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THE THEORY OF OPTIMUM CURRENCY AREAS AND BUSINESS CYCLE SYNCHRONIZATION IN CENTRAL AND EASTERN EUROPEAN COUNTRIES

Master's thesis

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I declare I have written the master's thesis independently.
All works and major viewpoints of the other authors, data from other sources of literature and elsewhere used for writing this paper have been referenced.

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ABSTRACT

In the thesis, the theory of optimum currency areas (OCA) is considered, primarily in respect with economic integration in the euro area. Main properties of OCA, the most relevant or "catch-all" property being synchronization of business cycles, are discussed. Other objects of examination are costs and benefits of adopting a common currency, specialization and endogeneity theories, and post-crisis studies, including studies on adjustment mechanisms. Empirical literature on the business cycle synchronization and the determinants of business cycle synchronization is being considered in details, as it is and will probably remain in the foreseen future the key issue for the euro area.

In the empirical part of the thesis, the focus is on the business cycle synchronization in eight Central and Eastern European countries, namely Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, and Slovenia that joined European Union in 2004. These countries have been chosen as they have been studied less compared to the old members of the European Union. Input data include quarterly data on real GDP and unemployment rates. Period examined is 1996 – 2013. Studied period is divided into five sub-periods. To assess the degree of synchronization Pearson correlation is used. As de-trending technique is used Hodrick-Prescott filter, moving window method is employed to track changes of synchronization in time. The main conclusions are the following. There is no common CEE business cycle, the degree of synchronization varies over time, but there are signs of convergence with the euro area. The determinants of different behaviour of business cycles need to be additionally examined.

Key words: Optimum currency areas theory, monetary integration, business cycle synchronization, euro area, Central and Eastern European countries

1. INTRODUCTION

Having existed for fourteen years, the euro area is intrinsically unfinished economic experiment. This experiment is particularly interesting as the underlying economic theory of the optimum currency areas is evolving together with the euro area. The recent global financial crisis has revealed that differences between countries, like differences in economic and institutional structures, consumption patterns, real income, financial exposure, etc. are of more importance than it was previously assumed. Asymmetric shocks caused by desynchronized economies are one of the main threats to the sustainability of the euro area. Besides, a symmetric negative shock being transmitted to national levels in different ways could be a source of troubles as well. That is why real convergence and insurance mechanisms are subjects to much discussion over the last years.

The aim of this thesis is twofold. First, to consider the theory of the optimum currency areas (OCA) in its evolution over time, shedding some light on the recent research in the field of alternative stabilization instruments, and secondly, to take a closer look at synchronization of economic activities in Europe, the degree of synchronization, trends, and determinants of synchronization. In the empirical part, we will focus on the Central and Eastern European countries' business cycles. We confirm the results of Kolasa (2013) and Stanisic (2013) that there is no CEE business cycle, but the convergence towards the euro area has a positive trend.

When Mundell (1961) coined the term *optimum currency area*, adopting a single currency in Europe was considered a hypothetically possible but unlikely scenario of the future development. Schematically simple at the beginning, the theory is being significantly expanded and corroborated with some empirical studies during the next decades. Different researches give their contribution to the OCA theory, suggesting various OCA properties as well as relative costs and benefits of pegging the exchange rates between countries. The basic properties are labour and production factor mobility, openness and diversification of the economy. Theoretically discovered preconditions for a currency area to be effective are considered unfeasible practically, and a conclusion is made that a system of floating exchange rates is preferable.

By 1990s, notwithstanding the big volume of literature on the topic, there is no *OCA-test* enabling to assess the degree of readiness of the European countries to enter a monetary union. At that time, numerous attempts to systematize and integrate theoretical and empirical studies are made. Similarity of economic shocks – *a catch-all property* is being suggested. Openness and flexibility of wages and prices are also considered of high importance. The costs and benefits are revised. The main cost of entering a single currency area – a sacrifice of an independent monetary policy – is no longer considered very significant as expansionary monetary policy is now thought to be ineffective and even detrimental in the long run; while benefits are numerous, the main of them being increased usefulness of money, reduced costs and riskiness of investments, low trade barriers, transparent financial market, and increased credibility.

However, a serious weakness of the euro area is still asymmetry of economies of the member-states, which, however, can be compensated by the insurance mechanisms, mainly through the integrated capital market and explicit transfers across the countries. It remains unclear whether further economic integration will lead to more specialized and consequently to more vulnerable economies, or business cycles will become more synchronized. At this time, goals and objectives of the euro area are being formulated. The primary goals are price stability, low budget deficit and real convergence.

By now, the euro is adopted and the euro area is permanently enlarging. Furthermore, the euro area has survived the world financial crisis. It cannot be said that the crisis passed with no negative consequences, but the worst apprehensions were not fulfilled – the euro area did not fall apart. The crisis has demonstrated that under conditions of limited adjustment mechanisms – no “emergency exit” – there is a problem of effective anti-crisis management on the one hand and erosion of trust in the sustainability of the euro area on the other.

One of the most relevant issues concerning euro framework is the problem of sustainable development of the euro area and its ability to counteract negative disturbances, both symmetric and asymmetric. We are in the transition period when adjustment mechanisms and stabilization tools are not yet fully developed. Under these conditions, convergence of business cycles is particularly important. There are two sets of questions concerning the examining of the business cycles. The first one is methodological, *i.e.* how to measure the economic activities and how to measure synchronization of the economic activities across the countries. The second one is connected with the factors driving business cycles synchronization.

The rest of the thesis is organized as follows. In chapter 2, we introduce the theory of the optimum currency areas and trace its evolution. Along with classical approach, we discuss a dynamic one, *i.e. ex post* approach, and its two paradigms: endogeneity of the optimum currency area properties and Krugman's specialization hypothesis. Besides, we consider some post-crisis studies, discussing main lessons of the recent crisis and necessary adjustment mechanisms.

In chapter 3, we make a review of studies on business cycle synchronization and determinants of business cycle synchronization. Division into the second and the third chapters is conventional, as sometimes it is hard to draw the line between theoretical and empirical studies. Sometimes we will corroborate theory referring to an empirical study or we may recall the theory making a review of empirical studies.

In chapter 4, using the most recent data on output and unemployment, we consider business cycle synchronization in eight Central and Eastern European (CEE) countries with the euro area. We perform correlation analysis of cycle components and discuss the results obtained. Observed data comprise years 1996 – 2013, and this period is divided into sub-periods to trace the development of co-movements in economic activities. Besides, the method of moving window is used to make the trends in synchronization more visible. The empirical analysis performed confirms major results of empirical studies discussed in chapter 3. We show that there is no common CEE business cycle; that the degree of synchronization with the euro area varies considerably across the periods; and that a tendency towards more synchronization with the euro area and with each other can be noticed.

Finally, in chapter 5, we briefly conclude all above discussed and speak about perspectives. We would recommend considering trade and financial integration as the most likely determinants of business cycle synchronization in the CEE countries and along with determinants of business cycle synchronization, we consider adjustment mechanisms suitable for the euro area to be the most challenging path of future studies.

2. THEORETICAL STUDIES

In this chapter, we will review the theory of the optimum currency areas in its evolution from 1960s until nowadays. We will consider two approaches to the topic: static and dynamic or *ex ante* and *ex post*. In other words, we will consider basic properties of the OCA, costs and benefits of adopting a common currency, *i.e.* we will consider the questions that are made *before* entering a currency area; and we will examine the processes that may take place *after* a common currency is adopted. Besides, we will review the modern amendments to the theory, dealing mostly with alternative insurance mechanisms, designed to replace lost independent monetary policy instruments.

2.1. The theory of the optimum currency areas

Robert Mundell is considered a father of the theory of the optimum currency areas. However, fixed and floating rate regimes were widely discussed during 1950s by different scientist before the publication of the Mundell's seminal article (1961). We will examine the evolution of the theory gradually, starting the review from the properties of the OCA.

2.1.1. The original theory

In his well-known article, Mundell (1961) examines the problem of a common currency in the context of internal and external balances. The main objects of critique are fixed exchange rates as well as rigid wages and price levels, preventing terms of trade from fulfilling adjustment role. As the most plausible solution, Mundell considers not a system of national currencies but *regional* currencies with flexible exchange rate. Mundell shows that in a two-country world a problem of demand shift from one country to another can easily be solved by appreciation or depreciation of the currencies. It would correct both the unemployment and the inflation as well as the external balance. If a demand shift occurs within the borders of a country, the Central Bank can either relieve the unemployment or restrain inflation, but both cannot be escaped.

Thus, according to Mundell (1961, 661) an optimum currency area as a region with "internal factor mobility and external factor immobility". It is noteworthy that optimality of a single currency area is defined by exogenous labour and production factor mobility. Later on Mongelli (2002) defines an optimum currency area as the optimal geographic domain of a single currency, or of several currencies, which exchange rates are fixed. A single currency and currencies with pegged exchange rate have been compared a lot in the literature. Meade (1957) speaking about adjustment of payments in the context of Western Europe, argues that the main reason why the system works for England and Wales and will not work for the Europe as a whole is that United Kingdom has got single common currency and banking system. Mundell (1961) points out the same idea: there will always be major differences between interregional and international adjustments. Cesarano (2012) notes that we cannot put equals sign between a common currency and currencies with fixed exchange rates as borders matter in the sense of availability of information and its impact on agent's behaviour and resources allocation.

Summing up, the classical approach to the problem of a single currency area is *per se* an empirical problem of defining the geographical borders of the area with a single currency and its prerequisite properties. Later on, the authors of the fundamental report "One Market, One Money" (EC 1990) have faced the necessity of defining the optimum economic and monetary competences of the OCA. This paper will be discussed in section 2.2.

2.1.2. Two approaches

The discussion about a single currency arose on the grounds of the economic integration in Western Europe. The theoretical developments were tightly connected with empirical studies. A conflict in approaches was present from the very beginning. Meade (1957) argued that the conditions for a single currency in Western Europe did not exist, thus, staying in the frameworks of exogenous properties of a common currency area. Meade saw flexible exchange rate as the worst option except the others. In her opinion, full unemployment was of much more importance for Europe than free trade. Being flexible exchange rate advocate, Meade notes, however, that it can be misused if the national governments start to manipulate it in order to obtain some benefits. Scitovsky (1958) claimed that a common currency stimulates the capital integration (cited by Mundell, 1961). Later, Mundell (1973) arrived at the similar standpoint. He saw a monetary union to be itself a solution to asymmetric shocks. This approach was later

on evolved into the endogeneity theory of the optimal currency area. We will discuss the issue in subsection 2.3.2.

These two approaches can be opposed in terms of time horizon. While original approach is static and more suitable for assessing the readiness of the countries to adopt a common currency, the endogeneity theory focuses on long-run effects of monetary integration and further developments of a common currency area (Cesarano 2012). Besides, the endogeneity theory can be opposed to Krugman specialization theory, as we will see in section 2.3. In the next two subsections we will examine properties of a common currency area and costs and benefits of joining a currency area for a single country discussed by different researchers of the OCA theory.

2.1.3. Properties of the OCA

The very first phase of the OCA theory evolution covers studies on properties, or prerequisites, or characteristics, or criteria of a currency area. Among the pioneers of the theory in the first place should be named McKinnon (1963), Kenen (1994), Ishiyama (1975), and Corden (1972). Besides the pioneering ideas, we will consider some later amendments to the theory. Although the studies were mostly theoretical, the underlying problem was purely practical – whether Western European countries should or should not adopt a common currency. Instruments were needed to assess the degree of readiness to integrate and the costs of concomitant adjustments. Below we will consider the OCA properties widely discussed by different authors.

2.1.3.1. Price and wage flexibility

Price and wage flexibility is perhaps the most important property at all. EC report (1990, 30) calls it “a necessary condition of success”. According to Mongelli (2002, 6), price and wage flexibility together with the similarity of shocks are the most relevant properties: “a group of countries sharing similar shocks and enjoying flexibility in nominal prices and wages would form a feasible currency area.” Almost every author considers this property a very important one. However, it is a property hard to obtain in practice.

2.1.3.2. Factor mobility

Mundell (1961) considered factor mobility to be the basic property of an optimum currency area. If the internal mobility is insufficient, then the economy cannot be stabilized and inflation and unemployment will persist. However, labour mobility is rather desirable then achievable property: “the human race tends to be rather immobile, and prefers to trade rather than migrate” (Mundell 1973, 116). Meade (1957) points out that labour mobility is practically unachievable across the Europe. Even if it were realistic, the costs of migration are rather high. Moreover, these costs reduce private returns on investments and have overall negative effect on welfare (Bertola 1994).

Fleming (1971, 472) criticized Mundell, saying that a distinction must be drawn between labour mobility and capital mobility. He defined capital mobility as “a high elasticity of substitution, for holders, between assets in one country and assets in another, and, for debtors, between liabilities in one country and liabilities in another”. Being altogether very sceptical about unifying Europe, Fleming sees mobility of capital rather as disequilibrating factor, making later a reservation that the mobility of capital is as likely to aggravate as to mitigate the costs of adopting a common currency. McKinnon (1963) notices that besides interregional mobility factor mobility among industries should be considered.

An important consideration concerning factor – and particularly labour – mobility is uncertainty of the microeconomic environment. It can be a serious obstacle for the labour mobility. Tavlas (1993) referring to an earlier paper of Bertola (1989) “Factor Flexibility, Uncertainty and Exchange Rate Regime”, points out that the more uncertain is the environment, the less mobile is the labour force. An important thing here is that labour mobility unlike capital mobility is not effective in the very short run.

2.1.3.3. Financial market integration

Financial market integration can be considered as a cushion in case of temporary adverse shocks, a mechanism of risk sharing. One of the first to mention it was Mundell (1973). Tower and Willet (1976) consider financial capital mobility as a factor facilitating adjustments and point out that an important distinction should be made between financing and adjusting. They note that “high capital mobility would not eliminate the need for explicit adjustment policies under all circumstances, as is indicated by the problems of depressed regions within

countries" (Tower and Willet 1976, 81). Financial integration is considered a counterbalance for heterogeneity of the member states of a currency area.

In an integrated stock market an insurance system works through diversifying income sources. The risk of a negative shock in one country is shared by all countries (De Grauwe 2007). However, such a scheme does not provide enough coverage for poor people. It should be noticed that insurance mechanisms do not substitute adjustments; these mechanisms just give an extra time to implement adjustments.

2.1.3.4. Economic openness

Economic openness mainly refers to the trade integration. The concept was elaborated by McKinnon (1963). It is considered to be one of the basic properties by Tower and Willet (1976). Comparing fixed and floating exchange rates, they argue that in very open economies exchange illusion disappears, thus, the absolute advantage of floating rates in adjusting to external and internal disturbances decreases with openness and become negative in very open economies (Tower and Willet 1976, 72).

The openness of the economy can be assessed by the ratio tradable and non-tradable goods; ratio of exports and imports over GDP can also be used. According to McKinnon (1963), this criterion should go in tandem with factor mobility to assure the optimality of a currency area. Mongelli (2002) points out that the higher the degree of openness, the more rapidly changes in international prices are transmitted to the domestic economy and the smaller the potential for money illusion by wage earners. Large and diversified economies are generally less open compared to smaller ones. Most authors agree that openness is likely to increase in a currency area (De Grauwe and Mongelli 2011).

2.1.3.5. Diversification

Diversification in production and consumption diminishes the shocks specific to any particular sector (Kenen 1994). The diversification may be in contradiction with the previous property – openness of economy. Tower and Willet (1976, 73), for instance, note: "open economies tend to be smaller and less diversified". It is not clear whether the economies within a monetary union will become more diversified or more specialized (see section 2.3).

2.1.3.6. Similarities of inflation rates

Similarities of inflation rates refers to stability of economy. According to Ishiyama (1975) similarities in inflation is the determinant property for a currency area. Vaubel (1976) adheres to the same opinion. He considers the differences in inflation preferences the main obstacle for the Europe to modify a currency area.

It should be kept in mind that some inflation differentials could originate from catching-up process of emerging countries known as Balassa-Samuelson effect referring to the regularity of positive correlation between productivity growth and inflation rate (Balassa 1964). Hence, if Balassa-Samuelson effect is present, inflation differentials across the countries are the result of equilibrating mechanism. However, not all differences in inflation rates are a part of this mechanism. Similarities of inflation rates could be seen as a desired outcome, not as a precondition. Tavlas (1993) refers to that as to time-inconsistency issue. This point is directly related to the reputation and credibility issues. A high inflation country is getting direct benefits by joining a monetary union with low inflation countries.

2.1.3.7. Real exchange rate variability

The need for real exchange rate variability is a good and clearly measurable criterion. Vaubel (1976, 18) points out that “the larger a member country's need for real exchange-rate changes *vis-a-vis* the other member countries, the less stable will be its domestic equilibrium price level if the average Community price level is kept constant and if the national member currencies are replaced by a Community currency (*i.e.* exchange rates are fixed)”. The converse is also true. Thus, if this need of a potential member was historically small, then the country is obviously a good candidate for a monetary union.

2.1.3.8. Fiscal and political integration

While integration of financial market is a private insurance mechanism, fiscal integration is a public insurance mechanism of transferring of income in the case of asymmetric shocks. It requires a deep political integration and a common budget. In case of asymmetric shocks, a transfer of income from a country with positive demand shock to a country with negative one could be a solution of the problem. However, it should be used along with

adjustment mechanisms (wage adjustments and mobility). The European government (given it exists) can redistribute income increasing its spending in the country with negative shock through pensions, unemployment benefits. The main problem here is moral hazard.

European budget amounts for less than 2% of EU GDP. Thus, this mechanism is not available in the euro area. Another possible insurance mechanism is through increasing or decreasing government debt. No moral hazard nor redistribution of income among the countries come along, but its use is restricted by high government debts (De Grauwe 2007). Political issues concerning differences in labour market institutions and legal systems, preferences of member states toward growth, inflation and unemployment are of great importance for a sustainable monetary union (De Grauwe 2007).

Preferences about inflation and unemployment should be homogeneous in order to have a well-functioning monetary union. Otherwise, the costs of a monetary union will be increased. Differences in labour market institutions – centralized or decentralized labour unions – could be a problem. The more labour market institutions differ, the more costly it is for the countries to form a monetary union. Differences in legal systems refer mostly to Anglo-Saxon legal tradition and financing mainly through equity market and to the continental tradition with prevailing financing through banking system. Interest rate increase is transmitted into consumption and investment spending very differently across EU. These differences will probably continue to exist for some time making it harder to make adjustments.

In Europe prevailed functional integration, e.g. a starting point was economic integration (Mongelli 2002), see Figure 1. Nobody can tell if it will lead to full-fledged political integration, and if it will, when it will happen.

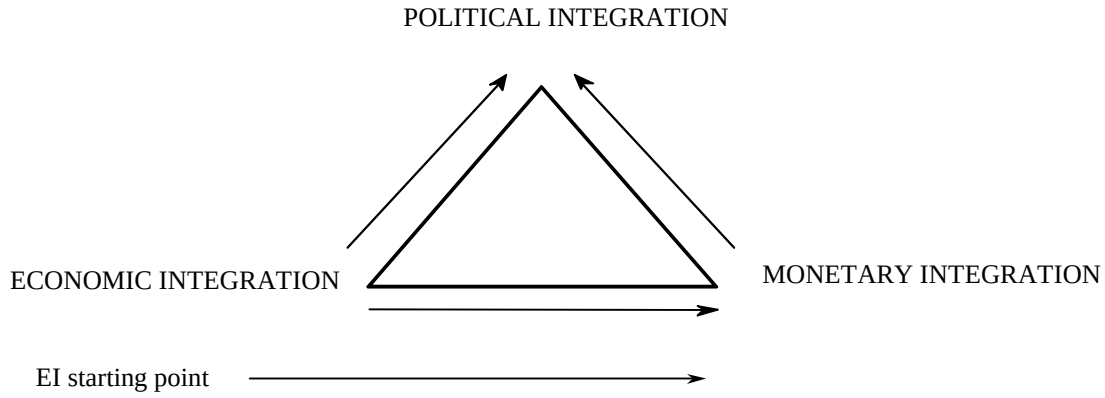

Figure 1. Functional integration process in Europe
Source: Mongelli 2002.

