of interest payable on the side of government expenditures), cyclically adjusted primary balance (CAPB) will be calculated. Empirical literature provides many approaches to calculate CAPB. In general, main algorithm follows the same procedure: (1) estimation of the potential GDP, (2) determination and calculation of key revenues and expenditures categories responses to the fluctuations in cyclical GDP, (3) adjustments in budgetary revenues and expenditures according to the cyclical effects in both sides of government budget. As a result we obtain cyclically adjusted structural or primary balance. On the other hand we have found some differences in step (2) in current empirical literature reflecting relative diversity in approaches employed to estimate income elasticities of main budgetary variables (on both revenue and expenditure sides). At the same time, most studies calculated cyclical component in real output by estimating potential output (and output gap) using simple HP filter<sup>9</sup> or potential employment based on detrending NAIRU calculations.

Bouthevillain et al. (2001) calculated fiscal elasticities using econometric regressions or derivation from tax or expenditures laws and from detailed information on the distribution of income and revenue. Altâr, Necula and Bobeica (2010) estimated tax and revenues elasticities by applying methodology similar to that employed by OECD and by the European Commission. Authors decomposed main components of revenue and expenditure budgetary sides using linear system of equations. Girouard and André (2005) calculated income elasticities of four different types of taxes while on the expenditure side there is only single item - unemployment related transfers - that authors treated as cyclically sensitive.

Günaydin and Uğraş Ülkü (2002) employed vector-error correction (VEC) model to estimate income elasticities of budgetary components. Provided there is a long-run equilibrium (cointegration) between GDP and budgetary variables, expected elasticity coefficients are represented by normalized cointegrating coefficient derived from cointegrating equations.

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<sup>9</sup> Despite a wide criticism of Hodrick-Prescott (HP) filter for inducing a spurious cycle in the time series (i.e. it cannot reflect an impact of structural breaks) as well as for poor approximation near the endpoint (so called endpoint bias), it still represents one of most frequently used filter in the current empirical literature.

To cyclically adjust a government budget, that is to estimate the underlying fiscal position when cyclical and/or automatic components are removed we follow a VEC methodology implemented by Günaydın and Uğraş Ülkü (2002).

Cyclically Adjusted Primary Balance (CAPB) is calculated by subtracting the cyclical component ( $B^C$ ) from the primary government balance ( $PB$ ):

$$CAPB_t = PB_t - B_t^C = PB_t - \sum_{i=1}^n B_{t,i}^C \quad (7.1)$$

where ( $PB$ ) represents actual government budget balance ( $B$ ) less interests payable ( $E^I$ ):

$$PB_t = B_t - E^I \quad (7.2)$$

and ( $B_{t,i}^C$ ) represents a cyclical component of each of  $n$  revenue and expenditure budgetary categories included in the model given by the following equation:

$$B_{t,i}^C = B_{t,i} \cdot e_i \cdot Y_t^{gap} \quad (7.3)$$

where ( $e_i$ ) represent individual elasticities of each particular budget category (that responds automatically to real output fluctuations) included in the model and ( $Y^{gap}$ ) represents output gap expressed as a percentage of GDP.

### 4.3 Income Elasticities of Budgetary Categories

In our model we include three types of budget revenues (revenues from direct taxes, indirect taxes and social contributions) and one budget expenditure category (unemployment related transfers) that seem to respond to short-run (cyclical) movements in real output. As a result, we expect that selected fiscal variables automatically respond to the cyclical fluctuations in real output.

To estimate income elasticities of budgetary categories we expect that there is a long-run equilibrium relationship (cointegration) between each included fiscal variable and real output. Cointegration methodology introduced by Johansen (1988, 1991) and Johansen and Juselius (1990) will be employed to estimate the long-run equilibrium relationships between different types of budgetary variables and real output in the Euro Area member countries. Johansen method is applied to the unrestricted vector autoregression (VAR) model that can be written by the following moving average representation of  $n$  non-stationary variables containing  $p$  lagged values:

$$Y_t = \mu + A_1 Y_{t-1} + A_2 Y_{t-2} + \dots + A_p Y_{t-p} + \varepsilon_t \quad (7.4)$$

where  $Y_t$  is a  $n \times 1$  vector of the contemporaneous endogenous variables,  $\mu$  is a  $n \times 1$  vector of the constants,  $A_i$  are  $n \times n$  polynomial variance-covariance matrix,  $\varepsilon_t \sim N_n(0, \Sigma_\varepsilon)$  is a  $n \times 1$

normalized vector of exogenous shocks (innovations) to the model representing unexplained changes in the variables.

If at least two of the variables are cointegrated of the order one (I(1)) the VAR representation in the equation (7.4) can be rewritten by subtracting  $Y_{t-1}$  to the following vector error correction model (VECM):

$$\Delta Y_t = \mu + \Pi Y_{t-p} + \sum_{i=1}^{p-1} \Gamma_i \Delta Y_{t-i} + \varepsilon_t \tag{7.5}$$

where  $\Delta Y_t$  is a  $n \times 1$  vector of the first differences of stochastic variables  $Y_t$ ,  $\Pi = \sum_{i=1}^p A_i - I$ ,

$$\Gamma_i = - \sum_{j=i+1}^p A_j, I \text{ is } n \times n \text{ identity matrix.}$$

Presented VECM contains information on both short-term and long-term adjustments to changes in  $Y_t$  included in estimated  $\Gamma$  and  $\Pi$  respectively.  $\Gamma$  is a  $n \times n$  matrix that represents the short-term dynamic - adjustments to changes in  $Y_t$ .  $\Pi$  is a  $n \times n$  matrix consisting of the long-run coefficients - the cointegrating relationships (cointegrating vectors) and of the error correction term.  $\Pi$  can be decomposed as follows:

$$\Pi = \alpha \beta' \tag{7.6}$$

where  $\alpha$  represents  $n \times r$  a loading matrix containing coefficients that describe the contribution of the  $r$  long-term (cointegrating) relationships in the individual equations and denotes the speed of adjustment from disequilibrium, while  $\beta$  is a  $n \times r$  matrix of long-run coefficients and represents the  $r$  linearly independent cointegrating vectors (each column of  $\beta$  is the cointegrating vector). The number of cointegrating relations among variables of  $Y_t$  is the same as the rank ( $r$ ) for the matrix  $\Pi$ . If it has a full rank, the rank  $r = n$  and it means there are  $n$  cointegrating relationships and that all variables are I(0). If a vector  $Y_t$  is a vector of endogenous variables that are I(1), then all terms in equation (7.5) are I(0), and  $\Pi Y_{t-1}$  must be also stationary for  $\varepsilon_t \sim I(0)$  to be white noise. If the matrix  $\Pi$  has reduced rank,  $r < n$ , there are  $n - 1$  cointegrating vectors and even if all endogenous variables in the model are I(1), the level-based long-run component would be stationary. VECM requires that there exists at least one cointegrating relationship.

In order to find a presence of cointegrating (long-run) relationships, we use trace test and maximum eigenvalue test. Determination of rank and estimation of the coefficients are computed as maximum likelihood estimation. The corresponding likelihood-ratio test statistics are:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^n \ln(1 - \hat{\lambda}_i) \quad \lambda_{max}(r, r+1) = -T \ln(1 - \hat{\lambda}_{r+1}) \quad (7.7)$$

where  $r$  is the number of cointegrating vectors under the null hypothesis and  $\hat{\lambda}$  is the estimated value for the  $i$ th ordered eigenvalue from the  $\Pi$  matrix. Under the trace statistic, the null hypothesis that the number of cointegrating vectors is less than or equal to  $r$  is tested against the alternative that there are more than  $r$  vectors. Whereas under the maximum eigenvalue test the null hypothesis that there are  $r$  cointegrating vectors is tested against the alternative of  $r+1$  cointegrating vectors.

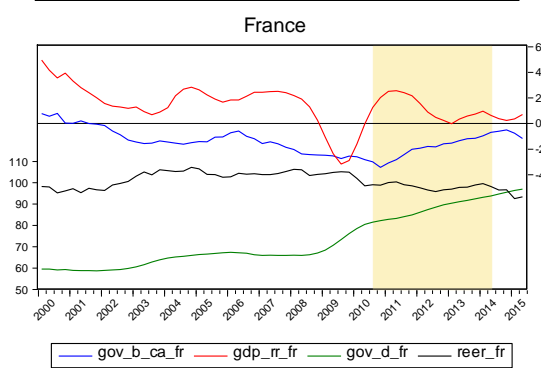
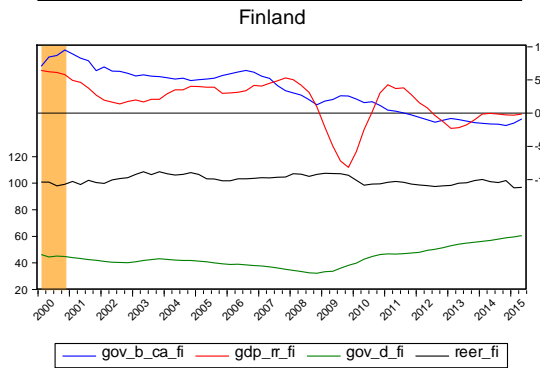
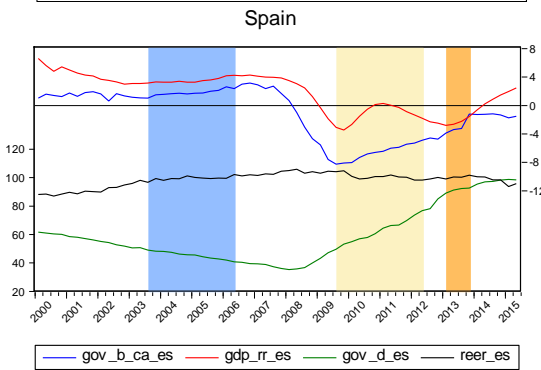
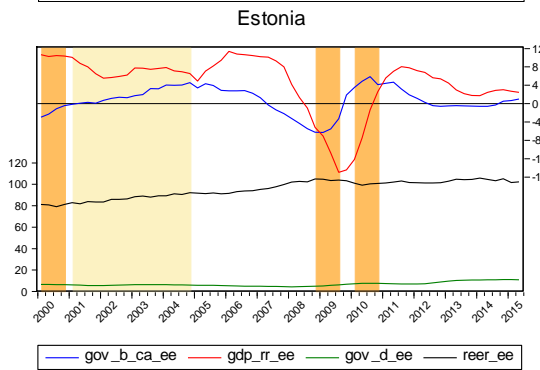
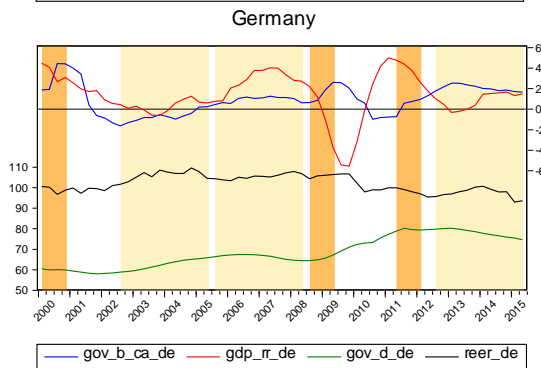
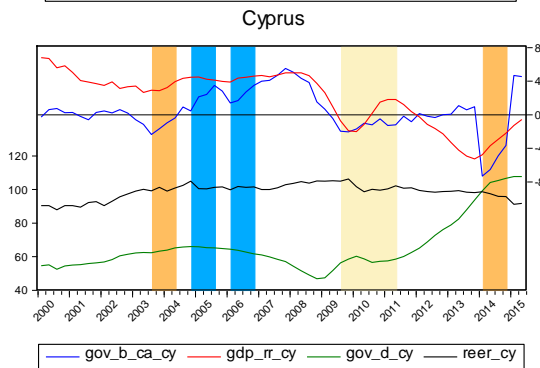
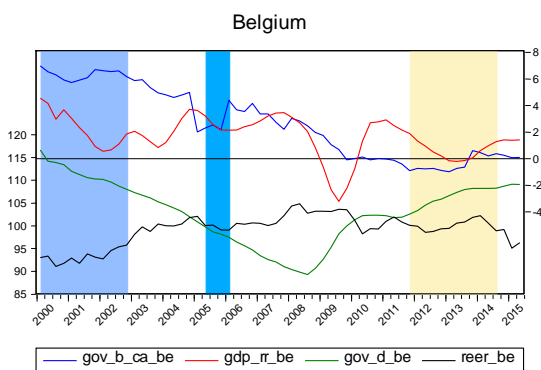
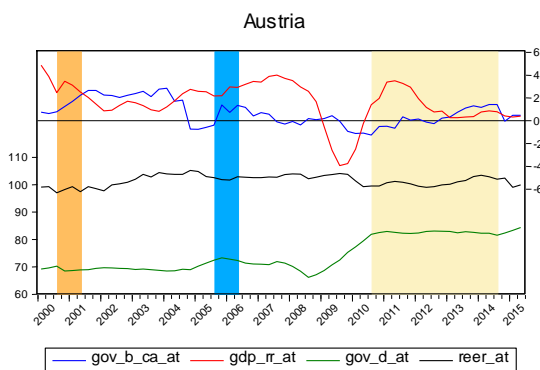
Provided that time series for direct tax revenues, indirect tax revenues, social contributions, unemployment related transfers and real output are  $I(1)$ <sup>10</sup> we estimate four different VEC models employing quarterly data for the period 2000Q1-2012Q3 (51 observations) for government expenditures, real output, inflation, tax revenues and long-term interest rates on 10-year government bonds drawn from Eurostat - Government Finance Statistics (October 2012) and IMF database (International Financial Statistics, March 2013). Time series for direct tax revenues, indirect tax revenues, social contributions, unemployment related transfers and real output were seasonally adjusted. Tests for the cointegration were computed using two lags as recommended by the AIC (Akaike Information Criterion).

