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DETERMINANTS OF BUSINESS CYCLES
SYNCHRONIZATION
IN THE EUROPEAN UNION – 1991–2011¹

INTRODUCTION

Further economic and monetary integration in Europe is currently at hold due to crisis and even questions about possible Greece exile. Especially in those conditions it is important to see whether integrated Europe can handle future problems and if economic and monetary integration can be helpful or rather more problematic. The main aim of this paper is to check to what degree business cycles are synchronized in the Eurozone and the European Union and what are the main determinants of business cycles synchronization. To achieve it, the following steps are taken. Firstly, we turn to optimum currency area theory, to see what conditions need to be meet, if the European Union and the Euro Area can use common monetary policy to deal with some economic shocks.

In our analysis we used yearly data from World Bank, IMF Directions of Trade, EUROSTAT, EU KLEMS, and IMF IFS. All data were available for the European Union and Euro Area member countries mostly for the period 1991–2011. The exceptions are time series of economy structure, which ended in 2007, and convergence, which ended in 2010.

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The structure of the paper is as follows. In section two the theoretical framework of traditional and recent optimum currency area concepts is briefly discussed. Section three contains all necessary methodological explanations. In section four the preliminary data analysis is employed to see how business cycles and their determinants were acting during last 20 years. Finally, in section five panel data analysis is used to check how those determinants actually influence business cycles synchronization. Section six concludes.

1. THEORY OF OPTIMUM CURRENCY AREAS

M. Friedman² in 1951 initiated an ongoing debate on optimal exchange rate for a given economy. According to his arguments in conditions of nominal rigidities within the country freely floating exchange rate works as an adjustment mechanism. But as other researchers pointed out, that country itself does not have to be an optimal entity for maintaining one currency. According to these observations, including several conditions is a necessity when defining borders of optimum currency area. Then optimum currency area can be defined as a domain where benefits of adopting common currency outweigh costs of lack of monetary autonomy and flexibility of a single country exchange rate³.

The so-called “old” theory of optimum currency areas was trying to identify criteria that would make abolition of flexible exchange rate and independent monetary policy for a member country as least costly as possible. Perfectly elastic wages and prices can replace flexible exchange rate and independent monetary policy⁴. Inspired by M. Friedman’s work, R. Mundell⁵ suggested that country itself did not need to be such a homogenous organism that adjustment processes could be accomplished through

² M. Friedman, *The Case for Flexible Exchange Rates*, “Essays in Positive Economics”, The University of Chicago Press, Chicago 1953.

³ C.P. Hallwood, R. MacDonald, *International Money and Finance*, Blackwell Publishing, Oxford 2000, p. 73.

⁴ P. de Grauwe, *Economics of Monetary Union*, Oxford University Press, New York 2007, p. 6–10.

⁵ R. Mundell, *Updating the Agenda for Monetary Union*, Extended version of a luncheon speech presented at the Conference on Optimum Currency Areas, Tel-Aviv University, December 5, 1997, p. 3.

exchange rate flexibility and after J. Meade⁶ proposed labour force mobility criterion⁷.

R. McKinnon proposed an additional criterion – openness of economies of potential currency union member countries⁸. Highly open to each other the member economies would be characterized with more symmetric distribution of economic shocks. Additionally high amplitude of variation of exchange rates would strongly disturb inner price stability of such a type of economy⁹. P. Kenen proposed two additional criteria of optimum currency area. Firstly covering fiscal and monetary domain¹⁰, which nowadays is described as fiscal federalism – interregional fiscal transfers are becoming adjustment mechanism within common currency area¹¹ (from regions experiencing expansion to ones experiencing depression)¹². The second criterion proposed by P. Kenen is diversification of production (and consumption) structure, which is reflected by versatile export structure¹³. According to the author, higher diversification of economy's structure leads to distribution of sector specific shocks more evenly in the whole economy¹⁴.

All those criteria laid fundamentals of old theory of optimum currency areas. The theory had static character and could be helpful in determining whether at a given point of time it is optimal for a given country to enter a currency union. On the other hand, development of economic theory, especially the concept of natural rate of unemployment by M. Friedman¹⁵ and

⁶ J. Meade, *The Balance-of-Payments Problems of a European Free-Trade Area*, “The Economic Journal”, Vol. 67, No. 267 (Sep. 1957), p. 385–386.

⁷ R. Mundell, *A Theory of Optimum Currency Areas*, „American Economic Review”, 1961, No. 51, p. 662.

⁸ R. McKinnon, *Optimum Currency Areas*, „American Economic Review”, 1963, No. 53, p. 717–718.

⁹ I. Maes, *Optimum Currency Area Theory and European Monetary Integration*, “Tijdschrift voor Economie en Management”, 1992, Vol. XXXVII, 2, p. 143.

¹⁰ P. Kenen, *The Theory of Optimum Currency Areas: An Eclectic View*, [in:] *Monetary Problems in the International Economy*, R. Mundell, A. Swobod (ed.), University of Chicago Press, Chicago–London 1969, p. 46.

¹¹ Ibidem.

¹² A. Fatás, *Does EMU Need a Fiscal Federation?*, INSEAD and CEPR, Economic Policy Panel, October 1997, p. 1.

¹³ S. Bukowski, *Unia monetarna teoria i polityka*, Difin, Warszawa 2007, p. 36.

¹⁴ M. Jurek, *Development of the Optimum Currency Areas Theory – Some Issues*, “Poznań University of Economics Review”, 2004, nr 4, p. 31.

¹⁵ M. Friedman, *The Role of Monetary Policy*, “The American Economic Review”, Vol. 58, No. 1 (Mar. 1968), p. 11.

E. Phelps¹⁶ as well as the influence of rational expectations theory on monetary policy effectiveness¹⁷ decreased perceived costs of independent monetary policy abolition. Portfolio-balance and assets models indicated that exchange rate could vary a lot from its fundamentals, particularly from international trade variables¹⁸. In the light of these concepts changes in nominal exchange rate and independent monetary policy have an impact on the economy only in the short run. At the same time economists started emphasizing qualitative character of monetary unification and large spread of benefits that it brings¹⁹. All those findings led to creation of the “new” theory of optimum currency areas²⁰.