Fiscal and political integration were mentioned by different researchers form the very incipience of the OCA theory. Political will to integrate was always considered to be extremely relevant. Nevertheless, fiscal and political integration are being considered as practical not purely theoretical options. “There is now realism and acceptance of the need for changes in governance and the strengthening of institutions”, points out Mongelli (2013, 6).

2.1.3.9. Similarity of shocks

Similarity of shocks, or synchronization of business cycles, or degree of goods market integration came out relatively recently. It is a meta-property combining different economic characteristics. Mongelli (2002) calls it “a “catch-all” property capturing the interaction between several OCA properties”.

Besides similarity of shocks not less important is the similarity in responses to shocks. It could be a problem that even symmetric shocks would require different responses due to the differences in structures, preferences, and track records across the countries (Mongelli 2002). Besides, symmetric shocks can be transmitted in an asymmetric way due to structural differences and this applies for both *flexible countries* and *rigid countries* (De Grauwe 2007). Shocks need to be similar for the very simple reason. The effectiveness of the ECB policy in regard of individual countries depends on whether their business cycles are synchronized and the shocks are symmetric or asymmetric. Stabilization for an individual country cannot be achieved if its economy is not synchronized with the rest of a currency union.

It is worth mentioning right away that deep financial integration may eliminate the pre-requisition of the similarity of shocks. The effects of asymmetric shocks can be diminished through the insurance mechanisms diversifying income sources and adjusting portfolios by borrowing and lending on international market (De Grauwe 2007). Financial integration and its impact on business cycles’ co-movements is discussed in subsection 3.3.2.

2.1.3.10. Summary

The main problem of the pioneering studies of the OCA theory is that discussed properties do not form clear unifying framework. Properties are indeterminate, they are of different nature, difficult to measure and evaluate against each other. Different authors rank properties differently; there is no general agreement on the quantitative importance of each

OCA property (Tower and Willet 1976). Tavlas (1993) points out that criteria are difficult to measure unambiguously and cannot be formally weighted against each other. Mongelli (2002) notes that empirical content is insufficient, some properties still need to be analysed and there are problems of inconclusiveness and inconsistency.

Later on De Grauwe and Mongelli (2011) pick up three the most relevant properties. They call it *OCA rating* and analyse it along three dimensions: (1) economic openness or integration, (2) income correlation and symmetry of shocks, and (3) product and labour flexibility. They show that there are close interactions between all these factors, e.g. costs of an asymmetry in income can be compensated by the benefits of integration or by higher flexibility etc.; and leaning on the endogeneity approach they conclude that "endogeneities in integration, symmetry and flexibility reinforce each other and speed-up the process into the OCA-space" (De Grauwe and Mongelli 2011, 6). In 2013Mongelli is speaking about the same properties, *i.e.* flexibility (now it is rather financial flexibility implied), openness, and income correlation.

2.1.4. Costs and benefits

The next step in the development of the OCA theory was the discussion about the costs and benefits of the OCA in the 1970-80s. The discussion is now more practical, as the monetary integration is already in the air. There are even more variety and ambiguity concerning costs and benefits then the properties of an optimum currency area. Ishiyama (1975) opposes this phase to the original studies as another paradigm and calls it a usefulness of OCA approach. The significant contributions have been made by Corden (1972), Ishiyama (1975), Tower and Willet (1976), Mundell (1973), and Vaubel (1990); De Grauwe (2007) has also made very thorough analysis of the costs and benefits of the OCA. Corden (1972) considers monetary integration in the context as an interim stage of full economic integration from custom union to fiscal union and – eventually – to political integration.

2.1.4.1. Costs

According to classical macroeconomic theory, two key stabilization instruments available for a government are monetary policy and fiscal policy. Joining a single currency area, a country relinquishes direct control over its own monetary policy. Monetary policy, which works through changes in the money supply and changes in interest rate, and fiscal policy,

which works through changes in government spending and taxes, can be used to offset the negative effects of disturbances to output and employment. Temporary fiscal expansion results in a rise of output and it causes the currency to appreciate. A temporary increase in the money supply, which does not affect the long-run expected exchange rate, causes a depreciation of the currency and a rise in output. A lower exchange rate reduces relative wages and prices, restoring a country's competitiveness, and reduces the international debt, denominated in the domestic currency, partially shifting the burden of the shock to the country's partners. Monetary policy can also stimulate depressed economy (and cool down overheated economy) by lowering (raising) interest rate.

A commitment to fix the exchange rate – or to adopt a single currency – forces the central bank to give up its ability to influence the economy through monetary policy (Krugman and Obstfeld 2003). Under a fixed exchange rate, central bank monetary policy tools are powerless to affect the economy's money supply or its output (Krugman and Obstfeld 2003, 494). It can be illustrated by an example. If central bank wants to increase money supply in order to increase output, it will buy domestic assets. However, to maintain fixed exchange rate on its initial level, central bank has to sell its foreign assets, thus decreasing money supply. Hence, the economy equilibrium remains at its initial point with no increment in output.

The relation between exchange rate, capital flows, and monetary policy is described by Mundell-Fleming model, also called Mundell-Fleming trilemma and impossible trinity. It proves that it is impossible to maintain simultaneously a fixed exchange rate, free capital movements, and an independent monetary policy. Only two of them can be obtained at the same time. Absence of the monetary policy tool could be particularly noticeable if wages and prices are rigid and labour mobility is limited. In that case, countries that form a monetary union will find it harder to adjust to asymmetric demand shocks than countries that have maintained their own national money and that can devalue or revalue their currency (De Grauwe 2007). One of the reasons explaining it is that monetary policy tools are as a rule easier to exercise, while fiscal policy is a subject to lengthy legislative deliberations (Krugman and Obstfeld 2003).

Most of pioneering authors believed that independent monetary policy was powerful stabilization tool and adjustment through the flexible exchange rate was in short-run the optimal adjustment mechanism. Later it turned out to be *fine tuning fallacy* not effective and even detrimental in long-run (Mongelli 2002). It can become itself a source of asymmetric shocks (EC 1990). However, adjusting through depreciating (appreciating) domestic currency could be

effective in some cases. There are empirical evidence supporting this point of view (De Grauwe 2007, Belgium case).

Nevertheless, a modern approach to the issue tends to believe in inefficiency of monetary policy in raising aggregate demand (De Grauwe 2007). Low effectiveness of monetary policy results from the fact that this mechanism operates with considerable time lags. Besides, expansionary monetary policy can be misused for purely political purposes, for instance, to create a boom before elections. That could lead to an inflation bias, *i.e.* high inflation but no average gain in output.

Another argument is the vertical long-run Phillips curve and natural rate of unemployment. It actually means that higher inflation do not lead to lower unemployment. De Grauwe (2007, 55) argues that:

> [..] when countries join a monetary union, they indeed lose an instrument of policy that allows them to better absorb temporary (asymmetric) shocks. However, this loss may not always be perceived to be very costly because countries that actively use such stabilization policies also pay a price in terms of a higher long-term rate of inflation.

It has become clear that due to the fact that wage negotiations take place in terms of real wages rather than nominal wages. Hence, Phillips curve needs to be augmented by the inflation, finally turning into vertical Phillips curve and being replaced by the concept of natural rate of unemployment. Consequently, the only thing the policy makers can choose is the rate of inflation.

It should be mentioned that fiscal policy is more effective under a fixed exchange rate. Fiscal expansion aimed at increasing output moves exchange rate down. To retrieve exchange rate to its initial level, fiscal expansion has to be accompanied with increase of money supply, thus pushing output even further. Besides, in a monetary union governments can finance budget deficits by borrowing in the common market at more favourable rate than it would be in domestic market.

In addition to renunciation of independent monetary policy, Ishiyama (1975) names another two drawbacks of joining a currency area. First, it is an uncertainty concerning national fiscal policy in a currency union. There is a concern that it may become rather limited. Secondly, it is a possible deterioration of regional economics due to “Verdoorn’s law”. This law was named after Petrus Verdoorn and developed by Nickolas Kaldor (1975). Verdoorn’s law describes the relationship between output and productivity. In a nutshell, according to this law,

wages grow more slowly than output, consequently, the productivity in fast growing regions is higher than in slow growing regions. This is why fast-growers attract increasingly more investments and slow-growers may become even more depressed.

There is an opposite apprehension as well, that differences in growth rates could lead to a trade account deficit for a faster growing country. Fortunately, there is little evidence that it is true. On the contrary, there is evidence that fast-growers experience real appreciation and not depreciation. Paul Krugman (1989) pointed out an empirical regularity that he named "the 45-degree rule", under which fast-growing countries face high income elasticities for their export and low income elasticities for their import, thus having no need to secular real depreciation. The second counterargument is the one we have mentioned above – the flows of capital to fast growing countries.

The need of a common fiscal policy is being actively discussed in recent years. The economic convergence is one of the objectives of the euro area (EC 1990). What about the main cost of joining a common currency area – "a narrower menu of policy instruments available to national governments" (Mongelli 2002, 5), it seems to be insignificant in long run. More scientists (Tavlas 1993, Handler 2013) point out that there are fewer costs then it was believed at the dawn of the OCA theory. However, the recent financial crisis has revealed the lack of adjustment mechanisms available in the euro area. This issue will be discussed in section 2.4.

2.1.4.2. Benefits

There is no consensus about the benefits from adopting a single currency. Mundell (1973) names six benefits: insurance or risk pooling, inventory or a reduction in the costs of financial management, internalization or reserve pooling, intermediation referring to fixed exchanged rates, information saving, and innovation. Ishiyama (1975, 364) criticizes the majority of these benefits, saying that they are "vague and await further research". He argues that the main benefits are: increased value of money, elimination of speculative capital flows, saving on exchange reserves, risk pooling (with a question mark; it "waits for further research"), and accelerating fiscal integration (although Ishiyama makes a remark that it is probably unrealizable in the foreseeable future). In EC report (1990) the benefits of a common currency (compared to floating exchange rate) are enumerated as follows.

- Impacts on the efficiency and growth: a common currency will eliminate (1) nominal exchange rate variability, (2) uncertainty, (3) transaction costs of exchanging currencies; (4) will reduce the riskiness of the investments and (5) that could have a substantial growth effect. And a somewhat vague impact – (6) single market measures will secure additional economic advantages.
- Impacts on the price stability: European Bank is believed to (7) secure price stability, what is (8) advantageous itself to resources allocation and is believed to be achieved at minimum transitional costs.
- Impacts on public finance: (9) enhanced discipline over excessive budgetary deficits is expected to be ensured as well as (10) increase in efficiency of public expenditures due to the competitive pressure.
- Impacts on the international financial system: (11) less transaction costs, (12) more euro-dominant financial issues, (13) smaller needs for reserves, and (14) seigniorage gains on foreign holdings of euro notes.

Benefits of a common currency compared to fixed exchange rate are (1) elimination of transaction costs, (2) transparency of prices, (3) economy of scale due to more efficient financial market, (4) credibility, (5) visibility, *i.e.* symbolic significance of a common currency, and (6) external benefits.

Tavlas (1993) points out the eliminating exchange rate risk as the main argument *pros* a monetary union as it favours trade and investments. The second one is a role of money as a unit of account. The other benefits are elimination of need for reserves and improved allocation efficiency. Mongelli (2002) summarizes the main benefits of adopting a common currency as follows: (1) increased usefulness of money, (2) disappearance of exchange rate uncertainty, (3) increase in inter-regional trade and foreign investments, (4) broader and more transparent financial market, and (5) increased credibility – direct function of the strength of the commitment to a single currency.

De Grauwe and Mongelli (2011) in addition to above mentioned name the following benefits referring to the endogeneity of the OCA. The first bloc of benefits is: (6) reducing trade costs, including currency hedging; (7) reducing information costs; (8) enhancing of price transparency and discouraging price discrimination. These benefits contribute to reducing market segmentation and fostering competition. Owing to (9) future long-term relationships

together with intensified foreign direct investments, and (10) deeper political integration will be promoted reciprocal trade, economic and financial integration and synchronized business cycles among the member-states. Besides, a common currency promotes (11) convergence in social conventions.

Table 1. A schematic presentation of costs and benefits of alternative exchange rate regimes.

		Financial autarky	Free float	EMU
Microeconomic efficiency		low	medium	high
Macroeconomic stability:				
(a)	In the presence of shocks			
	Asymmetric shocks	low	high	low
	Symmetric shocks	medium	low	high
	Exchange rate instability	high	low	high
(b)	Resulting from policy discipline			
	Monetary credibility	medium	country-dependent	high
	Fiscal discipline	country-dependent	medium	medium
External influence		low	low	high

Source: EC (1990)

As one can see from Table 1, the only weakness of the EMU is an exposure to asymmetric shocks, which leads to low macroeconomic stability. We will return to the question of adverse shocks in section 2.3 and in chapter 3, dealing with empirical studies on business cycle synchronization. The assessment of costs and benefits as well as properties of a currency area was a good starting point of integration process. However, by the time when the euro was about to be adopted, there was still no simple OCA-test, writes Mongelli (2002).

2.2. The "new" OCA theory

In 1990s, the interest towards the optimum currency area theory has revived, and the topic has become one of the most important issues in the context of the international monetary policy. The reasons for that were monetary integration in Europe and developments in

macroeconomic theory (Tavlas 1993). By 1990, the theory was inapplicable to the euro area being established. It was not suitable "to identify the economic mechanisms that actually deliver the final benefits and costs" (EC 1990). Practically, there was no unified theory of monetary unions, and attempts were made to structure and systemize previous studies.

One of them is the EC report "One Market, One Money. An Evaluation of the Potential Benefits and Costs of Forming an Economic and Monetary Union" (1990). Some issues covered by the report are already discussed in previous subsections or will be discussed later (2.1.4 Costs and benefits, 2.3.2 Endogeneity of the OCA criteria). Below are listed some of the main points of this paper. The report argues that the main potential cost of the monetary union – the loss of monetary and exchange rate policy – should not be exaggerated. Though, some costs of transitional period (disinflation, reducing budget deficit) could be notable. Referring to model simulations, report notes that the euro area compared to other regimes "would have been able to absorb the major economic shocks of the last two decades with less disturbance in terms of the rate of inflation and, to some extent also, the level of real activity" (EC 1990, 11). Furthermore, financial flows are believed to absorb economic shocks.

The report has in view three classical objectives of economic policies: microeconomic efficiency, macroeconomic stability, and equity between regions. However, an objective of the highest priority is price stability; it is emphasized though that a necessary condition of success is price and wage flexibility. Equity between regions implies long-term convergence of economic performance. Economic growth and adjusting to shocks are also of high importance. Still, asymmetric shocks are believed to diminish as a result of changes in the industrial structures and wage bargaining. Price and wage flexibility is believed to be not just a theoretical possibility and is considered a necessary condition of success.

Besides theoretical issues, further conditions for successful functioning of EMU are enumerated in the report. Here they are:

- An effective economic policy coordination via Council of Ministers for Economics and Finance and European Bank;
- Low levels of national budget deficits in the absence of precise centralized control;
- Flexible labour costs;
- Synergies between national development and stabilization efforts and the Community's policies needed for the catch-up process of the least-developed countries and regions.

Many reviews of the pioneering literature were made in 1990s and 2000s; among the profound ones are those made by Tavlas (1993) and Broz (2005). We will name the main contributions of the "new" theory following Tavlas (1993).

- An independent monetary policy effectiveness is doubtful in a long run.
- The only thing a country retaining its national currency can choose is the preferred inflation rate.
- Costs of transitional period can include increase in unemployment for high inflationary countries.
- Factor mobility could be reduced due to flexibility of wages.
- Short-term exchange rate volatility does not impede trade flows.

Summing up, the "new" OCA theory stands on the endogeneity platform. According to it, the OCA properties do not have to be fulfilled before adopting a common currency. The convergence is believed to take place after a currency union is established. However, the economies of member states should converge within a reasonable time to ensure sustainability of the union. In the bottom line, we have low inflation and low budget deficits as main targets; and fewer costs and more benefits of a currency union. However, a currency area without being supported by political steps is likely to gain little credibility (Mongelli 2002).

2.3. Dynamic approach. Two paradigms

Once a currency union is established, it is critical to evaluate its prospects and viability. While the classical optimum-currency-area approach "takes a snapshot" and tries to assess properties, costs and benefits of an OCA at a given moment of time, dynamic approach is looking to the future in order to predict what will happen after adopting a common currency. We can also name these approaches *ex ante* and *ex post* approaches.

Two basic scenarios are possible for future developments in a currency area. The first one is known as Krugman specialization hypothesis and the second one is the hypothesis of the endogeneity of the OCA. While Krugman's hypothesis has strong theoretical underpinning, endogeneity theory seems to have more empirical evidences.

2.3.1. Specialization theory

As was discussed in subsection 2.1.4, benefits of a monetary union (e.g. elimination of transaction costs, increased transparency of prices and credibility, secured price stability) are supposed to lead to increased inter-regional trade. According to classical Ricardian theory of comparative advantage, increased trade will result in increased specialization. One of the main contemporary proponents of the specialization theory is Paul Krugman. Among other authors whose studies support specialization theory could be named Kalemli-Ozcan *et al.* (2001), Ricci (1999), Wolfmayr-Schnitzer (1999).

The logic of the contemporary specialization theory is the following. There is a tendency for clustering in many industries. The main reason for that is the economy of scale. When trade and transaction barriers become lower, this tendency begins to dominate and industries become more geographically concentrated. Thus, deeper integration – understood as a reduction in the costs of doing business across the space – leads to a geographic concentration of industry (Krugman and Venable, 1996).

Besides the economies of scale, there is another argument for benefit of this hypothesis, *i.e.* financial integration leads to a better risk sharing what makes specialization more attractive. The empirical evidence for this argument was provided by Kalemli-Ozcan *et al.* (2001). We will consider this argument in section 3.3.2 in the context of determinants of business cycle synchronization.

Geographic concentration and high level of specialization mean that the member countries may become more vulnerable to idiosyncratic shocks and less correlated in income. Thus, overall effect of integration on the economies of individual member countries is negative. In this context, high level of economic integration may mean that the countries that were initially in the OCA zone will leave it once the level of integration is higher, from point 1 to point 2 in Figure 2.

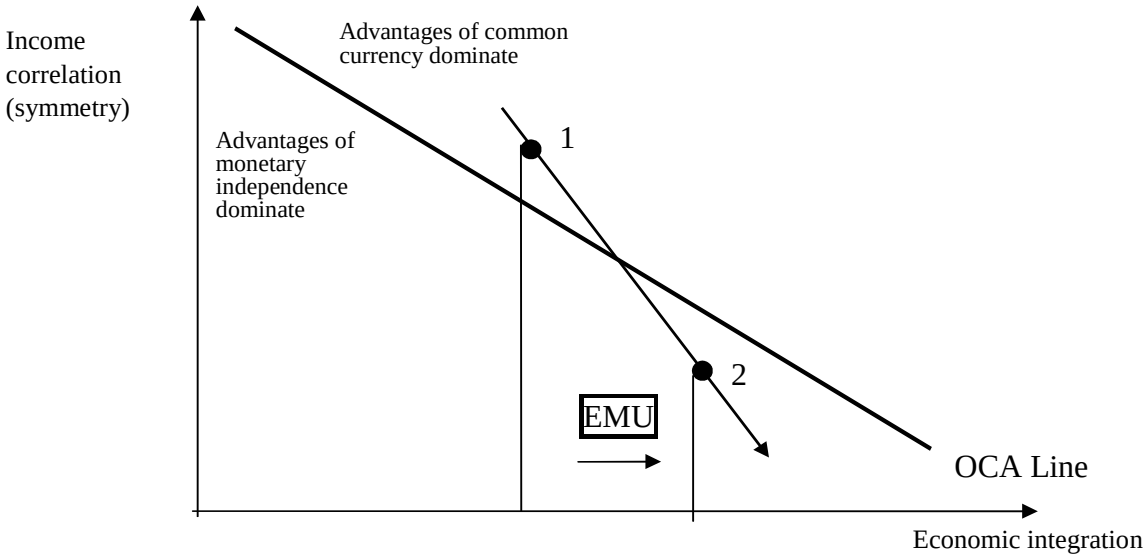

Figure 2. Increase in specialization and correlation in income
Source: De Grauwe and Mongelli 2011

In the article "Lessons of Massachusetts" (1993), Krugman is very categorical. Drawing parallels with the US economy, he predicts that the more integrated is the euro area, the less diversified are its regions, thus becoming more vulnerable to industry-specific shocks. That is, stabilization problems at the regional level are inevitable. Krugman also points out that specialization can bring along large divergence in long-term growth rates.