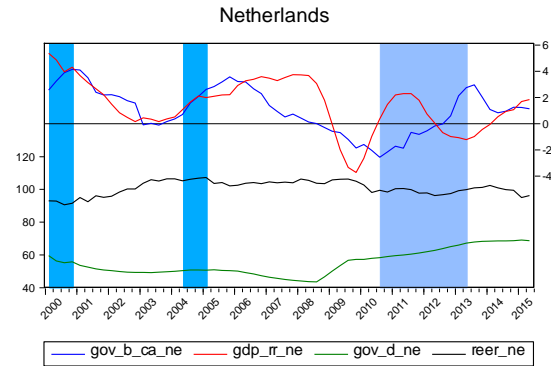
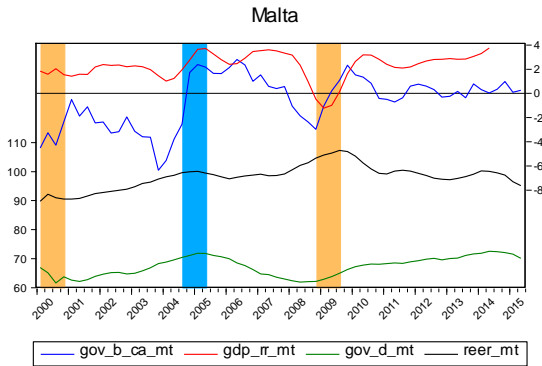
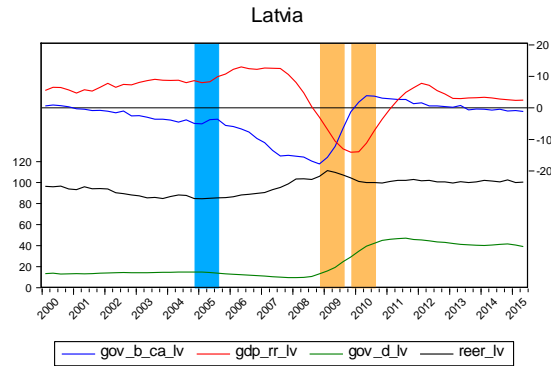
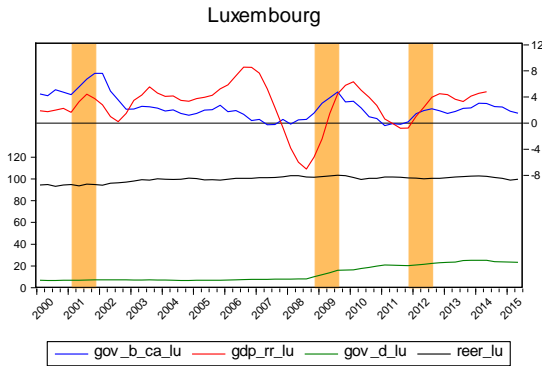
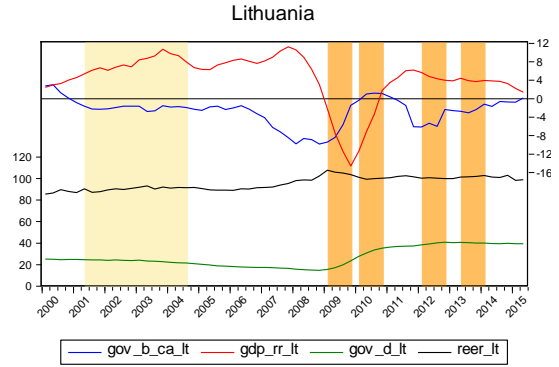
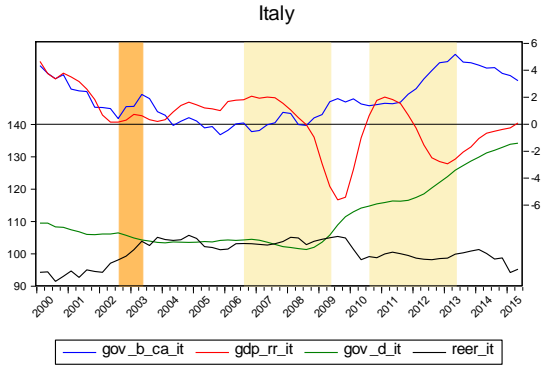
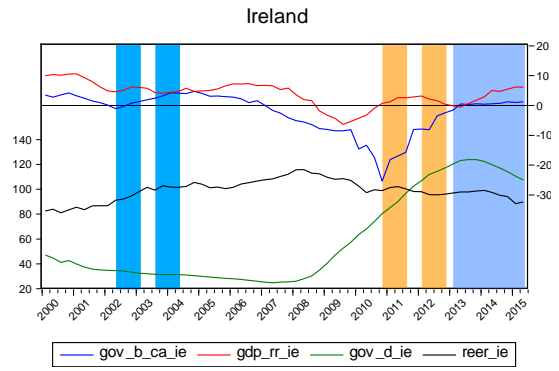
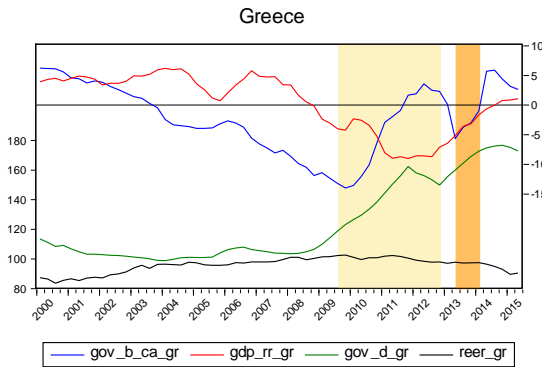
Results of both Johansen cointegration procedures (trace statistics and maximum eigenvalue statistics) confirmed our hypothesis about existence of one long-run equilibrium (cointegrating) relationship between each fiscal variable and real output. Normalized cointegrating coefficients derived from each cointegrating equation represent elasticity coefficients of each fiscal category with respect to real output.

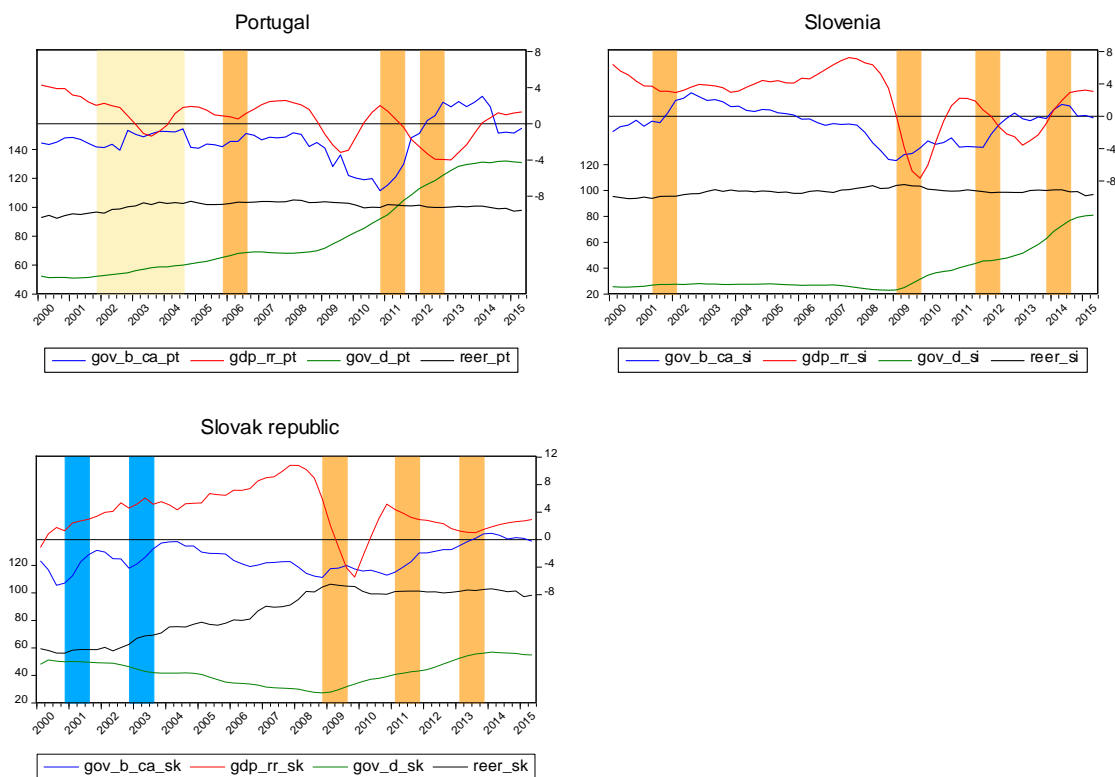
#### 7.4.4 Episodes of Fiscal Consolidation

The figure 6 reveals identified episodes of fiscal consolidation in the Euro Area member countries as well as the degree of their success since 2000. Individual countries have experienced several episodes of fiscal consolidation that in total represents 66 episodes of both types - one year consolidation (48) and gradual consolidation (18). However, we have assessed only 25 percent success in one year episodes of fiscal consolidations (12 *cold showers* succeeded). We have investigated only four successful gradual consolidations (22 percent degree of success). Our results are contrary to conclusions assessed by i.e. Barrios, Langedijk and Pench (2010) who performed investigation about a degree of fiscal consolidation success on the sample of EU15 countries since 1970. It seems that governments in our sample of countries significantly seek an effort to undertake gradual multi-year fiscal consolidations and thus strengthen financial discipline during a significant period of their political cycle. At the same time, none of six gradual consolidations (only one of them was successful) undertaken during the pre-crisis period was associated with deteriorating effects on the overall macroeconomic performance, revealing wasted chance of potentially effective fiscal consolidation.

<sup>10</sup> Detail results of unit root test are not reported here to save space. Like any other results, they are available upon request from the author.







Note: Variables - cyclically adjusted primary balance - CAPB (GOV\_B\_CA) and annual rate (on quarterly basis) of the real GDP growth (GDP\_RR) are expressed in percentage (right axis in figures). Sovereign debt (GOV\_D) is expressed as percentage share on GDP (left axis in figures). Real effective exchange rate (REER) is expressed as index (left axis in figures) (2005 = 100)

unsuccessful one-year consolidation
  unsuccessful gradual consolidation  
 successful one-year consolidation
  successful gradual consolidation

Source: Author's calculation.

**Figure 7.6 Fiscal Consolidation Episodes (2000Q1-2015Q2)**

**Austria** experienced three fiscal consolidations. *First*, one-year unsuccessful consolidation (2000Q3-2001Q2) seems to be expenditure based, as it was associated with moderate decrease in budgetary expenditures at faster rates than associated increase in revenues<sup>11</sup> (especially from direct taxes)). Despite examined positive trend in both budgetary expenditures and revenues, CAPB did not improved strong enough to induce a significant reduction in sovereign debt. At the same time, it doesn't seem to be effective because at the end of the episode it reduced initial increase in the rate of a real GDP growth. During this period REER appreciated and thus reduced consolidation effort. *Second*, one-year successful consolidation (2005Q3-2006Q2) seems to be expenditure based as it was associated with significant reduction in budgetary expenditure (due to decrease in other expenditures). It seems to be effective because the rate of a real GDP growth during this period moderately increased. The rate of REER appreciation was just a negligible that is why it did not reduce consolidation effort. *Third*, gradual unsuccessful consolidation (2010Q3-2014Q3) seems to be both expenditure

<sup>11</sup> Development of budgetary components in this section is evaluated according to their share in GDP.



(compensation of employees) and revenues based (especially due to increase in direct taxes). It seems to be ineffective because the rate of a real GDP growth during this period significantly decreased. Despite initial decrease in REER, since the second half of the period REER started to follow appreciation trend and thus it did not contribute to the consolidation effort.

**Belgium** experienced three fiscal consolidations. *First*, gradual **successful** consolidation (2000Q1-2002Q4) seems to be expenditure based, as it was associated with moderate decrease in budgetary expenditures. However, it doesn't seem to be effective because during this period the rate of a real GDP growth decreased. During this period REER appreciated and thus reduced consolidation effort. *Second*, one-year **successful** consolidation (2005Q2-2006Q1) seems to be expenditure based since we have examined a moderate decrease in other expenditures. However, it seems to be ineffective because the rate of a real GDP growth during this period slightly decreased. During this period REER moderately depreciated and thus contributed to consolidation effort. *Third*, gradual **unsuccessful** consolidation (2011Q4-2014Q3) seems to be revenue based as revenues from both direct and indirect taxes increased. It seems to be ineffective because the rate of a real GDP growth during this period slightly increased (despite positive trend in the real output development during the last quarter of the episode). During this period REER followed appreciation trend and thus it did not contribute to the consolidation effort (despite a depreciation trend that was initiated at the end of the episode).

**Cyprus** experienced five fiscal consolidations. *First*, one-year **unsuccessful** consolidation (2003Q3-2004Q2) seems to be revenue based, as it was associated with significant increase in budgetary revenues (especially from indirect taxes). Despite examined positive trend in budgetary revenues and moderate improvement in CAPB sovereign debt slightly increased during this episode. However, it seems to be effective because during this episode the rate of a real GDP growth increased. During this period REER appreciated and thus reduced consolidation effort. *Second*, one-year **successful** consolidation (2004Q4-2005Q3) seems to be both revenue and expenditure based and main contribution refers to an increase in direct taxes (together with negligible increase in indirect taxes) and minor decrease in intermediate consumption. However, it seems to be ineffective because the rate of a real GDP growth during this period slightly decreased. During this episode REER moderately depreciated and thus contributed to consolidation effort. *Third*, one-year **successful** consolidation (2006Q1-2006Q4) seems to be also revenue based due to reasonable increase in direct taxes and less dynamic increase in indirect taxes together with a minor decrease in government expenditures. It also seems to be effective because the rate of a real GDP growth during this episode slightly increased. However, during this period REER appreciated and thus it did not contribute to the consolidation effort. *Forth*, gradual **unsuccessful** consolidation (2009Q3-2011Q2) seems to be revenue based though the key component, direct taxes, experienced just a moderate increase. It also seems to be ineffective because the rate of a real GDP growth during this period slightly decreased (despite increased dynamic of real output during few quarters in the middle of the episode). During this period REER moderately depreciated and thus contributed to consolidation effort. *Fifth*, one-year **unsuccessful** consolidation (2014Q1-2014Q4) seems to be both revenue and expenditure based and main contribution refers to a reduction in government expenditures (capital transfers). However, it seem to be effective because during this period the country experienced a decreasing trend in the real output deterioration. During this period REER moderately depreciated and thus contributed to consolidation effort.