Along with “new” theory of optimum currency areas and more dynamic approach to integration processes within monetary union two contradicting views on its performance came about. First of them is known as “European Commission View” and states that the more advanced economic integration is, the lower probability of asymmetric economic shocks to occur is, they are also expected to be less frequent and less intensive²¹. This effect is explained by an increased share of intra-industry trade, which leads to a more symmetrical distribution of economic shocks²².

With “European Commission View” is connected endogeneity of optimum currency areas criteria hypothesis created by J. Frankel and A. Rose, who, as they stated, wanted to use “Lucas Critique”²³ to optimum currency area analysis. According to their observations, a progress in economic integration leads higher business cycles correlation through more symmetric

¹⁶ E. Phelps, *Phillips Curves, Expectations of Inflation and Optimal Unemployment over Time*, “Economica”, New Series, Vol. 34, No. 135 (Aug. 1967), p. 256.

¹⁷ R. Lucas, *Expectations and the Neutrality of Money*, “Journal of Economic Theory”, 4, 103–124 (1972), p. 114.

¹⁸ G.S. Tavlas, *The ‘New’ Theory of optimum Currency Areas*, “The World Economy”, 1993, Vol. 16, No. 6, p. 665–666.

¹⁹ F.P. Mongelli, *“New” Views on the Optimum Currency Area Theory: What is EMU Telling Us?*, European Central Bank Working Papers, April 2002, No. 138, p. 33.

²⁰ G.S. Tavlas, *The ‘New’ Theory...*, op. cit.

²¹ *One market, one money. An evaluation of the potential benefits and costs of forming an economic and monetary union*, “European Economy”, 1990, No. 44, p. 46.

²² R. Horvath, L. Komarek, *Optimum Currency Area Theory: an Approach for Thinking about Monetary Integration*, Warwick Economic Research Papers, No. 647, Warwick 2002, p. 15.

²³ R. Lucas, *Econometric Policy Evaluation: A Critique*, [in:] *The Phillips Curve and Labor Markets*, K. Brunner, A. Meltzer (ed.), North Holland, Amsterdam 1976, p. 41–42.

distribution of demand shocks and increase of intra-industry trade²⁴. This, in consequences, means that optimum currency area criteria do not need to be fulfilled *ex ante* and can be fulfilled *ex post*. G. Lee and M. Azali came to similar conclusions based on their research on East Asia²⁵ as well as J. Silvestre, A. Mendonça and J. Passos, who, on the other hand, found out that the increases of international trade intensity had decreasing marginal effect on business cycles synchronization²⁶.

Besides intra-industry trade nowadays, economists enlist different origins of optimum currency area endogeneity. R. Mundell and R. McKinnon argue that currency unification leads to domestic residents' portfolio diversification by adding foreign bonds or other foreign financial assets²⁷. Authors explain this occurrence by elimination of exchange rate risk – this phenomenon is known as risk sharing and was considered main part of the optimum currency area theory, by its founder R. Mundell in 1973²⁸. This theoretical view is strongly supported by the data on impact of monetary integration in Europe on international portfolio diversification²⁹. Higher degree of portfolio diversification leads to more symmetric economic shock distribution. Additionally, participation in common currency area implies inability to use idiosyncratic monetary policy which reduces the probability of asymmetric monetary shocks occurrence in the member countries³⁰ and in

²⁴ J. Frankel, A. Rose, *The Endogeneity of the Optimum Currency Area Criteria*, CPER 1997, p. 23.

²⁵ G. Lee, M. Azali, *The Endogeneity of The Optimum Currency Area Criteria in East Asia*, Discussion paper 15/09, Monasch 2009, p. 13.

²⁶ J. Silvestre, A. Mendonça, J. Passos, *The Shrinking Endogeneity of Optimum Currency Areas Criteria: Evidence from the European Monetary Union – A Beta Regression Approach*, ISEG Working Paper 022, DE 2007, p. 10.

²⁷ R. McKinnon, *Optimum Currency Areas and European Experience*, Stanford University Press, Stanford 2001, p. 5–11.

²⁸ T. Warin, P.V. Wunnava, H.P. Janicki, *Testing Mundell's Intuition of Endogenous OCA Theory*, IZA Discussion Paper, September 2008, No. 3739, p. 7.

²⁹ K. Beck, M. Możdżeń, *Instytucjonalne przyczyny kryzysu w Stanach Zjednoczonych*, [in:] *Wyzwania polityki ekonomicznej w warunkach światowego kryzysu finansowego i gospodarczego*, A. Prusek (ed.), Wydawnictwo Uniwersytetu Ekonomicznego w Krakowie, Kraków 2011, p. 256.

³⁰ K. Beck, *Aksesja Polski do strefy euro w świetle teorii optymalnych obszarów walutowych – weryfikacja empiryczna*, [in:] *Kontrowersje wokół akcesji Polski do Unii Gospodarczej i Walutowej*, S. Lis (ed.), Wydawnictwo Uniwersytetu Ekonomicznego w Krakowie, Kraków 2011, p. 227.

turn leads to higher business cycles correlation³¹. P. de Grauwe argues that difference in a type of monetary regime is considered one of the main sources of asymmetric economic shocks³².

Second voice considering dynamic approach to common currency area performance is known as “the Krugman’s View”. P. Krugman argues that in integrating economies four following phenomena will occur³³:

- 1) regional specialization – when there are low obstacles to trade production can be located in the way to achieve highest possible external scale effects (in regions with highest comparative advantage in specific good production)³⁴, that leads to;
- 2) instability of regional export – when region is highly specialized even slight changes in customers tastes or technology can cause high amplitude of demand fluctuation of demand for regional products, what in turn causes;
- 3) pro-cyclical capital flows – negative economic shocks are accompanied by capital outflows as a result of decreased profitability of investment in the region, which leads to;
- 4) divergence of long run growth – regions experienced by negative shocks are condemned to perpetual decrease of economic growth; this effect is amplified by labour force mobility (labour force emigration unable unemployment to increase and in turn stops pressure on wage decrease and competitiveness increase – negative impact of labour mobility has been described by P. Ganog and D. Shoag³⁵).

