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EVALUATING THE EURO AREA AS AN OPTIMUM CURRENCY AREA

Master's thesis

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I hereby declare that I have compiled the thesis independently
and all works, important standpoints and data by other authors
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has not been previously presented for grading.

The document length is 14028 words from the introduction to the end of the conclusion.

Renee Bahman 07.05.2024

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ABSTRACT

This master's thesis aims to evaluate whether the euro area can be seen as an optimum currency area (OCA) where business cycles are broadly synchronized. Theory posits that a currency area is more likely to have synchronised business cycles of a number of criteria are satisfied (Grauwe, 2020). It is important to investigate the degree of synchronization as divergent cycles may lead to internal tensions across the countries in the area.

The thesis considers various business cycle indicators, including calculating the output gap and Taylor rule (TR) proposed interest rate. TR interest rates are used to evaluate the suitability of ECB rates to individual euro area members.

The following research questions are addressed in the thesis. First, are the euro area member states in different business cycles? Second, is the level of synchronization different for euro area 12 core members than it is for the euro area as a whole? Third, what would be the TR proposed interest rates for each of the euro area members and how do these rates differ from the ECB steering rate?

The findings suggest that euro area was synchronized pre Global Financial Crisis and was on way to synchronisation in GFC after-match. External crises act as a great equalizer, GFC and Covid pandemic show higher degree of synchronization, albeit in different amplitude of impact. TR proposed interest rate is more in line with ECB interest rate in euro area 12 members.

Zotero was used for documented citations in this thesis.
Keywords: Optimal Currency Area, euro area, Taylor rule, Monetary policy

INTRODUCTION

Euro area proposes many benefits for the participants; increased trade by eliminating the exchange rate volatility and making it easier for businesses to trade across borders, the increased investment flows contributing to member states economic growth and lower transaction costs while facilitating both, direct investments as well as increased trade. (Sondermann & Vansteenkiste, 2019) In addition to the economic benefits, the euro area membership adds to a country's reputation and credibility in the eyes of the investors and other economic actors. One of the main goals of the one currency area is greater price stability and lower inflation across the member states. OCA theory suggests common monetary policy in order to achieve price stability, the main goal of a central bank is to maintain low and stable inflation which is typically achieved with the use of interest rates and other monetary policy tools. To support the goal of price stability, OCA suggests members states to have sound fiscal policies, including debt sustainability and balanced budgets.

This master's thesis aims to evaluate whether the euro area can be seen as an optimum currency area (OCA) where business cycles are broadly synchronized.

Following research questions are proposed in this thesis:

1) Are the euro area member states in different business cycles?
2) Is the level of synchronization different for euro area 12 core members than it is for the euro area as a whole?
3) What would be the Taylor rule proposed interest rates for each of the euro area members and how do these rates differ from the ECB steering rate?

To address the research questions, the GDP, Harmonized Index of Consumer Prices and unemployment data is considered. Analysis looks at all 20 members of the euro area and also compares whole euro synchronization against 12 core members: European Monetary Union members: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, and Spain.

First overall business cycle synchronization is compared. Using Hodrick-Prescott filter (Hodrick & Prescott, 1997), an output gap is calculated from the quarterly log GDP. The cyclical components are extracted and used to assess the degree of synchronization. In addition, the year-to-year changes in inflation (HICP) and unemployment are calculated and compared across countries.

Second part of the analysis looks at the standard deviation across following indicators: output gap and GDP growth, the unemployment rate, the rate of inflation. The standard deviations are computed for the whole euro area and for the original 12 members.

In the third part, the Taylor rule proposed interest rate is calculated for each country using above mentioned data and output gap from HP filter analysis. In addition, Taylor rule proposed interest rate will be calculated for comparison using unemployment data. HP filter will be utilized to get cyclical and trend data from unemployment and unemployment gap is utilized for Taylor rule based interest rule calculation.

The master thesis consists of three main chapters: Chapter 1 explores the theory and literature around Optimum Currency Area. Chapter 2 describes the data and empirical methodology. Chapter 3 presents, visualizes and analyses findings and discusses various explanations for the results.

1. OPTIMUM CURRENCY AREA AND TAYLOR RULE

In this chapter, the concepts of Optimum Currency Area (OCA) theory and empirical literature are discussed. First part focuses on the literature while second part looks at the theory in the light of euro area. Third part attempts to shed light on Taylor rule and connection of the OCA and business cycle synchronization. In the fourth part the overview of the empirical studies done on OCA criteria and studies and methods employed in on business level synchronization in euro area.

1.1. Optimal Currency Area Theory

One of the main goals of the one currency area is greater price stability across the member states. Optimal currency area theory proposes that member states can benefit from single currency and common monetary policy when certain conditions are met; labour force is ready to move across the region, free movement of capital, diversified economy with shared economic goals, similar business cycles and a fiscal system transferring money from one region to other. (Grauwe, 2020) OCA theory proposes means of common monetary policy to achieve economic stability. The main goal of a central bank is to maintain low and stable inflation which is typically achieved with the use of interest rates and other monetary policy tools. To achieve the economic stability, OCA suggests members states to have sound fiscal policies, including debt sustainability and balanced budgets. (Mundell, 1961) Theory of monetary integration economics, proposes similarly the importance of risk-sharing mechanisms via fiscal transfer, similarity of business cycles and economic interdependence. (Grauwe, 2020)

Idea of an optimal currency area proposes that in common currency area the economic shocks of individual member countries can be absorbed by unified monetary policy and one currency. It is well illustrated by Mundell describing the dynamics of full employment and balance-of-payments when equilibrium is disturbed. The shift of demand from one country (A) to another country (B) will cause unemployment in country A and inflationary pressure in country B – assuming that money wages are sticky, and monetary authorities act to prevent inflation. (Mundell, 1961)

The problem of fundamental disequilibria is also mentioned by Meade (1957), who argues that an absence of perfect competition in product and factor markets pushes the relative cost levels of participating countries out of line, this might cause temporary bouts of wage inflation. The second type of disequilibrium might arise because of the differences between in rates of productivity growth, inflation, national attitudes to full employment and strength of trade unionism.

One of the main benefits of the OCA is economic stability. This is achieved when countries are similar in economic structure and well-integrated with each other. In an exchange union the one price level reduces transaction costs and promotes trade. (Mundell, 1961) McKinnon added to this the dimension of the openness of the economy i.e., the ratio of tradable and non-tradable goods. The problem is to maintain the external and internal balance, emphasizing the need for internal price level stability. (McKinnon, 1963)

The argument above is, however, opposed by Grubel, who argues that Mundell and McKinnon overlooked some of the hidden assumptions. He argues that currency area formation might reduce the magnitude of the price fluctuations, but the frequency of the shocks is increased. He defines the function of price stability containing both frequency and magnitude of price fluctuations; therefore, the currency union increases stability only if the random shocks are less than perfectly and positively correlated. (Grubel, 1970)

Building on demand shift works of Mundell, De Grauwe (Grauwe, 1993) went farther and proposed that shift in the aggregate demand will be balanced by wage flexibility and mobility of labour. If wages are flexible, workers who are unemployed, because of the negative shift in demand, will reduce their claims to wages. In the other country, on the positive side of the shift, the additional demand will increase wage rates. The reduction of wage in country A will shift the aggregate supply curve downwards whereas the wage increase in country B will shift the aggregate supply curve upwards and thus, make new equilibrium. Lower wage country products are now more competitive, stimulating demand, and vice versa for higher wage country. Labour mobility is a second mechanism that will lead to new equilibrium: unemployed workers will move to other country where there is excess demand for works eliminating the need for wage adjustments in both countries, making unemployment problem disappear in one country and eliminating inflationary wage pressure on other. Thus, the problem should resolve itself, if the wage flexibility and mobility of labour is sufficiently high. (Grauwe, 2020)

An interesting approach is argued by Fleming (1971), who proposes that when disequilibria take place, the country in deficit should have more rise in unemployment than the decline of unemployment in the surplus country. The reason is that the inverse relationship between inflation and employment (Phillips, 1958) is typically curvilinear, at least in the presence of full employment, and as unemployment approaches zero, any successive point in decline of unemployment must have increasingly powerful stimuli to inflation. To prevent the net acceleration of inflation, the changes of unemployment – decline in deficit country and rise in surplus country should be different. (Fleming, 1971)

The shock absorption (and other aspects of OCA theory, which will be discussed further) are however opposed by Kenen, who argues that for the perfect labour mobility, the perfect occupational mobility must occur. This would require the geography of the monetary union to have homogeneous collection of producers that use same technology and a homogeneous labour force, a hard to reach concept as regions are not similar. (Kenen, 2019)

McKinnon argues, that if looking at the situation between two regions or countries A and B, both with own specialized industries. And in case of abovementioned asymmetric shock – rise in demand for the products of region A and decline in region B, that if region A cannot easily develop similar type industries to region B, then factor movements to A may be only thing that will prevent a large fall in the unit incomes of production in B. So directly aimed policy to overcome the immobility of factor movements between A and B may be optimal way and perhaps two should be joined in a common currency area. (McKinnon, 1963)

When asymmetric shocks are temporary, the results of unsynchronized booms and busts, the issue is not so much flexibility, but stability. Member countries in a monetary union are more vulnerable to changing market sentiments and this can lead to more volatility in the business cycle. Thus, when country experiences a recession and increase in the budget deficit may be hit with large-scale of its government bond sales, leading to a liquidity crisis and higher interest rates. This in turn will likely lead the governments to introduce budgetary austerity – increase taxes and reduce spending, which will enhance the recession even more. (Grauwe, 2020) Kenen proposed, in opposition to this view, that a diversification of output will mitigate the possible damage done by external shocks. (Kenen, 2019)

Alternatively, countries not in the monetary union have few tools of the monetary policy to adjust to the asymmetric shocks; in case of a flexible exchange rate regime, the mechanism is to change the domestic money supply and/or the interest rate, in case of the pegged exchange rate regime, the tools are to revalue or devalue currency. Exchange rate flexibility gives countries freedom to react to the shocks by implementing monetary and/or fiscal policy, possibly leading to a depreciation of their currency, to smooth the consequences of the shock to the economy. In monetary union the role for the reaction of the shocks is given to the monetary union central institutions. In addition to the labour movement flexibility, many economists argue that countries in OCA should also have free capital flows across countries and similar macroeconomic structure and also that financial markets need to be well integrated. (Grauwe, 2020; McKinnon, 1963; R. A. Mundell, 1961) If financial markets are not well integrated and the interest rates (besides the steering rates) are not similar, the common currency could lead to inflation and imbalances of balance of payments (McKinnon et al., 1996)

For protecting the monetary union member countries from the mechanics of asymmetric shocks, Mundell, McKinnon and Kenen proposed fiscal transfers. Fiscal transfers would enable to smooth the shocks and prevent the business cycles of member countries to go too far apart. Mundell found in his works, that fiscal policies have hidden consequences: if used systematically, the country might face debt sustainability problems, which consequently can hinder the fiscal instrument usage in the future if over used in the presence. Also, that country that has large fiscal deficit and high debt comparing to GDP can create situation where negative spillover effect will affect rest of the monetary union, which in turn drives interest rate upwards and increases the burden of financing government debts for other monetary union members. (Grauwe, 2020)

Kenen, again opposing some of the base principles of OCA, argued that Mundell and McKinnon did not address sufficiently the economic sovereignty dimensions, managing aggregate demand and maintaining full employment. There is no optimal mix of policies, and the fiscal and monetary policy must go hand in hand. Kenen proposes that opposing central bank, there should be treasury, empowered to tax and spend, to cooperate with monetary policy or to quarrel with it. (Kenen, 2019)

Ricci in 2008 analysed OCA from a perspective of model of trade with nominal rigidities which opened a way for comprehensive consideration of the monetary and real arguments from OCA and monetary integration literature. In his analysis, he found that it is impossible to find unifying rule

that would identify OCA as a currency area which creates positive benefits for all of the members. The benefits for the members ought to be:

  a) the correlation of real shocks;

  b) degree of adjustments provided by international labour mobility and fiscal tools as these are substitution for exchange rate;

  c) the difference between inflationary bias of the domestic authority and monetary union, as the participation in the monetary union is compared to "tying ones hands" (Giavazzi & Pagano, 1988);

  d) the variability of the domestic shocks as some parts of these shocks are transmitted to other currency union members;

  e) the size of the efficiency and deadweight losses eliminated via single currency. (Ricci, 2008)

Same benefits would diminish through:

  f) the variability of the real shocks as they generate costs for adjustments within currency union;

  g) the effects of foreign monetary shocks some of the effects will inevitably be transmitted within currency union;

  h) correlation of monetary shocks between countries, because correlation diminishes probability that these shocks neutralize each other within a monetary union.

In his work he pinpointed an important finding: the effect of the degree of openness on the benefits for the countries is not clear when monetary shocks and real shocks are taken into account. McKinnon argument that smaller countries would benefit from monetary stability when joining a currency area (McKinnon, 1963) does not hold. Also, claim that openness summarizes all criteria (Grauwe, 2020) was not confirmed. He also proposed that theoretical analysis for OCA is far from complete and that definition of an OCA is subject to change over time as cost benefit evolves over time. (Ricci, 2008)

OCA theory has received also lot of criticism. Mundell came back to the theory and added to his own work, that some of the ideas were overly too simple and did not take the complexity of macroeconomic interactions into account, also that institutions and political arrangements need to be considered for OCA to be successful. (R. Mundell, 1973) Friedman argued that the costs are ignored and that the costs may often outweigh the benefits. In his view, the OCA might lead to the governmental intervention in the economy and lost freedom of national sovereignty. He believed

that countries should be free to adjust their exchange rates as necessary and that giving up exchange rate could lead to economic instability. (Friedman, 1994) Theory of the OCA has been evolving through time and is not without its controversy. Different economists propose different properties as metrics for OCA. Some of the metrics are difficult to measure and are incomparable to each other. (Tavlas, 1993)

1.2. The conception of an Optimal Currency Area and euro area

The concept of an optimal currency area in the light of euro area emerged in 1960s and 1970s, in large part in response to the discussions of a desirability of a common currency in Europe. The idea emerged as part of broader effort to promote economic integration and cooperation in Europe following devastating World War II. The 1960s and 1970s were a period of rapid economic growth and prosperity in Europe. The creation of European Free trade Association, agreement on a common agricultural policy, cessation of customs duties between European Economic Community members, marking the beginning of Customs Union in 60s were steps on Europe's way towards unified economic environment. (European Union, 2023) Europe enjoyed rapid economic growth and prosperity in 1960s and 1970s and policymakers believed that a single currency would help to sustain the growth and facilitate greater economic cooperation.

Euro area proposes many benefits for the participants; increased trade by eliminating the exchange rate volatility and making it easier for businesses to trade across borders, the increased investment flows (Sondermann & Vansteenkiste, 2019) contributing to member states economic growth and lower transaction costs facilitating both, direct investments as well as increased trade. In addition to the economic benefits, the euro area membership adds to a country's reputation and credibility in the eyes of the investors and other economic actors.