**Germany** experienced six fiscal consolidations. *First*, one-year unsuccessful consolidation (2000Q1-2000Q4) seems to be expenditure based, as it was associated with sharp decrease in government expenditures (increase in direct taxes was associated with a reduction in indirect taxes that is why revenue side did not contribute to consolidation effort). It seems to be ineffective because during this period the rate of a real GDP growth decreased. During this period REER depreciated and thus contributed to consolidation effort. *Second*, gradual unsuccessful consolidation (2002Q3-2005Q2) seems to be expenditure based due to minor decrease in all key components of government expenditures. It also seems to be ineffective because the rate of a real GDP growth during this period slightly decreased. During this episode REER appreciated that is why it did not contribute to consolidation effort. *Third*, gradual unsuccessful consolidation (2005Q3-2008Q2) seems to be both expenditure and revenue based due to minor decrease in expenditures and more dynamic increase in revenues. Main contribution refers to an increase in indirect taxes and minor decrease in compensation of employees and social benefits. It also seems to be ineffective because the rate of a real GDP growth during this period decreased. During this period REER followed appreciation trend and thus it did not contribute to the consolidation effort. *Forth*, one-year unsuccessful consolidation (2008Q3-2009Q2) seems to be revenue based due to increase in indirect taxes. It also seems to be ineffective because the rate of a real GDP growth during this period significantly decreased. During this period REER followed appreciation trend and thus it did not contribute to the consolidation effort. *Fifth*, one-year unsuccessful consolidation (2011Q2-2012Q1) seems to be both expenditure and revenue based. Main contribution refers to more dynamic decrease in government expenditures (social benefits and capital transfers). However, it doesn't seem to be effective because during this episode the rate of a real GDP growth decreased. During this period REER depreciated and thus contributed to consolidation effort. *Sixth*, gradual unsuccessful consolidation (2012Q3-2015Q2) seems to be both expenditure and revenue based. Main contribution refers to moderate decrease in capital investments and increase in direct taxes. However, it seems to be effective because the rate of a real GDP growth during this period slightly increased. During this period REER followed depreciation trend that is why it contributed to consolidation effort.

**Estonia** experienced four fiscal consolidations. *First*, one-year unsuccessful consolidation (2000Q1-2000Q4) seems to be purely revenue based due to significant decrease in government expenditures (during this period CAPB improved despite reduction in government revenues). It seems to be effective because during this period the rate of a real GDP growth did not change at all. During this period REER did not experience any significant shift and thus it was in neutral stance. *Second*, gradual unsuccessful consolidation (2001Q1-2004Q4) seems to be both revenue and expenditure based and main contribution refers to small increase in direct taxes and decrease in intermediate consumption and capital investments. It seems to be ineffective because the rate of a real GDP growth during this period decreased. During this period REER appreciated and thus it did not contribute to consolidation effort. *Third*, one-year unsuccessful consolidation (2008Q4-2009Q3) seems to be purely revenue based (during this period CAPB improved despite significant increase in government expenditures, i.e. social benefits and compensation of employees) and main contribution refers to an increase in indirect taxes and social contributions. It seems to be ineffective because the rate of a real GDP growth during this period significantly dropped. During this episode REER slightly depreciated and thus contributed to consolidation effort. *Forth*, one-year unsuccessful consolidation (2010Q1-2010Q4)

seems to be expenditure based (during this period CAPB improved despite significant decrease in revenues, i.e. both direct and indirect taxes). Main contribution refers to an decrease in compensation of employees and social benefits. It seems to be effective because the rate of a real GDP growth during this period significantly increased. During this period REER did not experience any significant shift and thus it was in neutral stance.

**Spain** experienced three fiscal consolidations. *First*, gradual **successful** consolidation (2003Q3-2006Q2) seems to be both expenditure and revenue based as it was associated with moderate decrease in budgetary expenditures (compensation of employees) and increase in both direct and indirect taxes. Moreover, it seems to be effective because during this period the rate of a real GDP growth increased. During this episode REER appreciated that is why it reduced consolidation effort. *Second*, gradual **unsuccessful** consolidation (2009Q3-2012Q2) seems to be revenue due to increase mainly in direct taxes. It seems to be effective because the rate of a real GDP deterioration significantly reduced during this episode. During this period REER depreciated and thus contributed to consolidation effort. *Third*, one-year **unsuccessful** consolidation (2013Q1-2013Q4) seems to be both expenditure and revenue based as it was associated with decrease in budgetary expenditures (capital transfers) and moderate increase in indirect taxes. It seems to be effective because the rate of a real GDP deterioration significantly reduced during this episode. During this period REER followed appreciation trend and thus it did not contribute to the consolidation effort.

**Finland** experienced just one fiscal consolidation. *First*, one-year **unsuccessful** consolidation (2000Q1-2000Q4) seems to be both revenue and revenue based, as it was associated with increase in budgetary revenues (direct taxes) and reduction in government expenditures (compensation of employees and social contributions). However, it doesn't seem to be effective because during this period the rate of a real GDP growth decreased. During this period REER depreciated and thus it contributed to consolidation effort.

**France** experienced just one fiscal consolidation. *First*, gradual **unsuccessful** consolidation (2010Q3-2014Q2) seems to be revenue based, as it was associated with significant increase in budgetary revenues (both direct and indirect taxes). It seems to be effective because during this period the rate of a real GDP growth increased. During this period REER moderately depreciated and thus contributed to consolidation effort.

**Greece** experienced two fiscal consolidations. *First*, gradual **unsuccessful** consolidation (2009Q3-2012Q4) seems to be purely revenue based, as it was associated with significant increase in budgetary revenues (both direct and indirect taxes, capital transfers). During this period CAPB improved despite moderate increase in government expenditures. It also seems to be ineffective because during this episode the rate of a real GDP growth decreased. During this period REER depreciated and thus contributed to consolidation effort. *Second*, one-year **unsuccessful** consolidation (2013Q2-2014Q1) seems to be both revenue and expenditure based and main contribution refers to an increase in direct and indirect taxes and minor decrease in compensations of employees, social benefits and capital transfers. It also seems to be effective because the rate of a real GDP growth during this period slightly increased. Rate of REER appreciation nearly stagnated and thus not weakening consolidation effort.

**Ireland** experienced five fiscal consolidations. *First*, one-year **successful** consolidation (2002Q2-2003Q1) seems to be both expenditure and revenue based. Main contribution refers to more dynamic

increase in government revenues (indirect taxes) and moderate decrease in government expenditures (capital investments). It seems to be effective because during this period the rate of a real GDP growth increased. During this period REER appreciated and thus reduced consolidation effort. *Second*, one-year **successful** consolidation (2003Q3-2004Q2) seems to be both revenue and expenditure based and main contribution refers to an increase in direct and less dynamic increase in indirect taxes and minor decrease in government expenditures (intermediate consumption and capital investments). It also seems to be effective because the rate of a real GDP growth during this period slightly increased. During this episode REER slightly appreciated and thus reduced consolidation effort. *Third*, one-year **unsuccessful** consolidation (2010Q4-2011Q3) seems to be both revenue and expenditure based due to really sharp reduction in government expenditures (capital transfers and capital investments) and moderate increase in government revenues (direct taxes). It also seems to be effective because the rate of a real GDP growth during this episode slightly increased. During this period REER moderately appreciated and thus reduced consolidation effort. *Forth*, one-year **unsuccessful** consolidation (2012Q1-2012Q4) seems to be both expenditure and revenue based and main contribution refers to dynamic reduction in government expenditures (capital transfers, capital investments and intermediate consumption) and moderate increase in government revenues (direct and indirect taxes). It seems to be ineffective because the rate of a real GDP growth during this period decreased. During this episode REER depreciated and thus contributed to consolidation effort. *Fifth*, gradual **successful** consolidation (2013Q1-2015Q2) seems to be purely expenditure based, as it was associated with another wave of considerable decrease in government expenditures (compensation of employees and social benefits). It seems to be effective because during this episode the rate of a real GDP growth increased. During this period REER depreciated and thus contributed to consolidation effort.

**Italy** experienced three fiscal consolidations. *First*, one-year **unsuccessful** consolidation (2002Q3-2003Q2) seems to be both expenditure and revenue based, as it was associated with moderate decrease in government expenditures (intermediate consumptions and capital investments) and moderate increase in government revenues (capital taxes). It seems to be effective because during this period the rate of a real GDP growth moderately increased. During this period REER appreciated and thus reduced consolidation effort. *Second*, gradual **unsuccessful** consolidation (2006Q3-2009Q2) seems to be purely revenue based (during this period CAPB improved despite increase in government expenditures) and main contribution refers to increase direct taxes and social contributions. It seems to be ineffective because the rate of a real GDP growth during this episode considerably decreased. During this period REER moderately appreciated and thus reduced consolidation effort. *Third*, gradual **unsuccessful** consolidation (2010Q3-2013Q2) seems to be also revenue based (during this period CAPB improved despite increase in government expenditures) and main contribution refers to increase direct and indirect taxes. It seems to be ineffective because the rate of a real GDP growth during this period decreased. During this period REER moderately appreciated and thus reduced consolidation effort.

**Lithuania** experienced five fiscal consolidations. *First*, gradual **unsuccessful** consolidation (2001Q2-2004Q3) seems to be expenditure based (during this period CAPB improved despite decrease in government revenues), as it was associated with decrease in social benefits capital transfers. It seems to be effective because during this period the rate of a real GDP growth increased. During this episode REER moderately appreciated and thus slightly reduced consolidation effort. *Second*, one-year

unsuccessful consolidation (2009Q1-2009Q4) seems to be revenue based and main contribution refers to an increase in indirect taxes. It seems to be effective because the rate of a real GDP growth during this period increased. During this period REER depreciated and thus contributed to consolidation effort. *Third*, one-year unsuccessful consolidation (2010Q1-2010Q4) seems to be expenditure based (during this period CAPB improved despite moderate decrease in government revenues) and main contribution refers to an increase in compensation of employees and social benefits. It seems to be ineffective because the rate of a real GDP growth during this period decreased. During this period REER depreciation trend and thus contributed to the consolidation effort. *Forth*, one-year unsuccessful consolidation (2012Q1-2012Q4) seems to be expenditure based (during this period CAPB improved despite moderate decrease in government revenues) and main contribution refers to decrease in compensation of employees, social benefits and capital investments. It seems to be ineffective because the rate of a real GDP growth during this period decreased. During this period REER did not experience any significant shift and thus it was in neutral stance. *Fifth*, one-year unsuccessful consolidation (2013Q2-2014Q1) seems to be both expenditure and revenue based, as it was associated with decrease in budgetary expenditures (compensation of employees and social benefits) and increase in government revenues (indirect taxes and capital transfers). It seems to be ineffective because during this episode the rate of a real GDP growth decreased. During this period REER appreciated and thus reduced consolidation effort.

**Luxembourg** experienced three fiscal consolidations. *First*, one-year unsuccessful consolidation (2001Q1-2001Q4) seems to be revenue based (during this period CAPB improved despite moderate increase in government expenditures) and main contribution refers to indirect taxes. It seems to be effective because during this period the rate of a real GDP growth decreased. During this period REER did not experience any significant shift and thus it was in neutral stance. *Second*, one-year unsuccessful consolidation (2008Q4-2009Q3) seems to be also revenue based (during this period CAPB improved despite considerable increase in government expenditures) due increase in direct taxes, indirect taxes and social contributions. It seems to be ineffective because the rate of a real GDP growth during this episode slightly decreased. During this period REER appreciated and thus reduced consolidation effort. *Third*, one-year unsuccessful consolidation (2011Q4-2012Q3) seems to be revenue based and main contribution refers to an increase in indirect taxes and social contributions. It also seems to be ineffective because the rate of a real GDP growth during this period considerably decreased. During this period REER slightly depreciated and thus contributed to consolidation effort.

**Latvia** experienced three fiscal consolidations. *First*, one-year successful consolidation (2004Q4-2005Q3) seems to be both expenditure and revenue based, as it was associated with decrease in government expenditures (intermediate consumption, compensation of employees and capital investments) and increase in government revenues (indirect taxes and capital transfers). It seems to be effective because during this period the rate of a real GDP growth increased. During this period REER did not experience any significant shift and thus it was in neutral stance. *Second*, one-year unsuccessful consolidation (2008Q4-2009Q3) seems to be revenue based (during this period CAPB improved despite moderate increase in government expenditures) and main contribution refers to an increase in social contributions and sales. It seems to be ineffective because the rate of a real GDP growth during this period considerable decreased. During this period REER appreciated and thus reduced consolidation effort. *Third*, one-year unsuccessful consolidation (2009Q4-2010Q3) seems to

be revenue based and main contribution refers to an increase in direct and indirect taxes. It seems to be effective because the rate of a real GDP growth during this period increased. During this period REER depreciated and thus contributed to consolidation effort.

**Malta** experienced three fiscal consolidations. *First*, one-year unsuccessful consolidation (2000Q1-2000Q4) seems to be expenditure based (during this period CAPB improved despite decrease in government revenues), as it was associated with decompensation of employees and social benefits. It seems to be effective because during this period the rate of a real GDP growth increased. During this period REER moderately appreciated and thus reduced consolidation effort. *Second*, one-year successful consolidation (2004Q3-2005Q2) seems to be both revenue and expenditure based and main contribution refers to an increase in indirect taxes and capital transfers and decrease in compensation of employees and capital transfers. It seems to be ineffective because the rate of a real GDP growth during this episode decreased. During this period REER did not experience any significant shift and thus it was in neutral stance. *Third*, one-year unsuccessful consolidation (2008Q4-2009Q3) seems to be expenditure based and main contribution refers to an decrease in intermediate consumption and capital investments. It seems to be ineffective because the rate of a real GDP growth during this period decreased. During this period REER followed appreciation trend and thus it did not contribute to the consolidation effort.

