OPTIMUM CURRENCY AREA INDEX FOR EU COUNTRIES BEYOND EUROZONE

[a]KATARZYNA PIŁAT

Department of Economics, University of Łódź, Rewolucji 1905 r. 41, 90-214 Łódź, Poland
email: [a]katarzyna.pilat@gmail.com

Abstract: This paper empirically investigates the readiness of a country to join euro zone according to Eichengreen and Bayoumi's methodology – a measure named optimum currency area (OCA) index. Construction of a OCA index is based on the achievements of OCA theory. Optimum currency area index illustrates the variability of exchange rate which depends on such determinants as: asymmetric shocks, volume of bilateral trade, economy's structure and country size. Analysis concerns EU member states which are not members of euro area. OCA indices are calculated vis-à-vis eurozone and next vis-à-vis Poland. Results show that the beast candidates to join euro area are Hungary, United Kingdom and Poland while to countries which are economically similar to Poland we can include Czech Republic, Hungary and Bulgaria.

Keywords: optimum currency area index, monetary integration

1. Introduction

Although the optimum currency area theory (OCA) came under a wave of criticism formulated recently by many economists (Mongelli, 2008; Corsetti, 2008), it is still a benchmark of monetary unification analysis. OCA theory concentrates on indicating factors that can increase the probability of the successful currency area formation. Theory of the optimum currency area consists of two parts: traditional and new theory. Economists who were contributing the development of the theory especially drove the attention to: factor mobility, openness of the economy, similar monetary and fiscal policy, inflation rate convergence and similar structures of the economies. Although the OCA theory underwent many modifications and supplementations, its postulates remained difficult to measure and it was still very hard to move from the theory to empirical work. Eichengreen and Bayoumi (1998) developed a measure which enabled to capture more characteristics of countries to which optimum currency area theory points. They named this measure – the optimum currency area index. In this paper we analyze the readiness of a country to join eurozone according to the value OCA index but calculated for newest data than in the work of Eichengreen and Bayoumi.

2. Optimum Currency Area Theory

The beginning of optimum currency area theory is connected with the discussion on the exchange rate regimes which took place after the failure of Bretton Woods system and dates back to early 1960s. Economists and politicians were looking for the best solutions connected with exchange rates and adjustments under balance of payment disequilibria (Komarek, Cech, Horvath, 2003).
The theory of optimum currency area become one of the main theoretical contributions to monetary unification analysis. Monetary union consists of a group of countries which form homogeneous currency area and have common economic objectives. These characteristics are coherent with a general optimum currency area definition which characterizes such area as a region inside of which circulates one currency or a few currencies but with a fixed exchange rates. This definition was created by Mundell (1961) who pioneered the OCA theory. During the further discussion of optimum currency areas Mundell's definition was modified and supplemented. It was the result of implementing new postulates to the OCA theory (Bień, 1988). Recently, the most popular definition of optimum currency area is based on the cost and benefits analysis of a common currency. This means that countries should form a currency area only when establishing fixed exchange rates leads to economic benefits advantage (Grubel, 1970).
OCA theory development was strictly connected with new postulates of this theory which were introduced by economists analysing monetary unification processes. Since the seminal work of Mundell OCA theory was subsequently contributed mainly by McKinnon (1963), Kenen (1970) and Grubel (1970). These economist created a set of factors which are indispensable for creating optimum currency area.
Mundell (1960) starts thinking about optimum currency areas form the point of view of processes which could stabilise prices and employment. He postulates that in the economy certain mechanisms should exist which can eliminate the disequilibrium of the balance of payment and unemployment. Mundell claims that these processes should be automatic. He conducts his analysis on the basis of two models of countries with the balance of payment equilibrium and full employment. He checks what will happen if this equilibrium is disturbed. At the same time Mundell assumes that monetary authorities act to prevent inflation what is impossible without an increase in unemployment. He also tries to define the best size of the currency area. Mundell concludes that optimal currency area (area with fixed exchange rates or common currency) should characterise factor mobility.
McKinnon (1963) supplements OCA theory with the analysis of the impact of fiscal and monetary policy. Moreover he also modifies the idea of labour mobility by making the distinction between geographic factor mobility among regions and factor mobility among industries. McKinnon draw attention to the level of economy's openness as a crucial factor in the process of international integration. He adopts a ratio of tradable to non-tradable goods as a simple measure of country's openness. The higher level of this ratio is the more profits can the country gain in case of joining the currency area.
Kenen (1970) is also underlying the significance of the factor mobility adding that there should be occupational labour mobility. Furthermore, he pays the attention to the importance of economy;s diversification which should guarantee export and import diversity which reduces terms of trade fluctuations. Kenen postulates the over regional monetary and fiscal policy centralisation.
Grubel's (1970) theory become a link between traditional and new optimum currency area theory. He concentrates on the cost and benefits of the common currency adoption. He claims that a country should join the currency area only when benefits exceed costs what he analyses on the basis of the welfare function. Grubel mentions a number of advantages of monetary integration for example: higher national income, exchange rate risk elimination and price stabilisation.
The beginning of the new OCA theory is dated on 1970s. The attention here is driven to the problems of financial integration, inflation rate convergence and low exchange rate variability (Wojnicka, 2002). Economists postulate that countries which want to form currency area should have similar monetary and fiscal policy while business cycle synchronisation can ensure effective common monetary policy.