Economic integration is considered to one of the pillar stones of optimum currency area. One currency will give more benefits to participants if they are well integrated and share similarities in economic structures. The idea behind is, that the savings from the currency exchange as well as increased capital investment flows between countries will be higher because of the elimination of local currency risk. Before EMU had officially formalized, economists argued that common (Western) European currency an important condition for (Western) European economic union, and that its absence is an important obstacle. (Scitovsky, 2013)

Scitovsky made an argument for the currency union or, one common currency at that point, from the point of view of balance of payments. In classical theory of balance of payments, the adjustment of balance is achieved over time. Argument being, that the tendency is towards balance

of payments equilibrium. Building to the works of David Hume from 1752 (*sic!*) who proposed that flows from one country will create disbalance of prices between those countries and the divergent movement in the price levels will continue until equilibrium of balance of payments re-established. (Hume, 1752) While this citation does not candidate for the latest developments, it illustrates actuality of the topic throughout history.

Study by Giavazzi and Spaventa (2010) proposes that situation with current accounts balance and via that also the individual country balance of savings and investments is often neglected from the academic debates as well as in the management of euro area policies. Although literature supports that kind of behaviour under specific conditions: current account imbalances and external debt in monetary union are suitable only when borrowings are utilized towards increase of production (Ingram, 1973), the study concludes that although first impressions lead economists EU wide to cheerfully believe that all went well, the financial crisis of 2008 and 2009 was a sobering experience mainly because the balance of accounts and investment-borrowing relation was neglected.

Scitovsky added to the prices discussion, that prices probably were more flexible at that time and also, the stock of wealth has been accumulated since and also contributes to the balance of payments via Pigou effect. (Pigou, 2013) As there is much more wealth available, the effects of the price disequilibria are much smaller than it was in 1700s. Another aspect of classical theory is the influence of monetary policy on the balance of payments. This was believed to achieve not only through the effect on prices but also levels of income and economic activity, the argument being that pre-World War I the balance of payments were usually achieved due to the bank rates on the international flow of speculative short-term capital. (Scitovsky, 2013)

Income or modern theory addresses balance of payments disturbances in a way in which this affects incomes. The main difference with classical theory is that although the theory itself is dynamic as well, its main concern is the process of change, but it is not a theory of balance, as it does not assert that equilibrium of balance of payments will be restored. When demand for country's export changes, the changes on the income in that country will affect the marginal propensity to spend (Keynes, 1937) on imported goods. So, when change in the demand of exported goods will equal change in demand of imported goods, the balance of payment would balance itself, however there is no reason to expect that income effect would maintain or fully restore balance of payments. (Scitovsky, 2013) This is also argued by Metzler, who proposed that

the adjustments of a country's balance of payments is likely to be incomplete by the means of income. (Metzler, 1949)

Similarly to Scitovsky's argument, Meade added that any member of free trade area which is in overall deficit, it should allow the prices, incomes and costs to deflate so much that the balance of payments is restored via less consumption of imported goods and supply of more and cheaper products for export. Citing the gold standard approach, he argued that this is a dangerous solution and it leads to a situation where free trade members should aim their policies so, that those aimed at domestic inflations and full employment preservation are disregarded. (Meade, 1957) The price dynamic effect on balance of payments is well represented in the country's where economic policy is aimed at price stability and domestic employment. These kinds of policies dampen the effect on incomes and via that income-effect on imports. (Scitovsky, 2013)

In addition to the price effect, it is argued that also immigration influences balance of payment. A rise in regions income does not only raise its peoples import expenditures, but may as well attract immigrants. These additional earnings will add to the spending on imports and exports. Immigration is also dependent upon income differences in regions, therefore adding to the balancing force. (Scitovsky, 2013) Meade added to this, that when barriers for worker movements are absent, the free movement from one country to other will re-establish the balance. (Meade, 1957)

Free movement of capital are argued to help to restore the balance of payments. In an open economy the dynamic of yields and interest rates between regions of excess savings and investment are considered to be equilibrating factors. (Scitovsky, 2013) Although, it is stressed by Scitovsky that this is a slow process that might be temporarily obscured by speculative movements of funds in and out of securities. Meade looked at that from slightly different view point, that to make one country's control over exports of capital to countries outside the free-trade are effective, the exchange control regulations of all the members must be harmonised, if the aim is to maintain the freedom of capital movement within free-trade area. (Meade, 1957)

Employment policy has an interesting effect on the balance of payments. Above mentioned mechanisms have little effect on the balance of payments because most of them have an equilibrating effect via changing incomes and price levels to lesser extent and these effects are often counter measured by domestic economic policies keeping price levels and incomes stable.

So only effective measure to maintain balance of payments balance is the flow of international capital resulted in yield differences. (Scitovsky, 2013) Metzler argued similarly, though slightly from different angle, that the balance of payments (as well as short term capital movements and level of commodity imports and exports) may respond much easily to the changes in relative prices and interest rates. He gives an example if two countries are trading, and both of them have substantial level of unemployment, the inflexibility of minimum-wage laws and union restrictions, the balance of payments cannot be easily obtained by adjustments in prices and money costs. The balance therefore is maintained how the variations of investments and consumption in one country will be reacted upon in other country. (Metzler, 1949)

The employment policy is interference towards balance of payments policy, because when the policies are directed at stabilizing employments and incomes throughout many regions, the policies themselves become stabilizing factors. (Scitovsky, 2013) Meade added, to continue his above-mentioned argument about the deficit, that a member country of a free trade area experiencing deficit cannot postpone the price adjustment indefinitely cause its stock of foreign currencies and gold are limited and exhaustible. The domestic financial and full employment policy might have to be abandoned, even if for the period of the structural adjustments to take place. (Meade, 1957)

The above-mentioned equilibrating forces of the balance of payments were way into understanding and dealing with the problems of common (Western, at that time) currency. The analysis of Scitovsky, and contributions of other authors paved the way to a thought that common all-European capital market and a common all-European employment policy would be prime requisite of a common currency. He argued that integrated capital would create better environment for a better exploitation of economies of scale and location in European industry and that all-European employment policy would be only feasible policy within free trade area, because alternative uncoordinated national policies would be too costly. He stressed that apart both of these goals being desirable themselves – these may be necessary conditions of a common (Western) European currency. (Scitovsky, 2013)

DeGrauwe goes farther and proposes idea of budgetary union on top of the monetary union to help to mitigate any shocks and to counteract the vulnerability of the economy in the bad equilibria. The budgetary union requires broad political unity on the topic as well as giving up the budgetary independence. At the moment (2018 data from De Grauwe's book, Economics of Monetary

Union), EU budget consists of 1% of GDP of EMU for budgetary union the percentage needs to be much higher, and countries budgets is hard to achieve in reality and author argues as well, that in EMU this is not possible at the near future. (Grauwe, 2020) The idea is backed also by International Monetary Fund, who argues that fiscal mechanisms need to be in place to mitigate country specific macroeconomic shocks. (IMF, 2018)

The OCA theory history and progression has been also analysed by many others, Dellas and Davlas, for example. They emphasize the Friedman's strong case for flexible exchange rate (Friedman, 1953) importance as a foundation for Mundell's OCA theory. They go as far as propose that Friedman's response to Robbins, in which he stated that proposal for a single currency area is one that has one monetary policy and reasonable free movement of men, goods and capital is the core foundation of OCA theory! The conclusion of their paper is that depending upon country's structural characteristics: size, openness, and product diversification, the fixed or floating exchange rate policies are not equally applicable policies. Furthermore, they have concluded that first works of OCA Theory have several inconstancies, contradictions and tenuous model set up, which lead to the dead end of the theory in 1970s and 1980s. It took experience from European Monetary union to rethink the effectiveness of nationally tailored monetary policies to rehabilitate the interest of the subject matter. (Dellas & Tavlas, 2009)

Perhaps Krugman has the one of the loudest voices in criticism when it comes to OCA theory. He argues that assumptions of OCA are flawed, and labour is not as highly mobile as theory would lead to believe. Also, sudden shifts in the capital movements can have destabilizing effect on nations' economies. He also points out that the international policy coordination is difficult achieve due to the political and economic differences and tensions between member states. (Krugman, 1993) He also argues that OCA theory emphasizes trade between member countries too much and ignores the other trade with countries outside the monetary union. He finds that asymmetric shocks can lead to bad equilibria and member states can experience different shock that is not shared by other members – leading to a situation where one policy will not be sufficient for all the members, furthermore, giving up exchange rate adjustment tools can be too costly for a country. This would lead to the need for different policy response that are impossible to accommodate within single monetary policy. (Krugman, 1993) In his later works he proposes that euro area is facing economic and political crisis that threatens undermine the European project based upon the flawed assumptions mentioned above. He proposes similarly to other economists a necessity for fiscal

policy integration to address the imbalances. He proposes urgent reform within the Eurozone to avoid the potential collapse of the European project. (Krugman, 2011)

1.3. Business cycle and Taylor Rule

For modern business cycle analysis, at its core, three equations are used: forward looking IS and Phillips curves and interest rate rule for regulating monetary policy. (Belongia & Ireland, 2021) In the paper, they break down the history of business cycle development in a following way: nearly century ago an alternative view of monetary transmission mechanism was proposed by Fisher (1923, 1925, 1926) and Working (1923, 1926). During in which, Fisher (1926) discovers a statistical relationship between employment and inflation, a similar structure what would be later called as Phillips Curve (Phillips, 1958). An important development comes with Fishers definition (1923, 1925) of "so-called business cycle" which is the result of fluctuating currency rate, called as "dance of the dollar". Fisher singles out that nominal (interest rate) impulses are primary drivers for aggregate movements. The idea developed further and direct link was discovered between consumption growth and (ex-ante) real interest rate in household Eulers equation optimization problem. Keeping in mind that short term interest rates are key driver of output, a rule was prescribed in the New Keynesian model for interest rate adjustment in response to the prevailing economic conditions, which is in the same general form as Taylor's rule (1993) for interest rate computation. (Belongia & Ireland, 2021)

Taylor rule (TR) is a monetary policy tool, proposed by economist John Taylor in 1993, which provides guidance how central banks should change the interest rates in response to changes in inflation and output gap. TR prescribes recommendation for central banks to adjust their policy in response to changes in inflation and economic output. The rule suggests that interest rates should be raised when inflation rises above the central bank's target level or when economic output level is above its potential level, and conversely, interest rates should be lowered with economic output is below its potential or inflation falls below the target level.

The formula for the rule is:

$$i_t = r^* + \pi_t + \alpha(\pi_t - \pi^*) + \beta(y_t - \bar{y}_t),$$

where i_t is the nominal interest rate,

r^* is the rea interest rate,

π_t is the inflation rate,

π^* is the target inflation rate,

y_t is actual output represented by log of real GDP,

$\bar{y}_t$ is the log of potential output (identified empirically with a linear trend)

and α and β are the weights on the inflation rate and output cap respectively. (Woodford, 2001)

Since the creation of the TR, the formula has become trusted tool for evaluating central bank's policy. Many studies have been done to evaluate Federal Reserve as well as European Central Bank monetary policy. Among the most important goals of central banks is maintaining stabile output and inflation levels. Taking into account, that TR alone does not provide all of the information needed for interest rate policy, as central banks need to look forward and take account prediction of the inflation and output, the simplified tool provides a good measure to estimate central bank efficiency. (Beckworth & Hendrickson, 2020)

As a monetary policy rule, TR encompasses the key economic metrics, output gap, HICP inflation and unemployment rate. In the context of OCA theory, the TR provides one of the possibilities to evaluate appropriate interest rates for the entire currency area. By combining these metrics, TR gives an additional way to evaluate business cycle synchronization.

1.4. Empirical studies

This section aims to give an overview of the empirical studies that discuss currency unions and Optimal Currency Area theory. In the first part, the focus is on empirical studies done about Optimal Currency Area criteria with some of the studies highlighted. The list aims not to be exclusive, but to give an overview of the empirical studies and their findings. Second table focuses on different methodologies employed when evaluating business cycle synchronization and their findings. Similarly, this table does not qualify as exclusive list, its aim is similarly to the pervious table to provide with an overview of the methodologies and findings.

Eichengreen studied Europe as an OCA in 1990. He assessed labour mobility and the incidence of shocks in Europe and compared them with United States and Canadas respective measures. His finding was that the real exchange rate, as a standard measure of the extent to an asymmetrical shock, was greater in Europe than in United States which suggested greater prevailing of region-specific shocks. That made case for nominal exchange rate changes to coordinate price level adjustments between different regions. He also found that real securities prices were more variable within Europe, which underlined the importance of region-specific shocks. He also concluded, as other authors argued in theory (McKinnon, Krugman, Kenen), that labour mobility level is much lower than in US and that mechanism cannot be expected to work in Europe and proposed budgetary transfers to be stabilizing mechanism similar to the United States system of fiscal federalism. (Eichengreen, 1992)

Barbosa and Alves analysed in 2011 the euro area as an optimum currency area. They took under focus a descriptive performance of twelve original euro area countries, looking at several criteria via GDP and related indices, and in a second part assessed the impact of five OCA criteria on countries from the prism of competitiveness. The analysis of ECB`s real effective exchange rate (REER) showed a significant divergence among countries. During 1999 to 2009, 3 countries improved their position, Germany, Finland and Austria, while Spain, Greece and Italy were rather stagnating and losing ground. They argued, that the loss of competitiveness was partially to blame through current account deficits (Zemanek, 2010) As countries had very different economic trajectories, the effectiveness of the single monetary policy was reduced. (Friedman, 1953)

In the second part of the analysis, Barbosa and Alves analysed evolution of EMU via OCA properties. They took under consideration 5 criteria: Labour market integration and wage

flexibility; Economic openness and financial and capital markets integration; diversification of production; similarity and flexibility of inflation rates and price levels; and the fiscal integration. Labour market analysis showed interesting results while unemployment rates converged between Emu countries, wage policies had a different result, peripheral countries wages grew faster, but productivity growth was not similar – resulting in loss of competitiveness. (Arpaia & Pichelmann, OECD). Financial integration showed more integration, but authors argued it was more the result of a previous tendency (Berger & Nitsch, 2008) and economies have become more diversified. Inflation rate "golden rule" of 2% was in majority achieved (European Commission, 2008), but it was higher in peripheral countries. The higher inflation and strong wages growth was reason behind the lack of competitiveness. (Zemanek, 2010) Perhaps one of the more important findings from this papers point of view: Fiscal integration has been a failure: as some of the countries did not kept the budget deficit limit every year since 2000 and piled up massive debt. (Barbosa & Alves, 2011)

The following studies in table 1 is a further development of a table in the paper (Barbosa & Alves, 2011) which summarizes the studies done about how euro area is meeting OCA conditions in several different categories of OCA criteria. Author adds newer studies to take new information into account, added studies are marked with *.