**Netherlands** experienced three fiscal consolidations. *First*, one-year successful consolidation (2000Q1-2000Q4) seems to be both expenditure and revenue based, as it was associated with decrease in budgetary expenditures (compensation of employees and social benefits) and just a moderate increase in budgetary revenues (social contributions). It seems to be ineffective because during this period the rate of a real GDP growth decreased. During this period REER depreciated and thus reduced consolidation effort. *Second*, one-year successful consolidation (2004Q2-2005Q1) seems to be both revenue and expenditure based and main contribution refers to an increase in direct taxes and social contributions and decrease in social benefits and capital investments. It also seems to be effective because the rate of a real GDP growth during this period increased. During this period REER appreciated and thus reduced consolidation effort. *Third*, gradual successful consolidation (2010Q3-2013Q2) seems to be both revenue and expenditure based and main contribution refers to increase in social contributions and decrease in intermediate consumption, compensation of employees and capital investments. It seems to be ineffective because the rate of a real GDP growth during this period decreased. During this episode REER did not experience any significant shift and thus it was in neutral stance.

**Portugal** experienced four fiscal consolidations. *First*, gradual unsuccessful consolidation (2001Q4-2004Q3) seems to be revenue based, as it was associated with increase in budgetary revenues (during this period CAPB improved despite increase in government expenditures) and the main contribution refers to increase in direct taxes and social contributions. It seems to be ineffective because during this period the rate of a real GDP growth slightly decreased. During this period REER appreciated and thus reduced consolidation effort. *Second*, one-year unsuccessful consolidation (2005Q4-2006Q3) seems to be both revenue and expenditure based and main contribution refers to an increase in indirect taxes and direct taxes and decrease in the intermediate consumption, compensation of employees and capital investments. It seems to be effective because the rate of a real GDP growth during this period slightly increased. During this period REER appreciated and thus

reduced consolidation effort. *Third*, one-year unsuccessful consolidation (2010Q4-2011Q3) seems to be both revenue and expenditure based and main contribution refers to an increase in indirect taxes and direct taxes and slight reduction in compensation of employees. It seems to be ineffective because the rate of a real GDP growth during this period decreased. During this period REER followed appreciation trend and thus reduced consolidation effort. *Forth*, one-year unsuccessful consolidation (2012Q1-2012Q4) seems to be expenditure based and main contribution refers to decrease in intermediate consumption, compensation of employees and capital investments. It seems to be ineffective because the rate of a real GDP growth during this period decreased. During this period REER slightly depreciated and thus contributed to consolidation effort.

**Slovenia** experienced four fiscal consolidations. *First*, one-year unsuccessful consolidation (2001Q2-2002Q1) seems to be both revenue and expenditure based, as it was associated with increase in budgetary revenues (indirect taxes) and decrease in budgetary expenditures (subsidies, other current expenditures and capital transfers). It to be ineffective because during this period the rate of a real GDP growth decreased. During this period REER appreciated and thus reduced consolidation effort. *Second*, one-year unsuccessful consolidation (2009Q1-2009Q4) seems to be revenue based and main contribution refers to an increase in social contributions. It seems to be ineffective because the rate of a real GDP growth during this period considerably decreased. During this period REER depreciated and thus contributed to consolidation effort. *Third*, one-year unsuccessful consolidation (2011Q3-2012Q1) seems to be both expenditures and revenue based and main contribution refers to decrease in social benefits and capital transfers and increase in social contributions and sales. It seems to be ineffective because the rate of a real GDP growth during this period decreased. During this period REER depreciated and thus contributed to consolidation effort. *Forth*, one-year unsuccessful consolidation (2013Q4-2014Q3) seems to be expenditure based (during this period CAPB improved despite decrease in government revenues) and main contribution refers to an decrease in intermediate consumption, compensation of employees, social benefits and capital transfers. It seems to be effective because the rate of a real GDP growth during this period increased. During this period REER followed depreciation trend and thus contributed to consolidation effort.

**Slovak republic** experienced five fiscal consolidations. *First*, one-year successful consolidation (2000Q4-2001Q3) seems to be expenditure based (during this period CAPB improved despite decrease in government revenues) and main contribution refers to decrease in capital transfers and other current expenditures. It seems to be effective because during this period the rate of a real GDP growth increased. During this period REER appreciated and thus reduced consolidation effort. *Second*, one-year successful consolidation (2002Q4-2003Q3) seems to be expenditure based as it was associated with decrease in intermediate consumption, compensation of employees, social benefits, capital transfers and capital investments. It seems to be effective because the rate of a real GDP growth during this period increased. During this period REER appreciated and thus reduced consolidation effort. *Third*, one-year unsuccessful consolidation (2008Q4-2009Q3) seems to be revenue based (during this period CAPB improved despite increase in government expenditures) and main contribution refers to increase in social contributions, sales and capital transfers. It seems to be ineffective because the rate of a real GDP growth during this period decreased. During this period REER followed appreciation trend and thus reduced consolidation effort. *Forth*, one-year unsuccessful consolidation (2011Q1-2011Q4) seems to be both expenditures and revenue based and main

contribution refers to decrease in compensation of employees and social benefits and increase in indirect taxes and direct taxes, sales and other current revenues. It seems to be ineffective because the rate of a real GDP growth during this period decreased. During this episode REER did not experience any significant shift and thus it was in neutral stance. *Fifth*, one-year unsuccessful consolidation (2013Q1-2013Q4) seems to be revenue based (during this period CAPB improved despite increase in government expenditures) and main contribution refers to increase in indirect taxes, direct taxes, social contributions and sales. It seems to be effective because the rate of a real GDP growth during this period increased. During this period REER appreciated and thus reduced consolidation effort.

## 7.5. Fiscal Policy Shocks

### 7.5.1 Econometric Model

VAR models represent dynamic systems of equations in which the current level of each variable depends on past movements of that variable and all other variables involved in the system. Residuals of vector  $\varepsilon_t$  represent unexplained movements in variables (effects of exogenous shocks hitting the model); however as complex functions of structural shocks effects they have no economic interpretation. Structural shocks can be still recovered using transformation of the true form representation into the reduced-form by imposing a number of identifying restrictions. Applied restrictions should reflect some general assumptions about the underlying structure of the economy and they are obviously derived from economic theory. There are two general (most used) approaches to identify VAR models. (I) Cholesky decomposition of innovations implies the contemporaneous interactions between exogenous shocks and the endogenous variables are characterized by a Wald causal chain. Ordering of endogenous variables then reflects expected particular economy structure following general economic theory assumptions. However, the lack of reasonable guidance for appropriate ordering led to the development of more sophisticated and flexible identification methods - (II) structural VAR (SVAR) models. Identifying restrictions implemented in SVAR models reflect theoretical assumptions about the economy structure more precisely. However, restrictions based on the theoretical assumptions employed in both identifying schemes should be empirically tested to avoid shocks identification bias and imprecisions associated with endogenous variables responses to the shocks.

Understanding effects of fiscal policy shocks (positive government expenditure shock, positive direct and indirect tax revenue shock) on real output would help us to examine an impact of an initiation of the fiscal consolidation episodes. As a result, we should be able to reveal an appropriateness of fiscal revenues and expenditures based adjustments in each particular economy. Comparison of results for pre-crisis and extended period seems to be convenient to identify effects of the crisis period on particular fiscal adjustments feasibility.

Approach we use in our analysis to estimate effects of fiscal policy shocks is based on the vector autoregressive (VAR) methodology. In order to recover the structural shocks that affect the endogenous variables of the model we implement two identification approaches. First approach is based on the recursive Cholesky decomposition of the variance-covariance matrix of the model residuals. The recursive identification approach also considers the causal ordering of the variables. Second approach is based on the identification scheme that imposes long-run restrictions on the



variance-covariance matrix of the model residuals. Nevertheless both approaches uses different scheme to recover structural shocks we expect they both provide comparable results of the effects of the fiscal policy shocks in the Euro Area member countries.

True model is represented by the following infinite vector moving average representation:

$$A_0 Y_t = A(L)Y_{t-1} + B\varepsilon_t \quad (7.7)$$

where  $Y_t$  is a  $n \times 1$  vector of the endogenous macroeconomic variables,  $A(L)$  is a polynomial variance-covariance matrix (represents impulse-response functions of the shocks to the elements of  $Y$ ) of lag-length  $l$ ,  $L$  is lag operator and  $(\varepsilon_t)$  is a  $k \times 1$  vector of identically normally distributed, serially uncorrelated and mutually orthogonal white noise disturbances (vector of true structural shocks in elements of  $Y$ ):

$$E(\varepsilon_t) = 0, \quad E(\varepsilon_t \varepsilon_t') = \Sigma_\varepsilon = I, \quad E(\varepsilon_t \varepsilon_s') = [0] \quad \forall t \neq s \quad (7.8)$$

The vector  $Y_t$  of the endogenous variables of the model consists of the following five elements: government expenditures ( $g_t$ ), real output ( $y_{r,t}$ ), tax revenues ( $t_t$ ), inflation ( $p_t$ ) and long-term interest rates ( $i_t$ ). In our five-variate model we assume five exogenous shocks that determine endogenous variables - government expenditures shock ( $\varepsilon_{g,t}$ ), demand shock ( $\varepsilon_{y_{r,t}}$ ), tax revenues shock ( $\varepsilon_{t,t}$ ), inflation shock ( $\varepsilon_{p,t}$ ) and monetary policy shock ( $\varepsilon_{i_{r,t}}$ ).

By multiplying equation (7.7) by an inverse matrix  $A_0^{-1}$  we obtain the reduced-form of the VAR model (this adjustment is necessary because the model represented by the equation (7.7) is not directly observable and structural shocks cannot be correctly identified):

$$Y_t = A_0^{-1}A(L)Y_{t-1} + A_0^{-1}B\varepsilon_t = C(L)Y_{t-1} + u_t \quad (7.9)$$

where  $C(L)$  is again a matrix representing the relationship among variables on the lagged values and  $u_t$  is a  $n \times 1$  vector of normally distributed shocks (shocks in reduced form) that are serially uncorrelated but can be contemporaneously correlated with each other:

$$E(u_t) = 0, \quad E(u_t u_t') = \Sigma_u = \begin{pmatrix} \sigma_1^2 & \sigma_{12} & \sigma_{13} \\ \sigma_{12} & \sigma_2^2 & \sigma_{23} \\ \sigma_{13} & \sigma_{23} & \sigma_3^2 \end{pmatrix}, \quad E(u_t u_s') = [0] \quad \forall t \neq s \quad (7.10)$$

Equation (7.9) reveals the relationship between reduced-form VAR disturbances  $u_t$  and structural disturbances  $(\varepsilon_t)$ , that is given by

$$u_t = A_0^{-1}B\varepsilon_t \text{ or } A_0u_t = B\varepsilon_t \quad (7.11)$$

As we have already mentioned we implement an identification scheme based on two approaches. The first, recursive approach, is based on the Cholesky decomposition of innovations that allows us to identify structural shocks hitting the model. Cholesky decomposition of variance-covariance matrix of VAR residuals defines the matrix  $A_0$  as a lower triangular matrix and matrix  $B$  as k-dimensional identity matrix.

The lower triangularity of  $A_0$  implies a recursive scheme among variables that has clear economic implications and has to be empirically tested as any other relationship. Identification scheme of the matrix  $A_0$  implies that some structural shocks have no contemporaneous effects on some endogenous variables given the ordering of the endogenous variables.

At the same time the off-diagonal elements of  $B$  are all zero, implying that we do not allow for the structural shocks to be mutually correlated. This assumption is consistent with empirical results - the correlation between government spending and tax revenue shocks is not statistically different from zero.

The equation (7.11) we can now rewrite to the following form:

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 \end{bmatrix} \begin{bmatrix} u_{g,t} \\ u_{y_r,t} \\ u_{p,t} \\ u_{i,t} \\ u_{i_n,t} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_{g,t} \\ \varepsilon_{y_r,t} \\ \varepsilon_{p,t} \\ \varepsilon_{i,t} \\ \varepsilon_{i_n,t} \end{bmatrix} \quad (7.12)$$

The ordering of variables reveals following relations among them:

- Government expenditures don't respond contemporaneously to the shock from any other endogenous variable of the model.
- Real output doesn't respond contemporaneously to inflation, tax revenue and interest rate shocks, while it is contemporaneously affected only by the government expenditure shock.
- Inflation doesn't respond contemporaneously to the tax revenue and interest rate shocks, while it is contemporaneously affected by the government expenditure and the real output shocks.
- Tax revenues don't respond contemporaneously to the interest rates shock, while it is contemporaneously affected by the government expenditure, the real output and tax revenue shocks.

- Interest rates are contemporaneously affected by the shocks from all of the endogenous variables of the model.

It is also necessary to emphasize that after the initial period the endogenous variables of the model can interact freely without any restrictions.

The second approach, structural VAR (SVAR) approach, is based on decomposing a series into its permanent and temporary components. It imposes long-run restrictions to the reduced-form VAR model. Identification scheme in the SVAR models reflects a long-run neutrality assumption so that we expect the cumulative effect of a certain shock on the certain endogenous variable development is zero. The equation (7.11) we can now rewrite to the following form:

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & a_{24} & 0 \\ a_{31} & 0 & 1 & a_{34} & 0 \\ 0 & a_{42} & a_{43} & 1 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 \end{bmatrix} \begin{bmatrix} u_{g,t} \\ u_{y_r,t} \\ u_{p,t} \\ u_{i,t} \\ u_{i_n,t} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_{g,t} \\ \varepsilon_{y_r,t} \\ \varepsilon_{p,t} \\ \varepsilon_{i,t} \\ \varepsilon_{i_n,t} \end{bmatrix} \quad (7.13)$$

In order to correctly identify the model we impose following long-run restrictions:

- Government expenditures do not have a permanent effect on tax revenues.
- Real output does not have a permanent effect on government expenditures and inflation.
- Inflation does not have a permanent effect on government expenditures and real output.
- Tax revenues do not have a permanent effect on government expenditures.
- Interest rates do not have a permanent effect on any other endogenous variable of the model.