Later on, Krugman and Venable (1996) are less uncompromising and see some alternatives. They show that the production in Europe is not as localized as in the US. Looking forward, they see three different scenarios of European integration. It is possible that notwithstanding low trade costs, cultural and language barriers will remain insurmountable, the segmentation of markets will persist and nothing will happen. It is also possible that the degree of integration will be high but not high enough to change the geography of production. The third possibility is that the agglomeration will happen and will bring with it cost savings, what is obviously a positive thing. However, the costs of the adjustment period could be rather high. Krugman and Venable (1996, 967) point out that "each country will lose its presence in one of the industries, and workers in this industry will initially be hurt by integration and specialization". A rise of unemployment is also possible.

While Krugman and Venable (1996) speak about a country that may win or lose from the integration, De Grauwe (2007, 26) argues that the regional concentration is likely to occur but national borders will be relevant no more.

> The fact that economic integration can lead to concentration and agglomeration effects cannot be disputed. At the same time, however, it is also true that as market integration between countries proceeds, national borders become less and less important as factors that decide the location of economic activities. As a result, it becomes more and more likely that concentration and agglomeration effects will be blind to the existence of borders.

There is one empirical argument against Krugman's hypothesis, namely, that growing role of services that induces decline in the regional concentration of the economic activities (De Grauwe and Mongelli 2011).

Thus far, the question is open. It is not clear whether integration in the euro area leads to synchronization or rather to the specialization and concomitant asymmetry. We will examine empirical studies in chapter 3. If specialization hypothesis has to be materialized in the EU, when will it happen? That is the question of importance. If specialization theory overcomes the endogeneity theory then the consequences could be detrimental for the euro area. However, even if regional concentration will take place in the euro area, other channels like financial market integration, price and wage flexibility, and structural reforms could smooth or even completely absorb the negative impacts of idiosyncratic shocks. We will discuss adjustment mechanisms in subsection 2.4.2.

2.3.2. Endogeneity of the OCA criteria

A paradigm of endogeneity assumes that the very fact of adopting a common currency creates conditions favourable for good functioning of the monetary union (De Grauwe 2007). Endogeneity can be alternatively defined as a set of adjusting processes, triggered by the start of a monetary union that improve the OCA-rating of the union (De Grauwe and Mongelli 2004) or "gradual convergence of economic structures after commencement of the monetary union" (Handler, 2013, 3). More specifically, endogeneity implies that deeper economic integration fosters inter-regional trade and financial integration, leading to business cycles synchronization and income convergence and making membership in a currency union beneficial for all the member states.

While classical optimum-currency-area approach theory reflects Keynesian paradigm, endogeneity theory leans on the modern equilibrium approach (Cesarano 2012, 323).

The impact of the countries' border on agents' behaviour, institutions and economic policies bears heavily on the notion of optimum currency areas. This does not mean that the observed political geography defines the optimum, but rather that, once borders are set, it is hard to move away from equilibrium.

Graphically the idea of OCA endogeneity looks like this (see Figure 3).

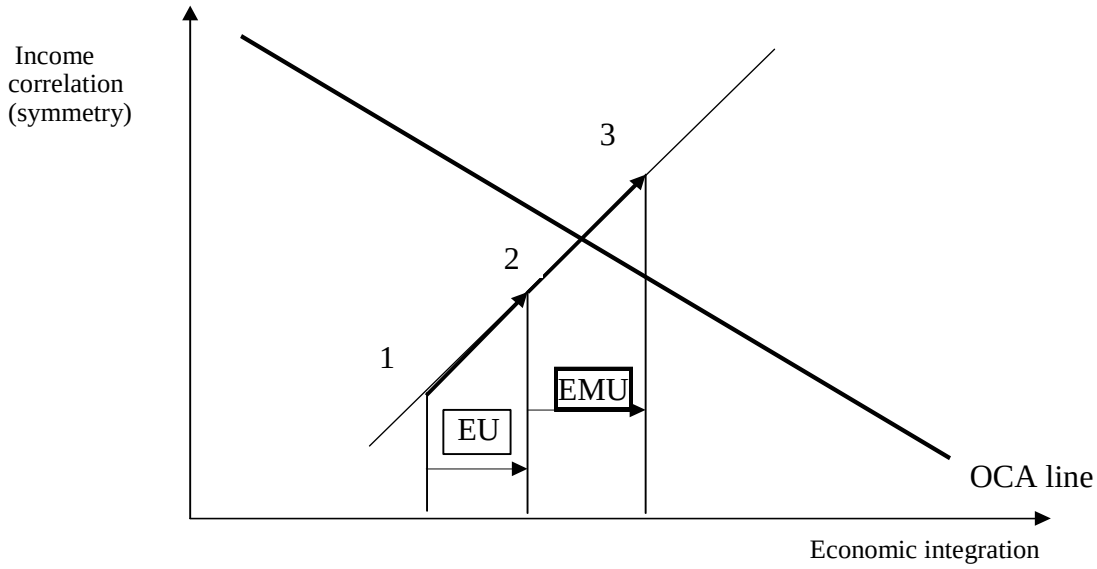

Figure 3. Endogeneity of OCA
Source: De Grauwe and Mongelli 2011

Some theoretical support was provided by Mundell (1973) in his second seminal article on the OCA theory. He argues that a common money performs the sharing (of gains and losses) function very effectively and illustrates it with an example. "A harvest failure, strikes or war in one of the countries causes a loss of real income, but the use of a common currency [..] allows country to run down its currency holdings and cushion the impact of the loss, drawing on the resources of the other country until the cost of adjustment has been efficiently spread over the future" (Mundell 1973, 115). In other words, Mundell points out here that an additional insurance mechanism is available to a country in a currency union that makes adjusting to adverse shocks smoother. The other adjustment mechanisms will be discussed in subsection 2.4.2.

Having formulated the endogeneity idea, we would like to stress that intrinsically it is an empirical regularity, not supported by any theory and waiting to be explained. The only theoretical finding we can mention in this context is the Lucas critique named after Robert

Lucas, who argues that one cannot predict the effects from the changes in the economic policy entirely based on historic data, since policy alters macroeconomic situation.

The seminal work on endogeneity of currency unions belongs to Frankel and Rose (1997), in which they provide empirical evidence that "a country is more likely to satisfy the criteria for entry into a currency union *ex post* than *ex ante*" (Frankel and Rose 1997, 760). More empirical evidences to the hypothesis of endogeneity can be found in the studies of Rose and Engel (2000), Rose (2002), Artis and Zhang (1997).

A fundamental report of the European Commission (1990) points out three reasons why country-specific shocks are likely to become less probable in the euro area. First, integration leads to changes in industrial structures, thus, increasing openness of the economies and making sector-specific shocks to a lesser degree country-specific in their impact. Secondly, in a credible monetary union wage bargaining is likely to diminish. Thirdly, some of country-specific shocks originating from exchange rate movements and imperfectly coordinated monetary policy will obviously vanish automatically.

The issue is still open. De Grauwe and Mongelli (2011) consider that although some moments remain uncertain paradigm of endogeneity of OCA will tend to prevail. Handler (2013) finds more evidences in the favour of clustering. Mongelli (2013, 5) points out that "the euro has accelerated a process of concentration and specialization". Obviously, it will take time and more research to the make an overall conclusion. A review of empirical studies on the topic will be made in section 3.2.

2.4.Post-crisis studies

After the global financial crisis of 2008-2009, the number of euro-pessimists has grown considerably. Given high degree of heterogeneity in the euro area, even symmetric shock was transmitted to the individual economies in very different ways, exacerbating the crisis and restricting the possibilities of applying a common monetary policy. Hence, a number of issues concerning the euro area sustainability have been brought to the forefront during and after the crisis. The issue is still relevant, as no "remedy" has yet been found. In support to it, we can name a recent paper of the leading European think-tank dealing with the issue of adjustment mechanisms in the euro area (Van Beers *et al.*, 2014), which will be discussed later in this chapter.

Making a review of post-crisis studies it is sometimes difficult to draw the line between the theoretical and empirical studies, as we are primarily interested in applying the theory to the euro area. The crisis was a "crash-test" for the euro area, passed but with some qualifications. The most pessimistic prognoses were not justified; the euro area did not fall apart. However, it has become clear that the endogenous forces are rather slow to absorb negative effects of shocks and the discussion has returned to the beginning – to the OCA properties. It is vitally important for a monetary union that OCA properties are fulfilled, points out Handler (2013).

The euro area is unique. It has a strong single market, a strong single currency, but modest political union (Mongelli 2013). It is not like US, but still can be viable and beneficial for its members. Mongelli points out that "while the crisis is a traumatic wake-up call, it is also a catalyst for change" (2013, 4).

2.4.1. Lessons from the crisis

What was the last financial crisis about? Mongelli (2013) answers that the crisis was not a monetary crisis. It was not a fault of euro, but exacerbation of various imbalances, including persistent budget deficit, rising current account deficit and feeble productivity growth. The euro on the contrary "can act as a shield against outside shocks [..] and foster internal stability" (Mongelli 2013, 6).

One of the main lessons of the recent crisis is that the differences between countries matter. Homogeneity of the economies has never been considered a prerequisite for adopting a single currency within the framework of the classical optimum-currency-area approach. However, heterogeneity in economic development can explain different effect on output, revealing different levels of vulnerability and resilience across the European countries (Kondor and Staehr 2011). On the data set of 27 European countries, Kondor and Staehr (2011) demonstrate that the main determinants of different economic performance after the financial crisis are financial leverage and financial deepening (measured by private loan growth, current account deficits, loans-to-deposits and the net international investment position) and intensity of trade. While level of financial depth, government deficits and degree of overheating of the economy (measured by the real effective exchange rate, inflation) do not seem to affect output negatively.

Some considerations regarding heterogeneity are provided in Ciccarelli *et al.* (2012). "First, although heterogeneity across countries matters, a common evolution of business cycles around the world remains a prominent feature of the data. [..] Second, financial shocks matter in the explanation of real developments and, perhaps more importantly, they spill over in a heterogeneous way across countries" (Ciccarelli *et al.* 2012, 23).

Two top-priority questions that the theory of optimum currency areas used to consider at the pioneering stage are the following. What are the preconditions of forming a sustainable monetary union? What costs and benefits are associated with the membership in a monetary union? After the crisis, the main question is what makes a currency area sustainable and effective? What are the most effective adjustment mechanisms under the crises?

Mongelli (2013) points out that under the crisis, a common crisis management and resolution framework is needed, as insurance mechanisms appropriate in "peaceful" environment do not apparently suit during the time of crisis. Tools for enhanced economic policy coordination proposed by the European Commission include broader macroeconomic surveillance and further fiscal policy coordination (Kondor and Staehr 2011). Below we will examine the adjustment mechanisms that could make the euro area more sustainable.

2.4.2. Adjustment mechanisms

After the crisis, the number of Eurosceptic has increased and some researchers consider the breakdown of the euro area to be the most probable future scenario. The euro area is a union of very dissimilar countries at different development stages without a central fiscal authority, without any enforcement of budget discipline and without deepening the economic convergence (Bergsten 2012). Moreover, heterogeneity was increasing due to the enlargement of the euro area on account of peripheral countries. However, Mongelli (2013) believes aggravation of the heterogeneity to be a temporary phenomenon, a side effect of the financial crisis. Besides, economic non-homogeneity may exist within a single nation as well.

Nevertheless, one of the core problems of the euro area is the problem of asymmetric shocks. There are two alternatives. Either idiosyncratic adverse shocks should diminish (issue of synchronization will be discussed in chapter 3) or there should be insurance mechanisms enabling to absorb shocks. There are a few adjustment channels available to a member country in a monetary union.

Handler (2013) proposes a few options that may have to be applied in succession:

- Lender of last resort is needed to provide liquidity and prevent immediate meltdown of the financial markets.
- Increase in flexibility of wages and prices is desirable to remain competitive.
- Structural reforms will help to lift productivity in a long run.

To improve external competitiveness through reducing labour costs, an alternative to the second option could be a "fiscal devaluation". It can be attained by switching the tax burden from companies to households, *i.e.* raising VAT and applying it uniformly to all goods and services, and eliminating payroll taxes at all or allowing firms to expense them fully against VAT. These methods were successfully applied in Argentina in 2001 (Cavallo and Cottani 2010).

The last option, structural reforms, refers to national adjustment measures concentrated on education and innovation and supra-national advancements towards establishing fiscal and political union (Handler 2013). Overall, Handler believes that the euro area must pay particular attention to improving on the compliance with the OCA criteria or establish a fiscal union, since a currency union without a fiscal union is likely to fail.

Van Beers *et al.* (2014) consider external adjustment channels. There are four of them:

- extent of similar economic evolution;
- labour and capital mobility;
- financial diversification and financial integration;
- transfers among the countries.

Economic similarity or extent of similar economic evolution refers to synchronization of business activities across the countries. We will discuss the extent of synchronization in Europe in section 3.2.

The second factor, labour and capital mobility is a property of an OCA suggested as the basic one by Mundell (1961) and discussed in subsection 2.1.3.2. Van Beers *et al.* (2014, 45) point out that migration in the EU countries has traditionally been less important channel of absorbing shocks than in the US; they find that the situation has improved, but levels of migration in response to shocks is still less than the one in the US.

The third factor that can smooth adverse shocks is financial diversification and financial integration. If assets of a country are being partially hold by foreigners, private holders or governments, the costs of the shocks in terms of changes in assets prices will be shared among

the countries. It can also take a form of an easier access to a credit from a foreign bank. Van Beers *et al.* (2014, 33) point out that capital markets in the EMU have become much more integrated since the introduction of the euro, however, the role of this cross-border ownership in insuring country-specific output shocks is still weak compared to the US, where it is one of the most important channels of insurance. It is worth mentioning that the role of this channel has decreased during the recent years (Beers *et al.* 2014).

The fourth channel – explicit transfers among the countries – refers to financial assistance to banks and moving towards the Single Supervisory Mechanism (SSM). Van Beer *et al.* (2014, 46) note that a preliminary analysis shows that the money flows among countries for bank restructuring will be modest. In the next section, we will make a review of the empirical studies of the euro area with the focus on the studies of business cycles.

3. STUDIES OF BUSINESS CYCLE SYNCHRONIZATION

As was discussed in subsection 2.1.4, when a country enters a monetary union it gives up its independent monetary policy, a tool, which could be used to counteract negative economic disturbances on output and employment. If the economies of the member countries are synchronized, there would be no obstacle to implementing a common monetary policy. If not, if business cycles are diverged, the impact of adverse shocks can be smoothed by insurance mechanisms like labour mobility, financial integration and explicit transfers. Under rather weak integration of financial markets and insufficiency of alternative mechanisms, asymmetric business cycles remain an acute problem, directly connected to the issue of sustainability of the monetary union.

In this chapter, we will examine the empirical studies on synchronization of business cycles and on the factors determining business cycles co-movements in the euro area and in the European Union as a whole.

3.1. Methodology

Two blocks of questions go together with business cycle studies. The first one is methodological: how do we measure the economic activities and how do we measure synchronization of the economic activities across the countries. The second block concerns the causes of convergence or divergence of business cycles.

The first issue concerns the data used. Two most important variables are quarterly data on GDP and monthly data on industrial production (IP). The latter represents less than 20% of aggregate output, so it could not be representative *a priori*. Besides, manufacturing output is much more volatile. Unemployment rate can be used for its more availability on regional levels (Fatás 1997), or inflation rates and consumption along with GDP can be used to assess co-movements of economic activities (Kolasa 2013, Van Beer *et al.* 2014).

Most researchers use as a measure of business activities deviations of output from trend, these deviations, or output gaps, are being usually referred to as deviation cycles. These kind of changes in economic activities are usually a result of shocks, e.g. shocks caused by fiscal policy, monetary policy, technological changes, or even weather. As de-trending techniques aimed at segregating cycle component are used first differences and non-parametric filters such as the Hodrick-Prescott (HP) filter, the Baxter-King, and the Christiano-Fitzgerald filters, and phase average trend (PAT). Another approach is to use time series models, e.g. (switching) vector autoregression (VAR or SVAR) models to identify supply and demand shocks (Bayoumi and Eichengreen 1992, Bataa *et al.* 2009) or dynamic factor models (Forni *et al.* 2000). Sometimes cluster analysis is used (Artis and Zhang 2001). The problem is that neither of these approaches are based on a macroeconomic model (Kolasa 2013).

To measure synchronization, most studies use simple (Pearson) correlation coefficient on the cycle part of GDP. The other measures are dynamic correlation measure, the phase-adjusted correlations, the concordance index, vector autoregression models, and wavelet analysis. The simplest solution to judge co-movements over time is to compare correlation in two periods, before and after. A more sophisticated approach is to use rolling windows to assess correlation changes over time. There are different approaches regarding countries included in the sample, benchmarks and sub-periods examined. Studies on business cycles in the euro area can be divided into studies on business cycle synchronization and studies examining determinants of synchronization. We will consider them separately.

3.2. Synchronization

Different studies on business cycles come to diverging conclusions. Referring to literature reviews, e.g. Broz (2005), De Haan *et al.* (2008a), Gouveia and Correia (2008), Bencik (2011), Handler (2013) and some individual papers that we will discuss later, we conclude that there are more empirical evidences that business cycles in the euro area are aligned to some extent and the synchronization of (some) European countries has increased after 1991. While De Haan *et al.* (2008a) points out that there is no common European cycle, more recent studies find strong convergence of the European business cycles, including the business cycles of less integrated CEE countries. There are, however, a few issues needed to be mentioned.

3.2.1. Core versus periphery

The first peculiarity of the euro area that should be noted is that the core countries are synchronized more compared to periphery. Core countries are Germany and France; sometimes Italy is added to the list. Periphery includes Greece, Portugal, Finland, Ireland, and Central and Eastern European countries (CEE); some authors add here Spain.