Table1: Optimum Currency Area criterium studies

	Main findings
Labour mobility	
Issing (*2000*)	Labor Markets were rigid in the run up to EMU.
Alesina & Giavazzi (2010)	There was a tendency to create a two-tier labour market.
Arpaia & Pichelmann(2007), OECD (2010), Zemanek (2010)	Rigidity contributed to the loss of competitiveness in the euro area periphery.
Hein & Truger (2005), Blanchard (2007)	Rigidity was responsible for weaker output growth and, thus, higher unemployment.
* Baglioni et al. (2016)	Federal budget appears to be essential to the efficient working of a currency area.
* Farhi & Werning (2014)	The demand shortfall in depressed region is mostly internal, migration may not help regional macroeconomic adjustment.
* Arpaia et al. (2016)	Cross-country mobility flows in the EU are still much lower than those recorded in other highly integrated economic areas (USA).
Financial integration	
European Commission (2008)	Strong integration and increased intra-EMU FDI
Fratzscher & Stracca (2009)	Integration led to diminished weight of domestic shocks and also to share of national risks.
Danthine et al. (2000)	Convergence of interest rates on public debt (now reduced).
Mongelli (2008)	Private debt markets and intra-EMU FDI increased.
* Wagner (2014)	Emerging market member economies have experienced real divergence instead of the desired/hoped for convergence
* Vukovic et al. (2017)	Sovereign crisis hit EMU more, leaving the deeper implications on the financial integration.
Trade integration	
European Commission (2008)	Increase in intra-EMU trade.
Fontagné et al. (2009)	Intra-EMU trade introduced lower price volatility & discrimination
Berger & Nitsch (2008)	Once the historic tendency is removed, there are no signs of increased intra-EMU trade.
Kappler (2011)	The positive relation between trade and business cycle sync. is more evident in the long run than in the short run.
* Gouveia & Correia (2013)	Trade imbalances have grown, positive and significant relationship between intra-EMU trade linkages and cyclical correlations.
Inflation rates and price flexibility	
Mongelli (2008)	Dispersion of inflation rates fell to historic levels.
Lopez & Papell (2007), Zhou et al. (2008)	Convergence of inflation rates began before monetary unification, casting doubts on the role of the single currency in the process.
Chen & Mahajan (2010)	There are more signs of PPP between vs inside currency blocks.
* Meller & Nautz (2012)	Degree of long run inflation persistence has converged.
* Stylianou (2022)	A one-percentage-point growth in the positive output gap leads to an increase ca 20 basis points in the inflation rate in EMU.
Fiscal integration	
OECD (2000)	Fiscal discipline diminished after EMU creation.
Zemanek (2010)	Fiscal indiscipline helped bringing about the sovereign debt crisis.
* Hinarejos (2013)	The surveillance model and fiscal federalism model, in extremes are either undesirable or politically unrealistic in the present moment.
* Matthes & Iara (2017)	The reform pressures of the recent crisis have significantly improved the structural functioning of the EMU.

Bayoumi and Eichengreen (1997) rhetorically asked is we are "Ever closer to heaven" in their same name analysis. They developed procedure or measuring OCA index and applied that on European countries. They measured the output disturbances as the standard deviation of the change in the log of relative output countries. Idea behind that is that for the countries that have symmetric business cycles, the value of this measure will be small. Then they also factored in dissimilarity of commodities in exports – as a second proxy to identify asymmetry of shocks as industry specific shocks would be more symmetric; the average value of exports and country size, as this indicates the benefits country receives from single currency, the smaller the country the bigger the benefit. The results showed European countries divided into three groups: countries with high level of readiness, countries with tendency to converge and countries where little or no evidence of convergence is evident. Additional finding was a symbiotic relationship between economic integration and monetary integration. Countries with greatest increase in bilateral trade got higher OCA index scores. Their conclusion was that the findings support the notion, that EMU and Single Market can constitute a virtuous and self-reinforcing circle. (Bayoumi & Eichengreen, 1997)

Artis (2003) analysed OCA criteria in the light of EMU, he reviews criteria's for evaluating optimality of monetary union arrangements. He reviews the data produced by SVAR analyses and the use of business cycle synchronization data – which led to core – periphery distinction. Author also reviewed the extensions that were proposed or generated in the context of the analysis; in particular that the criteria for EMU might be "endogenous". Artis also estimates Taylor rule proposed interest rates to check for in-homogeneities in euro area performance. The starting point of this analysis is an cost-benefit representation of OCA proposed by Krugman. (Krugman, 1989) In this cost-benefit analysis, the more open economy is, the more of benefits it will have from joining monetary union and less value the country has of its own monetary policy. (Artis, 2003) Same concept was proposed by McKinnon, who argued that more open economy the less likelihood there is, that changes in nominal exchange rate will be corresponding change in a real exchange rate. (McKinnon, 1963)

Secondly, Artis (2003) takes under consideration the Maastricht criteria. While a Maastricht criterion does not mention the anything from OCA criteria, the criteria should be seen as one of the unifying components for EMU countries. Not only because of the reference values for the debt and deficit values, but also as a criterion that describes fiscal policy unification among countries of EMU. This introduces a finding from EMU empirical studies, originating with Bayoumi and Eichengreen (Bayoumi & Eichengreen, 1992) and also backed up with numerous other studies,

that among EMU members there is a division between "core" and one or more "peripheral" groups. (Artis, 2003)

The empirical approach to evaluating OCA has been largely evaluating symmetry or to say differently the stochastic experience of member countries. There are few ways to go about this, implemented SVARs, what have been core for works of Bayoumi and Eichengreen (Bayoumi & Eichengreen, 1992, 1997) other way has looked at the measures of business cycles synchronicity and tested for the common cycles or for common features, using the HP filter and looking for the synchronicity by reference to cross-correlations of the cyclical components. (M. J. Artis & Zhang, 2002) More recent trend is to identify the cycle by using the approximate ideal band-pass filter (Baxter & King, 1995) but Markov-switching ARs and VARs have also been useful tool as well as estimation so-called classical cycle propagated by Pagan. (Pagan, 1997) Nearly all of the mentioned approaches agree upon the pattern of a "core" and "peripheral" countries. (Artis, 2003)

For an OCA based analysis, (M. j. Artis, 2003) uses "fuzzy clustering" analysis (Artis & Zhang, 2002) looking at six criteria, measured relative to Germany. Variables are: relative inflation; business cycle cross-correlation; labour market performance; real bilateral DM (Deutche Mark) exchange rate volatility; and monetary policy correlation. The analysis identifies three "membership coefficients" and clusters for member countries. Artis proposes to call them, the "core" and "Northern" and "Southern" peripheries. As the core creates coherent group for which monetary union is suitable, the peripheral groups are advised less strongly to participate. In-homogeneities prediction was done via Taylor rule proposed interest rates for each constituent economy and compared with the same interest rate given by the same rule for euro area (Bjorksten & Syrjänen, 1999), as a way of evaluating "one size fits all" monetary policy in a quick way. Interesting find is, that overall variance of the Taylor rule indicated interest rate grew sharply in 2001. The conclusion of the analysis is that OCA criteria might be a good first framework to consult suitability of a country for participating monetary union, and the framework can be quantified to a useful, though not a conclusive extent to make the decision. (M. j. Artis, 2003)

Fidrmuc (Fidrmuc, 2008) studied the endogeneity of the optimum currency area criteria, intra-industry trade and EMU enlargement. He tested endogeneity hypothesis of OCA in a selection of OECD countries. The argument was that intra-industry trade (IIT) promotes convergence of business cycles. The endogeneity hypothesis of OCA criteria suggests a comparable degree of business cycle harmonization of Central and Eastern European countries with EU originally

proposed by Frankel and Rose (Frankel & Rose, 1998). The article addressed the importance of trade structure for the synchronization of business cycles, and it found that IIT inclined to promote convergence of business cycles in OECD countries. Articles econometric analysis confirmed OCA criteria endogeneity hypothesis but with respect to IIT. It also concludes, that observed time period (between 1996 and 2001) is too short for making a conclusion if business cycles have already become similar. (Fidrmuc, 2008)

James L. Swofford (2000) studied Microeconomic foundations of an optimum currency area. He argued that for a common currency area, the uniting factor for an economic agent should be using currency and checkable deposits as money. If one country uses only currency as money and other uses checkable deposits and currency as money, then these two countries do not form a common currency area. He studied the common currency as an asset or assets in economic agents optimizing function. He used per capita data to maintain the representative agent and looked at utility via real capita per consumption, real per capita holdings of currency and demand deposits, and real per capita holdings of quasi-money which includes savings and time deposits. Sufficiency criteria for the data were to satisfy GARP (General Axion of Revealed Preference), when the sub-utility function was calculated using the Afriat inequalities (Afriat, 1967). Results came back mixed as from 10 countries for the 6 individual data sets sufficient conditions obtain both the necessary and Afriat sufficient. Study showed that southern European countries as Itali, Portugal and Spain may not be using the same assets as money as the rest of the euro area countries. He concluded, that preference results from preliminary tests indicate, that euro area countries do not form a common currency area. (Swofford, 2000)

The works by Gerlach and Schnabel, the authors evaluate the interest rate of EMU in 1990 – 1998 and find that with the exception of exchange market turmoil the interest rates moved very closely with average output gaps and inflation as suggested by the Taylor rule. Authors find that for the euro area, Taylor rule can be considered as an informal benchmarking for monetary policy setting. (Gerlach & Schnabel, 2000)

As studies about OCA criterium show various results from different aspect and this thesis concentrates in addition to business cycle synchronization aspect, author will also look more detailed view how empirical studies about business cycle synchronization has been carried out.

Following table 2 tries to summarise methods employed when researching same questions set up in this thesis. Table is not exclusive of all researches conducted of this topic, but should give representative idea of the methodologies and findings.

Table 2. Empirical studies of business cycle synchronization

	Methodology	Main findings
Cuaresma & Amador (2013a)	Analysis of the dynamics of the standard deviation	European synchronization differential with respect to other developed economies seems to have been diluted within a global cycle since 2004.
Cuaresma & Amador (2013b)	Sigma-convergence methods	The new EU members are relatively well synchronized with the EMU, enlargement of the EMU would not significantly decrease its optimality as a currency area.
Papageorgiou, Michaelides, Tsionas (2016)	Panel ARDL	The common monetary policy and the deeper financial integration constitute reasons for the decrease in the magnitude of the fluctuations.
Darvas and Szapáry (2008)	Detrended time series as cyclical measures.	Core EMU shows a high degree of synchronization, peripheral EMU countries synchronization levels are less advanced.
Furceri & Karras (2008)	HP and Band–Pass filter.	All countries in are better synchronized with the EMU-wide economy in the post-EMU period than before
Gonçalves, Rodrigues, Soares (2009)	Differences-in-differences	Bilateral correlation of business cycles increased more amongst EMU members after implementation of euro.
(Guerini et al., 2023)	PCA and RMT	Synchronization increased until Great Recession, but decreased thereafter.
Fatás (1997)	Correlations, co-movements.	Process of integration has increased cross-border correlations and reduced within-border co-movements.
Beine, Candelon, Sekkat (2003)	Markov-Switching VAR Analysis	Findings suggest 3 groups of synchronization within EMU.
Frankel & Rose (1997)	De-trending, HP filter	A country is more likely to satisfy the criteria for entry into a currency union ex post than ex ante.
Rose (2008)	Meta-analysis	EMU has created a virtuous circle by increasing trade and the synchronization of business cycles.
de Haan, Inklaar, Sleijpen (2002)	Detrending time-series, HP filter	Results support the view that the OCA criteria may be endogenous.
(Gómez-Loscos et al., 2020)	Finite Mixture Markov models	Co-movement among regions is quite low except during Great Recession, identified five distinct regions.
de Haan et al. (2008)	HP filter, Baxter-King filter.	Business cycles in the euro area have gone through periods of both convergence and divergence.
Gächter, Riedl (2014)	Time-varying correlation index	A country is more likely to satisfy the criteria for entry into a currency union ex post rather than ex ante.
Frankel (2004)		Econometric estimates suggest that the growing trade links will in turn lead to growing cyclical correlation, that is, to cyclical convergence
(Arčabić & Škrinjarić, 2021)	VAR	Business cycles become more synchronized after GFC; smaller countries more sensitive to spillovers
Traistaru (2004)	OLS	Paper finds asymmetries of business cycles between the CE-EU-8 and the euro area are significant.
Belke et al. (2017)	Correlation coefficients, standard deviation	Evidence of distinct core-periphery clusters.
Oman (2019)	Frequency based filter	Business cycle synchronization has increased, while financial cycle integration has decreased.

Cuaresma and Amador (2013b) analysed dynamics of the standard deviation of the demand component as well as demand and supply shocks of euro area member states. The aim was to evaluate the patterns of cyclical co-movement and compare these to the new members cyclical performance. For the method a sigma-convergence was used to identify synchronization patterns in business cycles. The results showed that euro area converged into lower level of dispersion of shocks, most likely affected by adoption of the Maastricht criteria. Because of the size of the economies of core members of euro area, authors propose that enlargement will not be affected by enlargement of the euro area by adding small new countries. Paper also indicates that the new members have to carefully consider potential factors of economic- and financial integration as well as fiscal coordination doe to the endogenous connection to the output fluctuations. (Crespo-Cuaresma & Fernández-Amador, 2013b)

Belke, Domnic and Gros (2017) examine business cycle synchronization in the euro area with a core-periphery focus in the period of aftermath of Global Financial Crisis (GFC). Quarterly index for business cycle synchronization (Cerqueira, 2013) method employed for the study. Paper also looked at co-movements of the cycle as a measure of synchronisation, but finds that it can be misleading because of the differences in the amplitudes. Paper concludes that core members experienced increased synchronisation after Q4 2007, but peripheral members synchronisation decreased both, with the core and among themselves. Interesting proposal arises from the findings: in order to decrease the core-periphery distinction, the structural reforms should be undertaken in the countries drifting away from the core group. (Belke et al., 2017)

European union synchronisation patterns were studied by Guerini, Luu and Napoletano (2023). The paper aimed for quantification of business cycle synchronisation with a combination of the Principal Component Analysis (PCA) and Random Matrix Theory (RMT), a balanced panel data was looked at between 2000 and 2017. The research results suggest that degree of synchronisation increased with the introduction of the euro until Grear Financial Crisis (GFC) and have become more de-synchronised after that. Paper also finds that clusters evolve during past decades and give significance to the rise of the sovereign debt crisis as a divider between northern and southern economies. (Guerini et al., 2023)

2. DATA AND EMPIRICAL METHODS

2.1. Data description

GDP data has been taken for all of the 20 EMU countries, data is chain linked volumes, indexed at 2010 = 100, seasonally and calendar adjusted data, national accounts indicator ESA 2010 resulting in quarterly data from q1 1999 – q4 2023. Inflation data has been taken from Eurostat, HICP neither seasonally or working day adjusted, 2015 = 100 from q1 1999 – q4 2023. Unemployment data originates from Eurostat. Unemployment according to ILO definition, seasonally adjusted not calendar adjusted monthly data, converted for quarterly for this thesis purposes from q1 1999 – q4 2023.

For comparison of the synchronization of the business cycles, cyclical component of GDP is analysed and compared within member countries. Hodric-Prescott filter (Hodrick & Prescott, 1997) is employed for calculating the cyclical component of output. Inflation and Unemployment growth year to year is calculated and analysed.

Table 3 describes some summary statistics of the selected variables. The data presents for each country, the year they joined euro area, mean and standard deviations od GDP growth, unemployment rate and HICP inflation.