Both systems are now just-identified and can be estimated using vector autoregression. From both identified true models we compute impulse-response functions to estimate the responses of the real output to the one standard deviation fiscal shocks. Effects of fiscal consolidating adjustments on the real output are calculated for two periods (pre-crisis with data 2000Q1-2007Q4 (model A) and extended with data 2000Q1-2015Q2 (model B)) to reveal crisis effects on fiscal consolidation efforts. Effects of shocks in each particular fiscal variable (positive (increase in) one standard deviation government expenditure shock ( $\varepsilon_{g,t}$ ), direct tax revenues shock ( $\varepsilon_{dt,t}$ ) and indirect tax revenues shock ( $\varepsilon_{it,t}$ )) on the macroeconomic performance were computed from separately estimated VAR models. As a result, three models were estimated with following endogenous variables:

- model A1, B1 ( $Y_t = [g_t, y_{r,t}, p_t, t_t, i_{n,t}]$ )
- model A2, B2 ( $Y_t = [g_t, y_{r,t}, p_t, dt_t, i_{n,t}]$ )
- model A3, B3 ( $Y_t = [g_t, y_{r,t}, p_t, it_t, i_{n,t}]$ )

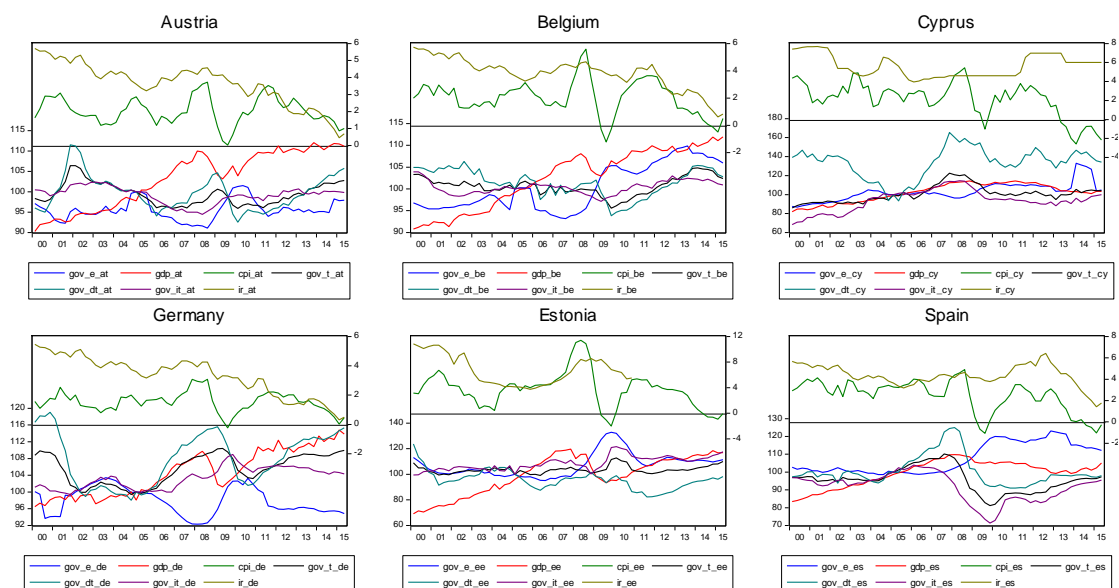
Impulse-response functions calculated from estimated VAR models with true shocks identified employing both identification schemes (based on Cholesky factorization and structural factorization)

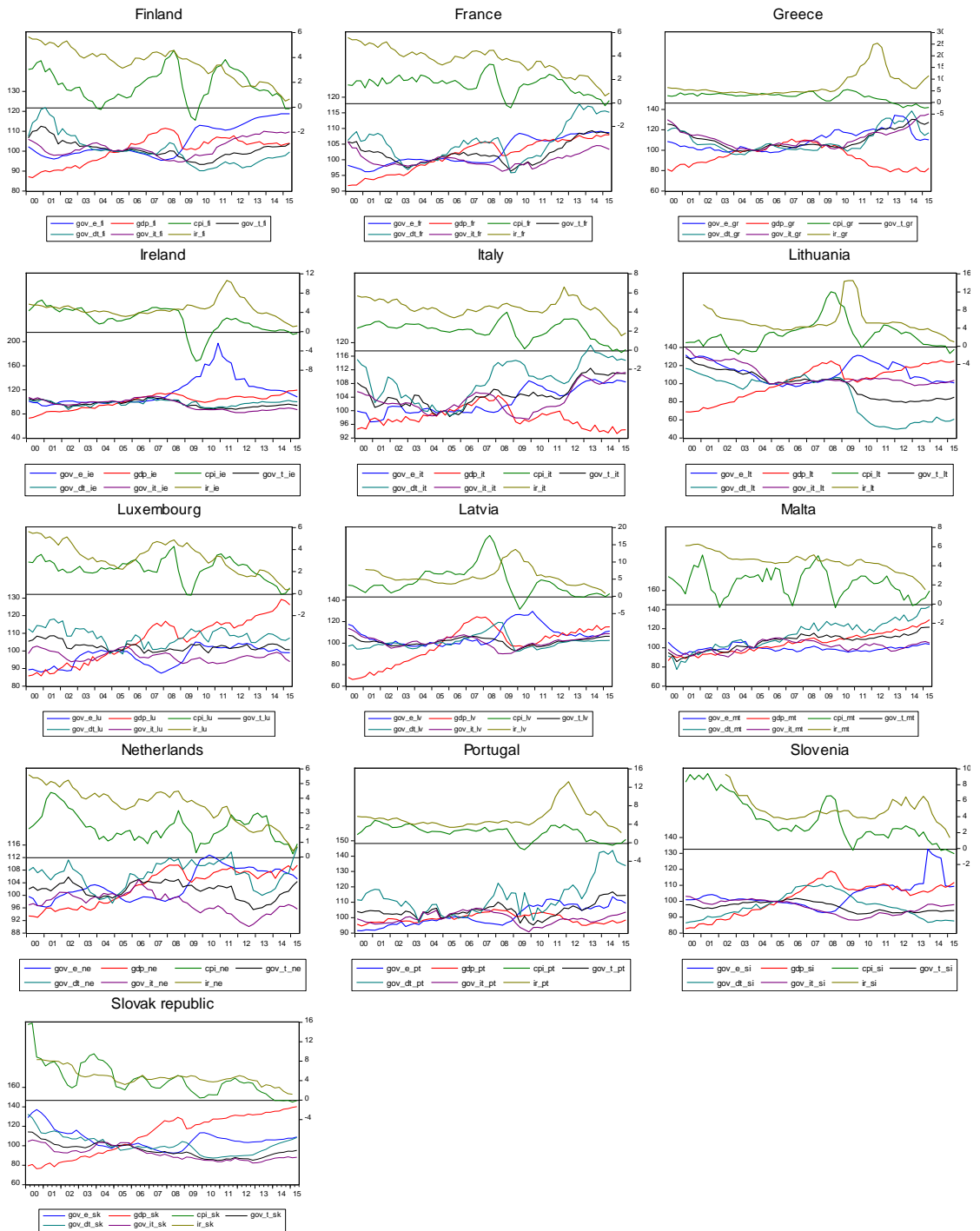
provided very similar results that is why we present results from structural VAR models (estimated results from models identified by recursive identification scheme are available upon request from the author). However, under Cholesky identification structure, the real government spending is not contemporaneously (within the same quarter) affected by changes in the real economic activity. That is the reason why government expenditure shock is considered as a discretionary fiscal adjustment. On the other hand, tax revenues are contemporaneously affected by the changes in the real economic activity and thus respond automatically to the real output adjustments.

As a result, structural VAR models seem to be more convenient for estimation of discrete fiscal shocks (both expenditure and revenue based) because recursive approach is sensitive to variables ordering and thus it has impact on shocks interpretation. However, Cholesky decomposition of innovations is more convenient to trace the distribution of the shock inside the country as it considers the underlying structure of the economy. In our model, tax revenues are positioned behind real output. As a result, associated changes in tax revenues could be interpreted as automatic response to changes in real output (due to cyclical adjustment) and operating more as automatic stabilizers while it rules out any impact response out real output to a revenue shock (Blanchard and Perotti, 2002).

## 7.5.2 Data and Results

In order to estimate our model represented by five endogenous variables for each Euro Area member country we employ quarterly data ranging from 2000Q1 to 2007Q4 (32 observations) for model A and quarterly data from 2000Q1 to 2015Q2 (62 observations) for model B for the government expenditures, real gross domestic product, inflation, tax revenues and long-term interest rates (figure 7). Time series for endogenous variables were drawn from Eurostat - Government Finance Statistics (November 2015) and IMF database - International Financial Statistics (November 2015).





Note: Endogenous variables - government expenditures (GOV\_E), real output (GDP), tax revenues (GOV\_T), direct tax revenues (GOV\_DT) and indirect tax revenues (GOV\_IT) are expressed as indexes (left axis in figures) (2005 = 100). Inflation (CPI) and interest rates (IR) are expressed in percentage (right axis in figures).

Source: Compiled by author based on data taken from Eurostat - Government Finance Statistics (November 2015) and IMF - International Financial Statistics (November 2015).

**Figure 7.7 Government Expenditures, Real output, Inflation, Tax Revenues and Interest Rates in the Euro Area member countries (2000Q1-2015Q2)**

Time series for the quarterly government expenditures, real output and tax revenues were seasonally adjusted. Time series for the nominal government expenditures and tax revenues were deflated using gross domestic product deflator. As an inflation indicator we used core inflation without food and energy. As a long-term interest rates indicator we used nominal interest rates on 10-year government bonds.

Before we estimate the model it is necessary to test the time series for stationarity and cointegration. The augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) tests were computed to test the endogenous variables for the existence of unit roots. Both ADF and PP tests indicate that most variables are non-stationary on the values so that the null hypothesis of a unit root cannot be rejected for any of the series. Testing variables on the first differences indicates the time series are stationary so that we conclude that variables are  $I(1)$ .

Because most of endogenous variables had a unit root on values it is necessary to test time series for cointegration using the Johansen and Juselius cointegration test (we found it reasonable to include variables  $I(0)$  for testing purposes following economic logic of expected results). The test for the cointegration was computed using two lags as recommended by the AIC (Akaike Information Criterion) and SIC (Schwarz Information Criterion). The results of the Johansen cointegration tests confirmed the results of the unit root tests. Both trace statistics and maximum eigenvalue statistics (both at 0.05 level) indicate that there is no cointegration among endogenous variables in most of estimated models (trace statistics reported a presence of single cointegrating equation in some models). However, increasing the lag length to three quarters resulted in the loss of long-run equilibrium among variables. The results of unit root and cointegration tests are not reported here to save space. Like any other results, they are available upon request from the author.

To test the stability of the VAR model we also applied a number of diagnostic tests. We found no evidence of serial correlation, heteroskedasticity and autoregressive conditional heteroskedasticity effect in the disturbances. The model also passes the Jarque-Bera normality test, so that errors seem to be normally distributed. The VAR models seem to be stable also because the inverted roots of the model for each country lie inside the unit.

Before we estimate VAR model we have to solve some model specification issues. In section 7.4.3 we have estimated four bivariate models consisting of one particular fiscal variable and real output considering that there exist long-run equilibrium relationships in each model. Existence of cointegrating relationship (assumption widely confirmed by many empirical studies) was required to calculate income elasticities of budgetary categories. Presence on one cointegrating equation in each model was confirmed by Johansen cointegrating test statistics. Thus, we have estimated VEC models.

However, testing five-variate models in section 7.5.2 for cointegration revealed ambiguous results. While trace statistics mostly confirmed the presence of single cointegrating equation, maximum eigenvalue statistics reported no cointegration in majority of countries (both at 0.05 level). Despite possible candidates for cointegration (fiscal variables and real output) we may find another potential couple of variables for cointegration - tax revenues and government expenditures, though according to Blanchard and Perotti (2002) the imposition of a cointegration between government expenditures

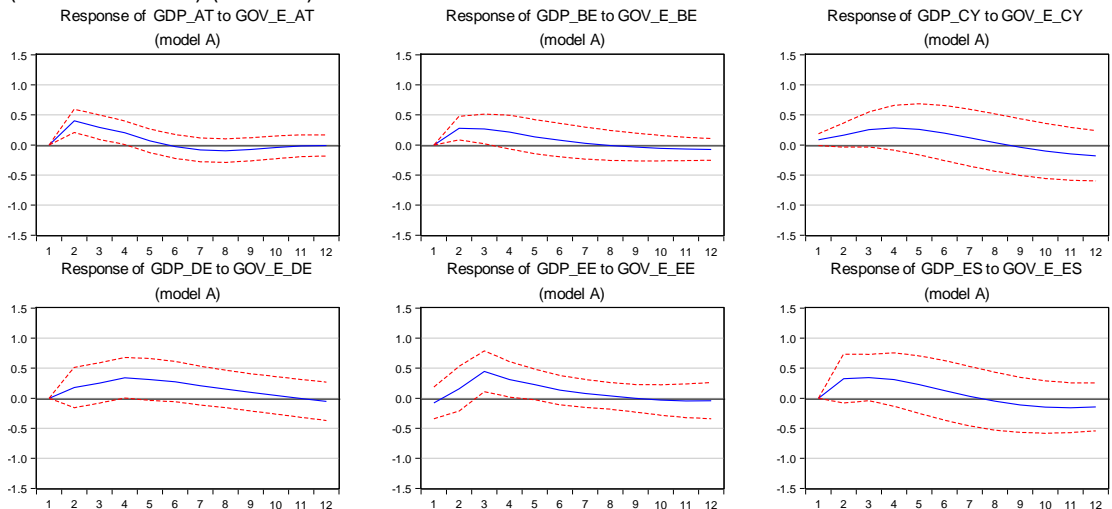
and tax revenues leads to very similar results in estimated effects of fiscal shocks (as a result such an expected cointegration may be confusing in estimating the cointegration rank). At the same time, Caldara and Camps (2008) suggest that in order to avoid imposing a wrong cointegration rank (in systems with just one ambiguous cointegration it seems to be quite disputable) it may be convenient to estimate unrestricted VAR models instead of VEC models.