T. Bayoumi and B. Eichengreen came to the same conclusions using econometrics. They argue that United States as a common currency area are characterized by higher specialization and higher intensification of asymmetric demand shocks when compared to less integrated European Union³⁶. Despite strong theoretical and empirical arguments “the European Commission View” and endogeneity of optimum currency criteria hypothesis seem to the

³¹ J. Babelski, *EU Enlargement and Endogeneity of OCA Criteria: Evidence from the CEECs*, Czech National Bank, Research Department, Working Papers No. 2004/02, p. 2.

³² P. de Grauwe, *Unia Walutowa*, Polskie Wydawnictwo Ekonomiczne, Warszawa 2003.

³³ P. Krugman, *Lessons of Massachusetts for EMU*, “Adjustment and growth in the European Monetary Union”, CEPR, Cambridge University Press, New York 1993, p. 242–243.

³⁴ J. Fidrmuc, *The Endogeneity of Optimum Currency Area Criteria, Intra industry Trade and EMU Enlargement*, BOFIT Discussion Papers, No. 8, Helsinki 2001, p. 23.

³⁵ P. Ganog, D. Shoag, *Why Has Regional Convergency in the U.S. Stopped*, Harvard Kennedy School Working Paper, 2012.

³⁶ T. Bayoumi, B. Eichengreen, *Shocking Aspects of European Monetary Integration*, NBER Working Paper, January 1992, No. 3949, p. 35.

dominate economic debate. This fact can be explained by the latest research contradicting Bayoumi and Eichengreen, but still the hypothesis has not been verified in a definite way³⁷.

More recent literature focuses attention on verifying hypotheses about different determinants of business cycles synchronization. J. Imbs³⁸ finds significant relationship between business cycles synchronization and specialization, capital mobility and trade using system of simultaneous equations. The same approach with the same results has been provided more recently by I. Siedschlag³⁹ and S. Nées and N. Zorell⁴⁰. M. Baxter and M. Kouparitsas⁴¹ employ extreme bounds analysis (methodological framework created by E. Leamer and H. Leonard⁴² and developed by R. Levine, D. Renelt⁴³ and X. Sala-i-Martin⁴⁴) to several potential determinants of business cycles synchronization, but beside the gravity variables they found only trade significant. In more recent approach U. Böwer and C. Guillemineau⁴⁵ using the same methodology but focusing their attention on the Euro Area found only trade, economic specialization at industry level, fiscal deficits, price competitiveness and stock market differentials significant business cycles synchronization determinants. On the

³⁷ P. de Grauwe, F.P. Mongelli, *Endogeneities of Optimum Currency Areas: What brings Countries Sharing a Single Currency Closer Together?*, EBC Working Paper No. 468, Frankfurt am Main 2005.

³⁸ J. Imbs, *Trade, Finance, Specialization, and Synchronization*, “Review of Economics and Statistics”, 2004, Vol. 86, No. 3, p. 723–734.

³⁹ I. Siedschlag, *Patterns and Determinants of Business Cycles Synchronization in Enlarged European and Monetary Union*, “Eastern Journal of European Studies”, 2010, Vol. 1, No. 1, p. 21–44.

⁴⁰ S. Nées, N. Zorell, *Business Cycles Synchronization. Disentangling Trade and Financial Linkages*, EBC Working Paper, 2011, No. 1322.

⁴¹ M. Baxter, M. Kouparitsas, *Determinants of Business Cycle Comovement: A Robust Analysis*, NBER Working Paper, 2004, No. 10725.

⁴² E. Leamer, H. Leonard, *Reporting the Fragility of Regression Estimates*, “The Review of Economics and Statistics”, 1981, Vol. 65, No. 2, p. 306–317; E. Leamer, *Let's Take the Con out of Econometrics*, “American Economic Review”, 1983, Vol. 73, No. 1, p. 31–43.

⁴³ R. Levine, D. Renelt, *A Sensitivity Analysis of Cross-Country Growth Regressions*, “American Economic Review”, 1992, Vol. 82, No. 4, p. 942–963.

⁴⁴ X. Sala-i-Martin, *I Just Ran Two Million Regressions*, “American Economic Review Papers and Proceedings”, 1997, Vol. 27, No. 2, p. 178–183; X. Sala-i-Martin, *I Just Ran Four Million Regressions*, NBER Working Papers, 1997, No. 6252.

⁴⁵ U. Böwer, C. Guillemineau, *Determinants of Business Cycles Synchronization Across Euro Area Countries*, EBC Working Papers, 2006, No. 587.

other hand, M. Bordo and T. Helbling⁴⁶ argue that increasing business cycles synchronization is a worldwide phenomenon. S. Lehwald⁴⁷ using Bayesian dynamic factor model and variance decomposition, argues that great part of increased business cycles synchronization among the Euro Area countries comes from worldwide tendencies rather than ongoing integration inside the region. J. Imbs and R. Wacziarg⁴⁸ have shown that higher convergence of real income leads to U-shaped structure similarity function. This suggest that level of convergence might also impact business cycles synchronization in different ways, depending on specific country real GDP *per capita*.

Summing up one can argue that development in economic theory led to verification of conclusions based on “old” theory of optimum currency areas. Nowadays loss of ability to conduct independent monetary policy and to adopt flexible exchange rate regime is not considered such a big cost for integrating countries as it was before. Moreover, endogenous theories and wide approach to qualitative aspects of monetary integration and accompanying benefits bring new arguments for currency union.