Table 3: summary statistics of the key indicators

Country	Joined euro	GDP growth Y2Y		Unemployment rate		HICP inflation	
		Mean	StD	Mean	StD	Mean	StD
Austria	1999	0.0146	0.0303	5.272	0.789	0.0243	0.0199
Belgium	1999	0.0170	0.0269	7.341	1.130	0.0232	0.0210
Croatia	2023	0.0237	0.0481	11.95	3.597	0.0277	0.0273
Cyprus	2008	0.0291	0.0419	7.689	3.964	0.0201	0.0233
Estonia	2011	0.0348	0.0566	8.552	3.438	0.0427	0.0448
Finland	1999	0.0141	0.0309	8.233	1.033	0.0197	0.0170
France	1999	0.0132	0.0312	8.909	0.959	0.0190	0.0147
Germany	1999	0.0119	0.0270	6.215	2.587	0.0204	0.0194
Greece	2001	0.0041	0.0546	15.35	6.326	0.0221	0.0253
Ireland	1999	0.0523	0.0628	7.622	3.881	0.0203	0.0243
Italy	1999	0.0055	0.0368	9.362	1.820	0.0219	0.0211
Latvia	2014	0.0338	0.0612	10.82	3.780	0.0429	0.0507
Lithuania	2015	0.0387	0.0497	10.31	4.101	0.0344	0.0457
Luxembourg	1999	0.0272	0.0335	4.759	1.301	0.0249	0.0186
Malta	2008	0.0431	0.0487	5.741	1.397	0.0227	0.0161
Netherlands	1999	0.0160	0.0261	5.509	1.519	0.0240	0.0242
Portugal	1999	0.0106	0.0383	9.439	3.439	0.0218	0.0211
Slovakia	2009	0.0338	0.0369	12.34	4.515	0.0402	0.0390
Slovenia	2007	0.0245	0.0388	6.475	1.773	0.0339	0.0309
Spain	1999	0.0171	0.0429	15.41	5.239	0.0236	0.0205

2.2. Output gap estimation with Hodric-Prescott filter

To understand how the productivity growth is affected by economic fluctuations and how much driven by structural factors, it is critical to distinct between these two. One way to do so is to decompose the time series into trend and cyclical component. The trend aims to capture the long-term growth while cyclical component represents the deviation from the trend. Hodric-Prescott (HP) filter is widely used mechanism to extract trend and cyclical component from time series data in macroeconomics.

For the output gap measuring, (HP) filter was applied to the log of GDP. The goal of applying HP filter is to separate the trend component from cyclical component. The trend component shows long term movements as well as structural changes in the data, cyclical component represents the short-term movements and business cycle movements. The aim of the HP filter is to eliminate the noise in the data by removing the short-term fluctuations. Smoothing parameter λ (lambda) represents a trade-off between the smoothness of the trend and the closeness of the cyclical data. For smoothing parameter λ (lambda), value 1600 was chosen as the data is quarterly. The seasonal component is removed by choosing the seasonally and working days adjusted data.

HP filter is not without its criticism. One of the weaknesses is the filters treatment of structural breaks as the filter smooths out break effect to the previous and subsequent period. The filter becomes unstable at the end and the beginning of the sample. (Darvas & Szapáry, 2008) Filter is also unable to detect if output is below potential level for long term or permanently, it is especially the case when country has experienced period of weak growth. In such case the estimate of the business cycle is flawed and underestimates the level of the output gap. (Belo, 2001)

2.3. Taylor rule

For calculating the Taylor rule (TR) proposed interest rate, the existing data is used. GDP gap is calculated from log GDP using HP filter. For the purpose of comparison, TR interest rates will be calculated twice; once using GDP cyclical component and second time using HP filtered unemployment time series cyclical component as unemployment gap. Having calculated all the necessary datapoints for the formula, nominal interest rate is calculated as:

$$i_t = r^* + \pi_t + \alpha(\pi_t - \pi^*) + \beta(y_t - \bar{y}_t)$$

Where:

i_t is the nominal interest rate,

r^* is the real interest rate,

π_t is the inflation rate,

π^* is the target inflation rate,

y_t is actual output represented by log of real GDP,

$\bar{y}_t$ is the log of potential output (identified empirically with a linear trend)

and α and β are the weights on the inflation rate and output cap respectively.

For r^*, the original 2% as proposed by Taylor was used. (Doménech et al., 2002) For the inflation rate target, 2% is taken from the original formula proposed by Taylor (1993), which also happens to be close to the inflation target of the eurozone. The TR proposed nominal interest rate is calculated in order to evaluate the suitability of the European Central Bank (ECB) nominal interest rate across the euro area members. As mentioned in chapter 1.1 and 1.2, OCA theory aims to achieve price stability via common monetary policy, and the main goal of a central bank is to maintain low and stable inflation, which is typically achieved with the use of interest rates and other monetary policy tools. Evaluating euro area as a one synchronized economic region with unified business cycles, monetary policy and integrated economies, TR interest rates, which encapsulate all of the key metrics of business cycle, output gap, HICP inflation and unemployment rate, provide good opportunity to test the ECB policy suitability for each country and to get an additional view of the business cycle synchronization.

2.4. Methods for evaluation of synchronization

For evaluation of the synchronization of business cycles, there are many different methodologies available, with different degrees of complexity. Popular methods include, correlation coefficients, analysis of dynamics of the standard deviations of GDP cyclical component. In this thesis, standard deviations for different series: GDP, HICP, unemployment, Traylor rule proposed interest rate, Taylor rule proposed interest rate based upon unemployment, are calculated, results analysed and compared. The business cycle synchronization is compared with an idea, that if the business cycles are synchronized, it should indicate that the euro area member states are not subject to significant asymmetric dynamics. (Darvas & Szapáry, 2008)

Usually, business cycles may vary across countries for many reasons: different shocks arising from different legislations or regional/local shocks, countries may respond to the shocks differently. However, evaluating EMU as an OCA, assumption is taken, that if the business cycles are synchronized and economic structures are similar as proposed by OCA theory, the responses and standard deviations should be similar to the external shocks. This is also proposed by European Commission, where it stated that monetary and economic integration will result in less divergence, and with the hope that so called stability culture will lead to smaller reactivity to the asymmetric shocks than any time since II World War. (Emerson, 1992) This view, of course is opposed by Krugman, who argues that integration will lead to specialization of industries and trades will be concentrated regionally. (Krugman, 1992)

According to Eurostat Business Cycle Clock, euro area has faced three recessions from the beginning of the EMU, the first was in the time of Global Financial Crisis, from Q1 2008 to Q2 2009, with the following recession in the aftermath between Q3 2011 to Q1 2013, third recession hit euro area in the time of Coronavirus pandemic between Q4 2019 and q2 2020. (Eurostat, 2024) For this thesis, pre–Global Financial Crisis (GFC) time period, GFC and its aftermath and Covid pandemic will be looked at as different periods of external shocks.

Standard deviation of the output gaps is regularly used method for evaluating convergence. Method for valuating business cycle synchronization is to measure the times series volatility. Volatility is defined as a deviation from the mean of the cycle. Lower values mark low deviation from the mean and vice-versa – higher deviation from mean results in higher values. Output gap is a measure of how much economy differs from potential production to either side of the scale – positive and negative. The output gap is calculated by the method described above in chapter 2.2

It is important to note, that the synchronization does not mean convergence of the GDP growth rate, the aim is to look for the co-movement of the growth rates.

3. EMPIRICAL ANALYSIS

Trying to evaluate euro area as an Optimum Currency Area, three steps will be undertaken: first, the look to an output gap with HP filter and evaluating if the business cycles show the signs of convergence over the time. Second, looking the inflation to see what are the developments of the inflation across EMU. And for the third part, the Taylor rule based interest rate is estimated from before mentioned data to compare the rates to the ECB rates and to evaluate the convergence across EMU.

3.1. Analysis of the business cycle indicators

3.1.1 GDP gap

Most inclusive measure of economic activity is GDP, widely used across different studies. Although business cycles usually are defined with many aggregates, DGP is useful measure as many studies are based upon that. For comparison of the synchronization of the business cycles, cyclical component of GDP is analysed and compared within member countries. Hodric-Prescott filter (Hodrick & Prescott, 1997) is employed to calculate the trend component of output. The cyclical component, the GDP gap, can be computed as GDP relative to calculated trend GDP or potential output. The output gap can be positive or negative, representing the state of production from the potential production. Figure 1 shows the output gap of all of the EMU members taking account their year of joining euro area.
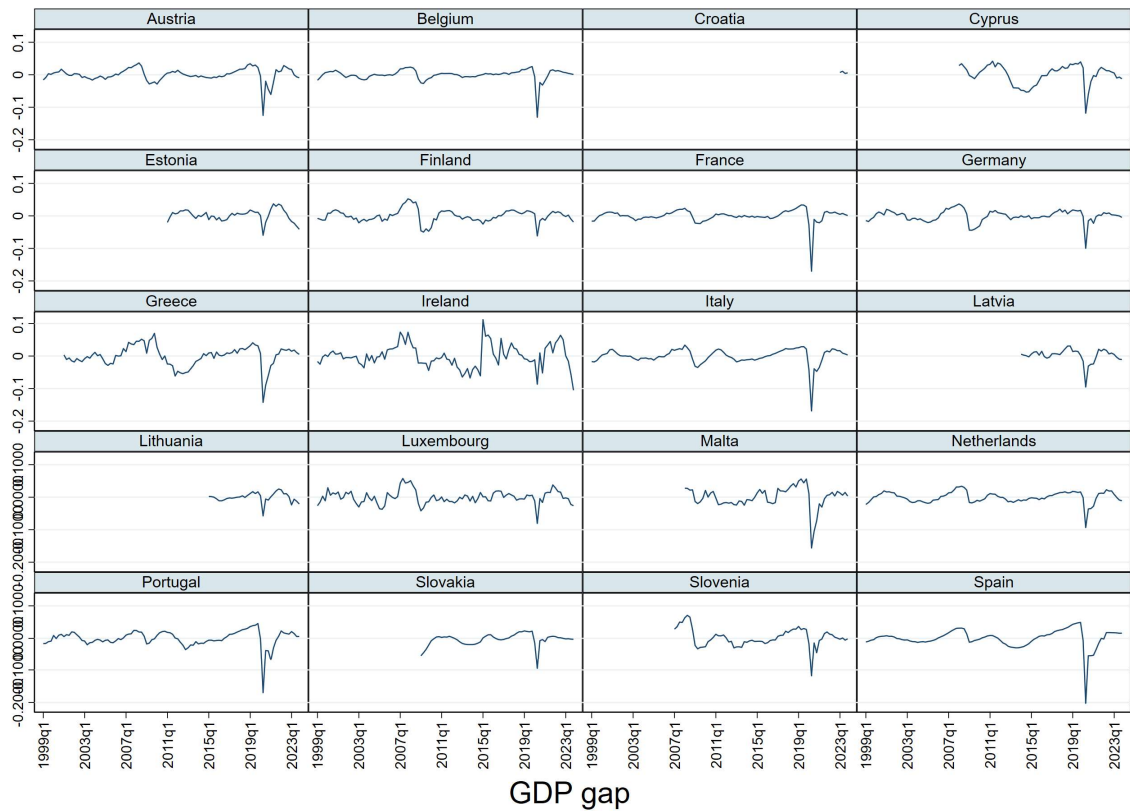
Figure 1: Output gap of euro area member states

Source: Stata, authors calculations

Figure 1 has few well-defined events that can be identified from the graphs. The Global Financial Crisis during 2007 – 2008 impacted all of the members of the euro area, the Covid pandemic in 2020 had more significant effect on all of the members, being biggest influencer of GDP in euro area thus far. For this paper, more detailed analysis of the output gap is undertaken below. Euro area 12 members and rest of the euro area members are looked at and analysed.

Table 4, summary statistics for GDP gap

Country	Mean	StD	Min	Max
Austria	0	0.0205	-0.1249	0.0365
Belgium	0	0.0172	-0.1308	0.0253
Croatia	0	0.024	0.0041	0.0107
Cyprus	0	0.0305	-0.1181	0.0418
Estonia	0	0.0180	-0.0594	0.0371
Finland	0	0.0193	-0.0616	0.0525
France	0	0.0211	-0.1701	0.0337
Germany	0	0.0184	-0.0994	0.0368
Greece	0	0.0321	-0.1425	0.0699
Ireland	0	0.0357	-0.1052	0.1120
Italy	0	0.0240	-0.1689	0.0338
Latvia	0	0.0207	-0.0951	0.0310
Lithuania	0	0.0146	-0.0574	0.0253
Luxembourg	0	0.0204	-0.0804	0.0577
Malta	0	0.0334	-0.1562	0.0560
Netherlands	0	0.0171	-0.0931	0.0338
Portugal	0	0.0251	-0.1698	0.0456
Slovakia	0	0.0189	-0.0951	0.0229
Slovenia	0	0.0281	-0.1181	0.0709
Spain	0	0.0287	-0.2023	0.0491

Table 4 shows the movement of the GDP gap during the period in the euro area for the country. Standard deviation shows relative movement from the mean GDP, clear outliers are Ireland and Malta whose deviation from the mean DGP is 35% and 33% respectively, Croatia results are small only cause there is only 4 data points (4 quarters) available in the euro area. Lowest gaps in the output are in Spain, France, Portugal and Italy, first glance shows that negative dips have impacted most the original euro 12 members. Biggest positive values are for Ireland, who in many studies is excluded because its proportion of DGP produced by the presence of the multinational

corporations (Regan & Brazys, 2021). Rest of the biggest positive growers are Slovenia, Greece, Luxembourg (who, could be argued, should not be here as a regular economy because of its size) and Malta.