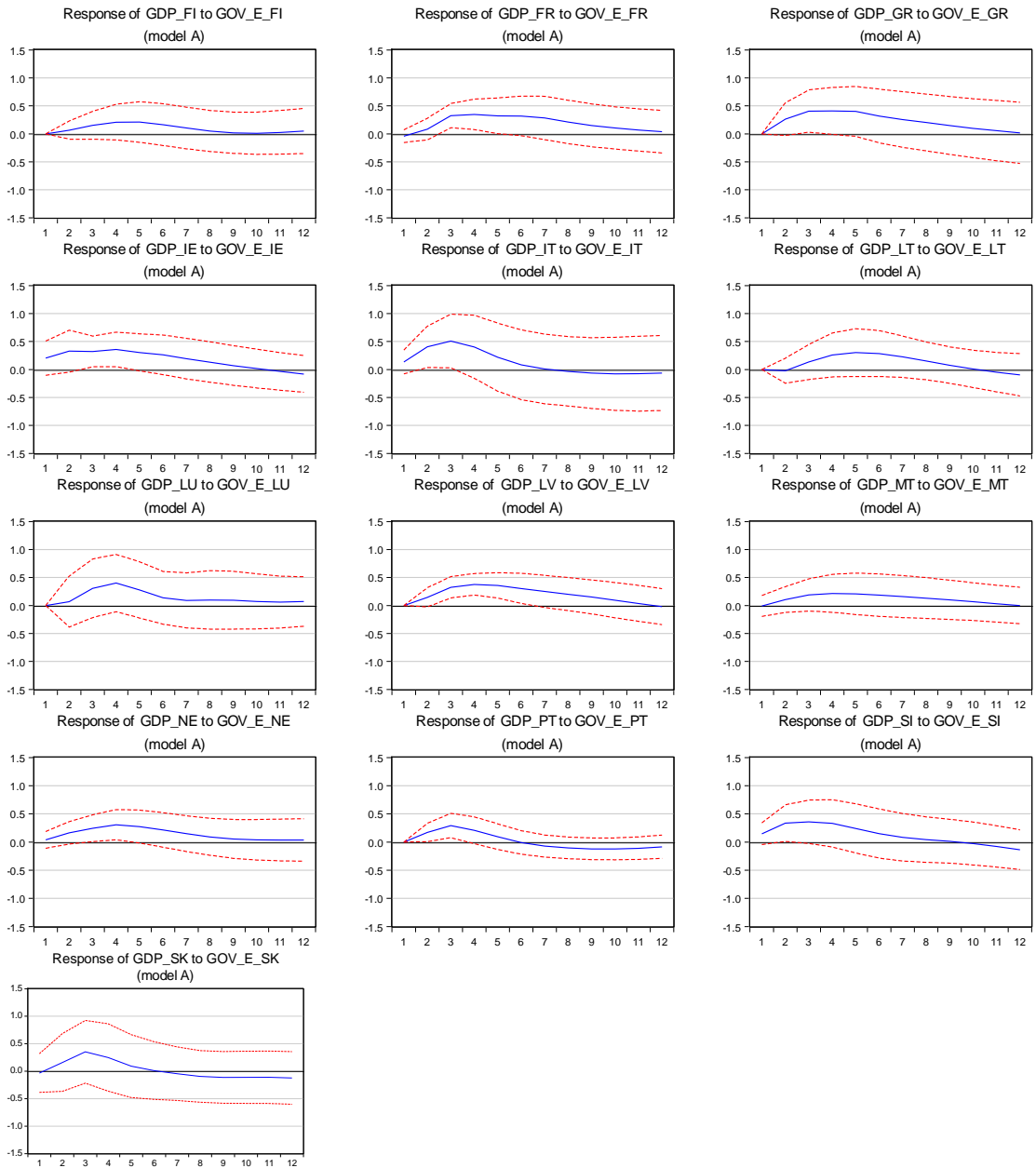
Following the results of the stationarity and cointegration tests we estimate three SVAR models for pre-crisis (2000-2007) and extended period (2000-2012) for each country from the Euro Area using the variables in the first differences to calculate impulse-response functions of government expenditures, direct taxes and indirect taxes (responses of the real output to a positive one standard deviation government expenditures shock and positive one standard deviation tax revenues shocks). Estimated responses of the real output fiscal shocks help us to evaluate macroeconomic effects of revenue and expenditure based fiscal adjustments and thus assess indirect costs of fiscal consolidation. At the same time, by estimating models for pre-crisis and extended period we evaluate crisis related costs of fiscal adjustments.

In figures 7.8-7.10 we summarize the responses of the real output to the positive (increase in) government expenditure shock and positive (increase) direct and indirect tax revenues during the pre-crisis period (model A1 with data 2000Q1-2007Q4) in the Euro Area member countries. In figures 11-13 we summarize the responses of the real output to the positive (increase in) government expenditure shock and positive (increase) direct and indirect tax revenues during the extended period (model B1 with data 2000Q1-2012Q3) in the Euro Area member countries.

In the figure 7.8 we summarize responses of the real output to the one standard deviation government expenditures for the model with time series for the pre-crisis period (model A1) in the Euro Area member countries.

(2000Q1-2007Q4) (Model A)





Source: Author's calculations.

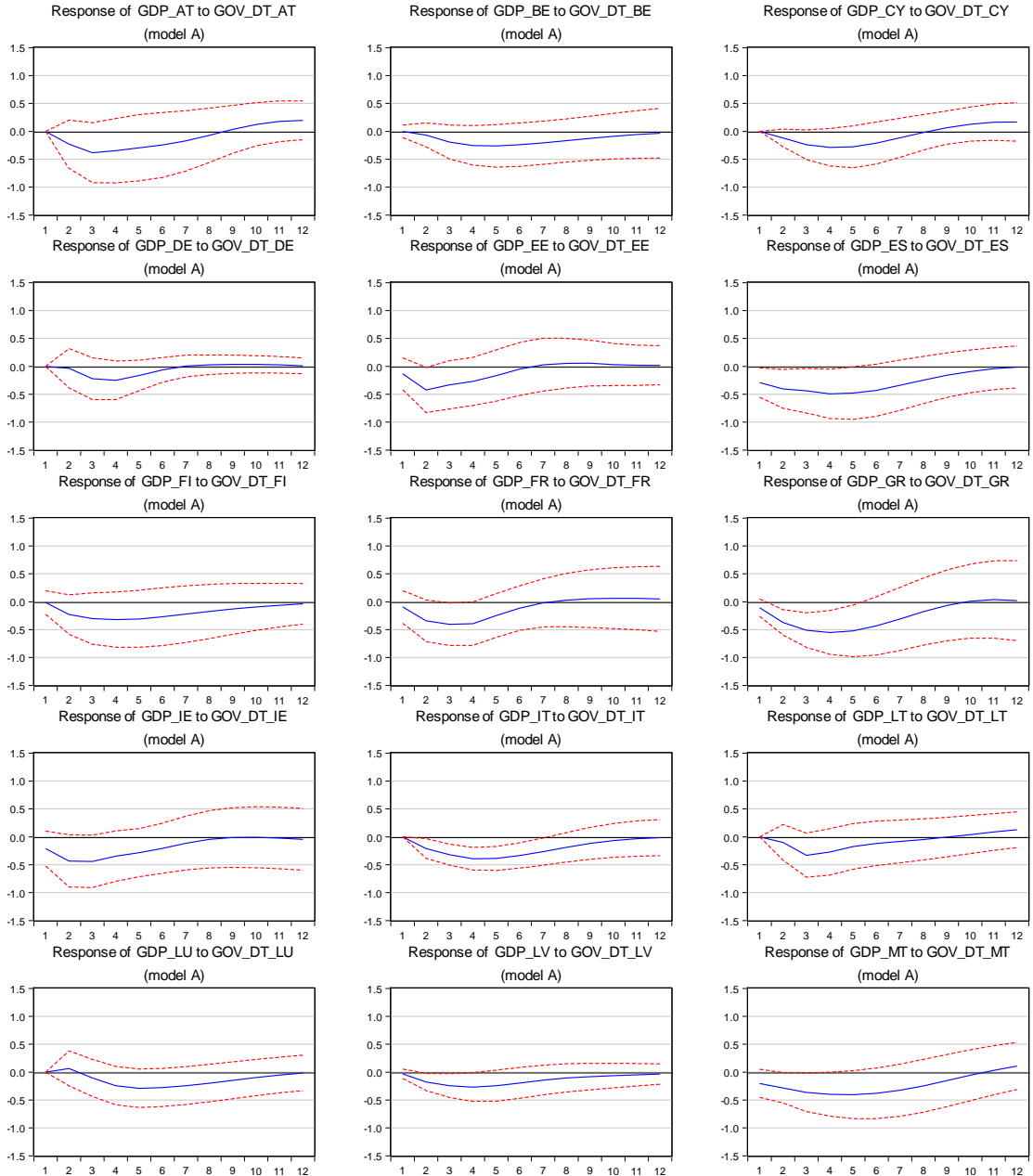
**Figure 7.8 Responses of Real Output to the Positive Government Expenditures Shock**

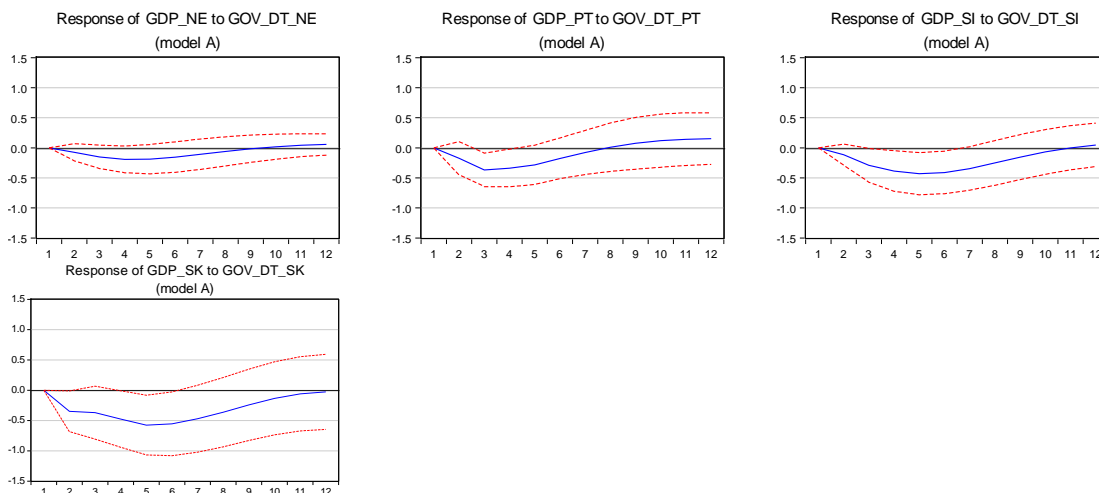
Positive shock (increase in) government expenditures shock was followed by the real output increase in all countries from the group. Despite some differences in the intensity of the shock it seems that the positive effect culminated within first two years after the shock and steadily died out during the third year since the shock. Government expenditures shock seems to be neutral in the long-run and did not affected leading path of the real output.



In the figure 7.9 we summarize responses of the real output to the positive one standard deviation shock of direct tax revenues for the model with time series for the pre-crisis period (model A1) in the Euro Area member countries.

(2000Q1-2007Q4) (Model A)