For instance, Bayoumi and Eichengreen (1992) point out that the core countries of the euro area are tightly synchronized while the periphery is much more diverged. Darvas and Szapary (2004) using the sample of data for EMU and CEE, point out that the extent of synchronization is very high within the core countries, even for consumption and services; while periphery is catching up, with Baltic States not synchronized at all. Gouveia and Correia (2008) having examined the period of 1980 – 2004 argue that after adopting the euro in 1999 larger countries have been increasingly synchronized, with one exception for Spain. Results for smaller countries are mixed; "outsiders" are Finland, Greece, Portugal, to lesser extent Belgium and Netherlands. An important observation is made concerning the fact that degree of synchronization varies over time. Aguiar-Conraria and Soares (2011) corroborate with empirical evidence that Germany and France are tightly synchronized, while Portugal, Greece, Ireland, Finland, and CEE countries are not; they observe that business cycle dissimilarities are highly correlated with geographical physical distances. Bencik (2011) shows that V4 countries (Czech Republic, Hungary, Poland, and Slovakia) are not synchronized with the euro area average before 2001; after 2001, correlations are positive. Lehwald (2013) observes that after the inception of the euro area, the synchronization has increased for the core countries and decreased for periphery. According to Gogas (2011), the synchronization has become stronger in the euro area, and has not weakened after the adoption of the euro. Both Kolasa (2013) and Stanisic (2013) focusing mostly on the CEE countries, find that there is no common CEE business cycle, but there is convergence trend towards the euro area. Benczúr and Rátfai (2010) investigate if there is a common pattern in CEE business cycle fluctuations. Is CEE a homogenous group or CEE countries need to be assessed on the individual basis? They provide evidence (sample data 1993 – 2004) that output in CEE countries are more volatile than in developed economies and that many CEE countries demonstrate similar cyclical behaviour towards developed countries. A correlation between high volatility and high inflation is found to take place. Having studied co-movements of output, inflation and consumption among the euro area countries, Van Beers *et al.* (2014, 14) find that co-movements of real GDP per capita

among EMU countries in the period 2002 – 2012 is on average slightly stronger than that among US states.

As one can see, Krugman's pessimistic scenario discussed in subsection 2.3.1 has not yet materialized in the euro area. That does not prove, however, that the specialization theory is not correct. It may be due to the insufficient degree of economic integration, and when the euro area is integrated more, the production will begin to specialize.

3.2.2. Components of business cycle

Another observation is that euro area is strongly linked with US, Canada and UK from 1992 onwards (Bataa *et al.* 2009). Darvas and Szapary (2004, 24) support this observation, pointing out that the reason why the increasing synchronization across the EMU countries cannot be unambiguously interpreted as endogeneity of OCA is that "non-EMU European countries and even US and to some extent Japan and Russia have also shown greater co-movement with the euro cycle". Amongst the studies aimed at detection of global (or common), industry-specific, and idiosyncratic shock components we would like to mention Clark and Shin (1998) who show that the common component across the states in the US is much larger than the one in Europe; besides, industry-specific shocks are significant part of the common fluctuations. Thus, various studies agree that business cycles are not just country-specific phenomena (De Haan *et al.* 2008a).

In a recent study of Van Beers *et al.* (2014) we can find the same observations that a convergence in many economic indicators has occurred more widely in OECD countries, not only in the EMU. Co-movements were more synchronized directly after adopting the euro and have decreased after the crisis. The last evidence leads us to the next point.

3.2.3. Fluctuations in correlation

An important factor that should be taken into consideration is that periods of greater and lesser synchronization tend to alternate (De Haan *et al.* 2008a). For instance, Inklaar and De Haan (2000, 8) find that most European countries show an increase in the correlation during the period 1971 – 1979, while in the period 1979 – 1987 the correlations decline. These findings are supported by Massmann and Mitchell (2003, 5), who using the 40 years data find that that the euro area has been characterised by periods of convergence and periods of divergence; they

also find the euro area has “switched” between periods of convergence and divergence many times in the last 40 years. Massmann and Mitchell’s periodization is consistent with the one of Inklaar and De Haan (2000), *i.e.* mid to late 1980s seems to be a period of low correlation between the countries of the euro area. These findings are not consistent, however, neither with those of Artis and Zhang (1997, 1999), nor with observations of Gouveia and Correia (2008), who find that correlations increase over time.

Van Beer *et al.* find that “although country specific shocks did decrease in the intermediate aftermath of the creation of the euro, since the financial crisis new divergence has emerged between business cycles in various regions in the EMU” (Van Beer *et al.*2014, 45). The dataset is, however, too small to make far-reaching conclusions. One can say that either the convergence of business cycles in the euro area is cyclical itself, or the low correlation in 1980s is irrelevant fluctuation, that waits to be explained. Howbeit, considering synchronization of the economic activities in the past, we want to be able to predict their movements in the future. We can recall in this context the Goodman’s (1983) “grue” colour, which refers to an object that is green before the time *t* and is blue after the time *t*, while the time *t* is somewhere in the future. Thus, seeing a green object, one could never be sure is it green or grue. We are more or less in the same situation with the synchronization of business cycles, even if we take it as a given that business cycles do synchronize in the euro area.

3.2.4. Summary

The main conclusions can be made as follows.

- Correlations between the core countries of the euro area are very high.
- The periphery is not synchronized with the core of the euro area, but the trend is positive.
- The synchronization of economic activities has increased since mid 1990s.
- Business cycles are not country-specific phenomena; besides idiosyncratic component, they include common (global) and industry-specific components.
- The extent of business cycle synchronization may vary over time.

Having considered main patterns in business cycle synchronization in the euro area, further we are going to discuss determinants of business cycle synchronization.

3.3. Determinants of synchronization

A question of interest concerning business cycles is the question about determinants of business cycle convergence or divergence. At present, there is no single model that could successfully explain the movements of business cycles across the euro area. Among the basic factors driving business cycle synchronization are named (i) bilateral trade (Frankel and Rose 1997), (ii) similarity in industrial structure (Imbs 2004), (iii) capital market integration (Imbs 2006, Kalemli-Ozcan *et al.* 2001, 2003), (iv) fiscal convergence (Clark and van Wincoop 2001, Darvas *et al.* 2005), (v) monetary integration (Fatás 1997, Rose and Engel 2000, Gächter and Riedl 2013, Van Beer *et al.* 2014,). We will consider them one by one.

3.3.1. Trade intensity

Trade can influence business cycle synchronization in different ways. As was discussed in section 2.3, according to the classical trade theory, openness could lead to increased specialization in production and inter-industry trade pattern. Thus, if negative disturbancies are sector-specific, increased trade will decrease business cycle synchronization. However, if shocks affect all industries, then increased trade will lead to increased business cycle correlation even at high degree of specialization. Similarly, if trade is dominated by intra-industry trade, *i.e.* countries do not specialize, then an increase in trade will correlate with more synchronized business cycles.

Frankel and Rose (1997) try to gauge the impact of lower trade barriers on the co-movements of business cycles across countries. They demonstrate that lower trade barriers lead to more intensive trade, and the effect of greater intensity of international trade on the correlation of economic activity is strongly positive and statistically significant. We can assume that economic integration leads to an increase of intra-industry trade. It is worth mentioning that Frankel and Rose (1997) acknowledge that inter- and intra-industry trade can affect business cycle synchronization both ways, but focus on the net effect of total trade on output co-movement.

De Haan *et al.* (2008b) using 21 OECD countries data during 1970 – 2003 confirm the trade effect on business cycle synchronization but demonstrate that it is much smaller than it was previously reported. They also bring empirical evidence that other factors, specialization, financial integration, and similarities of economic policies, have the same impact on the

business cycles as trade intensity. Inklaar *et al.* (2008) note that countries with tight trade relations are likely to have similar economic policies, which can influence business cycles along with trade; they point out that because Frankel and Rose (1997) did not specify a full model, the impact of trade on output correlation is overestimated.

Baxter and Kouparitsas (2005) are looking for the explanations of co-movements of business cycles. They also find that the more countries trade with each other, the more their business cycles are synchronized. They prove that while bilateral trade between countries is robust variable as a determinant of business cyle co-movements, sectoral structure and monetary unions are not. Baxter and Kouparitsas stand on the position of the classical trade theory and consider trade as "a conduit for the transmission of shocks that affect all industries" (Baxter and Kouparitsas 2005, 122).They demonstrate, that bilateral trade is robust even if the gravity variables are included in the regression. This is important as it indicates that trade matters for business cycle correlation independently of the effect on trade occuring through the gravity variables.

Clark and van Wincoop (2001), Gruben *et al.* (2002), and Calderon *et al.* (2007) also confirm Frankel and Rose's (1998) general conclusion that increased trade and business cycle synchronization are positively correlated, but according to their findings, the trade effect on business cycle correlation is considerably smaller than the one found by Frankel and Rose. While Frankel and Rose (1998) examine the effect of the total net trade on business cycles, Gruben *et al.* (2002) split data into inter-industry and intra-industry trade. They use them both in regression and claim that the effects of both variables are different: intra-industry trade has a positive effect and that the effect of inter-industry is insignificant. Inklaar *et el.* (2008) argue against this statement, bringing evidence that correlation between inter- and intra-industry trade is very high; hence, it is not appropriate to include these two variables into the model.

Gächter and Riedl (2013) confirm not only Frankel and Rose's conclusions about correlation of trade and business cycle synchronization, but also the magnitude of the trade effect on business cycles.

3.3.2. Financial integration and industrial similarity

Capital market integration is a part of monetary integration, as the latter implies not only a common currency, but the financial integration as well, understood as "a unified capital market with no geographic restrictions of any kind on capital movements (or rewards to capital)

within the area" (Corden 1972, 2). It should be noted that financial integration is still weak in Europe (Van Beer *et al.* 2014).

Kalemli-Ozcan *et al.* (2001, 2003) provide evidence that risk sharing through integrated capital markets and industrial specialization are positively correlated, that in turn leads to less symmetric outputs. They argue that it is not an argument against economic integration. On the contrary, it is an argument *pro*, as more asymmetric outputs do not necessarily mean more asymmetric income shocks, which can become even more symmetric due to diversification of portfolios.

Imbs (2004) comes to somewhat different conclusions. He points out that "a variety of alternative measures of financial integration suggest that economic regions with strong financial links are significantly more synchronized, even though they are also more specialized" (Imbs, 2004, 723). Imbs reports that the positive direct effect of finance on synchronization dominates the negative, indirect one, working via higher specialization (see Figure 4).

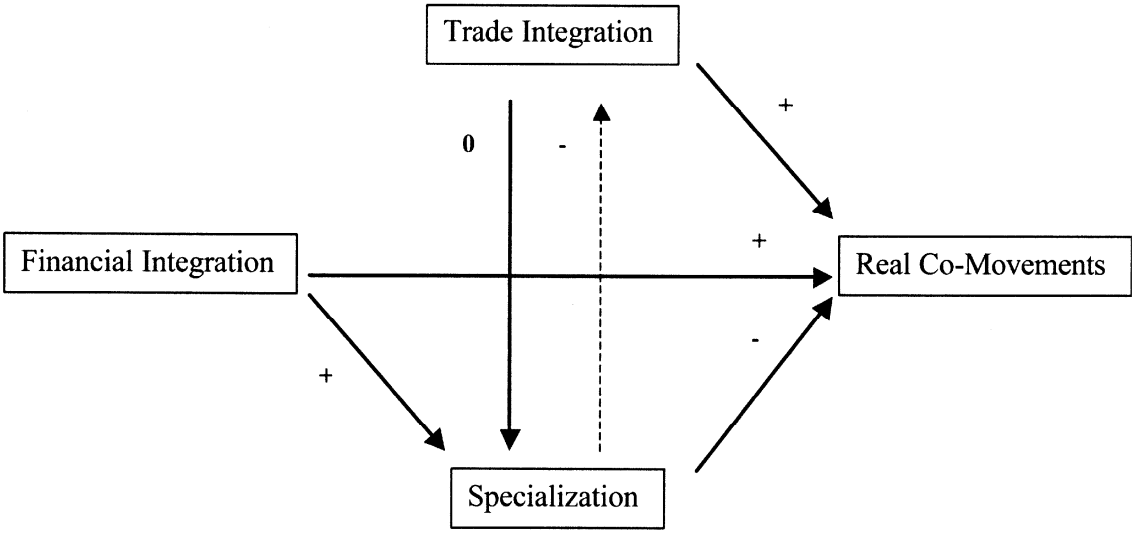

Figure 4. Direct and in-direct channels
Source: Imbs (2004)

Imbs (2004) also finds that financial integration has positive effect on consumption correlations. Another finding is that industrial similarity is associated with output correlations. Baxter and Kouparitsas (2005) do not confirm Imbs's results. Using a dataset that includes over 100 countries, they find that a variable of industrial similarity is not robust.

Another important channel through which economies can affect each other is foreign direct investments (FDI). Jansen and Stokman (2004) bring evidences that international business cycle linkages in 1995 – 2001 can be explained by FDI linkages among the countries.

3.3.3. Monetary integration

Economies in a monetary union may become more synchronized due to the commonality of monetary policy conducted by the unified Central Bank. However, monetary integration may have an opposite effect, *i.e.* may lead to less synchronized business cycles due to the absence of exchange rate mechanism as a shock absorbing mechanism (De Haan *et al.*, 2008a).

Gonçalves *et al.* (2009) using sample period 1980 – 2007 and difference-in-difference technique, provide empirical evidence that adoption of the euro has a significant positive effect on the business cycle synchronization across the member countries. Importantly, they demonstrate that the "euro effect" is not consequence of increased trade between countries as changes in trade are seen to be negatively correlated with changes in output.

Gächter and Riedl (2013) point out some weaknesses in Gonçalves *et al.* (2009) methodology. However, Gächter and Riedl (2013) come to the similar conclusions. Using an index, which allows observing business cycle synchronization on a year-by-year basis (sample period 1993 – 2011), they provide empirical evidence that the adoption of the euro has significantly increased the correlation of member countries' business cycles. Confirming the strong trade effect on business cycle synchronization found by Frankel and Rose (1998), Gächter and Riedl (2013) find that the "euro effect" is more than a half of the effect of trade integration. They conclude that "the lack of country-specific monetary policy shocks seem to smooth business cycles" (Gächter and Riedl 2013, 25). Thus, the assessment whether a country is an appropriate candidate for a currency union should not solely rely on an *ex ante* examination of business cycle synchronization.

Rose (2000) provides evidence that a common currency has very large positive effect on the intensity of trade. De Haan *et al.* (2008a) report that the other studies (Melitz 2001), Persson (2001) prove the effect to be much more modest. Rose and Engel (2000) demonstrate that business cycles across countries in a currency union are more synchronized than business cycles in countries with sovereign monies, but less synchronized than regions in a country. Baxter and Kouparitsas (2005) find that currency union is not robust predictor of business cycle

correlation; it is significant only if other variables are not included in the regression. Van Beer *et al.* (2014), having compared convergence between EMU countries and US states, suggest that increased co-movements in the Europe is partly due to the monetary union.

3.3.4. Fiscal convergence

European countries are qualified for entering the euro area on the basis of convergence criteria enshrined in Maastricht Treaty (1992), concerning target inflation, long-term bond yields, exchange rates, government debt, and government budget. Darvas *et al.* (2005) point out that Maastricht criteria have nothing to do with the properties or prerequisites of an optimum currency area, the direct correspondence is poor, and they ask if there is *indirect* connection. Using a panel of 40 years of annual data that includes 21 countries, Darvas *et al.* (2005) demonstrate that countries with divergent fiscal policies tend to have less synchronized business cycles. Another empirical regularity is that reduced levels of budget deficit tend to increase synchronization. In other words, fiscal convergence is associated with more synchronized economic activity. Hence, Maastricht criteria move the euro area members closer towards an optimum currency area, since imposed fiscal convergence – similarity on aggregate budget deficits at low levels – tends to synchronize business cycles.

Darvas *et al.* (2005) note that there is no theoretical model linking fiscal convergence and business cycle synchronization. They find it easy to understand, however, that irresponsible behaviour, *i.e.* running high budget deficits, is often a source of idiosyncratic shocks. If it is so, then reducing budget deficit will reduce the scope of idiosyncratic fiscal shocks. “Maastricht mimics Mundell!” (Darvas *et al.* 2005, 19). These conclusions correlate with findings of Artis and Zhang (1997, 1999) on monetary discipline as an important factor that makes business cycles synchronize.

3.3.5. Summary

Having considered different possible determinants of business cycle synchronization, we can make the following conclusions.

- Trade intensity is highly correlated with business cycle synchronization; magnitude of trade effect on business cycles is however ambiguous.
- Inter- and intra-industry trade are apparently correlated.

- We may assume that in the euro area intra-industry trade pattern prevail.
- Financial integration impact on business cycle synchronization is ambiguous.
- Due to the commonality of monetary policy, business cycles tend to synchronize in a monetary union.
- Fiscal convergence imposed by Maastricht Treaty seems to synchronize business cycles.

Co-movements of business cycles in the euro area need some further investigation, particularly in the enlarged euro area, as we have seen in subsection 3.2.1 the periphery of Europe is much less synchronized than the core. In the next chapter we will consider business cycle synchronization of eight Central and Eastern European countries. We will see if there is a CEE business cycle, are business cycles of the CEE countries synchronized with the euro area, what trends can be seen in the business cycle co-movements.

4. BUSINESS CYCLE SYNCHRONIZATION IN CENTRAL AND EASTERN EUROPEAN COUNTRIES

As was discussed in previous chapters, business cycle synchronization is a very relevant issue for the euro area, particularly for the enlarging euro area since the more new members it adopts the more heterogeneous it becomes. As was discussed in section 2.4, the recent financial crisis has revealed that heterogeneity of member states can be a serious problem for the sustainability of the euro area. It is an important issue particularly now, in the transition period, when alternative adjustment mechanisms are not available in full. Having considered synchronization studies in section 3.2, we would like to focus on the Central and Eastern European countries as the least examined in the literature compared to the old members of the European Union. Not all of the CEE countries are members of the euro area, but sooner or later they all have to joint it; that is why the question whether their economies are synchronized or not is of great importance.

As we have discussed in section 2.3, there is no unambiguous answer to the question whether further economic integration in the euro area will lead to more synchronized or desynchronized business cycles. We have pointed out in subsection 3.2.1, that there are strong empirical evidences that periphery of the European Union is less synchronized in comparison with the core countries. In this chapter, we would like to examine the topic using the most recent data and focusing on the CEE countries to check out whether their business cycles have become more synchronized after joining the European Union.

4.1. Data and methodology

In this chapter, we examine synchronization of business cycles in the CEE countries using one of the most often used methods (Artis and Zhang 2001), *i.e.* cross-correlations of the cycle component of output. To make the analysis more robust we compare obtained data with cross-correlations of unemployment rates in the same countries. The insight to use

unemployment rates as an economic activity measure is received from the paper of Fatás (1997), mentioned in section 3.1. We employ quarterly real GDP data, seasonally adjusted and adjusted by working days, and quarterly unemployment rates from the Eurostat database. The data comprise eight CEE countries, namely Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, and Slovenia that joined European Union in 2004. We do not include in our sample neither Romania and Bulgaria joined EU in 2007 nor Croatia joined EU in 2013. Four of eight countries (Estonia, Latvia, Slovakia, and Slovenia) are members of the euro area. Hereinafter, word-combination "CEE countries" refer only to the above-mentioned eight countries.

We examine data during period 1996Q1 – 2013Q4. Data on unemployment is available for period 2000Q1 – 2013Q4. To track the dynamics of business cycle synchronization we divide examined period into five sub-periods for GDP and 4 sub-periods for unemployment data. The sub-periods are:

- 1996Q1 – 1999Q4 – transition period from planned to market economy (only for output)
- 2000Q1 – 2004Q1 – movement towards integration with the European Union
- 2004Q2 – 2007Q4 – accession to the European Union
- 2008Q1 – 2010Q2 – global financial crisis
- 2010Q3 – 2013Q4 – post-crisis recovery

The main aim of this rather conventional division into sub-periods is to track dynamics of integration and to extract crisis years into a separate group. Besides, we use a moving window technique with the same objective – to assess the trends in business cycle synchronization across the countries. Moving window method consists of the following. We calculate correlation coefficients not for the whole dataset but for the first *n* values of our sample. In our case, moving window comprises data of four years, *i.e.* 16 quarters. Then we exclude from the window the very first pair of values and include the next one, in our case the 17^{th} pair of values and so on. Thus, we move until the end of the dataset, and as a result, we have a series of correlation coefficients between a pair of countries that clearly illustrates a trend in business cycle co-movements.

As a control group, we include in the samples cycle component of the aggregate of the euro area, aggregate of Germany, France, Italy (GIF), three biggest European economies, and

United States, keeping in mind global component of business cycles. The number of observations is 792 for output sample and 550 for unemployment sample.