Looking at the figure 1a, the line graph of GDP gap of 12 euro area core members: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain, the output gap moves relatively in one pace during those years for all of the member states with the exception of Greece, Ireland and Luxembourg who show higher volatility and de-synchronicity than other member states. The co-movement similarity pre-GFC can perhaps be explained with the Maastricht criteria adoption for all of the countries pre adoption of the euro as well as the tendency for business cycles synchronize ex post. The values are presented in relative terms.
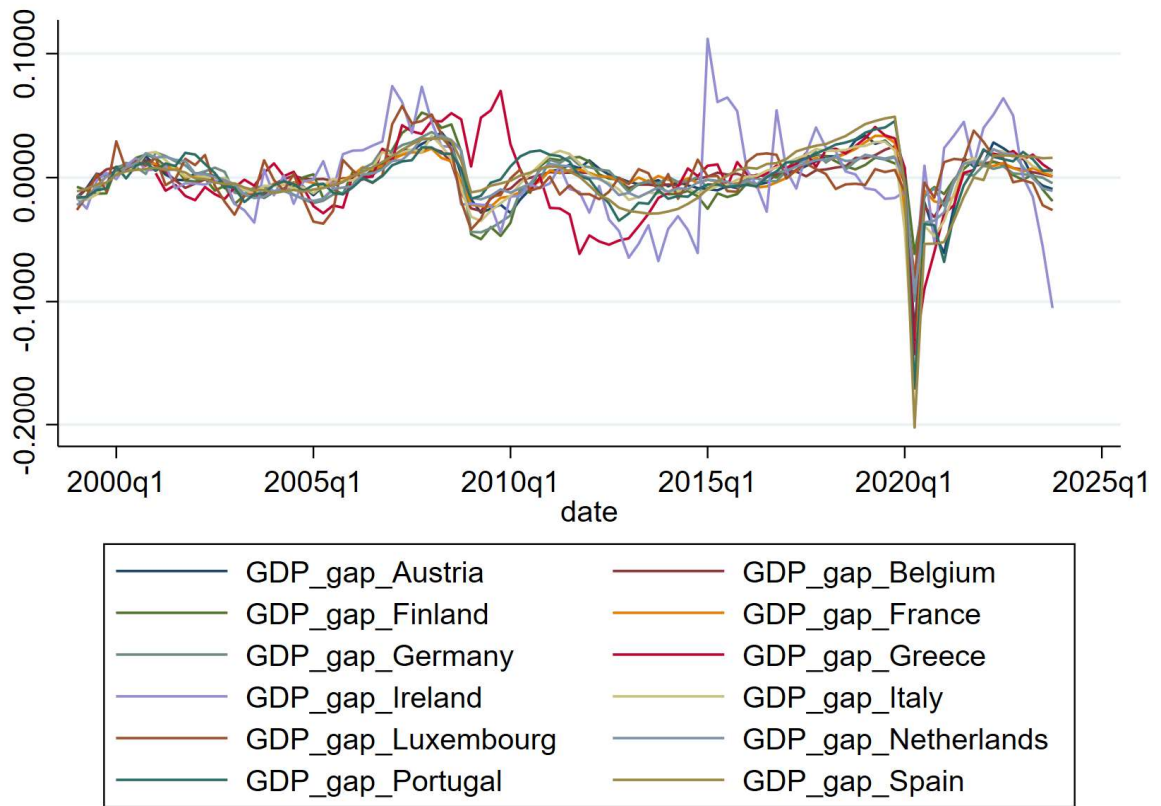
Figure 1a, business cycles pre–Global Financial Crisis, E12

Source: Stata, authors calculations

Financial crisis and the aftermath, shows somewhat similar results, having most of the E12 members moving relatively closely and also having same outlying countries present whose business cycle is desynchronized from the rest of the E12: Ireland, Greece and Portugal. The Covid pandemic caused crisis hit all of the members with different impact to the GDP gap, with the into negatives only after crisis in 2010 while other members were on their way to recovery. Mid 2011 shows good signs for most of the members, having their GDP growths back in the positive, with the exception of abovementioned Greece, as well as Ireland and surprisingly Belgum (who from the periphery-core synchronization literature is not in the same group with Greece or Ireland).

The period from 2016 until Covid pandemic, a stabile period where ECB nominal interest rates were near zero (European Central Bank, 2024), reflect the stability until the Covid Pandemic, with some exceptions. Luxembourg and Ireland, enter Covid Pandemic with lower output gap than other members. Covid pandemic, another external negative shock impacts member states with drastic downfall in production, but with various of degrees of magnitude having Portugal, Spain and Greece – southern regions, experiencing the worse of the pandemic possibly caused by bigger reliance of the tourism sector. Recovery from Covid shows larger degree in de-synchronicity as well as different degrees of volatility of the output gaps. Business cycles show more similarities after Q1 2022, with some exceptions, perhaps an attribute of both higher ECB interest rates and as well negative impact of the war in Ukraine as the movement shows reduction of the potential output.

Rest of the euro area members, presented in figure 1b, show somewhat different movement of business cycles. Each of the states enter the euro area in different period and affected by the economic events of that time. Slovenia joins euro area right before Global Financial Crisis and it is showed by positive output gap in 2007. 2008 when crisis begins to show the effects, all of the 3 members at that time show negative co-movement of the business cycle. Aftermath of the GFC shows some synchronicity of the business cycles as all of the 4 members show brief recovery which is abrupted by Malta. As more members join, the de-synchronization level larger up until 2016.

Entering the near zero interest policy, there is a brief window of relative synchronization and growth of positive output gap up until Covid pandemic. Covid affects all of the member business cycles negatively similar to the E12 members. Notable difference is the impact of which Estonia and Latvia had on covid – having their downfall significantly lower than rest of the EMU. Aftermath of the covid shows as larder degree of de-synchronicity, which is different from the E12 group. Same countries, Estonia and Latvia who were not impacted with Covid as much show significant downturn in the potential production, perhaps a situation which is impacted both from higher ECB interest rates as well as war in Ukraine.
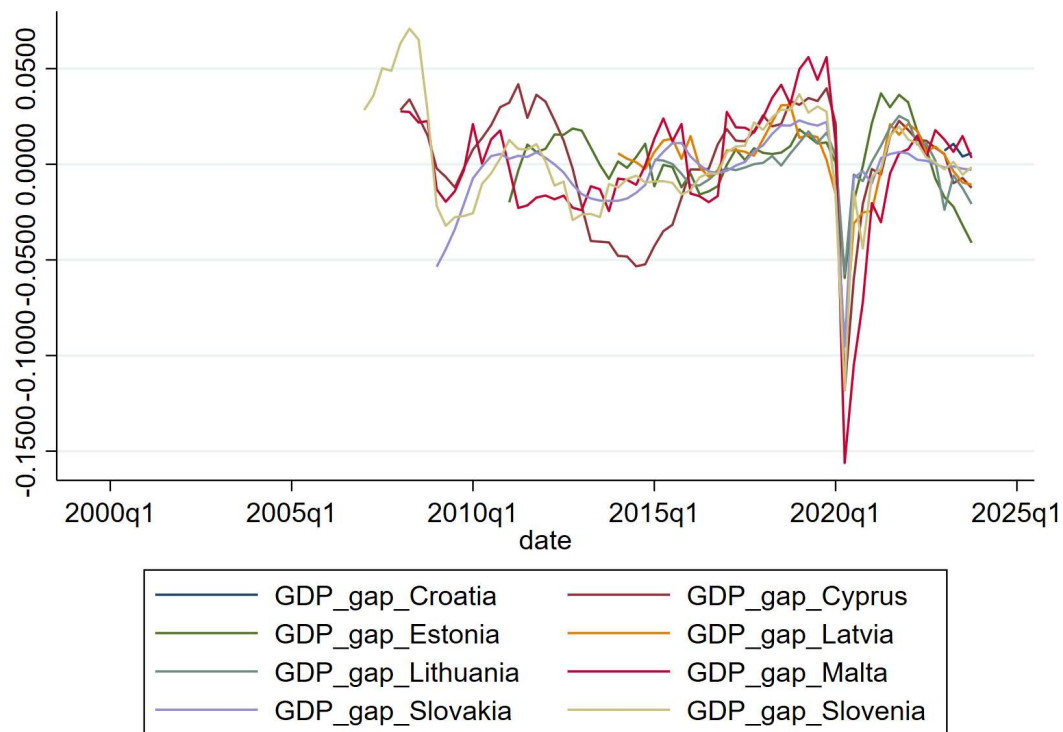
Figure 1b, business cycles rest of the euro area

Source: Stata, authors calculations

3.1.2 Unemployment

For further understanding of the synchronization of euro area business cycles, other economic indicators will be evaluated and analysed. In this part unemployment rate will be evaluated on merit how similar or synchronized are these measure across euro area members, unemployment rates are visualized in figure 2. The data is presented, similarly to the output gap, for all of the euro area members from the date they joined euro area.
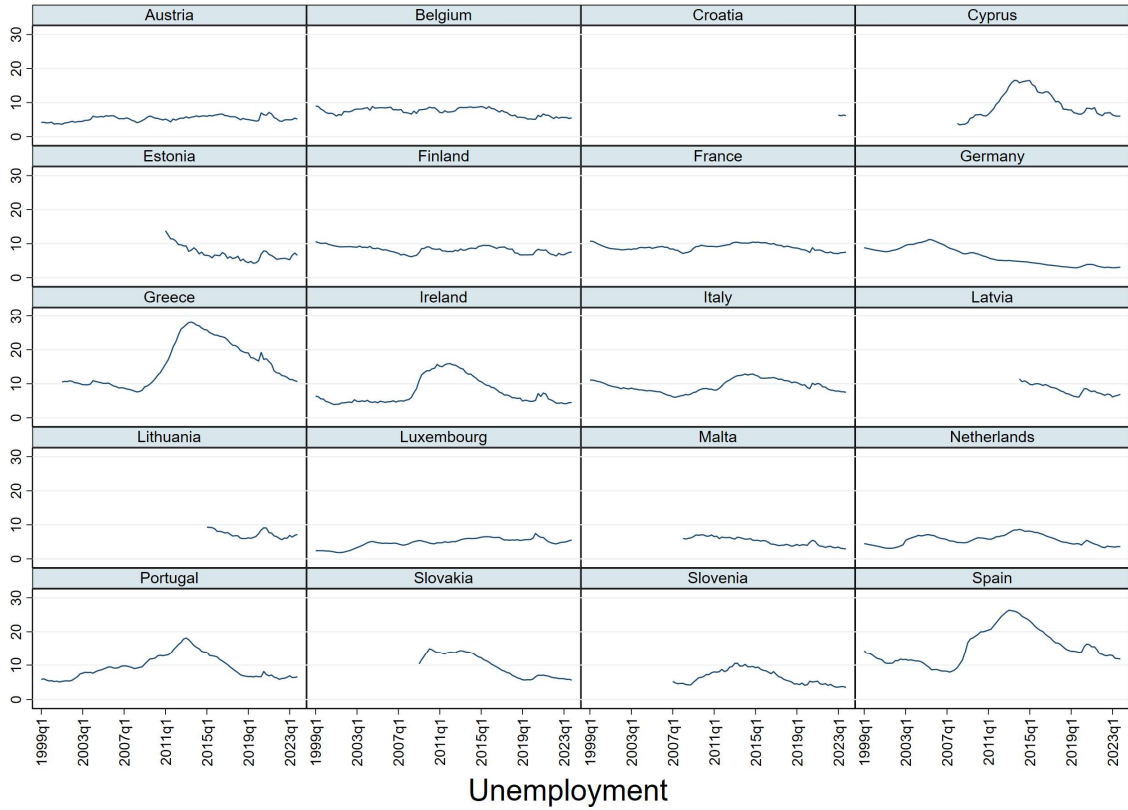

Figure 2: Unemployment rates in euro area member states.

Source: Stata, authors calculations

Looking at the line graph of core 12 members unemployment rates in the figure 2a, we can observe the similarities in the co-movement of the unemployment rate pre Global Financial Crisis (GFC) time period. The movement towards 2007 seems to bring the unemployment rate into even buffer approximately between 4% – 9%. GFC starts to bring out the dissimilarities of the euro zone economies in terms of labour market. Spain, Greece, Portugal and Ireland have clear and dramatic change in the unemployment rate, followed by Ireland in the second economic downturn after GFC (Eurostat, 2024).
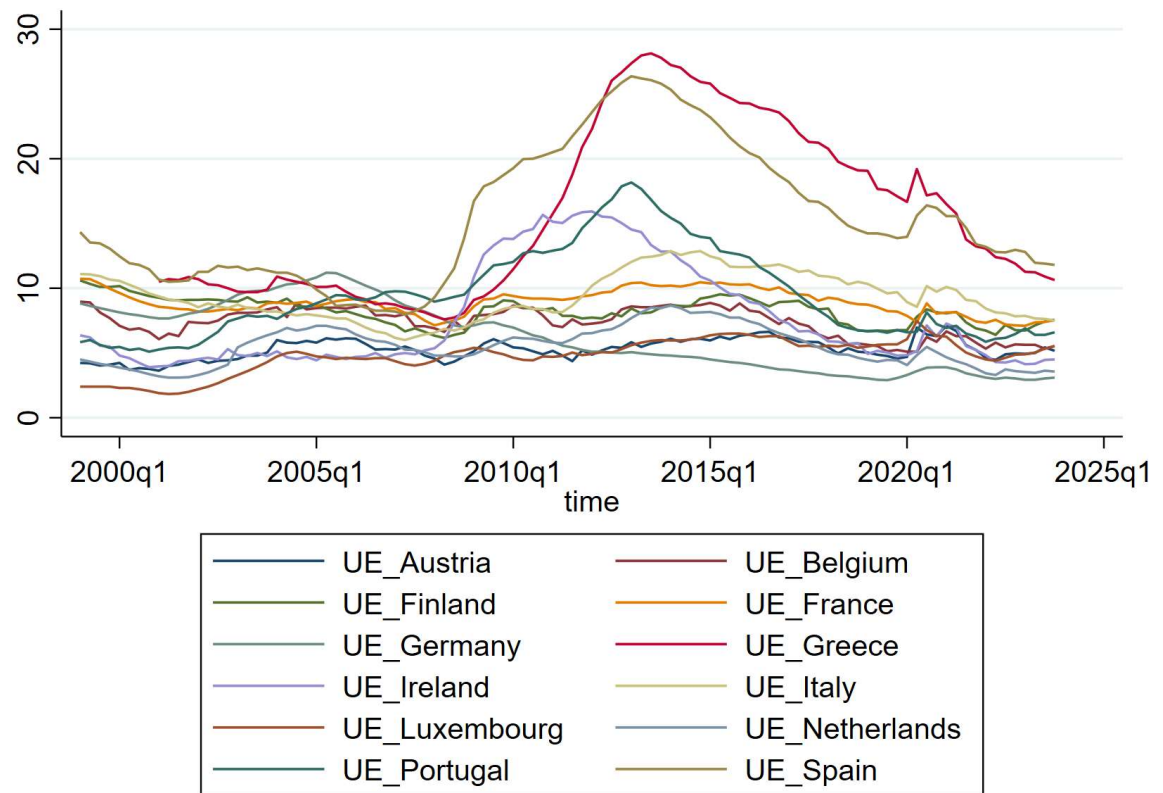
Figure 2a: Unemployment rates in E12

Source: Stata, authors calculations

On the other side of the spectrum, Austria, Luxembourg, Netherlands and Germany do not have dramatic change during GFC, and show good recovery during aftermath of the GFC. The near zero policy of ECB from the 2013 (European Central Bank, 2024) seem to slowly have an effect on the exceptionally high unemployment rate of abovementioned "front runners" it is possible to observe the decline in the unemployment rate for many E12 countries. Covid pandemic, again, is a great equalizer in terms of co-movement of the business cycles, all of the E12 members show temporary

rise in unemployment rates. After Covid pandemic, unemployment rates are steadily declining, which is perhaps controversial considering the ECB high interest rate policy during past few years.