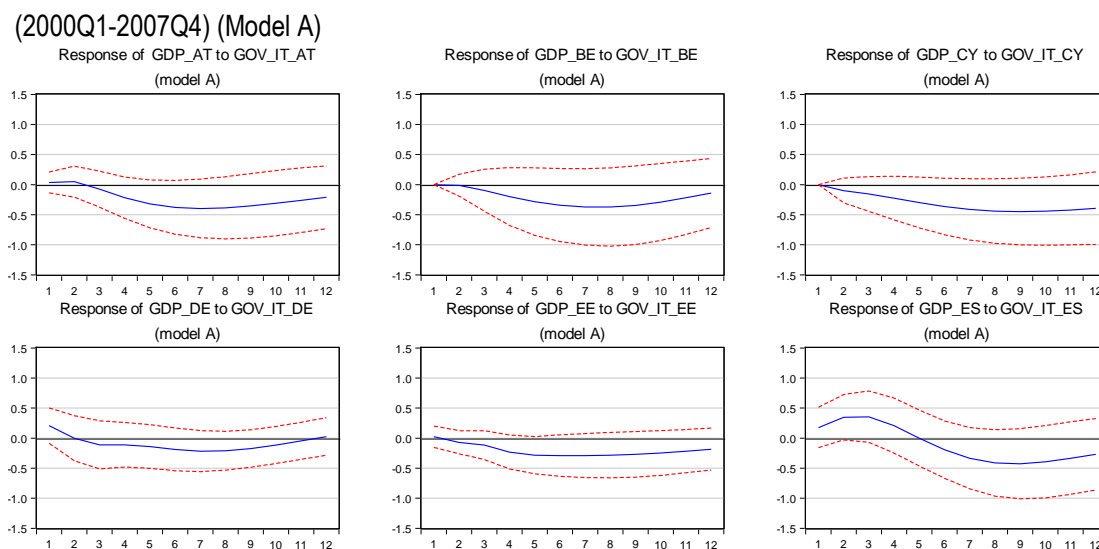


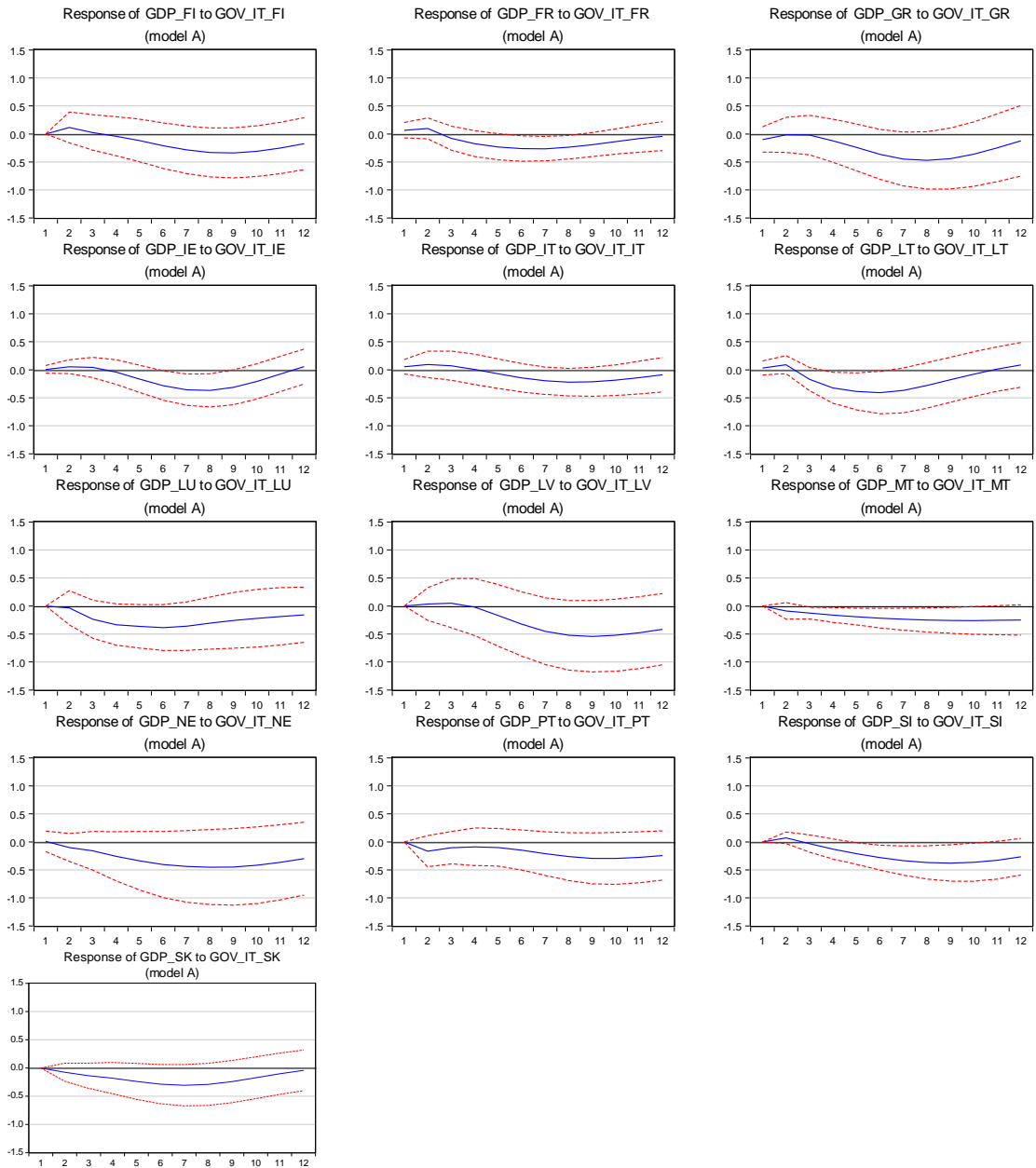
Source: Author's calculations.

**Figure 7.9 Responses of Real Output to the Positive Direct Tax Revenues Shock**

Positive (increase in) direct tax revenues shock had negative impact on the real output in all countries from the group. In comparison with government expenditures shock it seems that positive effect of the shock was slightly higher. As a result, the positive shock in direct tax revenues caused a real output decline during 2-3 years following initial impulse. Negative effect of the shock died out during the third year after the shock and as a result, the shock seems to be neutral in the long run. Despite quite similar features of the real output responses in all countries from the group we have revealed some differences in intensity as well as durability of the shock.

In the figure 7.10 we summarize responses of the real output to the positive one standard deviation shock of indirect tax revenues for the model with time series for the pre-crisis period (model A1) in the Euro Area member countries.





Source: Author's calculations.

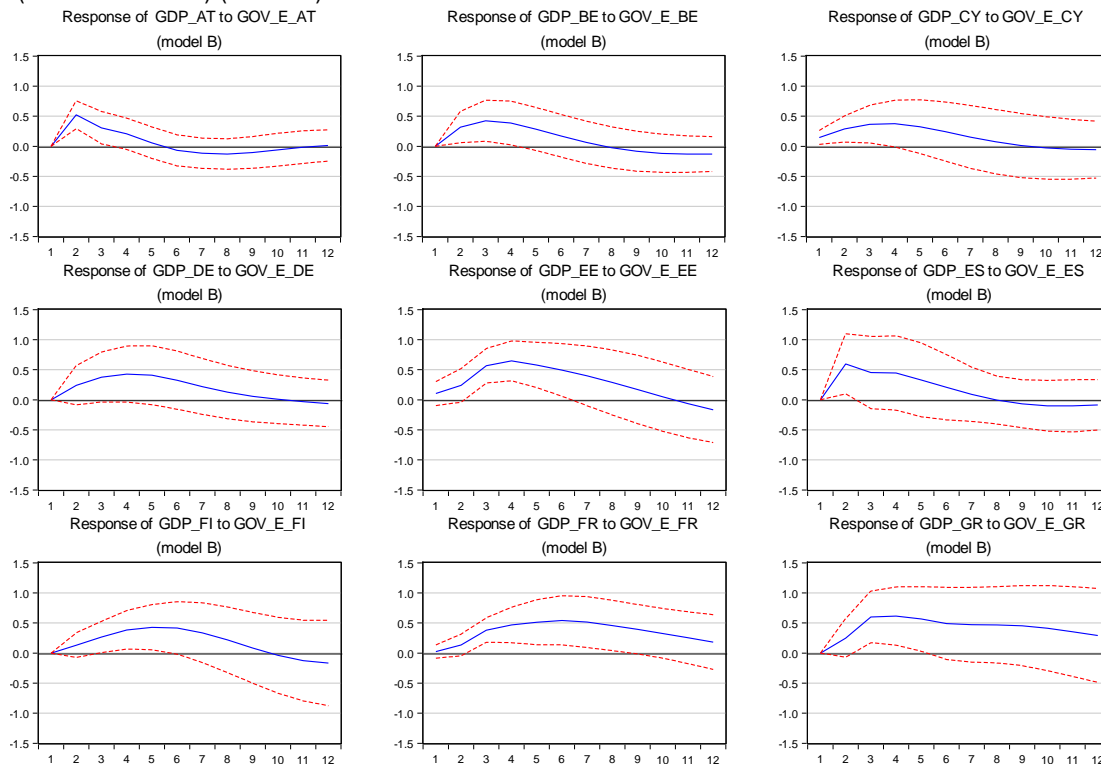
**Figure 7.10 Responses of Real Output to the Positive Indirect Tax Revenues Shock**

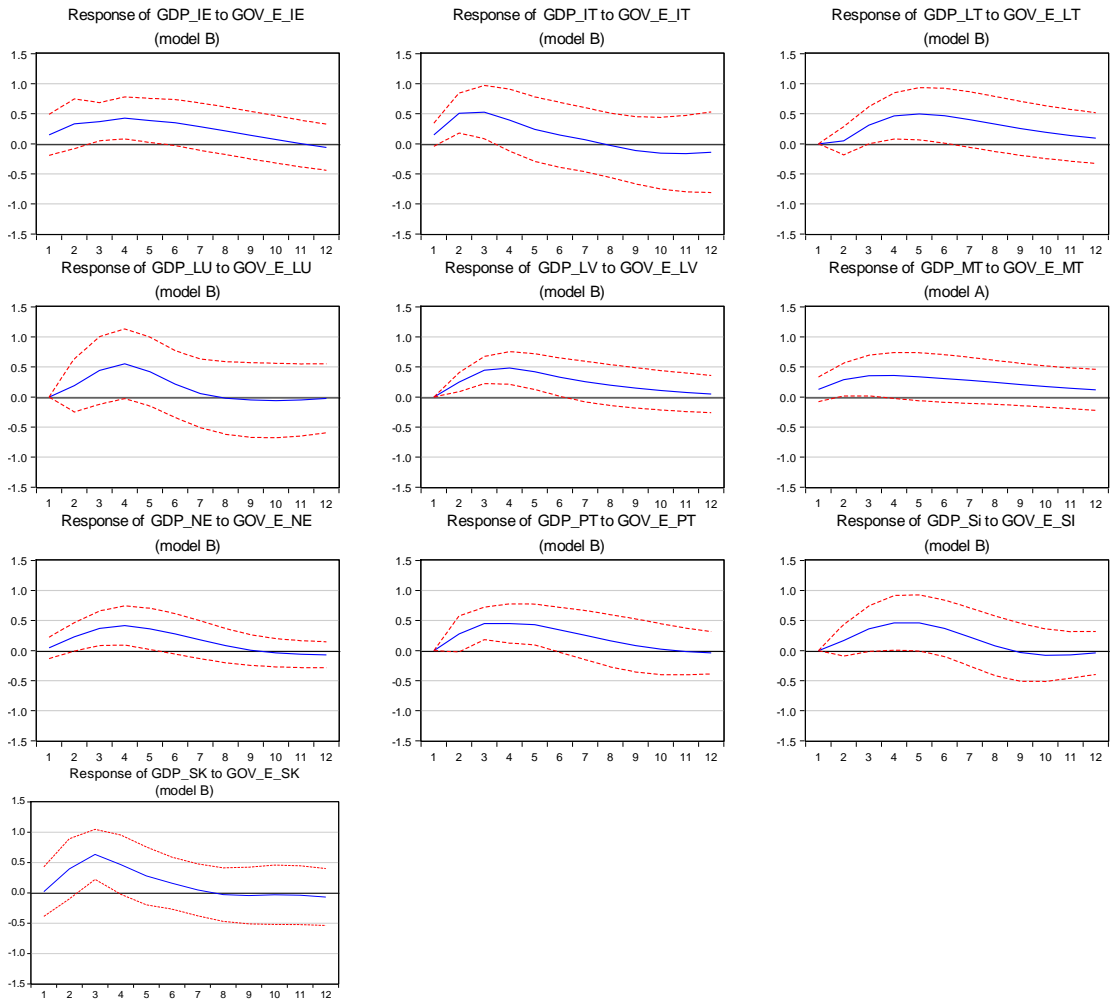
It seems to be clear that the positive (increase in) indirect tax revenues shock was followed by the real output decline. However, we have observed a slightly delayed negative response of real economic activities. Despite some differences identified across individual countries it seems that the negative effect of the shock culminated during the third year after the shock. At the same time, initial response of the real output is mostly weak and moderately increase over the time. Negative effect of the shock seems to be neutral in the long run as its impact of the real output died out during the third year after the shock.

Analysis of effects of fiscal policy shocks during the pre-crisis period revealed interesting implications about side (macroeconomic) effects of fiscal adjustments associated with tax and expenditure based fiscal consolidation in the Euro Area member countries. Increase in both government expenditures and tax revenues were followed by real output increase (decline). However, while effects of the expenditure based adjustments seem to be more significant within the first year since the shock, effects of both direct and indirect tax based adjustments generally dominates during second and third year since the shock. Moreover, effects of unexpected changes in taxes are generally followed by more responsive adjustments in real output. As a result, expenditure based approach seems to be more convenient (effective) for episodes of gradual fiscal consolidations provided that distortionary effects on the real output tend to be reduced during the second year followed by fiscal adjustment. At the same time, it has less distortionary effect on the real output. On the other hand, effects of adjustments in both direct and indirect tax revenues were largely distributed across several years (with slightly reduced deteriorating effect during the second year since the direct tax shock and third year since indirect tax shock in most countries) and thus revenue based fiscal adjustments seem to be more appropriate for episodes of one-year fiscal consolidations.

In the figure 7.11 we summarize responses of the real output to the positive one standard deviation government expenditures for the model with time series for the extended period (model B1) in the Euro Area member countries.