2. DATA AND METHODOLOGY

In order to verify, whether the Euro Area and the European Union are optimum currency areas business cycles synchronization approach is used. In order to justify this choice two arguments can be raised. First one considers lack of proper adjustment mechanisms in the absence of flexible exchange rates and independent monetary policy. Neither Euro Area, nor European Union have any institutions, that facilitates federal fiscalism. Certainly, the European Union provides redistribution of means as part of structural policy and even though this policy can lead to higher degree of real convergence⁴⁹, it cannot function as an adjustment mechanism. Also preliminary data analysis has shown a very low level of labour force mobility. Not only net migration rates are very low (especially in a case of the Euro Area), but

⁴⁶ M. Bordo, T. Helbling, *International Business Cycle Synchronization in Historical Perspective*, NBER Working Paper, 2011, No. 16103.

⁴⁷ S. Lehwald, *Has the Euro Changed Business Cycle Synchronization? Evidence from the Core and the Periphery*, IFO Working Papers, 2012, No. 122.

⁴⁸ J. Imbs, R. Wacziarg, *Stages of Diversification*, “American Economic Review”, 2003, Vol. 93, No. 1, p. 63–86.

⁴⁹ Higher degree of real convergence might lead to higher business cycles synchronization – this argument will be explored further in the text.

also are better explained by differences in real wage level than by changes of unemployment or GDP growth rate and their deviation from natural levels⁵⁰. Finally employing vector autoregression model (VAR)⁵¹ has shown insufficient degree of wage elasticity to serve as an adjustment mechanism⁵².

As a second reason one considers the nature of business cycles synchronization. Impact of optimum currency area criteria, which are focused on more symmetrical spread of economic shocks (level of trade and intra-industry trade, economy diversification, degree of specialization), is reflected in a higher business cycles synchronization. Of course symmetrical spread of economic shocks and business cycles synchronization are not the same thing, that is why in our analysis some control variables are used in order to correct that difference. Also business cycles approach allows to include some dynamic aspects of monetary integration, like impact of participation in the monetary union and its effects on convergence, specialization and trade.

To show how business cycles synchronization is determined by the above mentioned factors two approaches are used. Both in the preliminary analysis and panel data approach the same samples were used consisting of the European Union and the Euro Area member countries.

2.1. Measures of business cycles synchronization

In a case of the preliminary data analysis correlation coefficient for a period of ten years is calculated to investigate business cycles synchronization between two countries. Measure is defined as:

$$r(g_i, g_j) = \frac{\sum_{k=1}^{10} (g_{ik} - \bar{g}_i)(g_{jk} - \bar{g}_j)}{\sqrt{\sum_{k=1}^{10} (g_{ik} - \bar{g}_i)^2 * \sum_{k=1}^{10} (g_{jk} - \bar{g}_j)^2}}$$

where:

$r(g_i, g_j)$ – GDP growth rates correlation coefficient for countries A and B,

g_{ik} – GDP growth rate of country A at year k ,

g_{jk} – GDP growth rate of country B at year k ,

\bar{g}_i – average GDP growth of country A,

\bar{g}_j – average GDP growth of country B.

⁵⁰ Labor mobility determined by differences in real wage, can bring higher real wage and GDP per capita convergence level, but cannot work as an adjustment mechanism.

⁵¹ Model was formulated with endogenous variables representing changes in nominal wage, real wage, unit labor cost and unemployment rate.

⁵² As impulse-response approach have shown, in case of any Euro Area country, wage elasticity couldn't bring unemployment to initial level within time of five years.

Then in order to obtain measure of average business synchronization level for Euro Area the following correlation matrix is constructed:

$$\begin{bmatrix} 1 & r_{12} & \cdots & r_{1j} & \cdots & r_{1n} \\ r_{21} & 1 & \cdots & r_{2ij} & \cdots & r_{2n} \\ \vdots & \vdots & & \vdots & & \vdots \\ r_{i1} & r_{i2} & \cdots & 1 & \cdots & r_{in} \\ \vdots & \vdots & & \vdots & & \vdots \\ r_{n1} & r_{n2} & \cdots & r_{nj} & \cdots & 1 \end{bmatrix}$$

and the mean value of correlation coefficients is taken, which is defined as:

$$ear = \frac{1}{136} \sum_{i=1}^{n-1} \sum_{j=i+1}^n r_{ij},$$

due to the fact, that the Euro Area has 17 member countries. Analogically average value of correlation coefficient for the European Union can be defined as:

$$eur = \frac{1}{351} \sum_{i=1}^{n-1} \sum_{j=i+1}^n r_{ij}.$$

This measures have some very convenient properties. Firstly, for uneven number of countries, which is the case of both European Union and Euro Area, measure takes values from 1 (perfect business cycles synchronization) to 0. Close to zero value of average correlation coefficient suggest, that there are two groups of countries with very high business cycles synchronization degree within the group, and very low outside the group or simply business cycles of countries of interest are not synchronized. On the other hand, this measure has one drawback – it explores business cycles synchronization not for a given year but for ten year periods. The correlation coefficient proper usage requires at least several observations to be treated as a statistically significant measure. At the same time one must face an obvious discomfort of not being able to rely on yearly interpretation.

In a case of panel data approach, absolute difference in year to year GDP growth rates between two countries is used. Value of the measure at year k is defined as:

$$mod_k(g_{ik}, g_{jk}) = mod(g_{ik} - g_{jk}).$$

One must admit that this measure is less precise than the one presented previously, but it has an advantage of maintaining length of times series untouched.

2.2. Measures of international trade

In order to measure impact of international trade on business cycles synchronization in panel data approach bilateral values of international trade as percentage of GDP for each pair of countries for every year k were calculated. The measure is defined as:

$$trade_{bijk} = \frac{Imports_{ijk} + Exports_{ijk}}{GDP_{ik} + GDP_{jk}}.$$

For preliminary data analysis approach in case of the Euro Area, average value of bilateral trade as a percentage of GDP between all member countries was calculated. Measure for the Euro Area is defined as:

$$eatrade_{bij} = \frac{1}{136} \sum_{i=1}^{n-1} \sum_{j=i+1}^n \frac{Imports_{ij} + Exports_{ij}}{GDP_i + GDP_j},$$

and for the European Union as:

$$eatrade_{bij} = \frac{1}{351} \sum_{i=1}^{n-1} \sum_{j=i+1}^n \frac{Imports_{ij} + Exports_{ij}}{GDP_i + GDP_j}.$$

2.3. Measures of economy structure similarity

To measure the level of similarity of economy structures for panel data analysis two bilateral correlation coefficients were calculated. First is defined as:

$$Cor_{ijk}(x) = \frac{cov(x_{ik}^l, x_{jk}^l)}{s(x_{ik}^l) * s(x_{jk}^l)}.$$

where:

$(x_{ik})^l$ – production of sector l as a percentage of GDP of country i , at year k ,

$(x_{jk})^l$ – production of sector l as a percentage of GDP of country j , at year k ,

cov – covariance,

s – standard deviation.