For the rest of the euro area countries, presented in figure 2b, the unemployment rate behaves differently from the perspective of amplitude but similarly as the rates decline dramatically, in some cases more than two-fold, perhaps a result of near zero interest rate policy. Similarly, temporary rise and continuous decline in the unemployment rate can be observed as within E12 members.
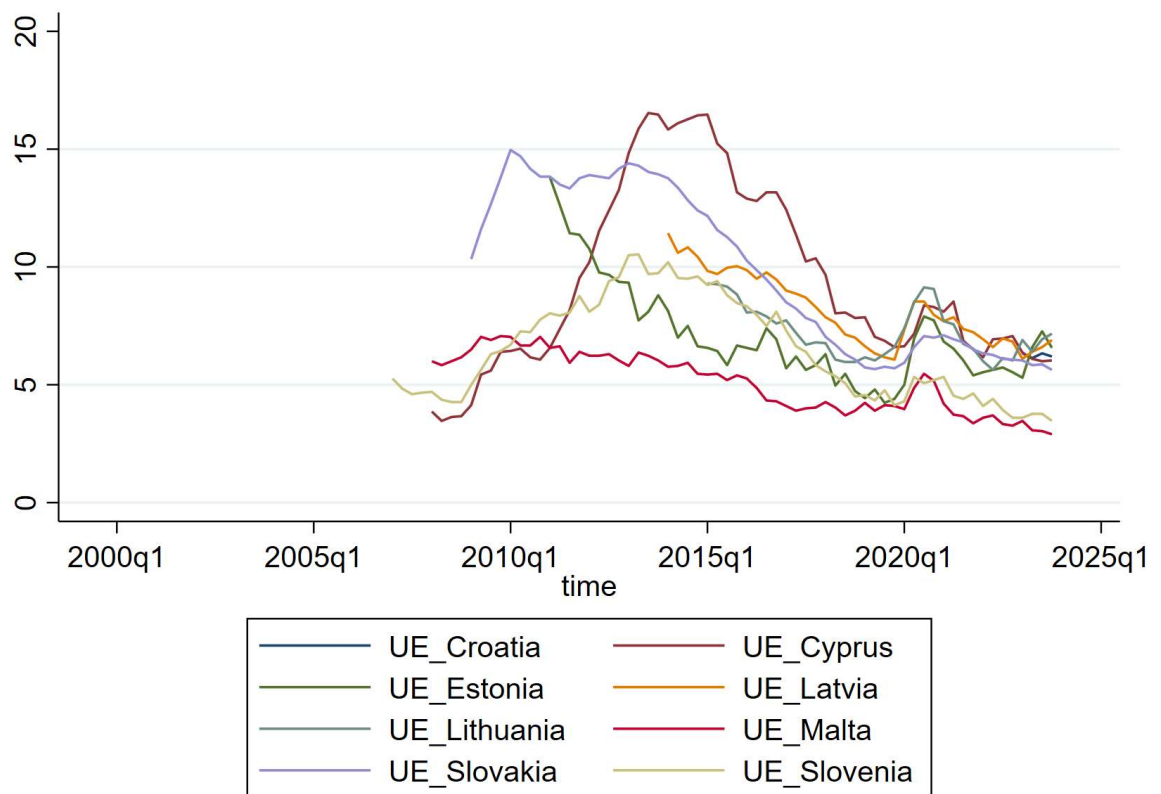
Figure 2b: Unemployment rates, rest of the euro area members.

Source: Stata, authors calculations

3.1.3 HICP inflation

One of the goals of the optimal currency area is lower inflation, role of the central bank is to maintain stable levels of output and inflation. We have seen similarities of the output gap previously; this section tries to observe if inflation shows the similarities in the movement patterns sections above. Figure 3 captures inflation growth year to year basis for each of the euro area members.
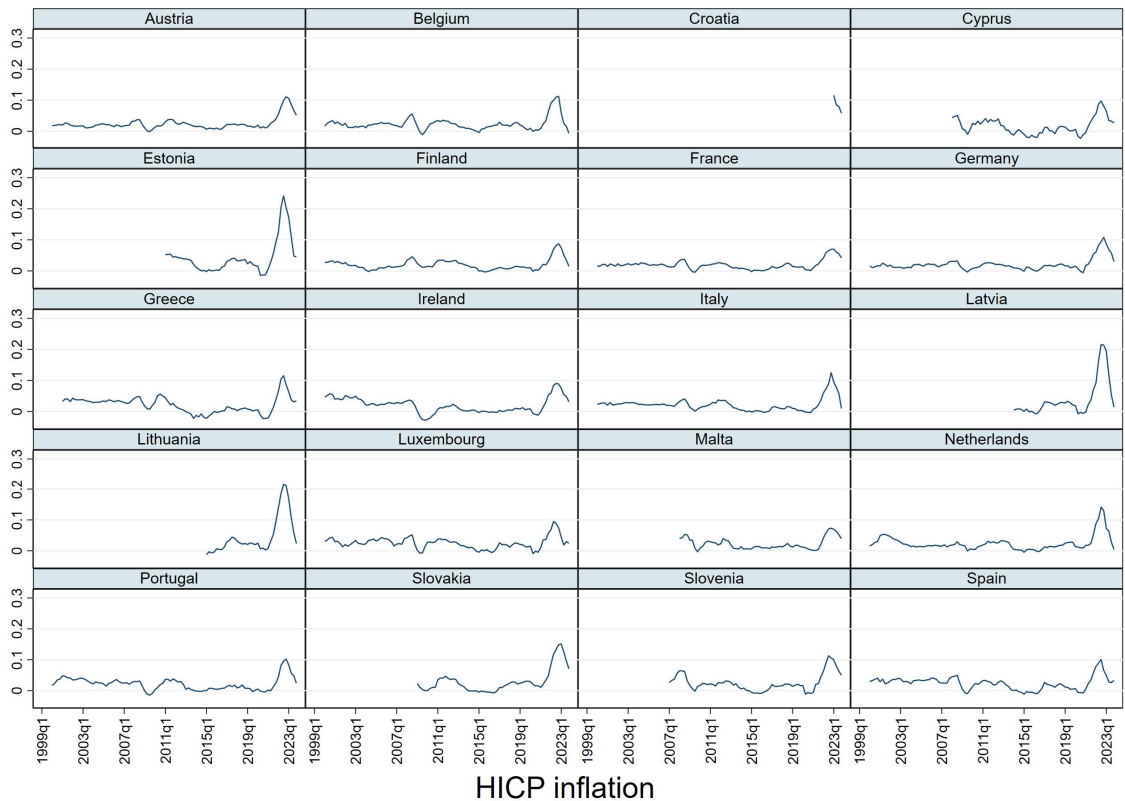
Figure 3: Harmonized Index of Consumer Prices (HICP) growth year to year

Source: Stata, authors calculations

As shown in the figure 3a, (GFC) E12 HICP pre Global Financial Crisis movement shows different amplitudes of the inflation, but somewhat similar co-movement of inflation rates. Reaction to the GFC results in the abrupt decline of inflation for all of the E12 members, having Ireland experiencing bigger volatility comparing to others. Greece reacts later, but experiences lower levels of inflation in longer terms then rest of the group. Near zero policy time period, from 2016 until Covid pandemic, seem to keep the E12 in relatively good inflation zone between 0 and ~

2,5% of inflation growth – which from the perspective of any central bank could be interpreted as desired goal. Covid pandemic breaks the cycle and whole group is undergoing dramatic levels of price increases, in different amplitudes, having the group experiencing inflation like none since creation of euro area. Aftermath of Covid has brough down the inflation levels, which to some countries are yet to meet pre-Covid period levels.
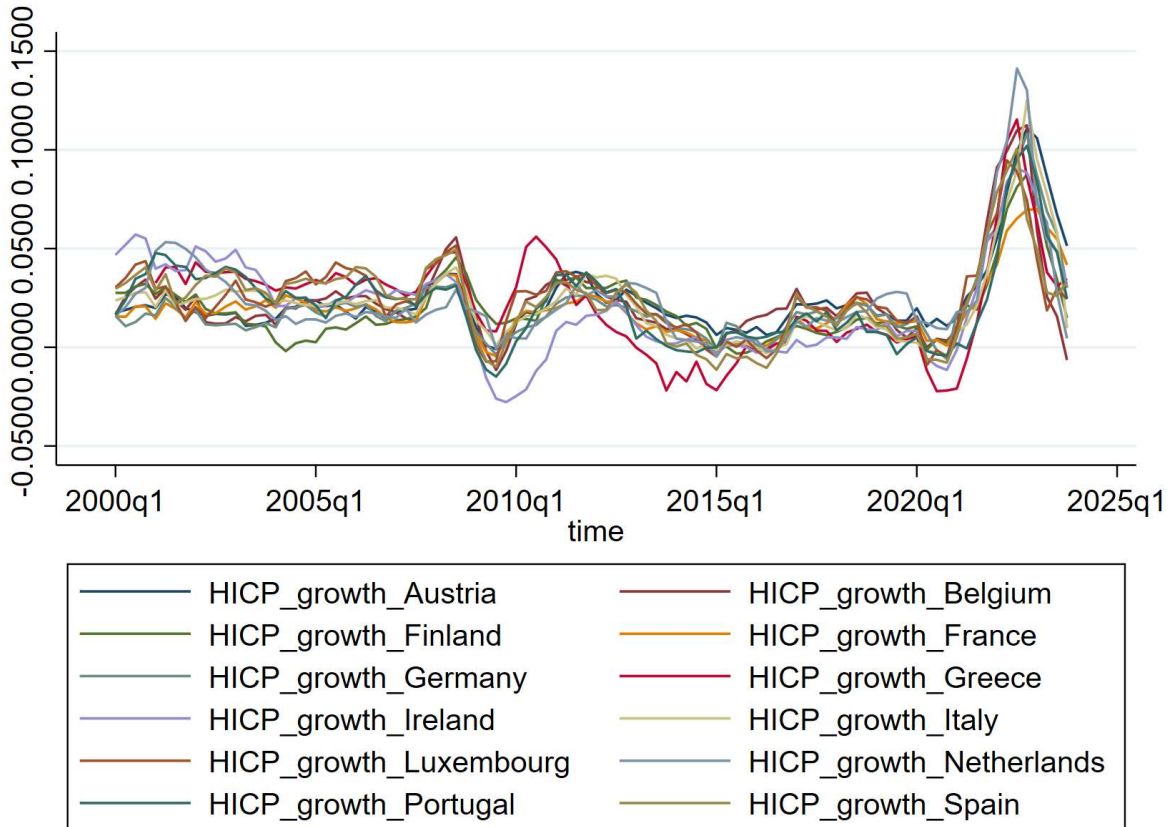

Figure 3a: HICP growth, E12

Source: Stata, authors calculations

For the rest of the euro area, represented in figure 3b, the amplitude and co-movement of inflation tells different story. Countries entering euro area during or briefly after GFC show similar levels of price level increase, around 5%, similar to the E12 group, as well as dip in the prices in the aftermath. Following movement of inflation between GCF and Covid have more irregularities in the co-movement than e12 group. Covid pandemic results in price level increase similar to E12 group, but with substantially higher amplitudes. The Baltic states experience price level increase more than 20%, unprecedented levels of inflation pre- or after euro.
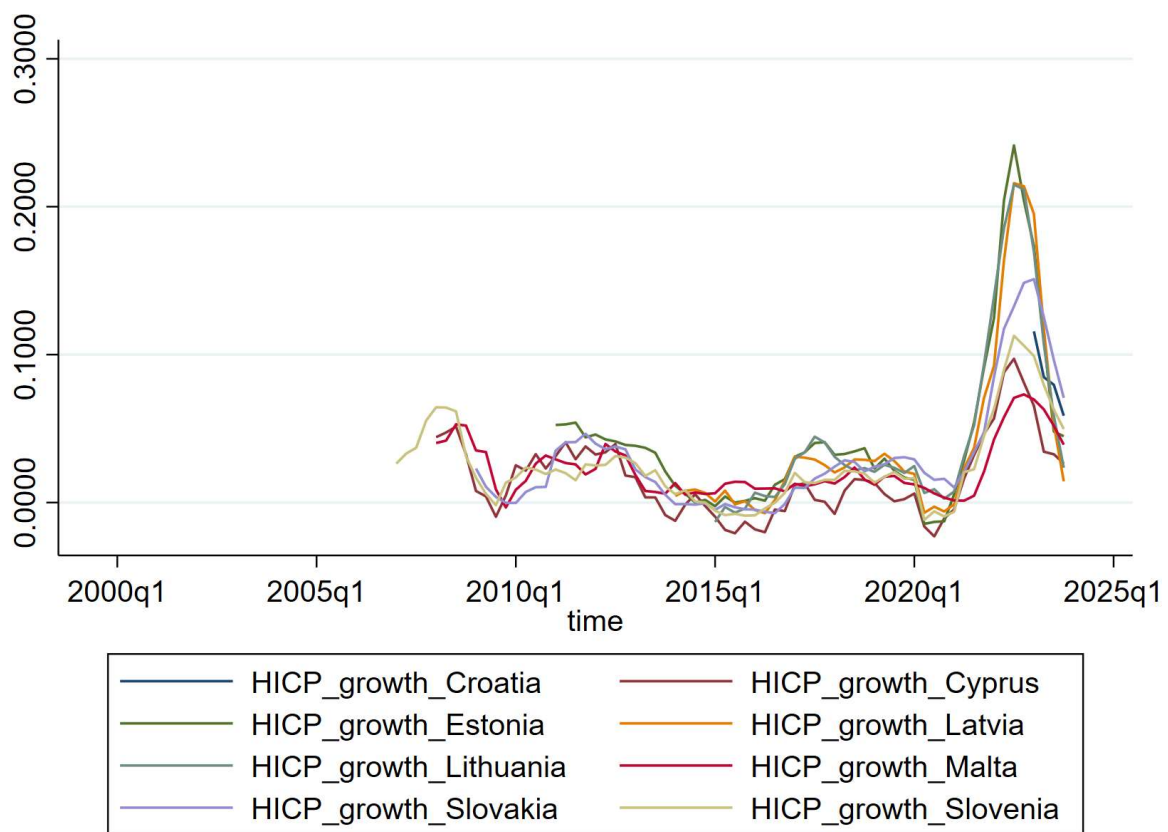
Figure 3b: HICP growth, rest of the euro area

Source: Stata, authors calculations

3.2. Standard deviation and synchronization

This part of thesis provides the measures of the dispersion of the key economic indicators discussed in section 3.1. The analysis comprises the initial 12 members of the euro area as well as the eight members that have subsequently joined. Time for the series is from Q1 1999 to Q4 2023. For the new member states of the euro area data is represented from the dates each member state joined.