As was discussed in section 3.1, one of the most widely used in business cycle studies de-trending techniques is Hodrick-Prescott filter (HP). We apply HP filter with recommended for quarterly data λ=1600 to our GDP data, having previously taken natural logarithm. We exploit standard procedure used in the majority of studies, *i.e.* we apply filter once and then subtract derived trend from the original data series to obtain cycle component. Afterwards, we compare these cycle components across the countries and regions using Pearson correlation. Data on unemployment is not processed and used as it is.

4.2. Results

Referring to studies of Stanisic (2013) and Kolasa (2013), discussed in subsection 3.2.1, we have pointed out that there is no common business cycle in the CEE countries. Our results confirm this observation. Figures 5 and 6 show business cycles in CEE countries derived with the technique of HP filter from the output data. Individual graphs can be found in Appendix 2.

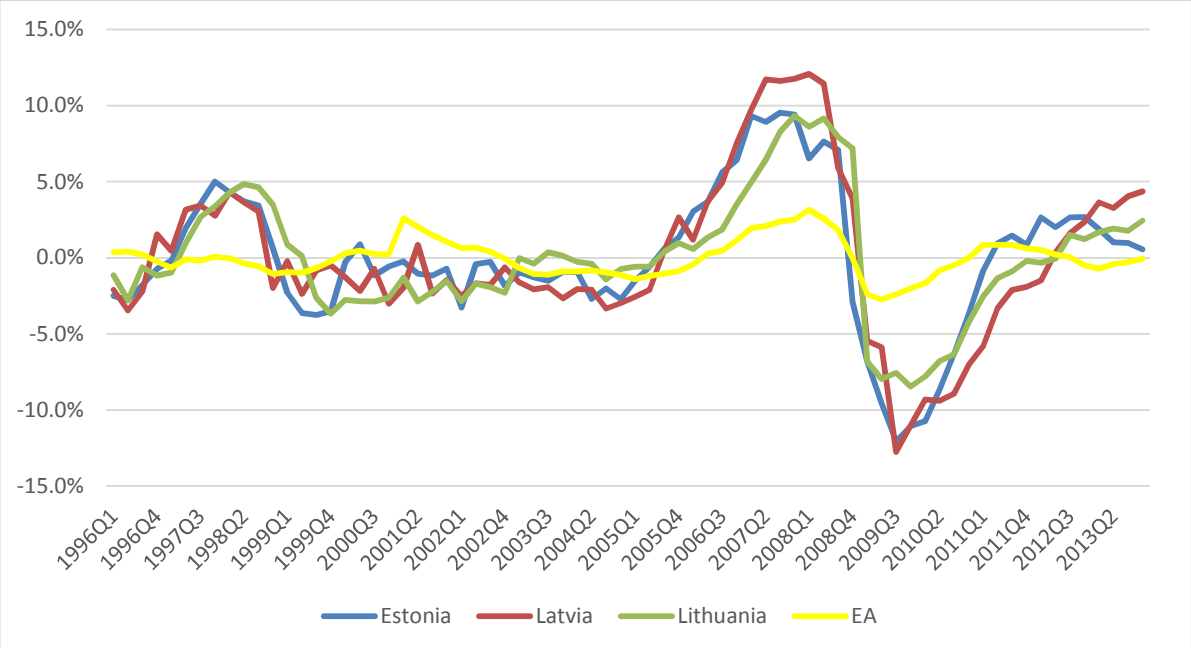

Figure 5. Output gaps in Baltic States and in the euro area
Source: Appendix 1

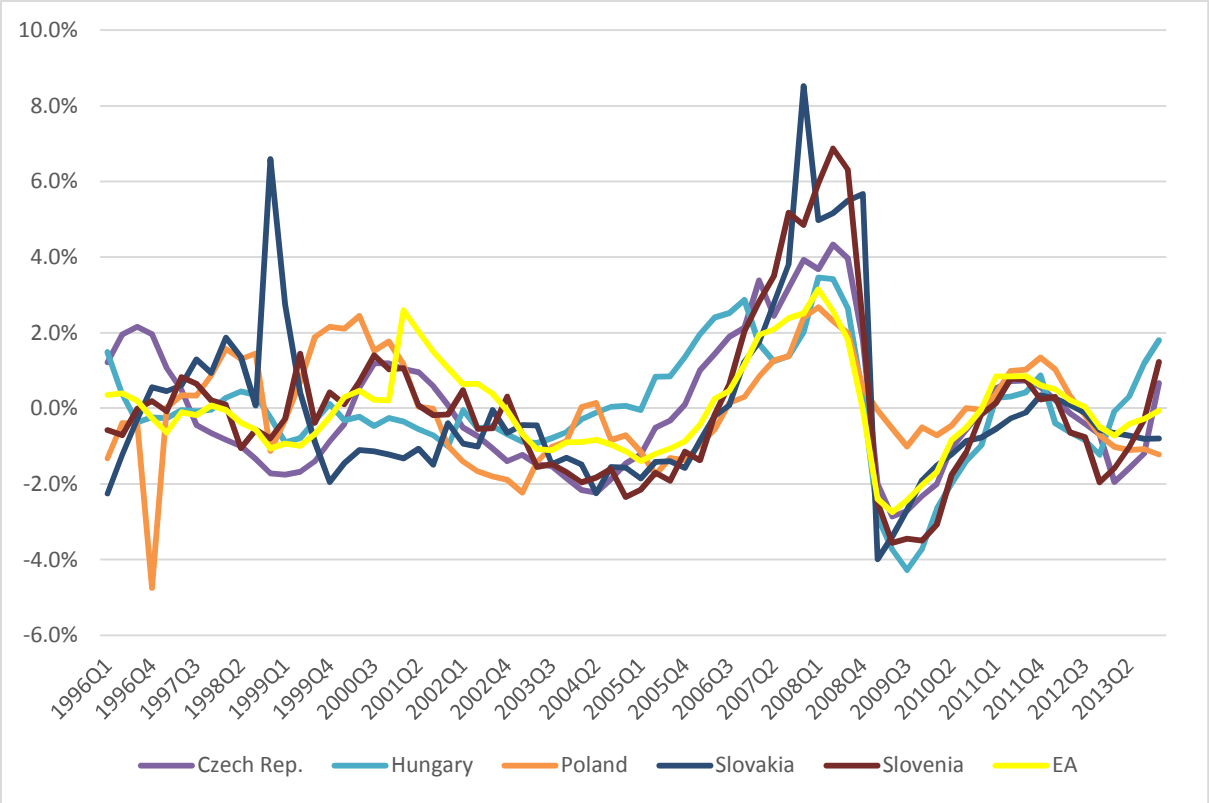

Figure 6. Output gaps in Czech Republic, Hungary, Poland, Slovakia, Slovenia and in the euro area
Source: Appendix 1

The graphs demonstrate different patterns of economic activities in the CEE countries (see also Appendix 2). Besides symmetric negative shock in 2008-2009 with concomitant drastic decline in output, we can see quite diverse reactions to Russian banking crisis of 1998 and desynchronised movements of output between and after the crises. These observations do not conflict with logic as the CEE countries have different backgrounds, different growth and inflation rates, and different paths of economic development. For instance, while Baltic States have chosen austerity policy during and after the recent financial crisis (Staehr, 2013), the rest of the CEE countries have preferred milder policies to help their countries to come out from the crisis.

The output of the CEE countries is generally more volatile than the output of the euro area. While the standard deviation of the euro area's cycle component is 0.012, standard deviation of cycle component in Baltic States is between 0.040 and 0.052. Poland, Hungary, and Czech Republic are closer of all to the euro area. Their standard deviations fluctuate between 0.014 and 0.017. Slovakia and Slovenia is somewhere in between with standard

deviations 0.023 and 0.021 respectively. The same picture gives us the growth rates of the CEE countries during the examined period (see Table 2).

Table 2. Average annual growth rates

GEO/TIME	96Q1-99Q4	00Q1-04Q1	04Q2-07Q4	08Q1-10Q2	10Q3-13Q4	96Q1-13Q4
EU (28)	2.9	2.1	2.8	-1.3	0.7	1.7
EA	2.7	1.7	2.5	-1.2	0.2	1.4
Czech Republic	0.7	3.4	6.2	-0.6	0.5	2.3
Germany	1.8	0.9	2.4	-0.6	1.5	1.3
Estonia	6.2	7.6	7.4	-7.3	4.5	4.6
France	2.8	1.7	2.2	-0.9	0.9	1.5
Italy	1.5	1.5	1.3	-2.0	-1.1	0.5
Latvia	6.3	7.0	9.2	-9.7	4.8	4.6
Lithuania	4.1	7.5	8.2	-5.7	4.2	4.4
Hungary	3.2	4.0	2.7	-2.3	0.6	2.0
Poland	5.5	2.9	5.4	2.8	2.7	4.0
Slovenia	5.5	3.4	5.5	-2.4	-0.3	2.8
Slovakia	3.1	4.3	8.9	-0.5	1.9	3.8
US	4.6	2.3	2.6	-0.7	2.3	2.5
CEE average	4.3	5.0	6.7	-3.2	2.4	3.6

As one can see from the Table 2, the most high growth rates (both positive and negative) have Estonia, Latvia, and Lithuania. Poland is the forth, Slovakia and Slovenia follow after, and the lowest growth rates among the CEE countries have Czech Republic and Hungary, but their growth rates are still in average higher than the growth rates of the euro area. High growth rates in the CEE countries owe to so-called “catching-up” process accompanied with inflows of capital and current account deficits. That resulted in the drastic decline in economic activities later, during the crisis; in the Baltic States above all, where the numbers of budget deficit and net foreign liabilities were particularly high (Staehr, 2013).

Hence, CEE countries are in general faster growing countries compared to the euro area and their output is more volatile. In the next subsections, we will consider the synchronization of business cycles in the Central and Eastern Europe and trends in economic integration, using correlation analysis of output gaps and moving window method. Besides, we will examine unemployment as a measure of economic activities.

4.2.1. Output gaps

We are going to get an estimation of synchronicity of business cycles using correlation analysis. Tables 3 – 7 present cross-correlations of output gaps in CEE countries and the euro area during the period 1996Q1 – 2013Q4, divided into sub-periods. For full tables of cross-correlations, which include core countries of the euro area and the US see Appendix 3. Statistically significant positive correlations are marked with light green, statistically significant negative correlations are marked with light red, correlation coefficients bigger than 0.8 or less than (0.8) are marked with bold.

As one can see from the Table 3, business cycles of the CEE countries during the first sub-period 1996 – 1999 are not synchronized; 16 out of 36 coefficients are negative, which may imply that the countries are at different stages of the business cycle. Only Baltic States are positively correlated with each other, Estonia being more strongly correlated with both Latvia and Lithuania (correlation coefficients 0.855 and 0.866 respectively), than Latvia and Lithuania with each other (correlation coefficient 0.669). Hungary and Czech Republic are positively correlated with aggregate of the euro area, having correlation coefficients 0.637 and 0.708 respectively. Although, as we can see correlation is not very strong. It is a period of transition from planned to market economy. Notwithstanding Russian banking crisis in 1998, which has negatively affected the majority of the CEE countries, it is a period of high growth, average annual growth rate in our sample is 4.3% (see Table 2).

Table 3. Correlations of business cycles during 1996Q1-1999Q4

96Q1-99Q4	*Estonia*	*Latvia*	*Lithuania*	*Czech Rep.*	*Hungary*	*Poland*	*Slovakia*	*Slovenia*
Estonia	1							
Latvia	**0.855**	1						
Lithuania	**0.866**	0.669	1					
Czech Rep.	-0.180	-0.230	-0.460	1				
Hungary	0.197	0.100	0.062	0.296	1			
Poland	0.178	0.233	0.191	-0.574	0.019	1		
Slovakia	0.392	0.176	0.621	-0.456	-0.414	-0.157	1	
Slovenia	-0.071	0.114	-0.160	-0.046	-0.440	0.064	-0.145	1
EA	0.128	0.043	-0.195	0.708	0. 637	-0.102	-0.577	-0.069

Table 4 shows cross-correlations during the next sub-period 2000Q1 – 2004Q1, *i.e.* directly before CEE countries have joined the European Union.

Table 4. Correlations of business cycle during 2000Q1-2004Q1

00Q1-04Q1	*Estonia*	*Latvia*	*Lithuania*	*Czech Rep.*	*Hungary*	*Poland*	*Slovakia*	*Slovenia*
Estonia	1							
Latvia	-0.032	1						
Lithuania	-0.054	-0.306	1					
Czech Rep.	0.269	0.190	-0.705	1				
Hungary	0.049	-0.216	-0.532	0.289	1			
Poland	0.510	-0.049	-0.483	0.653	0.547	1		
Slovakia	-0.043	0.166	0.022	-0.197	-0.404	-0.594	1	
Slovenia	0.111	0.189	**-0.812**	**0.852**	0.445	0.548	-0.045	1
EA	0.176	0.312	-0.595	0.761	0.237	0.310	-0.089	0.644

Czech Republic has strong positive correlation with Slovenia (correlation coefficient 0.852) and statistically significant correlations with Poland and EA (0.653 and 0.761 respectively). Slovenia is to some extent synchronized with the euro area (0.644). Baltic States are desynchronized with the rest of the sample and with each other; their correlation coefficients are mainly close to zero and even negative. Lithuania has strong negative correlations with Czech Republic and Slovenia ((0.705) and (0.812) respectively). Average annual growth rate in the CEE countries during this period is 5.0% (see Table 2). This is the period when the CEE countries are preparing to join the European Union; their business cycles, however, do not show signs of convergence.

Table 5 shows cross-correlations directly after the CEE countries have joined the European Union. All correlations are positive and the majority are very strong. Apparent outlier in this period is Hungary whose correlations with other countries and regions are rather weak. One can also notice high correlations of CEE countries with US economy (see Table 9). However, average correlation between CEE countries and the euro area is 0.90, while average correlation with US is 0.83. Having used Student's t-test, we have found that the difference in correlations between the EA and the US is statistically significant. This is the period of the boom preceding the financial crisis. The average annual growth rate in the CEE countries is 6.7% (see Table 2); while the euro area grows only by 2.0% a year and the US grow 2.6%.

Table 5. Correlation of business cycles during 2004Q2-2007Q4

04Q2-07Q4	*Estonia*	*Latvia*	*Lithuania*	*Czech Rep.*	*Hungary*	*Poland*	*Slovakia*	*Slovenia*
Estonia	1							
Latvia	**0.981**	1						
Lithuania	**0.920**	**0.956**	1					
Czech Rep.	**0.983**	**0.951**	**0.895**	1				
Hungary	0.723	0.654	0.497	0.784	1			
Poland	0.797	**0.844**	**0.904**	0.749	0.364	1		
Slovakia	**0.833**	**0.858**	**0.946**	**0.840**	0.478	**0.891**	1	
Slovenia	**0.942**	**0.964**	**0.979**	**0.905**	0.540	**0.907**	**0.913**	1
EA	**0.959**	**0.971**	**0.959**	**0.923**	0.586	**0.920**	**0.892**	**0.985**

During financial crisis 2008Q1 – 2010Q2 all the countries and regions in our sample are highly correlated with each other (see Table 6). Average correlation coefficient among CEE countries during this period is 0.954, average correlation of CEE with EA is 0.949, and average correlation of CEE with US is 0.931. In the Table 6, we have numerical expression of sharp slump in output in 2008 that we have seen in the graph of the CEE countries' business cycles earlier (see Figure 5). Growth rates during this period for the CEE countries, the euro area and the US are respectively (3.2%), (1.2%), (0.7%) (see Table 2).

Table 6. Correlations of business cycles during 2008Q1-2010Q2

08Q1-10Q2	*Estonia*	*Latvia*	*Lithuania*	*Czech Rep.*	*Hungary*	*Poland*	*Slovakia*	*Slovenia*
Estonia	1							
Latvia	**0.961**	1						
Lithuania	**0.939**	**0.957**	1					
Czech Rep.	**0.973**	**0.946**	**0.976**	1				
Hungary	**0.978**	**0.960**	**0.959**	**0.991**	1			
Poland	**0.988**	**0.967**	**0.926**	**0.957**	**0.973**	1		
Slovakia	**0.872**	**0.885**	**0.971**	**0.954**	**0.926**	**0.857**	1	
Slovenia	**0.987**	**0.955**	**0.971**	**0.996**	**0.990**	**0.971**	**0.932**	1
EA	**0.950**	**0.921**	**0.926**	**0.972**	**0.985**	**0.959**	**0.909**	**0.970**

Finally, Table 7 shows cross-correlations in post-crisis period 2010Q3 – 2013Q4.

Table 7. Correlations of business cycles during 2010Q3-2013Q4

10Q3-13Q4	*Estonia*	*Latvia*	*Lithuania*	*Czech Rep.*	*Hungary*	*Poland*	*Slovakia*	*Slovenia*
Estonia	1							
Latvia	0.752	1						
Lithuania	**0.846**	**0.973**	1					
Czech Rep.	-0.054	-0.442	-0.301	1				
Hungary	0.273	0.442	0.500	0.237	1			
Poland	-0.010	-0.603	-0.458	0.706	-0.117	1		
Slovakia	0.510	-0.039	0.111	0.466	-0.017	0.775	1	
Slovenia	0.016	-0.166	-0.047	**0.812**	0.648	0.459	0.284	1
EA	0.161	-0.387	-0.200	**0.850**	0.278	**0.830**	0.634	0.758

The pattern of business cycle correlations resembles the pattern of our second sub-period 2000Q1-2004Q1 (see Table 4), but in the fifth sub-period the number of statistically significant correlations are higher (nine versus four) and the number of negative coefficients are less (thirteen versus sixteen*)* than in the second sub-period. However, the tendency in this period is towards divergence, which refers probably to the fact that countries in our sample are coming out of the crisis using different methods. Baltic States are highly correlated among each other and with the US (see Table 9), while Czech Republic, Poland, and Slovenia have high correlation with the euro area (correlation coefficients are 0.850, 0.830 and 0.758 respectively). Slovakia is synchronized only with Poland. Hungary is desynchronized with our sample.

Having used Hodrick-Prescott filter to extract business cycle components from the real GDP data and having compared them with each other, we can conclude that:

- CEE countries are completely desynchronized during the period 1996Q1-1999Q4, except Baltic countries with relatively high correlations with each other;
- CEE countries show some signs of synchronization preparing to join the EU, except desynchronized Baltic countries, and particularly Lithuania who is negatively correlated with the majority of countries from the sample;
- CEE countries are correlated with each other and with the euro area, directly after joining the EU; CEE countries also have relatively high correlations with the US, but it is lower than the correlation with the EA.

– Correlation during financial crisis is close to one, which shows that the crisis was perfectly symmetric.
– During 2010Q3 – 2013Q4 degree of correlation among CEE countries is lower than the one directly before the crisis; this may refer to the asymmetric responses to adverse shock across the countries. In the post-crisis period, Baltic States are correlated with each other and with the US and are not correlated with euro area; Czech Republic, Poland and Slovenia have high correlations with each other and with the euro area.

In Table 8, we have collected correlation coefficients of the CEE countries with aggregate of the euro area. In Table 9, we show correlations of the CEE countries with the US.

Table 8. Correlation of the CEE countries with the euro area

Correlation with EA	**96Q1-99Q4 (1)**	**00Q1-04Q1 (2)**	**04Q2-07Q4 (3)**	**08Q1-10Q2 (4)**	**10Q3-13Q4 (5)**
Estonia	0.128	0.176	0.959	0.950	0.161
Latvia	0.043	0.312	0.971	0.921	-0.387
Lithuania	-0.195	-0.595	0.959	0.926	-0.200
Czech Republic	0.708	0.761	0.923	0.972	0.850
Hungary	0.637	0.237	0.586	0.985	0.278
Poland	-0.102	0.310	0.920	0.959	0.830
Slovakia	-0.577	-0.089	0.892	0.909	0.634
Slovenia	-0.069	0.644	0.985	0.970	0.758
Mean	**0.072**	**0.220**	**0.900**	**0.949**	**0.365**

If we compare period 2 and period 5, *i.e.* periods before entering the EU and right after the crisis, we can tell that the pattern is very similar. Baltic States are not synchronized with the EA, Czech Republic, Poland and Slovenia are highly synchronized with the EA. Slovakia has changes not only the degree of its synchronization but also a sign, from negative to positive; the synchronization of Hungary is low in both periods.