Second measure is defined as:

$$Cor_{ijk}(y) = \frac{cov(y_{ik}^l, y_{jk}^l)}{s(y) * s(y_{jk}^l)},$$

where:

$(y_{ik}^l)^l$ – employment of sector l as a percentage of total employment of country i , at year k ;

$(y_{jk}^l)^l$ – employment of sector l as a percentage of total employment of country j , at year k .

In preliminary data analysis approach average values of above mentioned measures were calculated. For the Euro Area and the European Union respectively, they are defined as:

$$eaCor_{ijk}(x) = \frac{1}{136} \sum_{i=1}^{n-1} \sum_{j=i+1}^n \frac{cov(x_{ik}^l, x_{jk}^l)}{s(x_{ik}^l) * s(x_{jk}^l)},$$

$$euCor_{ijk}(x) = \frac{1}{351} \sum_{i=1}^{n-1} \sum_{j=i+1}^n \frac{cov(x_{ik}^l, x_{jk}^l)}{s(x_{ik}^l) * s(x_{jk}^l)},$$

$$eaCor_{ijk}(y) = \frac{1}{136} \sum_{i=1}^{n-1} \sum_{j=i+1}^n \frac{cov(y_{ik}^l, y_{jk}^l)}{s(y_{ik}^l) * s(y_{jk}^l)},$$

$$euCor_{ijk}(y) = \frac{1}{351} \sum_{i=1}^{n-1} \sum_{j=i+1}^n \frac{cov(y_{ik}^l, y_{jk}^l)}{s(y_{ik}^l) * s(y_{jk}^l)}.$$

In all cases values of proposed measures belong to interval $[-1, 1]$, and the higher the value the more similar economies structures are.

2.4. Measures of specialization

To measure level of specialization pairwise Krugman Specialization Indices were employed. In as case of panel data approach, their values are defined as:

$$KSF_{ijk}^x = \sum_l^{I_1} |x_{i,k^l} - x_{j,l^k}|,$$

for production and:

$$KSF_{ijk}^y = \sum_l^{I_1} |y_{i,k^l} - y_{j,l^k}|,$$

for employment.

In preliminary data analysis approach average values of above mentioned measures were calculated. For the Euro Area and the European Union respectively, they are defined as:

$$eaKSF^x_{ijk} = \frac{1}{136} \sum_{i=1}^{n-1} \sum_{j=i+1}^n \sum_t^{11} |x_{i,k^t} - x_{j,l^t}|,$$

$$euKSF^x_{ijk} = \frac{1}{351} \sum_{i=1}^{n-1} \sum_{j=i+1}^n \sum_t^{11} |x_{i,k^t} - x_{j,l^t}|,$$

$$eaKSF^y_{ijk} = \frac{1}{136} \sum_{i=1}^{n-1} \sum_{j=i+1}^n \sum_t^{11} |x_{i,k^t} - x_{j,l^t}|,$$

$$euKSF^y_{ijk} = \frac{1}{351} \sum_{i=1}^{n-1} \sum_{j=i+1}^n \sum_t^{11} |x_{i,k^t} - x_{j,l^t}|.$$

In all cases values of the proposed measures belong to interval $[0, 2]$, and the higher the value the less similar two economies are.

2.5. Measure of real GDP distance

For the panel data approach to include in the analysis of the impact of convergence, measure of real GDP distance between two countries is introduced and defined as:

$$conv_{ijk} = mod[\ln(\text{GDP per capita}_i) - \ln(\text{GDP per capita}_j)].$$

In the preliminary data analysis approach average values of above mentioned measures were calculated. For the Euro Area and the European Union respectively, they are defined as:

$$eaconv_{ijk} = \frac{1}{136} \sum_{i=1}^{n-1} \sum_{j=i+1}^n mod[\ln(\text{GDP per capita}_i) - \ln(\text{GDP per capita}_j)],$$

$$euconv_{ijk} = \frac{1}{351} \sum_{i=1}^{n-1} \sum_{j=i+1}^n mod[\ln(\text{GDP per capita}_i) - \ln(\text{GDP per capita}_j)].$$

The lower the value of proposed measure, the more converged the two economies are.

2.6. Measure of monetary union participation

In panel data analysis dummy variable was defined to measure the impact of participation in the monetary union. If both countries are monetary union members: “both countries are monetary union members”= 1; if at least one of them is not: “at least one of the countries in not monetary union member”= 0. In a case of preliminary data analysis approach average value of dummy variable was calculated – by division by 136 for Euro Area and 351 for the European Union. So values of monetary union participation belong to interval [0, 1) for the European Union and [0, 1] for Euro Area. The higher the value of variable, more countries are the Euro Area members.

2.7. Control variables

Presented above measures, intact with optimum currency areas theory should reflect economic shocks distribution. To measure the impact of monetary union participation, bilateral trade, structure similarities and specialization on business cycles synchronization the macroeconomic policy variables should be defined as control ones. In the panel data analysis we measure impact of differences in the monetary policy using following formula:

$$m2 = mod[g_i(M2) - g_j(M2)],$$

where:

$g_i(M2)$ – growth rate of $M2$ in country i ;

$g_j(M2)$ – growth rate of $M2$ in country j .