(2000Q1-2015Q2) (Model B)





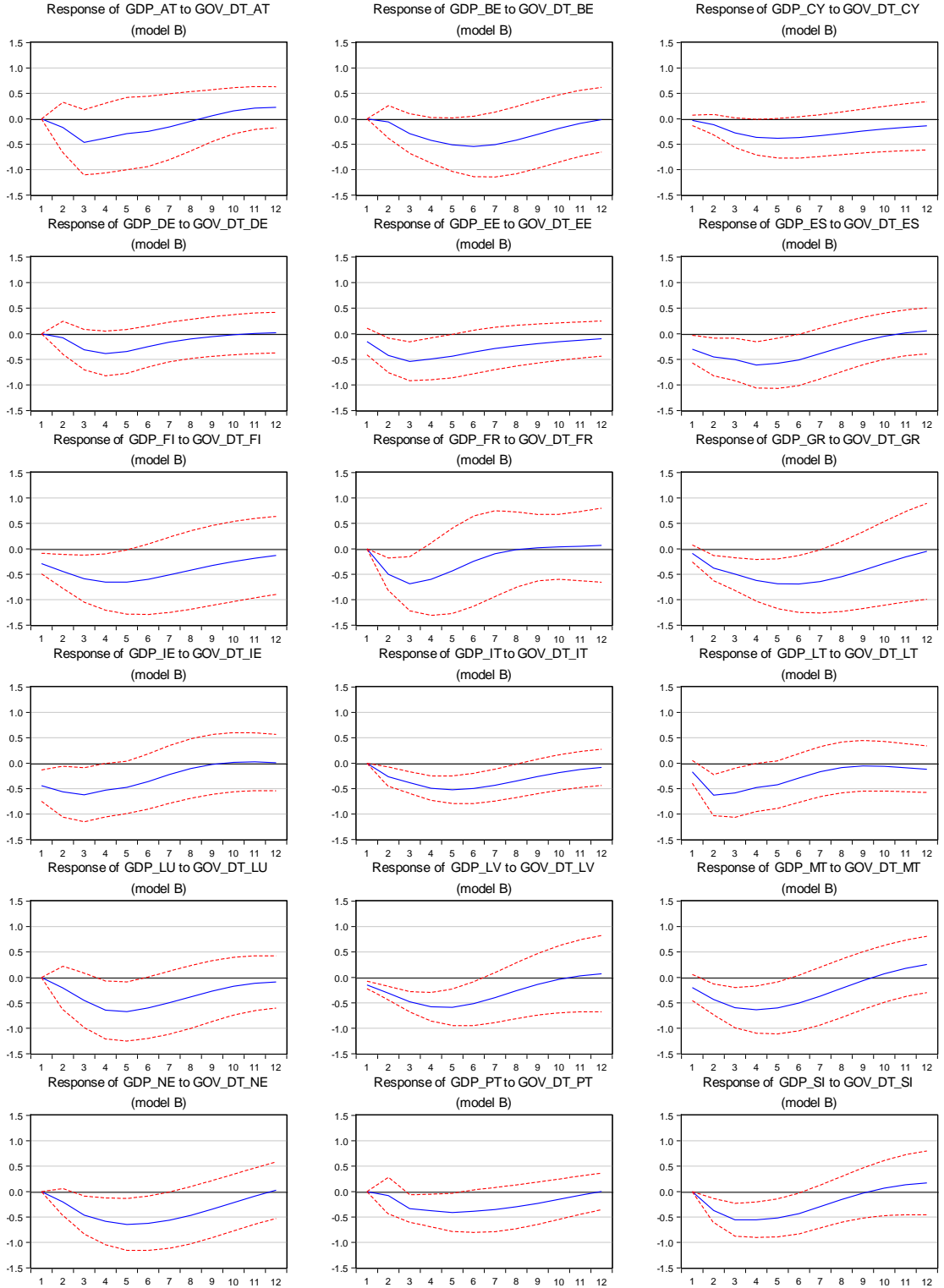
Source: Author's calculations.

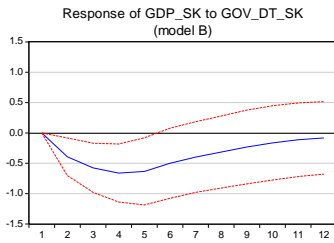
**Figure 7.11 Responses of Real Output to the Positive Government Expenditures Shock**

Crisis period affected responsiveness of real output to the positive (increase in) government expenditures shock across individual countries with a different manner. Both intensity and durability of the positive real output response considerably increased though overall effect in the long-run remained neutral (and effect of the shock died out during third year since the shock). Thus, crisis period seems to intensify positive effects associated with government expenditures adjustments. As a result, time vulnerability of real output to expenditure based fiscal adjustments during the crisis period increased.

In the figure 7.12 we summarize responses of the real output to the positive one standard deviation shock of direct tax revenues for the model with time series for the extended period (model B1) in the Euro Area member countries.

(2000Q1-2015Q2) (Model B)





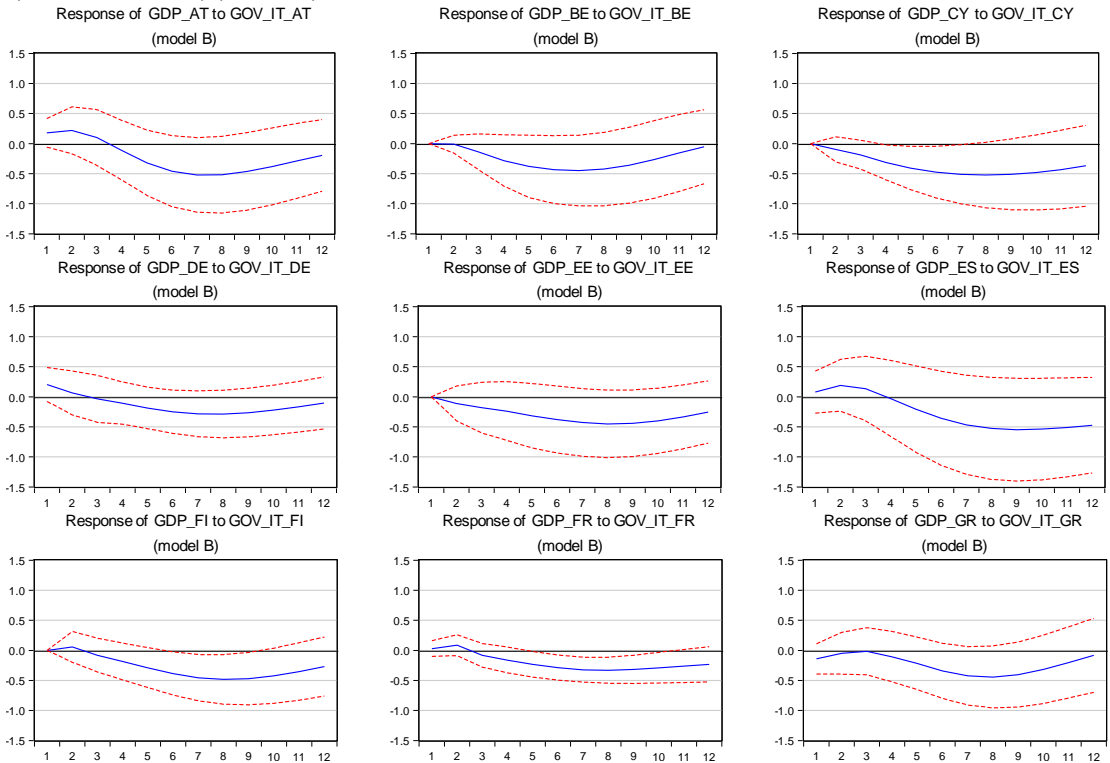
Source: Author's calculations.

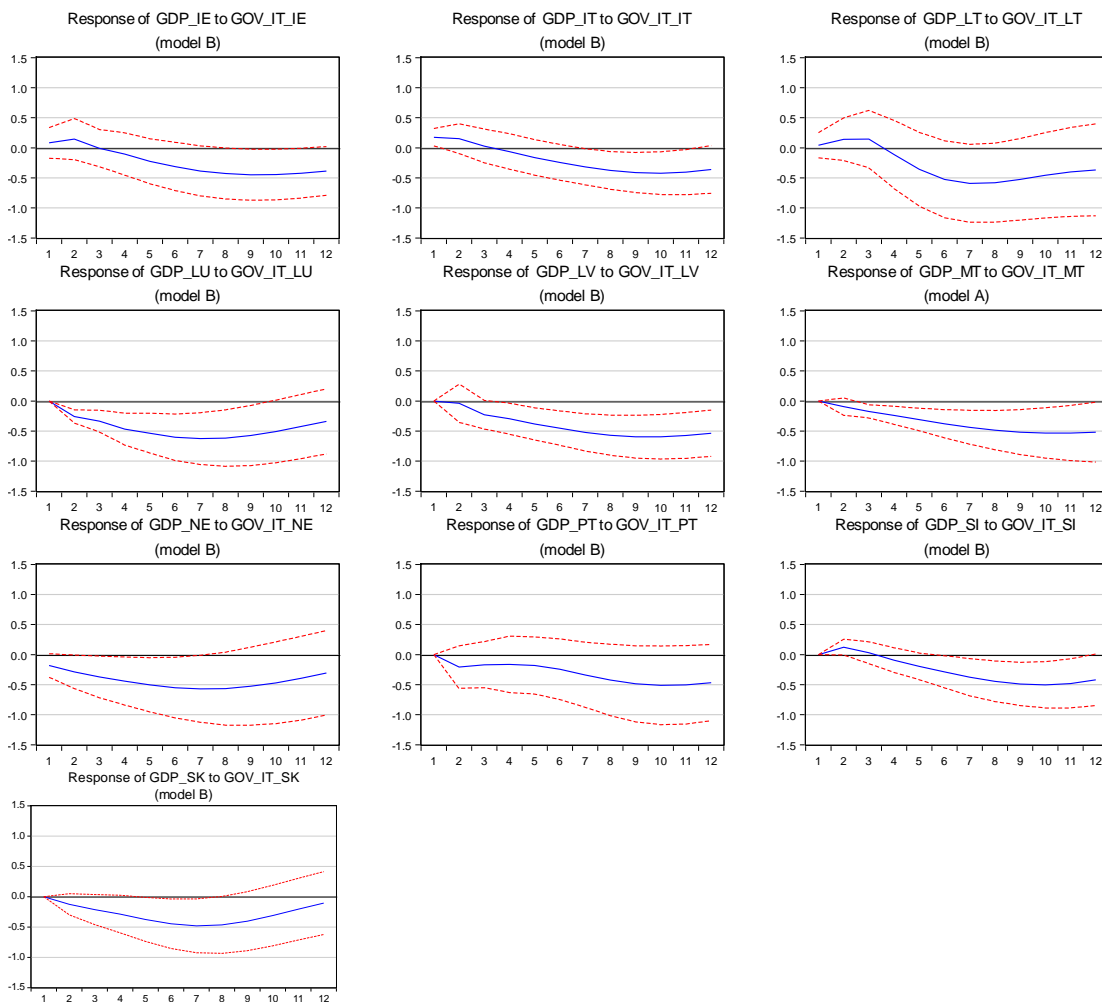
**Figure 7.12 Responses of Real Output to the Positive Direct Tax Revenues Shock**

Due to crisis period we have examined slightly changed responses of real output to the positive (increase in) direct tax revenues shock in all countries from the group. It seems that not only increased durability of the deteriorating effects on the real output occurred but also overall drop in the real output increased. Although overall effect of the shock seems to be neutral in the long run, its effect died out till the end of the third year. As a result, real output became more vulnerable (as of intensity as well as durability of the effect) to direct tax based fiscal adjustments during the crisis period.

In the figure 7.13 we summarize responses of the real output to the positive one standard deviation shock of indirect tax revenues for the model with time series for the extended period (model B1) in the Euro Area member countries.

(2000Q1-2015Q2) (Model B)





Source: Author's calculations.

**Figure 7.13 Responses of Real Output to the Positive Indirect Tax Revenues Shock**

Analysis of the real output responses to the positive (increase in) indirect tax revenues shock revealed quite similar results in comparison with effects of the direct tax revenues shock. Despite general increase in intensity of the real output decline, all countries from the group have also experienced higher persistence of the deteriorating effect of the shock. As a result, the negative effect of the tax revenues shock on the real output endured around 3-5 years and thus significantly prolonged side effects of the indirect tax (revenue) based fiscal adjustments during the crisis period.

Crisis period accelerated side (macroeconomic) effects of fiscal adjustments associated with tax and expenditure based fiscal consolidation in the Euro Area member countries. Generally, we emphasize increased durability of effects associated with fiscal adjustments (both revenue and expenditure based) on the real output. Provided that a degree of success of fiscal adjustments during the crisis period is reduced due to excessive pressures on both revenues and expenditure sides it seems that increased durability of real output responsiveness, followed by tax and/or revenue based adjustments,



significantly reduced a degree of success to perform an effective (without side effects on real output) fiscal consolidation.

### Conclusion

In the chapter we have analyzed main trends in the financial stance of general governments in the Euro Area member countries during last two decades. Brief overview of main trends in selected fiscal indicators and rapid deterioration in the fiscal policy stance during the crisis period revealed a crucial need of fiscal consolidation as it became urgent almost immediately after the debt crisis contagion flooded Europe.

We have identified episodes of successful and unsuccessful (cold showers versus gradual) fiscal (expenditure versus revenue based) consolidations by analyzing effects of improvements in cyclically adjusted primary balance on the sovereign debt ratio reduction. Individual countries have experienced several episodes of fiscal consolidation that in total represents 66 episodes of both types - one year consolidation (48) and gradual consolidation (18). However, we have assessed only 25 percent success in one year episodes of fiscal consolidations (12 *cold showers* succeeded). We have investigated only 4 successful gradual consolidations (22 percent degree of success). It seems that governments in our sample of countries significantly seek an effort to undertake gradual multi-year fiscal consolidations and thus strengthen financial discipline during a significant period of their political cycle. At the same time, 6 of 8 gradual consolidations (only 2 of them were successful) undertaken during the pre-crisis period were associated with deteriorating effects on the overall macroeconomic performance, revealing wasted chance of successful fiscal consolidation during "good times".

We have also estimated VAR model to analyze effects of fiscal shocks (based on one standard deviation (increase in) total expenditures and (increase in) direct and indirect taxes) to real output. Both, government expenditures increase and tax revenues increases were followed by real output declines. However, effects of expenditure based adjustments seem to be more significant within the same fiscal year (effects of the shock culminated during first four quarters). As a result, expenditure based approach seems to be more convenient (effective) for episodes of gradual fiscal consolidations provided that distortionary effects on the real output tend to be reduced during the 2-3 years following the fiscal adjustment. On the other hand, effects of adjustments in both direct and indirect tax revenues were largely distributed across several years (with slightly reduced deteriorating effect during the first year in most countries in case of indirect taxes) and thus revenue based fiscal adjustments seem to be more appropriate for episodes of one-year fiscal consolidations.

Crisis period accelerated negative side (macroeconomic) effects of fiscal adjustments associated with tax and expenditure based fiscal consolidation in the Euro Area member countries. Generally, we emphasize increased durability of deteriorating effects of fiscal adjustments (both revenue and expenditure based) on the real output. Provided that a degree of success of fiscal adjustments during the crisis period is reduced due to excessive pressures on both revenues and expenditure sides it seems, that increased durability of real output deterioration, followed by tax and/or revenue based adjustments, significantly reduced a degree of success to perform an effective (without deteriorating side effects on real output) fiscal consolidation.

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