Table 9. Correlation of the CEE countries with the US

Correlation with US	96Q1-99Q4 (1)	00Q1-04Q1 (2)	04Q2-07Q4 (3)	08Q1-10Q2 (4)	10Q3-13Q4 (5)
Estonia	-0.378	0.496	0.904	0.946	0.567
Latvia	-0.202	-0.018	0.879	0.887	0.836
Lithuania	-0.233	-0.519	0.856	0.891	0.794
Czech Republic	-0.648	0.648	0.932	0.962	-0.314
Hungary	-0.445	0.618	0.751	0.972	0.297
Poland	0.423	0.956	0.639	0.945	-0.511
Slovakia	0.114	-0.551	0.811	0.880	0.069
Slovenia	0.193	0.568	0.828	0.962	-0.087
Mean	**-0.147**	**0.275**	**0.825**	**0.931**	**0.206**

An interesting observation concerns the fact that two of four member countries of the euro area (Slovakia and Slovenia) are highly synchronized with the EA; while the rest two (Estonia and Latvia) are not synchronized with it, Latvia being synchronized with the US (see Table 9). These facts need some further investigation in the context of monetary integration as a determinant of business cycle synchronization discussed in subsection 3.3.3.

4.2.2. Trends in economic integration with the euro area

To make dynamics of integration of the CEE countries into the European economy more illustrative, we have applied moving window method to the correlations of the CEE countries with the euro area. On the Figure 7, we can see the pattern of the CEE countries' business cycles in regard with the euro area business cycle. Business cycles of the CEE countries are completely desynchronized before joining the EU. The degree of synchronization is very high after joining the EU and during the financial crisis. In the post-crisis period we again see divergence of business cycles, but not as grave as before joining the EU.

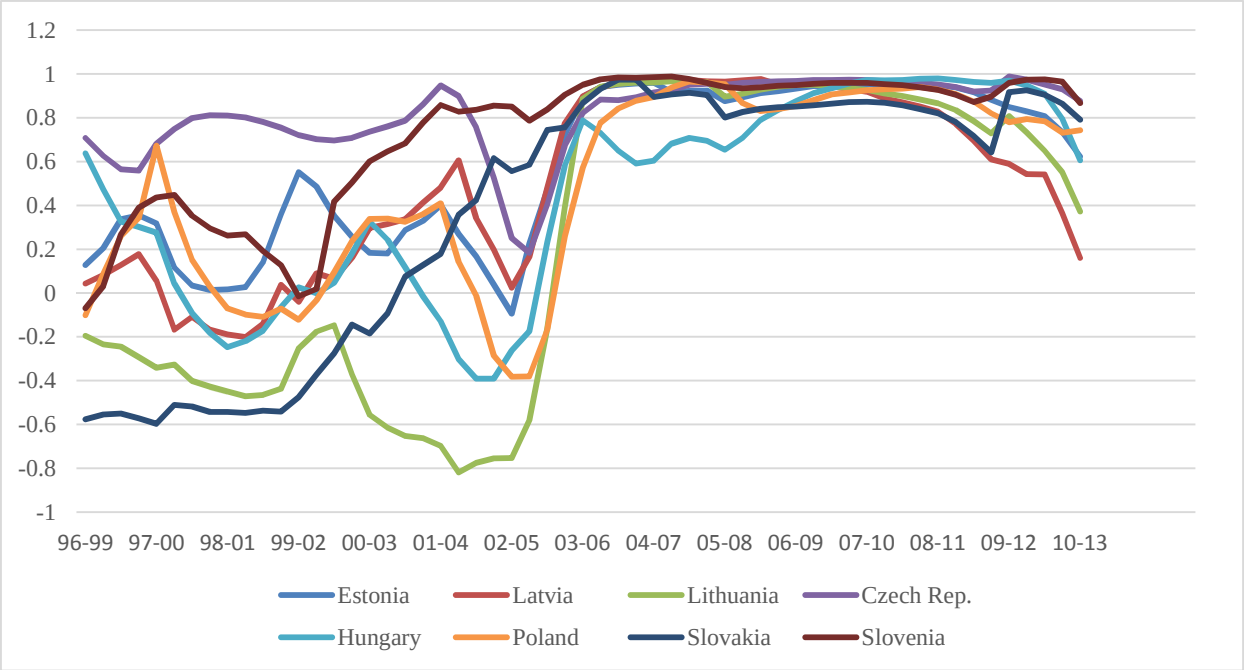

Figure 7. Moving correlations of output gaps of the CEE countries with aggregate of the EA

4.2.3. Unemployment rate as a measure of economic activity

Business cycles assessed by unemployment rates show a bit different pattern. While in the previous subsections we used the euro area aggregate as a benchmark, here we take the unemployment rates of three core countries of the euro area: Germany, France, and Italy. The problem here is that while output gaps of these three countries are highly correlated with each other, their unemployment rates are not. Speaking more precisely, unemployment rates of France and Italy move together while Germany's unemployment seems to be in anti-phase after the crisis. In fact, unemployment rates differ a lot across the Europe, even more than the output. See Figure 8.

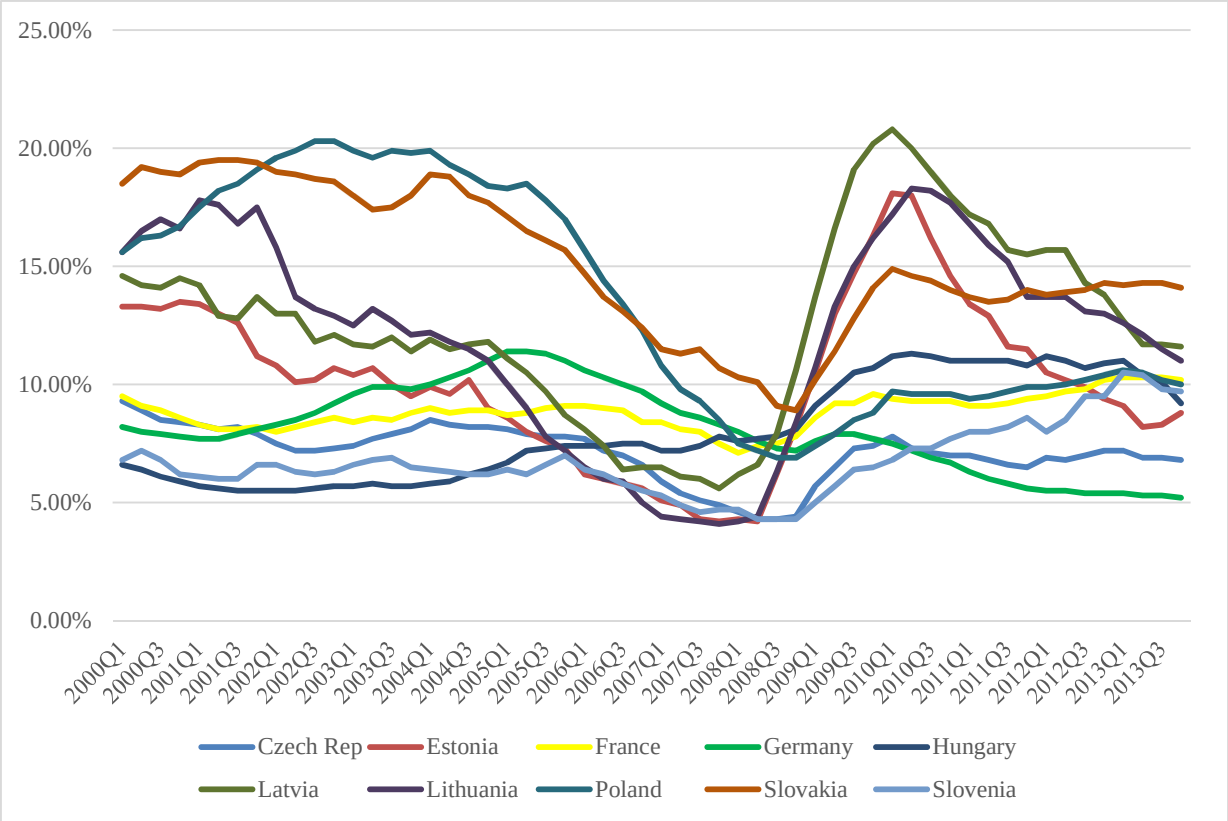

Figure 8. Unemployment rates during 2000 – 2013
NOTE: Germany's rate of unemployment (green line) is about 5-6% after the crisis; France's rate of unemployment (yellow line) is two times higher, about 9-10%.

Figure 9 demonstrates moving correlations of output gaps for a single CEE country with aggregate of the euro area (blue line), and correlations of unemployment rates, separately with Germany (green line) and France (yellow line). Not to overload the graph we do not show correlation with Italy's unemployment as it is very close to the correlation with France. The data for unemployment are available from 2000. The technique is the same as used in the previous subsection and described in section 4.1.

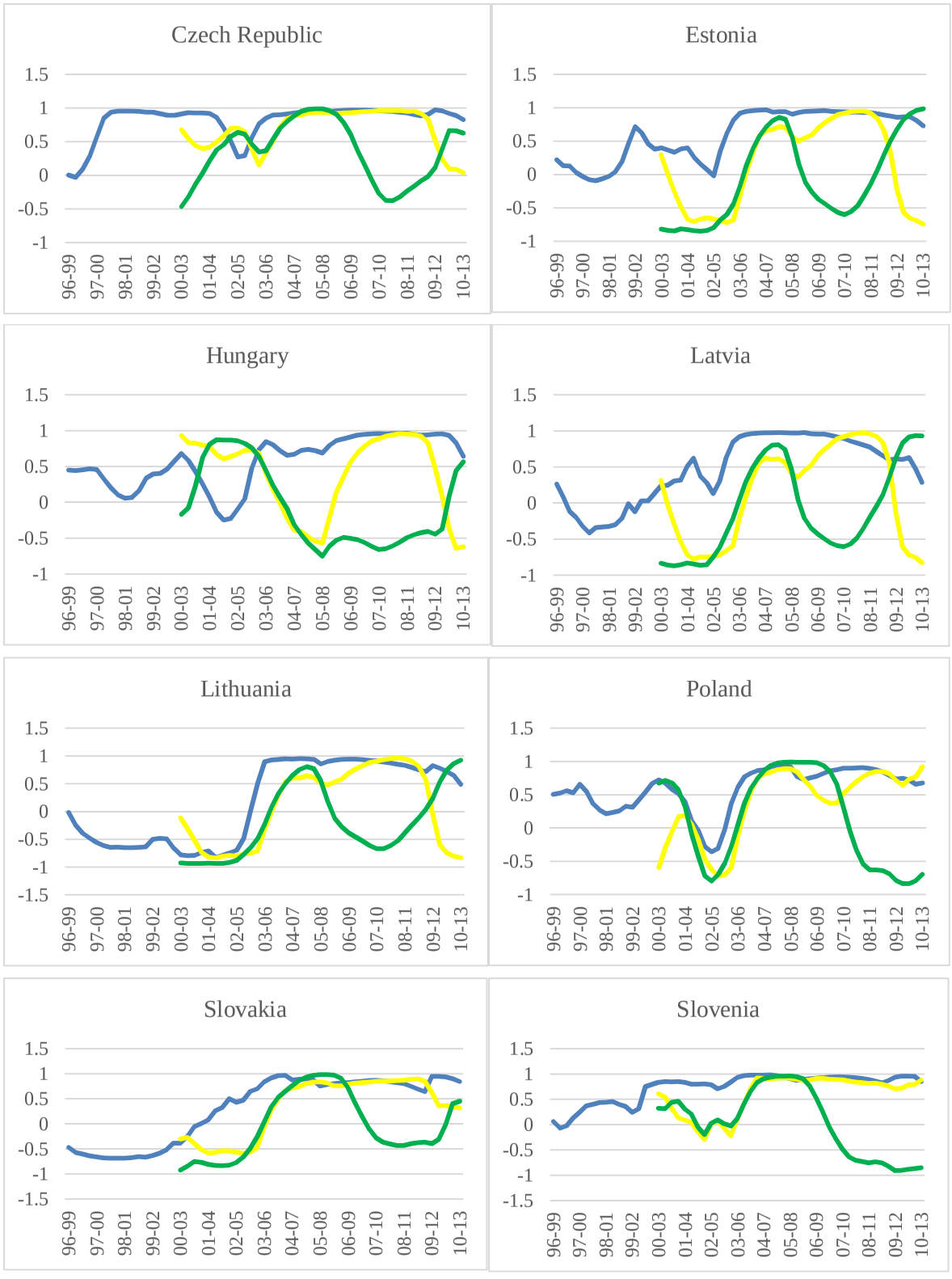

Figure 9. Correlations of output gaps and unemployment rates in the CEE countries

All these three lines embody the degree of synchronization between a single CEE country and the euro area and are supposed to move in sync. They do more or less so, may be

with some time lags, until the crisis of 2008–2009, when correlation with Germany's unemployment goes down with an exception for Hungary which shows the weirdest pattern of all. After the crisis, we see very different movements of correlations what may refer to the different economic policies in the CEE countries as well as in France and Germany.

4.3. Conclusions and recommendations

Having used data on output and unemployment of eight Central and Eastern European countries during the period of 1996Q1 – 2013Q4, we have confirmed major results of Stanisic (2013) and Kolasa (2013) that there is no common CEE business cycle, but there is a tendency to converge with the euro area. The synchronicity of business cycles in the CEE countries differs a lot across the periods. Business cycles of the CEE countries were not synchronized before entering the European Union, converged after accession to the EU and diverged again in post-crisis period, but not as considerably as they did before.

Worth mentioning high synchronicity of CEE countries with the US before and during the crisis. Latvia and Lithuania have relatively high correlations with the US in post-crisis period as well. High degree of synchronization with the US leads us to the point discussed in subsection 3.2.2, namely, to the global component of the business cycles. Leaning on the results obtained from our data, we can assume that the global component during examined period, particularly during 2004Q2 – 2010Q2, is rather considerable.

We can affirm that the CEE countries is not a homogenous group, although they show some signs of convergence with each other as well as with the euro area. It can be assumed that low degree of correlation between the countries in the post-crisis period is caused by the different responses of the CEE countries to the shock. Baltic States have chosen austerity policy, while the rest of our sample have preferred milder methods of coming out of the crisis. However, the determinants of business cycle movements across the CEE countries need to be additionally examined. As was discussed in subsection 3.3.3, monetary integration can lead to more synchronized business cycles due to the common monetary policy. In fact, there are many empirical evidences in support of this point. We could have expected more high correlation of member countries of the euro area, but as we have seen, it is not the case. Two of four member countries of the euro area from our sample are highly synchronized with the euro area as a whole and with its core countries, while the other two show high correlation with the US in the

post-crisis period. One could argue that countries in our sample have become members of the euro area only recently, in 2007, 2009, 2011 and 2014. In reply we could remind arguments discussed in subsection 3.3.4, where referring to Darvas *et al.* (2005) we pointed out that Maastricht mimics Mundell. In other words, Maastricht Treaty (1992), aimed at preparing a country for accession to the European Union by means of fiscal integration in terms of reducing budget deficit, reduces the scope of idiosyncratic fiscal shocks leading to more convergence and more synchronized business cycles. However, being a good explanation of business cycles synchronization *per se*, it is not working in our case.

In the post-crisis period, three groups of countries can be distinguished. Baltic States may be considered as a quite isolated group. It has shown high degree of synchronization in the very first sub-period 1996-1999, and these countries are highly synchronized in recent years as well. Another reason why we distinguish them into a separate group is that at present they are correlated with the US, but are not correlated with the euro area. In the second group we may place Czech Republic, Poland and Slovenia. Check Republic shows high degree of correlation with the euro area throughout the whole considered period. Poland and Slovenia where not synchronized with the euro area initially, but after joining the European Union their business cycles move together with the euro area's aggregate. Interesting that two of these three countries are not members of the euro area. Slovakia and Hungary stand apart. Slovakia, having adopted the euro, has a bent for the euro area's business cycle, while Hungary is not like anyone in our sample and its moves are quite surprising in every sub-period considered.

To be able to predict the future economic developments, we need to understand the determinants of business cycles movements and transmission mechanisms or channels of transmission of shocks to national economies. We have briefly discussed plausible explanations of divergence in the CEE business cycles, but this question obviously needs further investigation. We would propose to consider all possible determinants of business cycle synchronization discussed in section 3.3 and first of all we would consider trade, financial integration, monetary integration, and fiscal convergence. It is worth examining to what extent these mechanisms are at the same time channels of transmission of shocks. Besides, it could be useful to compare CEE countries with the rest of periphery of the euro area – Finland, Ireland, Spain, Portugal, and Greece.

Once a crisis has happened, it is necessary to have adequate tools to return to the equilibrium. As we have discussed earlier in the thesis, a monetary policy tool is no longer

available for individual member countries of the euro area, and a common monetary policy is not always the most effective for all the members, as their economies are not yet fully synchronized. Thus, alternative methods have to be worked out. One of the challenges for economists and politicians is to elaborate effective adjustment mechanisms that could be used instead of the lost monetary policy tool. It is all the more important as the question whether business cycle will become more synchronized along with more economic and monetary integration is still open. Alternative adjustment mechanisms were discussed in the theoretical part of the thesis. However, we do know that the issue is still very relevant and effective adjustment tools are waiting to be found.

Summing up, determinants of business cycle synchronization, transmission mechanisms, full picture of the enlarged euro area economic activities, and effective adjustment mechanisms suitable for the specific conditions of the euro area are, from our point of view, the most promising directions of research considering the euro area developments.

5. CONCLUSIONS

In the thesis, we have considered the theory of optimum currency areas introduced by Mundell in 1961. We have traced the evolution of the OCA theory from its origin until our days. The OCA theory was considered primarily in the context of integrating Europe and enlarging euro area. A few phases in the development of the OCA theory can be distinguished. During the first phase, properties or prerequisites of an OCA are being considered. At present, the most relevant properties are believed to be economic openness, product and labour flexibility, and symmetry of business cycles. The next phase concerns the costs and benefits of adopting a single currency. The most significant cost is considered the loss of an independent monetary policy, which, however, can be replaced with alternative adjusting mechanisms, the most efficient of them being adjusting through financial integration and explicit transfers among the countries. Along with costs, there are numerous benefits of entering a monetary union, among which are increased usefulness of money, disappearance of exchange rate uncertainty, increased credibility, reduced trade and information costs, which are supposed to lead to increased inter-regional trade and foreign investments, long-term relationships between member states, and deeper political and social integration.

The question is still open, whether further economic integration will lead to more homogeneous economies and synchronized business cycles or it will lead to concentration of industries and high degree of specialization, which in turn means higher vulnerability of national economies to idiosyncratic shocks. Official position of the European authorities is leaning towards the endogeneity theory, in other words, it is being assumed that due to more intensive inter-regional trade and improved convergence, countries are more likely to meet the requirements of the OCA theory *ex post* than *ex ante*. However, recent financial crisis has revealed that the endogeneity forces are rather slow, and there is lack of adjusting mechanisms that could be used to recover the equilibrium after a crisis. That is why the discussion has returned to the beginning and now OCA properties are being discussed, a “catch-all” property being a similarity of shocks or synchronization of business cycles.