3.2.1 GDP gap and GDP growth

For evaluating economic convergence of the euro area, the standard deviations of the output gaps are a useful measure. When dispersion levels are low, the member states have broadly similar output gaps, possibly indicating a high level of convergence; the opposite is also true, when dispersion levels are high, the higher level of divergence could be indicated. It is important to note, that lower level of dispersion do not necessarily indicate higher convergence, the countries might still be de-synchronized and low level of dispersion is the result of low amplitude of the cycles.
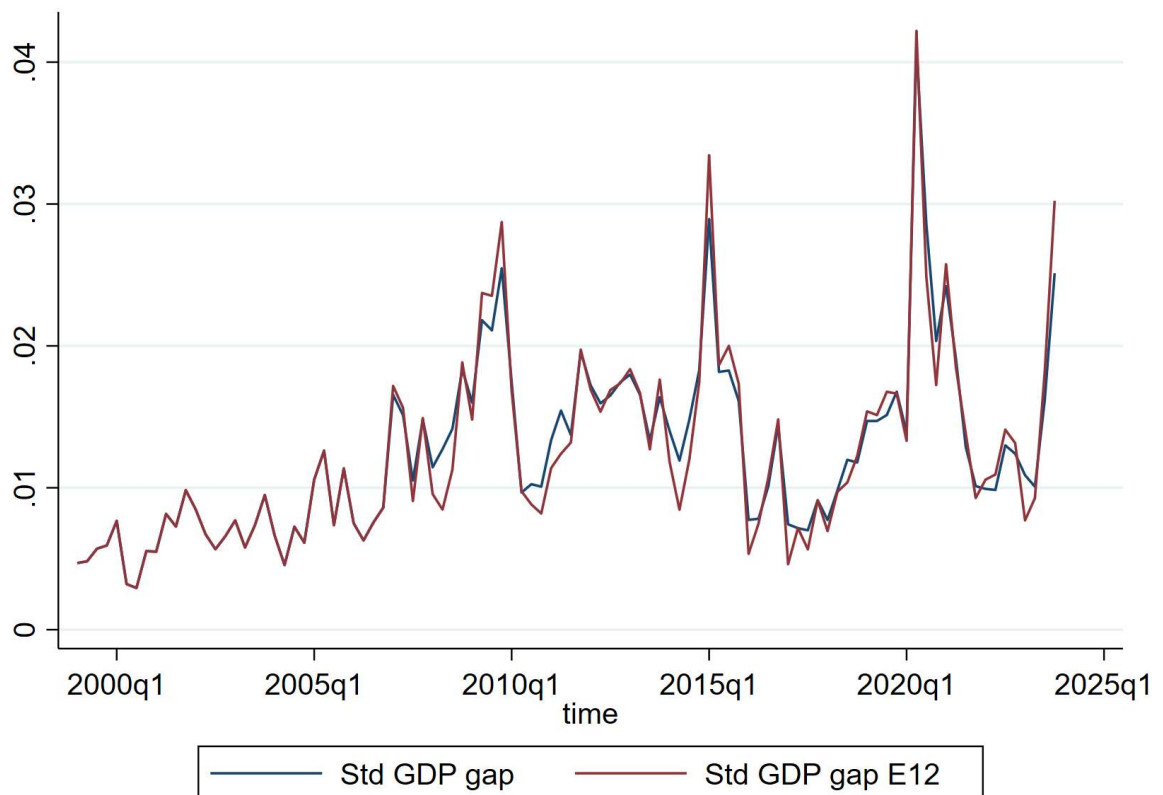

Figure 4a: Standard deviations of GDP gap, euro area (EA) and euro area 12 (E12)

Source Stata, authors calculations

In figure 4a, results show relatively smooth movement and possibly a good convergence of the euro area before Global Financial Crisis (GFC). The period of the GFC 2007 – 2009 and its aftermath show higher dispersion and period of divergence within euro area members. The countries GDP gap reacted differently to the GFC as clearly shown in the graph. Higher levels of dispersion in around 2015 and 2016 can partly be explained by the movements in the Greece output gap. While the rest of the EMU was having relatively low levels of dispersion, Greece experienced high fluctuations. Covid pandemic brings out the highest of divergence within euro area. This tendency was also present in output gap line graphs above, where the co-movement was strongly present, but the amplitude of the output gap varied enormously.

Looking at the standard deviations of GDP growth in figure 4b, we can observe a similar pattern evolving. There are few surprising moments where the euro area as a whole has had a lower standard deviation than the E12; this can perhaps be explained with new members joining the euro area with better economic indicators as they had to comply with the Maastricht criteria before joining – existing euro area members did not face similar discipline.
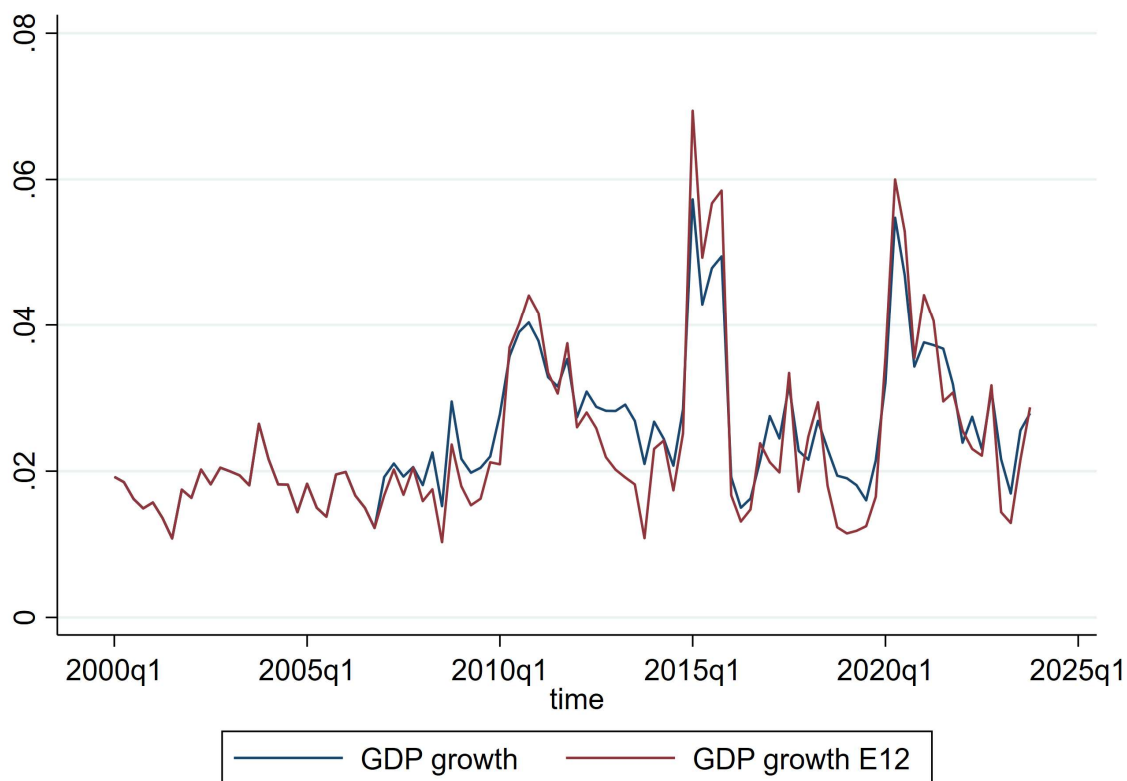

Figure 4b: Standard deviations of GDP growth, EA and E12

Source Stata, authors calculations

3.2.2 Unemployment

The standard deviations of unemployment for each quarter are presented in figure 5. Perhaps surprisingly, the standard deviations are generally larger in the E12 group than in the full euro area sample. Perhaps a phenomenon explained by higher amplitude resulted by unemployment rate of Spain. The trend shows similar story until Global Financial Crisis (GFC), where deviation from mean is low, both possibly an attribute of business cycle synchronization and low amplitudes of unemployment rates.
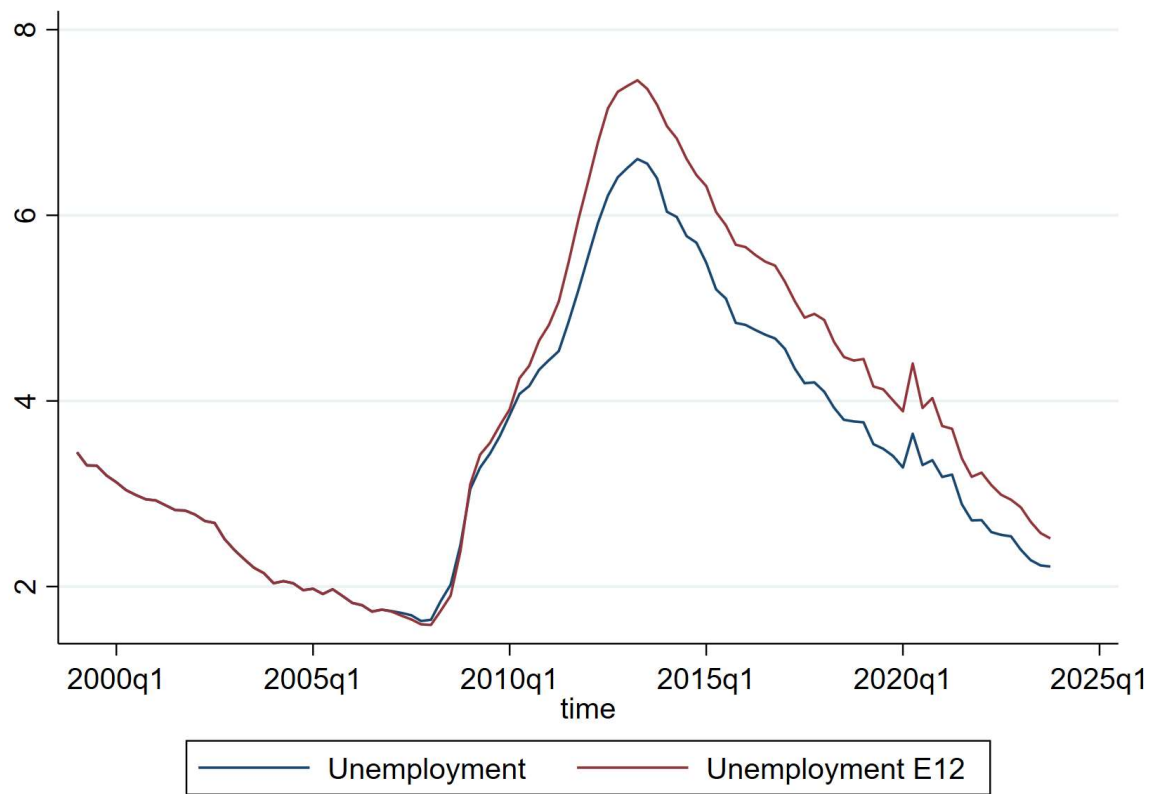
Figure 5: Standard deviations of unemployment rate, EA and E12

Source Stata, authors calculations

3.2.3 Inflation

Inflation, presented in figure 6, however has the biggest heterogeneity of the group, GFC is the great equalizer as inflation rates are getting even throughout the euro area. Right around the time where the start of near zero interest policy begins; the inflation standard deviation shows huge difference both within euro area and more remarkably between E12 and euro area as a whole.
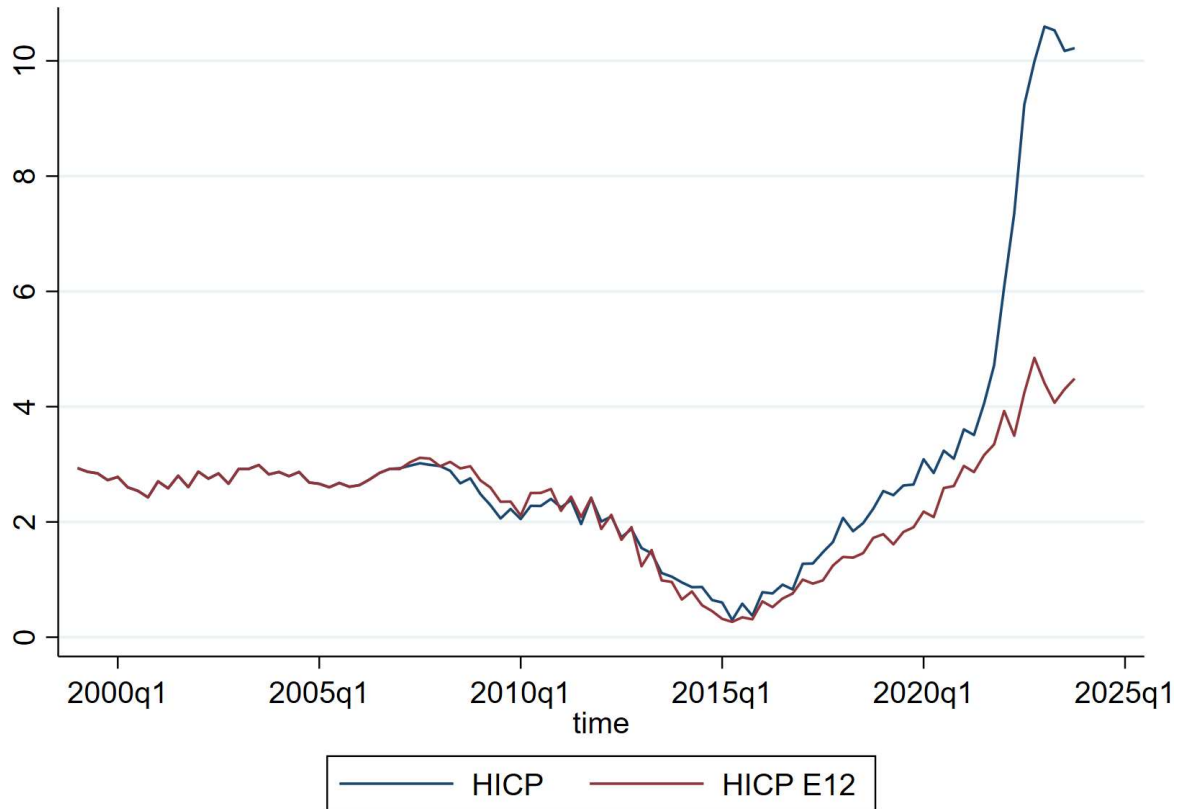

Figure 6: Standard deviations of HICP, EA and E12

Source: Stata, authors calculations

3.3. Evaluating synchronization using Taylor rule

In this section, Taylor rule (TR) is used to calculate interest rates for each country and compared these to the ECB interest rate. As mentioned in chapter 1.3, TR encompasses the key economic metrics, output gap, HICP inflation and unemployment rate. By combining these metrics, TR gives an additional way to evaluate business cycle synchronization.