For the preliminary data analysis approach proper averages were calculated, so that the measures are defined as:

$$eam2 = \frac{1}{136} \sum_{i=1}^{n-1} \sum_{j=i+1}^n mod[g_i(M2) - g_j(M2)],$$

and

$$eum2 = \frac{1}{351} \sum_{i=1}^{n-1} \sum_{j=i+1}^n mod[g_i(M2) - g_j(M2)],$$

for the Euro Area and the European Union respectively.

To measure impact of differences in fiscal policy for panel data approach following two measures were calculated:

$$bd = \text{mod}[dif(bd_i) - dif(bd_j)],$$

where:

$dif(bd_i)$ – year to year change in government budget position of country i as a percentage of GDP,

$dif(bd_j)$ – year to year change in government budget position of country j as a percentage of GDP,

and:

$$ge = \text{mod}[dif(ge_i) - dif(ge_j)],$$

where:

$dif(ge_i)$ – year to year change in level of government expenditure of country i as a percentage of GDP,

$dif(ge_j)$ – year to year change in level of government expenditure of country j as a percentage of GDP.

For preliminary data analysis as measures of differences in fiscal policy averages for all countries of the Euro Area and the European Union were calculated:

$$eabd = \frac{1}{136} \sum_{i=1}^{n-1} \sum_{j=i+1}^n \text{mod}[dif(bd_i) - dif(bd_j)],$$

$$eubd = \frac{1}{351} \sum_{i=1}^{n-1} \sum_{j=i+1}^n \text{mod}[dif(bd_i) - dif(bd_j)],$$

$$eage = \frac{1}{136} \sum_{i=1}^{n-1} \sum_{j=i+1}^n \text{mod}[dif(ge_i) - dif(ge_j)],$$

$$euge = \frac{1}{351} \sum_{i=1}^{n-1} \sum_{j=i+1}^n \text{mod}[dif(ge_i) - dif(ge_j)].$$

For all presented measures, the lower the value, the lower the differences in economic policy between member countries.

3. PRELIMINARY DATA ANALYSIS

In order to measure business cycles synchronization we used yearly data on GDP growth rates from the World Bank. As main determinants suggested by theory of optimum currency areas following variable were chosen: bilateral trade among member countries; correlation of economies structure, pairwise Krugman Specialization Index, convergence and monetary union participation dummy variable. To measure bilateral trade yearly data from the IMF Directions of Trade was used, for correlation of economies structure, pairwise Krugman Specialization Index from the EU KLEMS database was taken. To measure convergence data from the World Bank was used. Also control variable were defined: changes in government budget position and changes government expenditure for which yearly data were extracted from the EUROSTAT. To measure differences in monetary policy regime, differences in M2 growth rates were applied, and the data for that purpose come from the World Bank and the IMF IFS. All data were available for the European Union and Euro Area member countries mostly for the period 1991–2011. The exceptions are time series of economy structure, which ended in 2007 and convergence, which ended in 2010.

3.1. Business cycles synchronization

Values of average correlation coefficients of GDP growth for European Union are presented in table 1.

Table 1
Average correlation coefficients of GDP growth for the European Union countries (1991–2011)
and their descriptive statistics

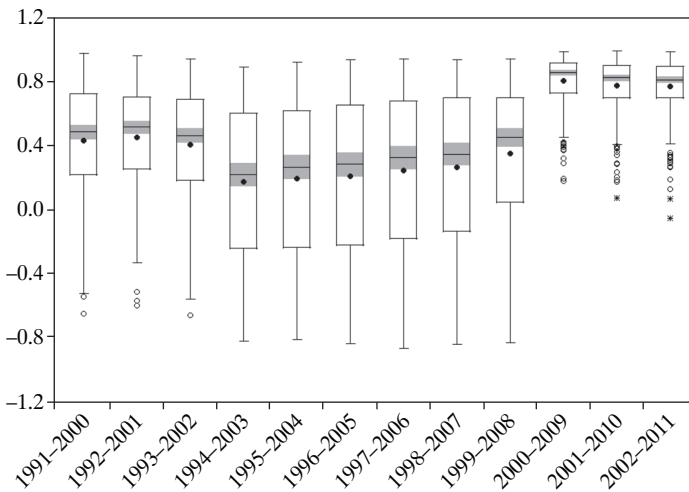
Period	1991–2000	1992–2001	1993–2002	1994–2003	1995–2004	1996–2005	1997–2006	1998–2007	1999–2008	2000–2009	2001–2010	2002–2011
Eur	0.43	0.45	0.40	0.17	0.19	0.21	0.24	0.26	0.35	0.80	0.77	0.77
Median	0.48	0.51	0.46	0.22	0.26	0.28	0.32	0.34	0.45	0.85	0.82	0.81
Maximum	0.97	0.96	0.94	0.89	0.92	0.94	0.94	0.94	0.94	0.98	0.99	0.98
Minimum	-0.65	-0.60	-0.66	-0.82	-0.81	-0.84	-0.87	-0.84	-0.83	0.18	0.07	-0.06
Std. Dev.	0.35	0.32	0.35	0.47	0.48	0.48	0.47	0.47	0.42	0.15	0.17	0.17
Skewness	-0.72	-0.74	-0.69	-0.22	-0.25	-0.29	-0.36	-0.38	-0.61	-1.39	-1.39	-1.58
Kurtosis	2.96	3.13	2.83	1.74	1.70	1.73	1.80	1.87	2.40	4.89	4.92	6.29

Source: Own calculations based on data from: *ibidem*.

During first three analyzed periods values of average correlation coefficient had been above 0.4, and then they dropped significantly in the fourth. Since then we have observed consecutive increase in its value till extreme rise in period between 1999–2009. This high increase might have had its sources on one hand in creation of monetary union, and in financial crisis that had negative impact on the GDP growth rates of all of the European Union countries on the other. Negative values of skewness suggest for the whole analyzed period majority of pairs of countries had positively correlated GDP growth rates. Especially since period between 1999 and 2009 50% of all pairs of countries had their business cycles correlated on level above 0.8. This phenomenon can be seen more clearly in boxplot presented in figure 1.