Hence, the synchronization of business cycles of present and future members of the euro area is a very relevant issue with regard to sustainability of the European monetary union. Studies on business cycle synchronization in the euro area are divided into studies that deal with the degree of synchronization and studies that consider determinants of business cycle co-movements. Empirical studies on business cycles come to diverging and sometimes contradictory conclusions. However, we may make several assertions. There are many empirical evidences that there is no common European business cycle and that the core countries of the euro area are highly synchronized while the periphery is not. Besides, there are studies confirming that the extent of business cycle synchronization may vary over time.

The findings of studies on determinants of business cycles are quite ambiguous. A few factors may affect movements of business cycles; they are openness or trade intensity, financial integration, industrial similarity, monetary integration, and fiscal convergence. It can be asserted that trade intensity has positive correlation with business cycle synchronization. Only the magnitude of trade effect on synchronization of economic activities is unclear and requires additional examinations. Impact of the other factors named above remains ambiguous, however, monetary integration and fiscal convergence imposed by Maastricht Treaty are likely to have positive impact on business cycle synchronization.

In the empirical part of the thesis, we have focused on the business cycles of eight Central and Eastern European countries and their correlations with each other and with the euro area. We have also compared movements of business cycles in the CEE countries and the US and three biggest countries of the euro area – Germany, Italy, and France. Having used correlation analysis and moving window technique, we have come to a few conclusions. We have demonstrated that the examined CEE countries are quite heterogeneous in respect with their economic activities, and there is no common CEE business cycle. Leaning on the examined data, we find that there is a trend towards convergence of business cycles of some CEE countries with euro area. The determinants of business cycle movements are waiting for the further investigation. We would recommend considering trade and financial integration as the most likely determinants of business cycle synchronization in the CEE countries.

As to the directions of the future research, along with determinants of business cycle synchronization and transmission mechanisms, we consider effective adjustment mechanisms suitable for the euro area to be the most challenging one.

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RESÜMEE

OPTIMAALSE VALUUTAPIIRKONNA TEOORIA JA MAJANDUSTSÜKLITE SÜNKRONISEERIMINE KESK- JA IDA-EUROOPA RIIKIDES

Natalia Levenko

Antud töös kirjeldatakse optimaalse valuutapiirkonna (edaspidi OCA) teooria arengut alates 1960ndaist tänasepäevani. OCA teooriat käsitletakse peamiselt integreeruva Euroopa ja laieneva euroala kontekstis. Hiljutine ülemaailmne finantskriis näitas, et riikidevahelised erinevused omavad suuremat tähtsust kui arvati enne kriisi. Asümmeetrilised šokid on üks peamisi ohte euroala jätkusuutlikkusele. See on põhjuseks, miks OCA omadused, reaalne konvergents ja kohanemismehhanismid põhjustavad palju arutelusid viimastel aastatel.

OCA teooria arengus võib eristada mitut etappi. Esimese etapi jooksul arutatakse erinevaid OCA omadusi ehk eeltingimusi, mis on vajalikud OCA loomiseks. Praegu peetakse kõige relevantsemateks OCA omadusteks majanduslikku avatust, tööjõuturu paindlikkust ja majandustsüklite sümmeetriat. OCA teooria järgmises etapis räägitakse ühisraha vastuvõtmise plussidest ja miinustest. Kõige olulisem negatiivne tagajärg on sõltumatu rahapoliitika kaotamine, see võib olla aga asendatud alternatiivsete kohanemismehhanismidega. Neist kõige tõhusamateks peetakse finantsintegratsiooni ja riikidevahelisi otseülekandeid. Ühisrahal on palju eeliseid, nagu näiteks suurem raha kasulikkus, vahetuskursi ebakindluse kadumine, suurenenud usaldusväärsus, vähendatud kaubandus- ja infokulud, mis kokkuvõttes peaksid suurendama piirkondade vahelist kaubandust ja välismaiseid investeeringuid, edendama pikaajalisi suhteid liikmesriikide vahel ja tihedamat poliitilist ja sotsiaalset integratsiooni.

Siiamaani ei ole selge, kas edaspidine majanduslik integratsioon viib ühtlasema majanduse ja sünkroniseeritud äritsüklite suunas või vastupidi, toimub tööstuse kontsentratsioon, spetsialiseerumine, mis omakorda tähendab riikide kõrgemat haavatavust idiosünkraatiliste šokkide osas. Euroopa ametiasutused kalduvad endogeensuse teooria kasuks,

teiste sõnadega, oletatakse, et tänu intensiivsemale kaubandusele ja paranenud konvergentsile on tõenäoline, et riigid vastavad OCA nõuetele pigem *ex post* kui *ex ante*. Hiljutine finantskriis on aga näidanud, et endogeensuse jõud on üsna aeglased ja kohanemismehhanismid, mida võiks kasutada tasakaalu taastamiseks, on puudulikud. See on põhjuseks, miks diskussioon on jõudnud tagasi OCA omaduste juurde, kusjuures tähtsaimaks omaduseks peetakse majandustsüklite sünkroniseerimist või šokkide sarnasust.

Arvestades eespool öeldut on selge, miks majandustsüklite sünkroniseerimine euroalal on praegu väga oluline teema, mis otseselt puudutab Euroopa rahaliidu jätkusuutlikkust. Majandustsüklite uuringud võib jagada kaheks grupiks: uuringud, mis tegelevad äritsüklite sünkroniseerimise astmega, ja uuringud, mis käsitlevad tegureid, millest äritsüklid sõltuvad. Empiiriliste uuringute järeldused on väga erinevad ja mõnikord ka vastuolulised. Sellest hoolimata võib väita, et Euroopas ei ole ühist äritsükli, kusjuures, tuumriigid on sünkroniseeritud paremini võrreldes äärealade riikidega. On olemas empiirilised tõendid, et majandustsüklite sünkroniseerimise aste varieerub aja jooksul.

Uurimistulemused, mis puudutavad äritsükleid mõjutavaid tegureid, on üsna ebamäärased. Nende tegurite hulgas on avatus ehk kaubanduse intensiivsus, finantsintegratsioon, tööstuse struktuuri sarnasus, rahandusintegratsioon ja fiskaalkonvergents. Võib väita, et kaubanduse intensiivsus mõjutab äritsüklite sünkroniseerimist positiivselt, mõju suurusjärk on aga ebaselge. Teiste tegurite mõju on ebamäärane, kuid võib eeldada, et rahandusintegratsioonil ja fiskaalkonvergentsil on positiivne mõju äritsüklite sünkroniseerimisele.

Töö empiirilises osas käsitletakse kaheksa Kesk- ja Ida-Euroopa riigi majandustsükleid ja nende korrelatsioone omavahel ja euroalaga. Uurimismeetodid on korrelatsioonianalüüs ja nn „liikuva akna“ meetod. Selleks, et eristada tsüklilist komponenti, on kasutatud Hodrick-Prescott filtrit. Tuginedes tehtud analüüsile, võib väita, et uuritud riigid on väga erinevad oma majandustegevuste poolest ja neil ei ole ühist äritsüklit. Samuti on näha suundumust euroalaga konvergeerumise poole. Tegurid, mis avaldavad mõju Kesk- ja Ida-Euroopa riikide äritsüklitele, ootavad edasist uurimist. Eeskätt oleks mõistlik uurida kaubandust ja finantsintegratsiooni. Edasiste uuringute hulka võiks kuuluda ka euroalale sobilike kohanemismehhanismide uurimine.

APPENDICES

Appendix 1. Cycle components in 1996 – 2013

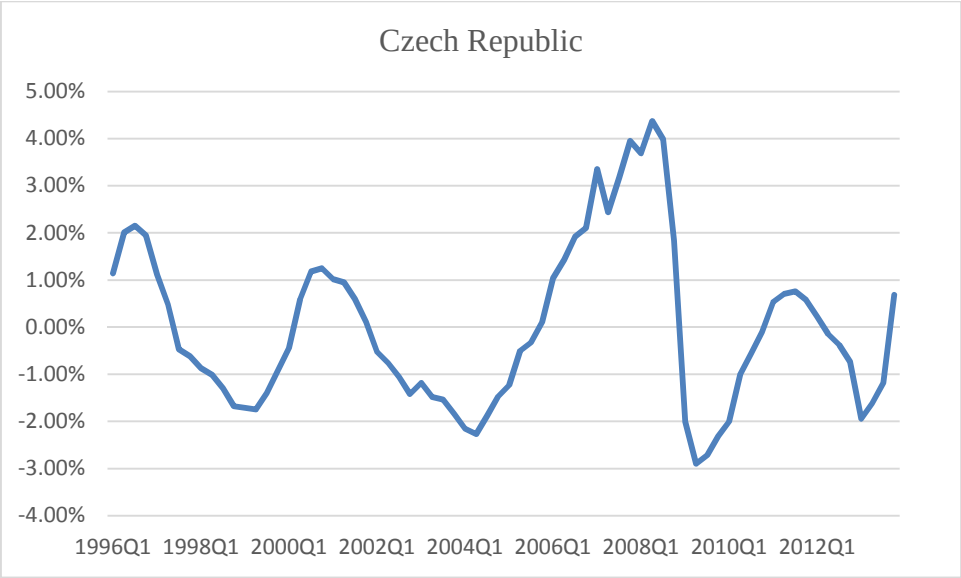
TIME/ GEO	Estonia	Latvia	Lithuania	Czech Rep.	Hungary	Poland	Slovakia	Slovenia	EA	GIF*	US
1996Q1	1.2%	0.4%	-2.5%	0.2%	1.5%	-2.1%	-1.1%	-1.3%	-2.3%	-0.6%	-1.1%
1996Q2	2.0%	0.4%	-2.8%	0.2%	0.4%	-3.5%	-2.8%	-0.4%	-1.2%	-0.7%	-0.4%
1996Q3	2.2%	0.2%	-1.8%	0.1%	-0.4%	-2.2%	-0.6%	-0.4%	-0.3%	0.0%	-0.5%
1996Q4	2.0%	-0.3%	-0.7%	-0.4%	-0.2%	1.5%	-1.2%	-4.8%	0.6%	0.2%	-0.5%
1997Q1	1.1%	-0.6%	-0.2%	-0.8%	-0.3%	0.5%	-1.0%	0.0%	0.5%	-0.1%	-0.8%
1997Q2	0.5%	-0.1%	2.0%	-0.2%	0.0%	3.2%	1.0%	0.3%	0.6%	0.8%	-0.3%
1997Q3	-0.4%	-0.2%	3.5%	-0.2%	-0.1%	3.4%	2.7%	0.3%	1.3%	0.6%	-0.1%
1997Q4	-0.7%	0.1%	5.0%	0.1%	0.0%	2.8%	3.4%	0.9%	0.9%	0.2%	-0.3%
1998Q1	-0.8%	0.0%	4.3%	0.1%	0.3%	4.3%	4.3%	1.6%	1.9%	0.1%	-0.3%
1998Q2	-1.0%	-0.4%	3.7%	-0.3%	0.4%	3.6%	4.8%	1.3%	1.3%	-1.1%	-0.4%
1998Q3	-1.3%	-0.6%	3.4%	-0.4%	0.4%	3.0%	4.6%	1.5%	0.1%	-0.6%	0.0%
1998Q4	-1.7%	-1.1%	0.6%	-0.9%	-0.2%	-2.0%	3.5%	-1.1%	6.6%	-0.8%	0.6%
1999Q1	-1.8%	-0.9%	-2.3%	-0.8%	-0.9%	-0.2%	0.9%	-0.3%	2.7%	-0.3%	0.6%
1999Q2	-1.7%	-1.0%	-3.6%	-0.8%	-0.8%	-2.4%	0.1%	0.7%	0.4%	1.4%	0.5%
1999Q3	-1.4%	-0.7%	-3.8%	-0.5%	-0.3%	-0.8%	-2.6%	1.9%	-0.9%	-0.4%	0.9%
1999Q4	-0.9%	-0.2%	-3.5%	0.2%	0.1%	-0.5%	-3.7%	2.2%	-1.9%	0.4%	1.8%
2000Q1	-0.4%	0.3%	-0.3%	0.9%	-0.3%	-1.3%	-2.8%	2.1%	-1.5%	0.1%	1.2%
2000Q2	0.6%	0.5%	0.9%	1.3%	-0.2%	-2.2%	-2.8%	2.4%	-1.1%	0.7%	2.3%
2000Q3	1.2%	0.2%	-1.2%	1.1%	-0.5%	-0.7%	-2.9%	1.5%	-1.1%	1.4%	1.6%
2000Q4	1.2%	0.2%	-0.6%	1.2%	-0.3%	-3.0%	-2.6%	1.8%	-1.2%	1.0%	1.4%
2001Q1	1.0%	2.6%	-0.3%	1.8%	-0.3%	-2.0%	-1.3%	1.2%	-1.3%	1.1%	0.4%
2001Q2	1.0%	2.0%	-1.1%	1.3%	-0.6%	0.8%	-2.9%	0.0%	-1.1%	0.1%	0.2%
2001Q3	0.6%	1.5%	-1.2%	0.8%	-0.7%	-2.3%	-2.2%	0.0%	-1.5%	-0.2%	-0.8%
2001Q4	0.1%	1.1%	-0.7%	0.5%	-1.0%	-1.5%	-1.5%	-1.0%	-0.4%	-0.2%	-1.2%
2002Q1	-0.5%	0.6%	-3.3%	0.2%	0.0%	-2.5%	-2.9%	-1.4%	-0.9%	0.5%	-1.0%
2002Q2	-0.7%	0.7%	-0.4%	0.3%	-0.5%	-1.7%	-1.7%	-1.7%	-1.0%	-0.5%	-1.1%
2002Q3	-1.1%	0.4%	-0.3%	0.2%	-0.5%	-1.8%	-1.9%	-1.8%	0.0%	-0.5%	-1.3%
2002Q4	-1.4%	-0.1%	-1.8%	-0.2%	-0.7%	-0.6%	-2.3%	-1.9%	-0.6%	0.3%	-1.9%
2003Q1	-1.2%	-0.7%	-1.0%	-0.9%	-0.9%	-1.6%	0.0%	-2.2%	-0.4%	-0.7%	-2.1%
2003Q2	-1.5%	-1.1%	-1.3%	-1.3%	-0.9%	-2.1%	-0.4%	-1.4%	-0.4%	-1.5%	-1.8%
2003Q3	-1.5%	-1.1%	-1.5%	-1.1%	-0.8%	-1.9%	0.4%	-1.0%	-1.5%	-1.5%	-0.8%
2003Q4	-1.8%	-0.9%	-0.9%	-0.9%	-0.6%	-2.7%	0.1%	-0.9%	-1.3%	-1.7%	-0.4%
2004Q1	-2.2%	-0.9%	-0.9%	-0.9%	-0.3%	-2.1%	-0.3%	0.0%	-1.5%	-2.0%	-0.4%
2004Q2	-2.2%	-0.8%	-2.7%	-0.8%	-0.1%	-2.1%	-0.4%	0.1%	-2.2%	-1.8%	-0.3%
2004Q3	-1.9%	-1.0%	-2.0%	-0.9%	0.0%	-3.3%	-1.4%	-0.8%	-1.5%	-1.6%	-0.1%
2004Q4	-1.5%	-1.1%	-2.7%	-1.1%	0.1%	-3.0%	-0.7%	-0.7%	-1.6%	-2.3%	0.1%
2005Q1	-1.2%	-1.4%	-1.5%	-1.4%	0.0%	-2.6%	-0.6%	-1.1%	-1.9%	-2.1%	0.6%
2005Q2	-0.5%	-1.2%	-0.6%	-1.1%	0.8%	-2.1%	-0.6%	-1.8%	-1.4%	-1.7%	0.6%

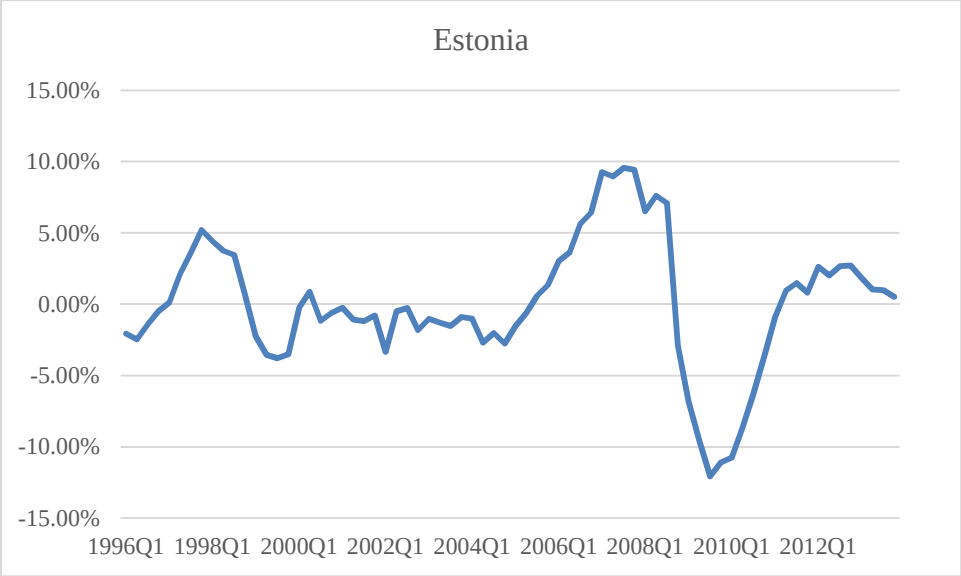
Appendix 1. Cycle components in 1996 – 2013 (continued)