In Figure 7, Taylor rule (TR) based nominal interest rate is computed and showed together with ECB nominal interest rates. Pre GFC time period shows TR rate and ECB rate going hand-in-hand with Austria, Belgium, Finland, France Germany, Italy and Netherlands, countries occasionally showing as "core" in empirical analysis (with exception of Italy), for Portugal, Spain and Ireland, pre-GFC interest rates could have been higher to believe in TR interest rates. Economic growth shows in TR proposed interest rates pre-GFC final period, followed by GFC, again acting here as a great equalizer – not only in terms of business cycles but as well in agreeableness in both interest rates. Recovery from GFC shows quick rise in TR rate, probably caused by rising inflation rates in conjunction with negative output gap. Period on 2015 seems to be time when TR and ECB rates are in agreement on most of the countries. TR rate decline could be interpreted as a result from negative output gap and lower inflation rates caused by recession between 2011-2013 (Eurostat, 2024)

Covid pandemic illustrates similar viewpoint as with output gap as well as inflation. TR proposed interest rates skyrocket, proposing nominal interest rates up to nearly 40% in case of Baltic States (caused most likely by unprecedented inflation levels during pandemic). Overall, we can observe, that TR agrees with ECB mostly with the "core" euro area members, disagreeing only in few places and in period during and after Covid pandemic. For others, the symbiosis of interest rates does not go together so well. Baltic states, Malta, Cyprus and Greece could have benefited from higher interest rates. Even southern countries like Italy, Spain and Portugal – whose TR rate is quite in agreement with ECB rate until GFC, could have benefited from higher interest rates, at least according to TR rate.
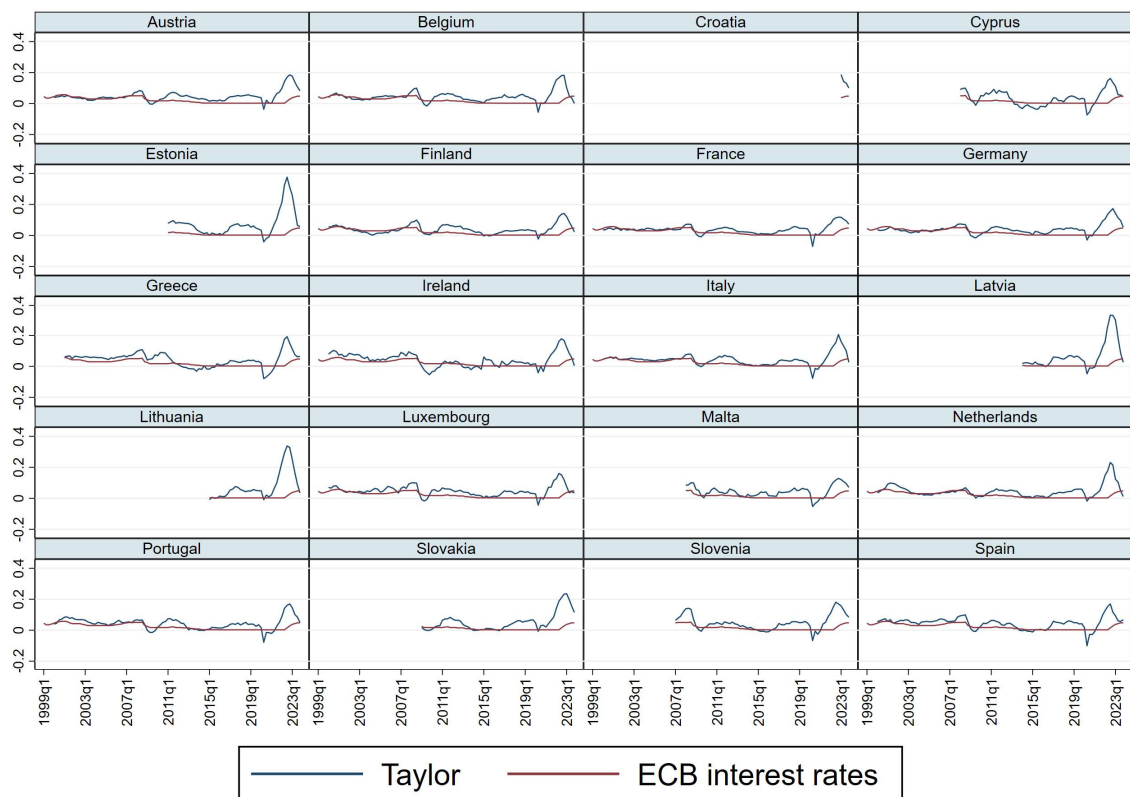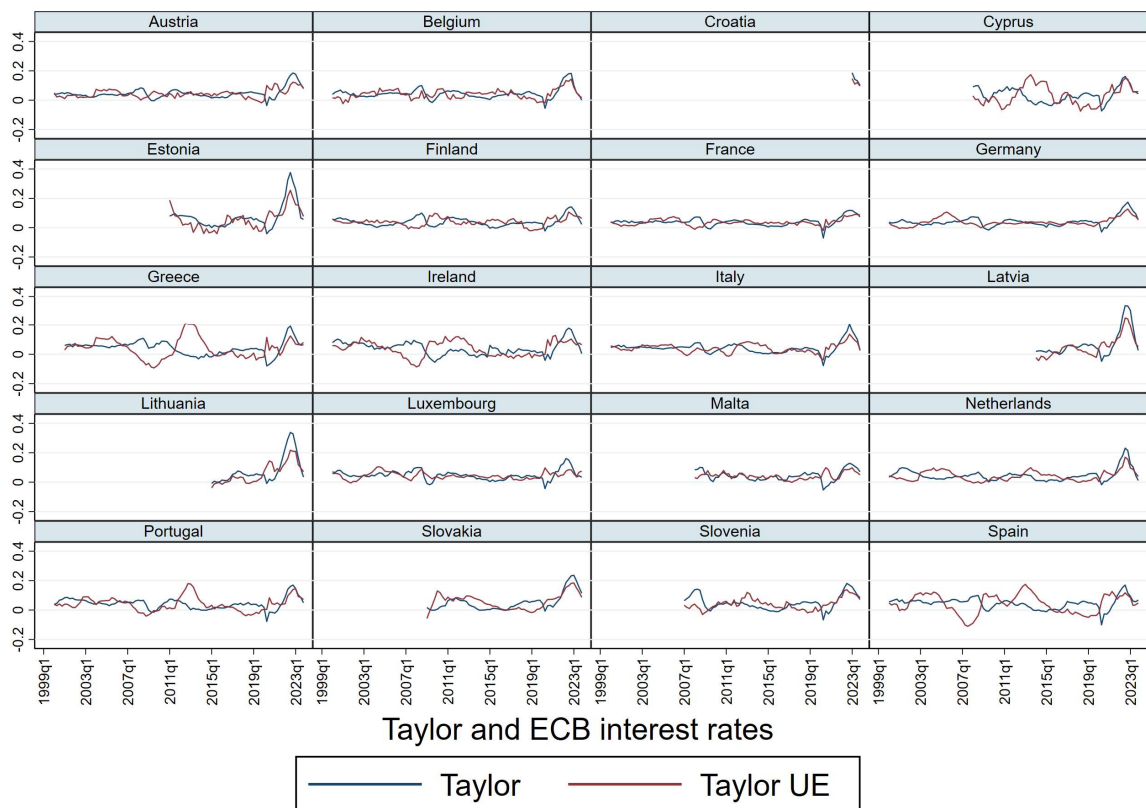

Figure 7: Taylor rule proposed interest rates and ECB interest rate for euro area

Source: Stata, authors calculations

Additionally, the Taylor rule proposed interest rates with Unemployment gap was calculated. The calculation of the unemployment gap followed same HP filter procedure as with output gap, except trend and cyclical component was taken directly from unemployment rates rather than logs of those values. In table 8 we can observe differences of TR rates using calculation of output gap and unemployment gap. Unemployment TR rate splits countries into two groups, for one group, the unemployment TR rate does not agree well with output gap TR rate and for others both of the proposed interest rates are in relative agreement – mostly countries identified from empirical studies as "core" members of eurozone. Interesting contracyclical movement is present during GFC for Greece, Ireland, Portugal and Spain: interest rate calculated with unemployment gap proposes lower interest levels sooner than one using output gap, and then movement switches. This could be the result of bigger amplitude of unemployment movement. Covid pandemic proposes similar interest rates in most cases having regular TR interest rule propose higher rates.

Graph 8: Taylor rule proposed interest rate vs Taylor rule (UE) proposed interest rate
Source: Stata, authors calculations.

The results seem to suggest that TR interest rate is more aligned with ECB interest rates for E12, and more so with the core countries of the literature. The huge gap of the interest rate difference in smaller economies is evident. External events act as an equalizer also on TR interest rates, as both of the crises; GFC and Covid pandemic make TR move in the same direction, although in different amplitudes. TR rates of two different methodologies, utilizing GDP gap and unemployment gap, show mostly same level rates with exception of southern countries. An interesting pattern of contracyclical rates is present.

CONCLUSION

This master's thesis aimed to evaluate whether the euro area can be seen as an optimum currency area (OCA) where business cycles are broadly synchronized.

The research aimed to answer three questions:

1) Are the euro area member states in different business cycles?
2) Is the level of synchronization different for euro area 12 core members than it is for the euro area as a whole?
3) What would be the Taylor rule proposed interest rates for each of the euro area members and how do these rates differ from the ECB steering rate?

Having looked at the key economic indicators: output, unemployment and inflation for the euro area from Q1 1999 – Q4 2023, it can be noted that euro area business cycles were relatively synchronized before GFC, economic growth abrupted by the shock and were on their way to synchronisation again before Covid pandemic, never quite reaching the synchronization and level of co-movements as they were pre-GFC. Original euro area 12 members are more synchronized with each other, while the business cycles in the newer members usually converged after joining euro area, which supports the finding of conversion of business cycles ex post. (Frankel & Rose, 1997) Signs of convergence are also present in the post Covid pandemic time period.

The studies support different findings of this thesis. Pre-GFC level of synchronization, whether it is the reduced synchronization differential of European economies (Crespo-Cuaresma & Fernández-Amador, 2013b) or a good level of overall synchronization of the new euro area members with the rest of the EMU (Crespo-Cuaresma & Fernández-Amador, 2013a). Convergence of the business cycles ex post (Frankel & Rose, 1997; Gächter & Riedl, 2014; Rose, 2008). The differences in synchronizations within the euro area member states, although with different "core-periphery" grouping as more advanced methods allow for more precise division between regions (Beine et al., 2003; Belke et al., 2017; Darvas & Szapáry, 2008). Similarities of the business cycles in the recession are found present. (Altavilla, 2004; Oman, 2019).

The crises of the euro area are great equalizers – both GFC and Covid pandemic affected euro area members similarly, albeit with different amplitude of impact. The reaction to the shocks were similar throughout the euro area. Co-movement of the key economic indicators and the business cycle synchronicity was greater at the times of downturn. From the Optimal Currency Area theory point of view, this is a good finding as it supports the theoretical criterium similarity reaction to the external shocks. (Grauwe, 2020) For ECB it provides good opportunity to adjust the monetary policy relevant to the situation, a position that would not be possible, if the reactions to the shocks were to be de-synchronized.

Taylor rule (TR) proposed interest rate in comparison to the ECB interest rate seems to support the division of the countries within the euro area as the TR rate moves more in line with the ECB rate within E12 countries, with the partial exception of the southern countries, a finding which resonates with the "core-periphery" division findings in earlier studies. The separation of the TR rates from the ECB interest rates is more dramatic in periphery countries.

What can be learned from this thesis in terms of OCA and opposing views of European Commission and Paul Krugman? From the findings the situation does not appear to be as grim as Krugman leads us to believe. Even though the labour movement is not as mobile as Krugman argues, (Krugman, 1993) the effects and the aftermath of the shocks by euro area seem to indicate the recovery of the high unemployment rates to normal over time. The effect of these is still noticeable in TR proposed interest rates and this is something to consider. The difficulties of international policy coordination have not yielded in the tensions between member states as proposed by Krugman and contrary to the argument, (asymmetric) shocks have not resulted in bad equilibria (Krugman, 1993), the evidence from the thesis seem to indicate that shocks act as great equalizers of the euro area, with the differences in the impact of the shock.

Krugman is right in his proposal for the necessity of the fiscal policy integration to address the imbalances (Krugman, 2013). This argument seems to be backed by the findings of TR interest rate differences as well as the level of impact of the shocks on periphery. While core members, with mature economies have done relatively well from the TR and output gap point of view, the newer members as well "southern" region have experienced higher amplitude of de-synchronization. This as well could be the result of low fiscal discipline and not holding to the Maastricht criteria after joining euro area.

The overall findings of this thesis would evaluate euro area as an Optimal Currency Area, with some proposals for further improvement. As the business cycle convergence is more evident ex

post and the tendency to synchronize is evident after both great shocks, it would seem to be reasonable to further coordinate the economic policies of member states. A united fiscal policy integration would be beneficial to soften the amplitude of the shocks on peripheral countries.

KOKKUVÕTE

HINNATES EUROALA KUI OPTIMAALSET VALUUTAALA

Renee Bahman

Käesoleva töö eesmärk on leida euroala vastavust optimaalse valuuta-ala (OCA) teooriale. Töö uurib euroala majandustsüklite sünkroniseritust ja võrrelda euroala liikmete Taylori reegli pakutud intressi määra Euroopa Keskpanga intressimääraga.

Ühise valuutaala peamine eesmärk on suurem hinnastabiilsus liikmesriikide vahel. OCA teooria pakub välja ühise rahapoliitika vahendid majandusstabiilsuse saavutamiseks. Keskpanka peamine eesmärk on hoida madalat ja stabiilset inflatsiooni, mida tavaliselt saavutatakse intressimäärade ja muude rahapoliitiliste vahenditega. Hinnastabiilsuse saavutamiseks soovitab OCA liikmesriikidel rakendada tugevat fiskaalpoliitikat, sealhulgas tasakaalustatud eelarvet. Rahaliidu majandusteooria pakub välja sarnaselt riskijagamise mehhanismide tähtsuse fiskaalülekannete kaudu, äritsüklite sarnasuse ja majandusliku omavahelise sõltuvuse. Euroala idee muutus majandusteadlaste jaoks aktuaalseks peamiselt peale II maailmasõja laastavat mõju euroopa majandusele.

OCA teooria väidab, et liikmesriigid võivad ühisraha ja ühise rahapoliitika korral kasu saada, kui teatud kriteeriumid on täidetud:
- Vaba kapitali liikumine
- Vaba tööjõu liikumine
- Diversifitseeritud majandused mis töötavad ühiste eesmärkide nimel
- Majandustsükli sünkronasitsioon
- Valuuta-ala ülene fiskaalpoliitika

Töö otsis vastust kolmele uurimisküsimusele:

1) Kas euroala liikmesriigid on erinevates äritsüklites?
2) Kas euroala tervikuna on äritsüklite sünkroniseerituselt erinev võrreldes euroala esimese 12 liikmega?
3) Mis oleks Taylori reegli järgi arvutatav intressimäär ning palju see erineb Euroopa Keskpanga poolt määratud intressimäärast.

Töö empiiriises osas käsitleti euroala majandustsükleid ja nende omavahelist sünkroniseeritust. Uurimismeetoditeks on sisemajanduse kogutoodandu SKT lõhe *(output gap)* arvutamine ja omavaheline võrdlus. Selleks eraldati sisemajanduse kogutoodangu (SKT) tsükliline component kasutades Hodrick-Prescott filtrit. Majandustsüklite sünkroniseerituse analüüsiks kasutati põhiliste majandusnäitajate: SKT lõhe, SKT kasv, töötuse määra ning inflatsiooni standardhälvete võrdlust. Lisaks arvutati Taylori reegli järgi pakutav intressimäär igale riigile, ning võrreldi seda Euroopa Keskpanga poot sätestatud intressimääraga.

Tuginedes tehtud analüüsile võib väita, et euroala oli enne finantskriisi 2007-2009 hästi sünkroniseeritud, peale kriisi taastumine näitas sünkroniseerituse taastumist kuid mitte samale tasemele kui kriisieelsel perioodil. Kriisid on mõjunud võrdsustajana majandustsüklites, kuna kõikide riikide majandustsüklid on kriiside ajal samasuunalised, küll erineva amplituudiga. Peale Covid period näitab majandustsüklite sünkroniseerimise tõusu. Taylori reegli intressimäär näitas Euroopa Keskpanga intressimäära sobivust rohkem euroala esialgsele 12 liikmele. Kokkuvõtvalt leidis töö, et euroala vastab OCA nõuetele.

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