Figure 1

Boxplot for average correlation coefficient for the European Union countries (1991–2011)



Source: Own calculations based on data from: ibidem.

Even though any clear tendency hasn't appeared, we can observe steady rise in average value and stronger concentration of observations since period between 1994 and 2003. At this point we cannot add anything more, but some conclusions arise when we compare this values with those of Euro Area. Values of average correlation coefficients of GDP growth for the Euro Area are presented in table 2.

Table 2
 Average correlation coefficients of GDP growth for the Euro Area countries (1991–2011)
 and their descriptive statistics

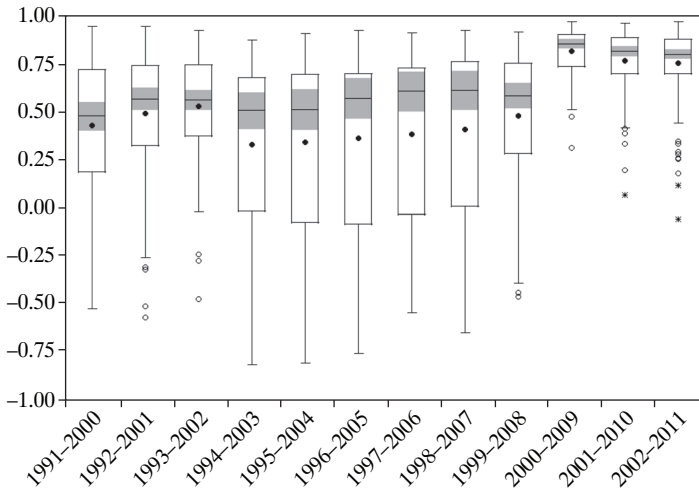
Period	1991– 2000	1992– 2001	1993– 2002	1994– 2003	1995– 2004	1996– 2005	1997– 2006	1998– 2007	1999– 2008	2000– 2009	2001– 2010	2002– 2011
Ear	0.44	0.50	0.54	0.34	0.35	0.37	0.39	0.41	0.49	0.83	0.78	0.77
Median	0.49	0.58	0.57	0.52	0.52	0.58	0.62	0.62	0.59	0.87	0.83	0.81
Maximum	0.96	0.96	0.94	0.89	0.92	0.94	0.93	0.94	0.93	0.98	0.98	0.98
Minimum	-0.52	-0.57	-0.47	-0.82	-0.81	-0.76	-0.54	-0.65	-0.46	0.32	0.07	-0.06
Std. Dev.	0.35	0.32	0.26	0.45	0.46	0.46	0.44	0.45	0.36	0.12	0.17	0.19
Skewness	-0.57	-1.03	-0.94	-0.77	-0.81	-0.77	-0.71	-0.74	-0.89	-1.17	-1.49	-1.82
Kurtosis	2.60	3.81	4.21	2.33	2.39	2.22	1.99	2.13	2.83	4.33	5.40	6.77

Source: Own calculations based on data from: <http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG/countries> (20.03.2013).

In comparison with the European Union, values of average correlation coefficient are constantly higher for entire analyzed period. Skewness is consecutively negative, so as before most pair of countries have positively correlated GDP growth rates. Value of median suggests that 50% of all pairs of countries had correlation coefficient above 0.49 and starting since period between 2000 and 2009 even above 0.8. This phenomenon can be seen more clearly in the boxplot presented in figure 2.

Figure 2

Boxplot for average correlation coefficient for Euro Area countries (1991–2011)



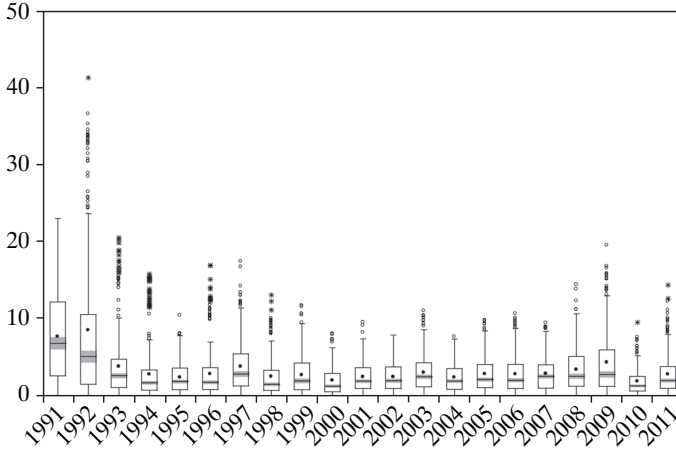
Source: Own calculations based on data from: ibidem.

Comparison of two box plots allows to draw couple conclusions. Firstly, changes in degree of business cycles synchronization are very similar in case of the European Union and the Euro Area. The Euro Area is constantly characterized by higher values of correlation coefficients and concentration. Unfortunately those differences can be explained by participation, as well as initial differences in the level of integration of the member countries.

Average absolute values of differences in the GDP growth rates between pairs of European Union countries are presented in figure 3.

Figure 3

Boxplot for absolute values of GDP growth differences for European Union countries (1991–2011)

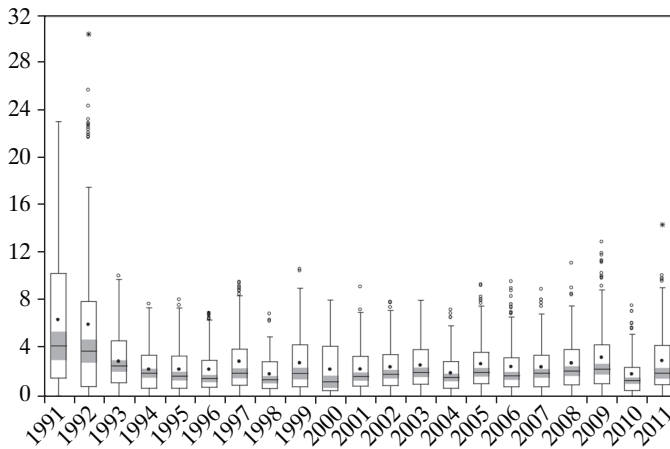


Source: Own calculations based on data from: ibidem.