TIME/ GEO	Estonia	Latvia	Lithuania	Czech Rep.	Hungary	Poland	Slovakia	Slovenia	EA	GIF*	US
2005Q3	-0.3%	-1.1%	0.6%	-0.9%	0.8%	0.5%	0.4%	-1.3%	-1.4%	-1.9%	0.8%
2005Q4	0.1%	-0.9%	1.3%	-0.7%	1.3%	2.6%	1.0%	-1.4%	-1.6%	-1.1%	0.9%
2006Q1	1.0%	-0.4%	3.0%	-0.2%	2.0%	1.2%	0.6%	-1.0%	-0.9%	-1.4%	1.6%
2006Q2	1.4%	0.3%	3.7%	0.6%	2.4%	3.7%	1.3%	-0.6%	-0.2%	-0.2%	1.5%
2006Q3	1.9%	0.5%	5.6%	0.9%	2.5%	4.9%	1.8%	0.1%	0.1%	0.6%	1.1%
2006Q4	2.1%	1.1%	6.4%	1.7%	2.9%	7.5%	3.5%	0.3%	1.2%	2.0%	1.6%
2007Q1	3.4%	1.9%	9.3%	1.9%	1.7%	9.7%	4.9%	0.8%	1.8%	2.8%	1.3%
2007Q2	2.4%	2.1%	8.9%	2.2%	1.2%	11.7%	6.4%	1.3%	2.8%	3.5%	1.8%
2007Q3	3.2%	2.4%	9.5%	2.6%	1.4%	11.6%	8.3%	1.4%	3.8%	5.2%	2.2%
2007Q4	3.9%	2.5%	9.4%	2.5%	2.0%	11.8%	9.3%	2.4%	8.5%	4.9%	2.3%
2008Q1	3.7%	3.2%	6.5%	3.1%	3.5%	12.1%	8.6%	2.7%	5.0%	5.9%	1.5%
2008Q2	4.3%	2.6%	7.6%	2.4%	3.4%	11.4%	9.1%	2.3%	5.2%	6.9%	1.8%
2008Q3	4.0%	1.8%	7.1%	1.7%	2.6%	5.9%	7.9%	2.0%	5.5%	6.3%	1.1%
2008Q4	1.8%	0.0%	-2.9%	-0.1%	0.3%	3.9%	7.2%	0.5%	5.7%	2.2%	-1.2%
2009Q1	-2.0%	-2.4%	-6.8%	-3.4%	-2.9%	-5.5%	-6.8%	0.0%	-4.0%	-2.5%	-2.7%
2009Q2	-2.9%	-2.7%	-9.5%	-3.5%	-3.7%	-5.9%	-8.0%	-0.5%	-3.4%	-3.6%	-3.0%
2009Q3	-2.7%	-2.4%	-12.1%	-3.1%	-4.3%	-12.8%	-7.6%	-1.0%	-2.7%	-3.4%	-2.9%
2009Q4	-2.3%	-2.0%	-11.1%	-2.5%	-3.7%	-11.0%	-8.5%	-0.5%	-1.9%	-3.5%	-2.1%
2010Q1	-2.0%	-1.7%	-10.7%	-2.1%	-2.7%	-9.3%	-7.8%	-0.7%	-1.5%	-3.1%	-2.0%
2010Q2	-1.0%	-0.8%	-8.7%	-1.0%	-2.0%	-9.4%	-6.8%	-0.5%	-1.2%	-1.8%	-1.3%
2010Q3	-0.6%	-0.5%	-6.3%	-0.5%	-1.4%	-8.9%	-6.3%	0.0%	-0.9%	-1.2%	-0.9%
2010Q4	-0.1%	0.0%	-3.7%	0.0%	-1.0%	-7.0%	-4.2%	0.0%	-0.8%	-0.2%	-0.5%
2011Q1	0.5%	0.8%	-0.9%	0.9%	0.3%	-5.8%	-2.5%	0.4%	-0.5%	0.1%	-1.1%
2011Q2	0.7%	0.8%	1.0%	0.9%	0.3%	-3.3%	-1.3%	1.0%	-0.3%	0.8%	-0.7%
2011Q3	0.7%	0.9%	1.5%	1.0%	0.4%	-2.1%	-0.9%	1.0%	-0.1%	0.8%	-0.7%
2011Q4	0.6%	0.6%	0.8%	0.8%	0.9%	-1.9%	-0.2%	1.3%	0.3%	0.2%	0.1%
2012Q1	0.2%	0.5%	2.7%	0.8%	-0.4%	-1.5%	-0.3%	1.0%	0.3%	0.3%	0.6%
2012Q2	-0.1%	0.2%	2.0%	0.4%	-0.6%	0.4%	-0.1%	0.3%	0.1%	-0.6%	0.5%
2012Q3	-0.4%	0.0%	2.7%	0.3%	-0.8%	1.6%	1.5%	-0.2%	-0.1%	-0.8%	0.7%
2012Q4	-0.7%	-0.5%	2.7%	-0.3%	-1.2%	2.4%	1.2%	-0.7%	-0.6%	-2.0%	0.3%
2013Q1	-2.0%	-0.7%	1.9%	-0.5%	-0.1%	3.6%	1.7%	-1.0%	-0.7%	-1.6%	0.2%
2013Q2	-1.6%	-0.4%	1.0%	-0.2%	0.3%	3.3%	1.9%	-1.1%	-0.7%	-1.0%	0.4%
2013Q3	-1.2%	-0.3%	1.0%	-0.2%	1.2%	4.0%	1.8%	-1.1%	-0.8%	-0.3%	0.9%
2013Q4	0.7%	-0.1%	0.6%	0.0%	1.8%	4.4%	2.4%	-1.2%	-0.8%	1.2%	1.1%

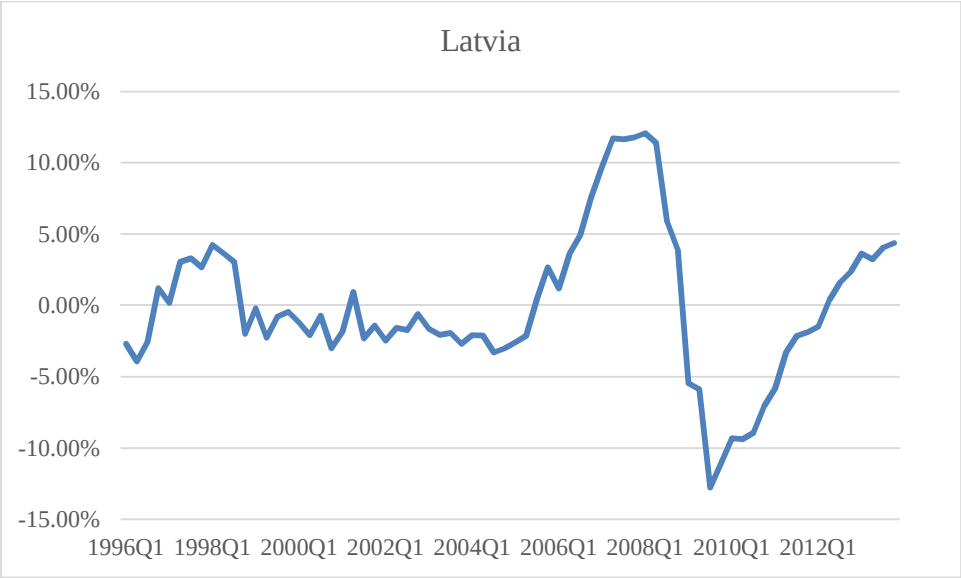
NOTE: *GIF – Germany, Italy, and France aggregate.

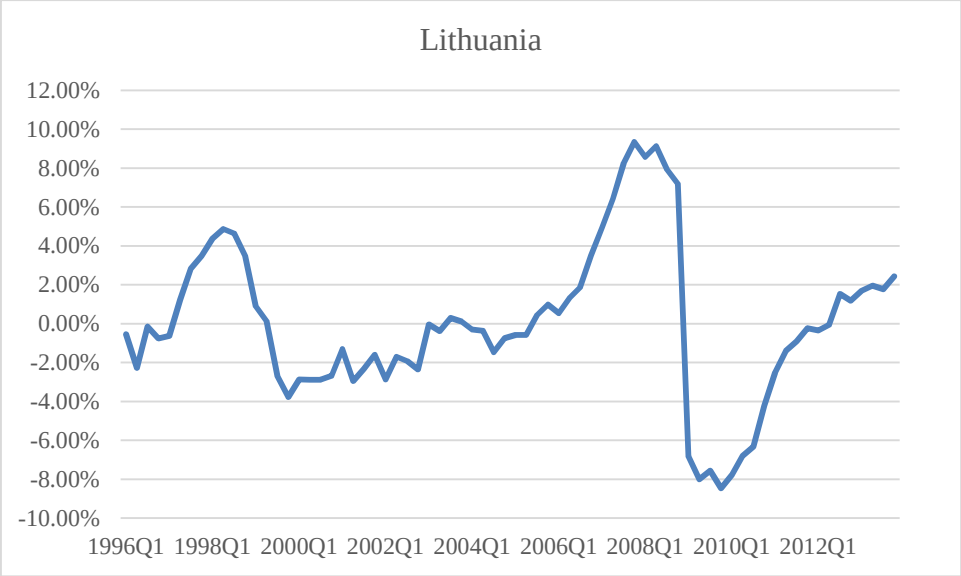
Appendix 2. Business cycles in CEE countries



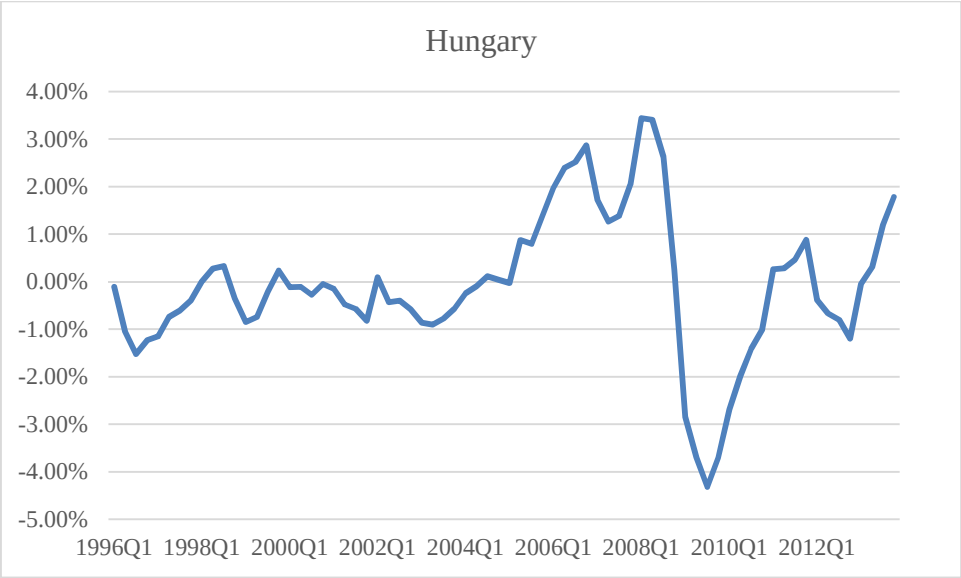


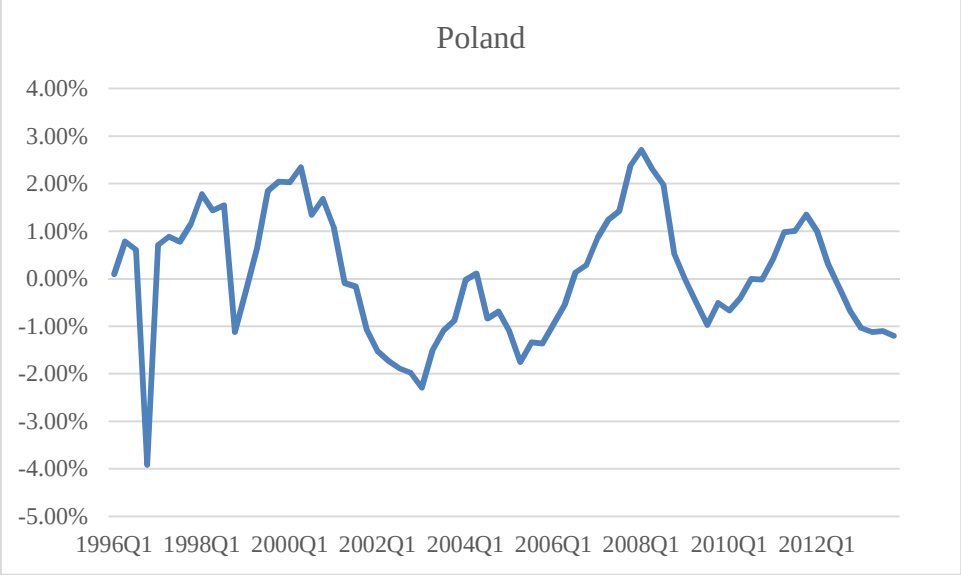
Appendix 2. Business cycles in CEE countries (continued)



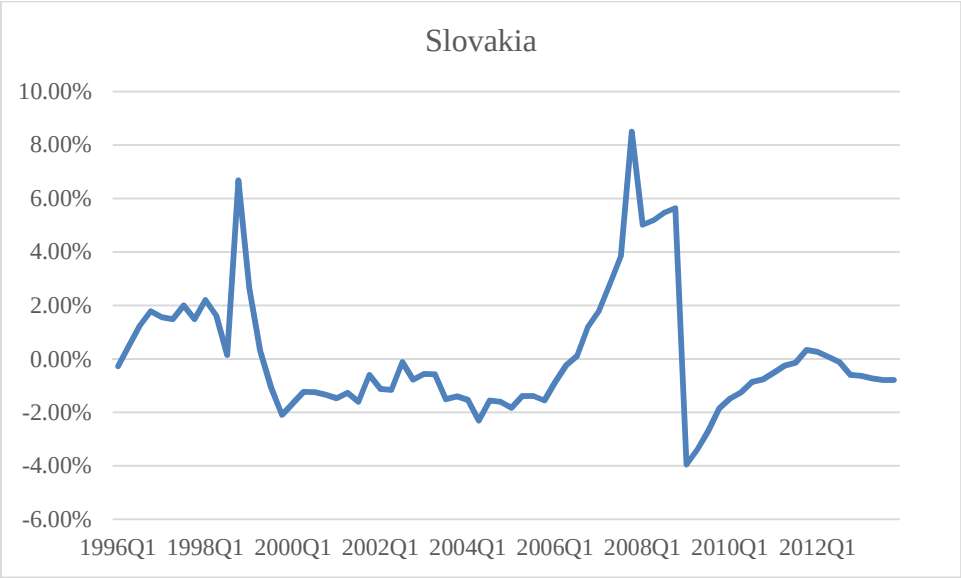


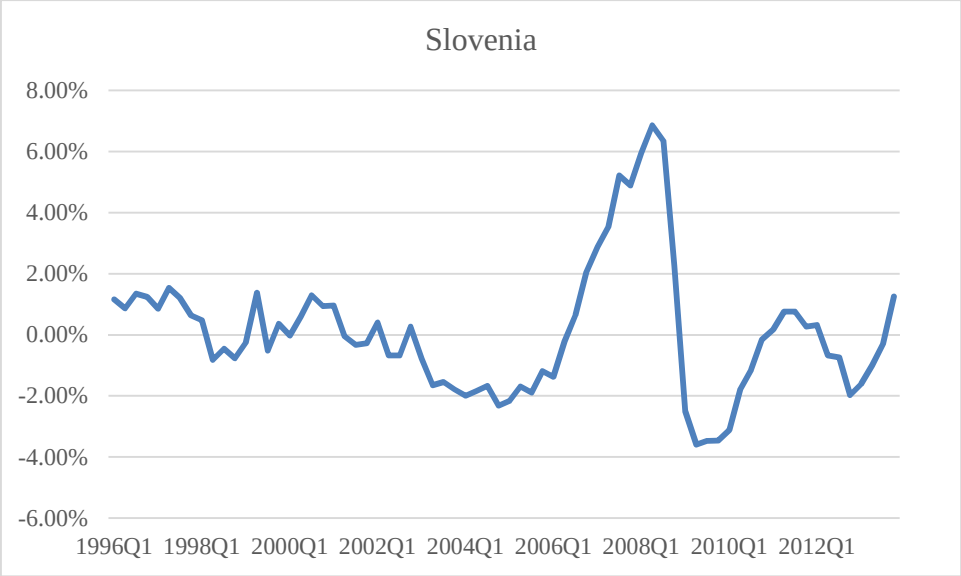
Appendix 2. Business cycles in CEE countries (continued)





Appendix 2. Business cycles in CEE countries (continued)





Appendix 3. Cross-correlations of output gaps in 1996 – 2013

96Q1-99Q4	*Estonia*	*Latvia*	*Lithuania*	*Czech Rep.*	*Hungary*	*Poland*	*Slovakia*	*Slovenia*	*EA*	*GIF**	*US*
Estonia	1										
Latvia	0.855	1									
Lithuania	0.866	0.669	1								
Czech Rep.	-0.180	-0.230	-0.460	1							
Hungary	0.197	0.100	0.062	0.296	1						
Poland	0.178	0.233	0.191	-0.574	0.019	1					
Slovakia	0.392	0.176	0.621	-0.456	-0.414	-0.157	1				
Slovenia	-0.071	0.114	-0.160	-0.046	-0.440	0.064	-0.145	1			
EA	0.128	0.043	-0.195	0.708	0.637	-0.102	-0.577	-0.069	1		
GIF*	0.119	0.095	-0.177	0.456	0.627	0.129	-0.592	-0.027	0.927	1	
US	-0.378	-0.202	-0.233	-0.648	-0.445	0.423	0.114	0.193	-0.529	-0.226	1

00Q1-04Q1	*Estonia*	*Latvia*	*Lithuania*	*Czech Rep.*	*Hungary*	*Poland*	*Slovakia*	*Slovenia*	*EA*	*GIF**	*US*
Estonia	1										
Latvia	-0.032	1									
Lithuania	-0.054	-0.306	1								
Czech Rep.	0.269	0.190	-0.705	1							
Hungary	0.049	-0.216	-0.532	0.289	1						
Poland	0.510	-0.049	-0.483	0.653	0.547	1					
Slovakia	-0.043	0.166	0.022	-0.197	-0.404	-0.594	1				
Slovenia	0.111	0.189	-0.812	**0.852**	0.445	0.548	-0.045	1			
EA	0.176	0.312	-0.595	0.761	0.237	0.310	-0.089	0.644	1		
GIF*	0.384	0.226	-0.795	**0.918**	0.473	0.683	-0.222	**0.856**	**0.854**	1	
US	0.496	-0.018	-0.519	0.648	0.618	**0.956**	-0.551	0.568	0.270	0.679	1

04Q2-07Q4	*Estonia*	*Latvia*	*Lithuania*	*Czech Rep.*	*Hungary*	*Poland*	*Slovakia*	*Slovenia*	*EA*	*GIF**	*US*
Estonia	1										
Latvia	**0.981**	1									
Lithuania	**0.920**	**0.956**	1								
Czech Rep.	**0.983**	**0.951**	**0.895**	1							
Hungary	0.723	0.654	0.497	0.784	1						
Poland	0.797	**0.844**	**0.904**	0.749	0.364	1					
Slovakia	**0.833**	**0.858**	**0.946**	**0.840**	0.478	**0.891**	1				
Slovenia	**0.942**	**0.964**	**0.979**	**0.905**	0.540	**0.907**	**0.913**	1			
EA	**0.959**	**0.971**	**0.959**	**0.923**	0.586	**0.920**	**0.892**	**0.985**	1		
GIF*	**0.965**	**0.973**	**0.942**	**0.933**	0.652	**0.899**	**0.869**	**0.976**	**0.994**	1	
US	**0.904**	**0.879**	**0.856**	**0.932**	0.751	0.639	**0.811**	**0.828**	**0.823**	**0.838**	1

Appendix 3. Cross-correlations of output gaps in 1996 – 2013 (continued)

08Q1-10Q2	*Estonia*	*Latvia*	*Lithuania*	*Czech Rep.*	*Hungary*	*Poland*	*Slovakia*	*Slovenia*	*EA*	*GIF**	*US*
Estonia	1										
Latvia	**0.961**	1									
Lithuania	**0.939**	**0.957**	1								
Czech Rep.	**0.973**	**0.946**	**0.976**	1							
Hungary	**0.978**	**0.960**	**0.959**	**0.991**	1						
Poland	**0.988**	**0.967**	**0.926**	**0.957**	**0.973**	1					
Slovakia	**0.872**	**0.885**	**0.971**	**0.954**	**0.926**	**0.857**	1				
Slovenia	**0.987**	**0.955**	**0.971**	**0.996**	**0.990**	**0.971**	**0.932**	1			
EA	**0.950**	**0.921**	**0.926**	**0.972**	**0.985**	**0.959**	**0.909**	**0.970**	1		
GIF*	**0.930**	**0.902**	**0.921**	**0.968**	**0.977**	**0.937**	**0.922**	**0.961**	**0.997**	1	
US	**0.946**	**0.887**	**0.891**	**0.962**	**0.972**	**0.945**	**0.880**	**0.962**	**0.987**	**0.985**	1

10Q3-13Q4	*Estonia*	*Latvia*	*Lithuania*	*Czech Rep.*	*Hungary*	*Poland*	*Slovakia*	*Slovenia*	*EA*	*GIF**	*US*
Estonia	1										
Latvia	0.752	1									
Lithuania	**0.846**	**0.973**	1								
Czech Rep.	-0.054	-0.442	-0.301	1							
Hungary	0.273	0.442	0.500	0.237	1						
Poland	-0.010	-0.603	-0.458	0.706	-0.117	1					
Slovakia	0.510	-0.039	0.111	0.466	-0.017	0.775	1				
Slovenia	0.016	-0.166	-0.047	**0.812**	0.648	0.459	0.284	1			
EA	0.161	-0.387	-0.200	**0.850**	0.278	**0.830**	0.634	0.758	1		
GIF*	0.273	-0.310	-0.111	**0.804**	0.253	**0.836**	0.717	0.700	**0.988**	1	
US	0.567	**0.836**	0.794	-0.314	0.297	-0.511	0.069	-0.087	-0.407	-0.339	1

NOTE: *GIF – Germany, Italy, and France aggregate.