3. Optimum Currency Area Index

Optimum currency area theory focuses on determining characteristics which make exchange rates more stable and make the monetary unification more desirable. Unfortunately, great majority of these features are very difficult to measure what cause problems with empirical analysis. This is the reason why most researches limit their empirical investigation only to the verification of one single criterion of the OCA theory. A new approach to this problem was adopted by Eichengreen and Bayoumi (1998). They created a new measure which enabled to capture more characteristics of countries to which optimum currency area theory points. These were: asymmetric disturbances to output, usefulness of money for transactions and trade linkages. Eichengreen and Bayoumi's measure, named optimum currency area index, successfully joined the core implications of both traditional and new OCA theory. What is more this new empirical procedure was based on cross-country data.
Whole investigation concerning OCA index is based on analyzing the variability of exchange rate. The lower it gets the higher probability there is of successful monetary integration from the point of view of optimum currency area theory. As a

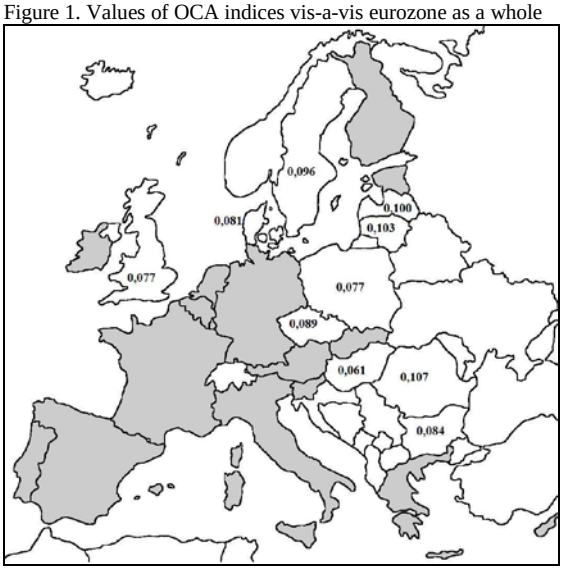
key factors which can make the exchange rate more stable authors indicate the lack of asymmetric shocks, high volume of bilateral trade and labour mobility.
Eichengreen and Bayoumi measure asymmetric disturbances as the standard deviation of the change in the logarithm of relative output in the two countries. Hence, if business cycles of a couple of countries are synchronised OCA index should have lower values.
Authors took also under consideration the similarity of countries' economy structures. This measure was a second proxy for the asymmetry of shocks. When the dissimilarity of the commodity composition is larger we can expect stronger impact of industry-specific shocks on the economy.
Furthermore, analysis includes a factor which is a representation of trade linkages between countries. Eichengreen and Bayoumi measure the importance of bilateral trade using the average value of shares of export to partner country in GDP. The more intensive the trade exchange is (what means that economies are more open) the better prospects for future of the currency area.
The last determinant of OCA index value is the size of the country. Eichengreen and Bayoumi assume that smaller countries should benefit more from adopting common currency mainly because of higher stability of this currency.
The estimated equation (1) has a following structure:

(1)
$$SD(e_{ij}) = a + \beta_1 SD(\Delta y_i - \Delta y_j) + \beta_2 DISSIM_{ij} + \beta_3 TRADE_{ij} + \beta_4 SIZE_{ij} + \xi_{ij}$$
Where:
a, β1, β2, β3, β4 – are the parameters of the model,
$SD(e_{ij})$ – is the standard deviation of the change in the logarithm of the end-year bilateral exchange rate between countries i and j ,
$SD(\Delta y_i - \Delta y_j)$ – is the standard deviation of the difference in the logarithm of real output between countries i and j,
$DISSIM_{ij}$ – is the sum of the absolute differences in the shares of agricultural, mineral and manufacturing trade in total merchandise trade between countries i and j,
$TRADE_{ij}$ – is the mean of the ratio of bilateral exports to domestic GDP for the two countries i and j,
$SIZE_{ij}$ – is the mean of the logarithm of the two GDPs measures in US dollars.
All values of the variables were calculated as averages over the whole sample. Analysis is based on the sample that covers annual data from 1983 to 1992 for 21 countries. Values of OCA indices were calculated vis-à-vis Germany first for the whole sample period and next as a out-of-sample forecasting for the year 1995. According to estimation results which Eichengreen and Bayoumi achieved countries were divided into three groups: prime candidates for European Monetary Union with Germany (first group), those which show respectively high (second group) and low (third group) level of convergence with EMU.
The first group consists of Austria, Belgium, The Netherlands, Ireland and one more country which is not EMU member – Switzerland. Authors express surprise over the absence of France in the first group. Results in the case of France show little convergence despite of relatively low exchange rate variability. However, authors anticipate the crucial role of France in the integration process in Europe and its viability of this enterprise. Eichengreen and Bayoumi are also deeply convinced that Austria and Benelux countries are strongly connected with German economy but they seem to be rather not so sure about the existence of such close relationship between Ireland and Germany.
United Kingdom, Finland, Norway, Denmark and mentioned above France are the members of the second group, described as those who are converging to EMU. Finally, the third group includes Sweden, Italy, Greece, Portugal and Spain. The membership of the last four countries in the third group take on special meaning in the light of current crisis and the financial problems of, so called, PIIGS countries.
Differences between average levels of optimum currency area indices among analyzed countries are mainly determined by relative size (which is rather stable over time) and the intensity of bilateral trade. Therefore, Eichengreen and Bayoumi explain that a very low value of OCA index for France is probably driven by its considerable size and because it is relatively closed (in comparison with other European countries).
Changes of the OCA index over time are mainly determined by the level of bilateral trade and asymmetry in fluctuations of economic activity. This implies that the policy which aims to increase the intra-European trade is a crucial factor which can stimulate the process of convergence. That is why, according to authors, improving the Single Market (which should promote trade) can lead to successful monetary integration. The second important factor which dominated the value of OCA index is business cycle synchronisation. Consistency of fluctuations of production is very important from the point of view of the effectiveness of common monetary policy.

4. Empirical Results

This paper empirically investigates the readiness of a country to join euro zone according to Eichengreen and Bayoumi's methodology. Analysis is conducted for EU countries which are not members of euro area no matter if they opt-out of joining eurozone or they have not fulfilled Maastricht criteria yet . Indices are calculated first vis-à-vis euro zone as a whole and then vis-à-vis Poland. Such analysis is aimed at pointing out these countries which show the highest level of convergence with euro zone and next those which are economically similar to Poland. Due the fact that Poland is the main point of this analysis it is also investigated how indices for Poland vis-à-vis euro zone were changing over time.
In order to calculate values of optimum currency area indices, parameters of the equation (1) were reestimated. This was necessary because of the willingness to include more actual information. The sample period is form the year 1999 to 2009. However, a few data modification are implemented. Changes goes as follows:
- $DISSIM_{ij}$ – is now the sum of the absolute differences in the shares of agricultural, mineral, services and manufacturing trade in total value added between countries i and j,
- $TRADE_{ij}$ – is now the mean of the ratio of total exports to domestic GDP for the two countries i and j.
After the first estimation of the coefficients of equation (1) parameter α was not significantly different from zero that is why it was removed and estimation procedure was repeated. The estimation results are presented below.
(2)
$$\hat{SD}(e_{ij}) = 0{,}386\overset{(2{,}02)}{SD}(\Delta y_i - \Delta y_j) + 0{,}111\overset{(2{,}47)}{DISSIM}_{ij} - 0{,}082\overset{(-2{,}26)}{TRADE}_{ij} + 0{,}005\overset{(3{,}33)}{SIZE}_{ij}$$
Values in brackets over variables are the t-student statistics. All four variables have anticipated signs and values of t-student test which inform that their coefficients are significantly different from zero on the 95% confidence level.
As it was in the analysis conducted by Eichengreen and Bayoumi, factor which have the strongest influence on OCA index is the consistency of economic activity fluctuations ($SD(\Delta y_i - \Delta y_j)$ variable). The second important factor is here the level of similarity of economic structure ($DISSIM_{ij}$ variable). This means that higher level of these variables (higher asymmetry of business cycles and significant differences in the value added components between countries) leads to a rise of the value of OCA index. In such situation costs of the adoption of common currency and resignation form independent monetary policy can be considerably high.
Equation (2) became a basis for OCA indices calculation for all countries vis-à-vis euro zone as a whole over the whole sample period. Results are presented in figure 1 (countries coloured grey are members of eurozone both in figure 1 and 2).

Figure 1. Values of OCA indices vis-a-vis eurozone as a whole



Source: Author's calculations

Results indicate that the best candidates to join euro zone are: Hungary, United Kingdom and Poland. All these countries have OCA indices lower than 0,08 what suggests that their exchange rates are relatively stable. To the second group we can include Bulgaria, Czech Republic and Denmark. Their OCA indices do not exceed 0,09. According to Eichengreen and Bayoumi nomenclature we can describe these countries as converging the euro area. In the last group we can find: Lithuania, Latvia, Romania and Sweden. OCA indices for these countries are the highest from all analyzed countries and their values are about 0,1.

Similar analysis was conducted in order to measure the values of OCA indices but this time vis-à-vis Poland and again for whole sample period. The findings presented in figure 2 shows that the best candidate countries to form a currency area with Poland are: Czech Republic, Bulgaria and Hungary. Less similar to Poland are: Denmark, Lithuania and Sweden. The most economically different from Poland, taking under consideration values of OCA indices, are Latvia, Romania and United Kingdom.

Figure 2. Values of OCA indices vis-a-vis poland

Source: Author's calculations

The last part of this empirical analysis is measuring OCA indices for Poland vis-à-vis euro zone, but this time not for whole sample period, but for few chosen years. It occurred that the lowest values of OCA index were for the year 2004 and 2005. This were the first two years of polish membership in European Union. OCA indices value were about 0,077. Then the value of index was gradually increasing to reach 0,09 in 2009. Due to the fact that the value of OCA index is strongly determined by the level of business cycle synchronisation one can assume that these were differences in business fluctuations during recent crisis that led to the deterioration of OCA index. Moreover, Poland and euro zone have different structures of economies. In euro area largest part of the value added is driven from services than it is in Poland where large part of value added comprise of agriculture.

5. Conclusion Remarks

The aim of this paper was to provide the analysis based on Eichengreen and Bayoumi's optimum currency area index which could answer the question: which current EU member states beyond euro area are the best candidates to join eurozone. OCA index seem to be relatively good measure for such investigation because it has a strong theoretical background – it successfully joins the core implications of both traditional and new OCA theory. The empirical investigation was conducted in two directions. Firstly, to measure the values of OCA indices vis-à-vis eurozone. Secondly, to repeat this procedure, but this time in order to calculate the values of OCA indices vis-à-vis Poland.

The results show that the best candidate countries to join eurozone are: Hungary, United Kingdom and Poland. The further findings are that the most similar countries to Poland according to OCA indices are: Czech Republic, Hungary and Bulgaria.

Investigation findings also confirm the thesis that there is a strong influence of the level of business cycle synchronisation and similarity of economies' structures on the monetary integration. That is the economic integration significantly increases country's readiness for joining common currency area.

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Primary Paper Section: A

Secondary Paper Section: H