In figure 3 we can observe (not very steady) decline in mod values and number of outliers till year 2000. After that the situation has been pretty much stable until 2008. Since then we can observe an increase of number of outliers. Average absolute values of differences in the GDP growth rates between pairs of the Euro Area countries are presented in figure 4.

Figure 4

Boxplot for absolute values of GDP growth differences for Euro Area countries (1991–2011)



Source: Own arrangement based on data from: ibidem.

Except for a very strong decline in average value of mod and interval of values, no vital observation can be made on the basis of the data presented above. Average mods are below 4%, since then but spread and number of outlier seem not to show any tendencies. On the other hand, in comparison with the European Union mods are consecutively lower.

3.2. Trade, structure similarities, specialization and convergence

Descriptive statistics concerning bilateral trade, structure similarities, specialization and convergence for European Union countries are presented in table 3.

Table 3

Bilateral trade (1991–2011), correlation coefficient of economy structure (1991–2007), Pairwise Krugman Specialization Index (1991–2007), and GDP distance (1991–2010) in European Union countries

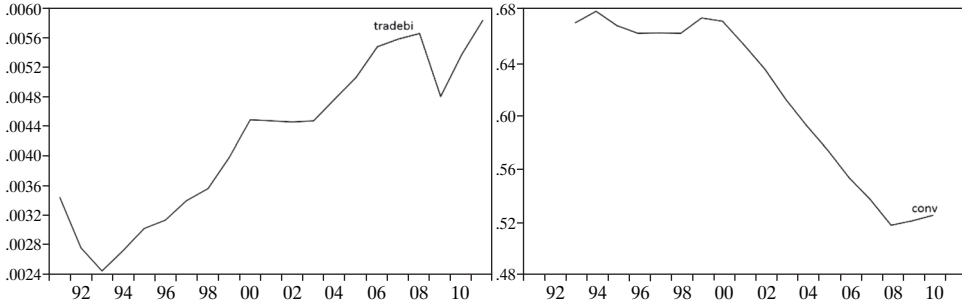
Variable	tradebi	cor(x)	cor(y)	ksi(x)	ksi(y)	conv
Mean	0.004068	0.879555	0.911655	0.312494	0.276023	0.633218
Median	0.004462	0.870327	0.908284	0.321692	0.278545	0.661397
Maximum	0.005587	0.932384	0.941936	0.369624	0.292378	0.678254
Minimum	0.002441	0.839553	0.900684	0.231468	0.242157	0.536518
Std. Dev.	0.000985	0.024447	0.011963	0.036533	0.013666	0.047755
Skewness	-0.100272	0.786789	1.965287	-0.952362	-1.528387	-0.916517
Kurtosis	1.879728	3.208089	5.287412	3.449804	4.485118	2.345043

Source: Own calculations based on data from: IMF Directions of Trade statistics; <http://www.rug.nl/research/ggdc/data/eu-klems-database>; <http://data.worldbank.org/topic> (20.03.2013).

On average, value of bilateral trade between any two European Union countries is equal to roughly 11% of GDP. Both correlation coefficients and pairwise Krugman Specialization Indices show rather high similarities between the European Union countries. When we put those values against time, more developed conclusions arise. In figure 5 data on average values of bilateral trade and GDP distance are presented.

Figure 5

**Bilateral trade (1991–2011) and GDP distance (1991–2010)
in European Union countries**



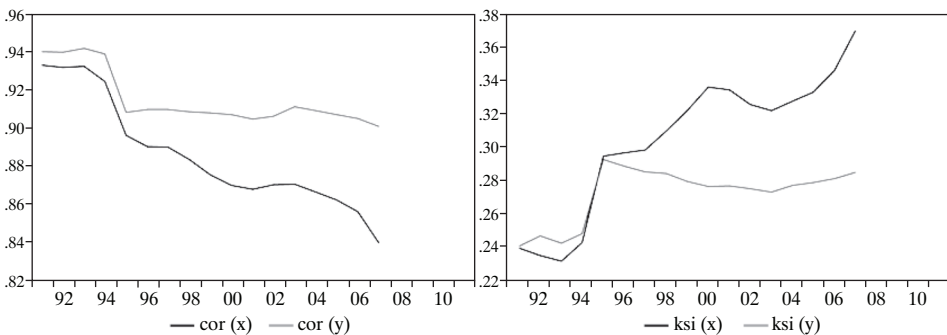
Source: Own calculations based on data from: *ibidem*.

Value of trade has been steadily increasing over the whole analyzed period. On the other hand we can observe very impressive decrease in differences between GDP per capita level among member countries. If theory predictions are correct, both these factors should lead to higher business cycles synchronization.

In figure 6 we can observe values of correlation coefficients and pairwise Krugman Specialization Index for both production and employment.

Figure 6

**Correlation coefficient of economy structure (1991–2007) and pairwise Krugman
Specialization Index (1991–2007) in the European Union countries**



Source: Own calculations based on data from: <http://www.rug.nl/research/ggdc/data/eu-klems-database> (20.03.2013).

During the entire period similarities of economies structure were declining – downfall of correlation coefficient and rise in pairwise Krugman Specialization Index for both production and employment can be observed almost consecutively between 1991 and 2007. But in both cases divergence of economic structures is higher in the case of production than in the case of employment. This phenomenon can be explained by differences in productivity among sectors. If there are obstacles in free labour factor movements among sectors (like the European Union support for agriculture sector), countries can't effectively specialize in production of goods in which they have comparative advantage. So one might conclude, that removal of these impediments will result in further specialization.

Descriptive statistics concerning bilateral trade, structure similarities, specialization and convergence for the Euro Area countries are presented in table 4.

Table 4

Bilateral trade (1991–2011), correlation coefficient of economy structure (1991–2007), Pairwise Krugman Specialization Index (1991–2007), and convergence (1991–2010) in Euro Area countries

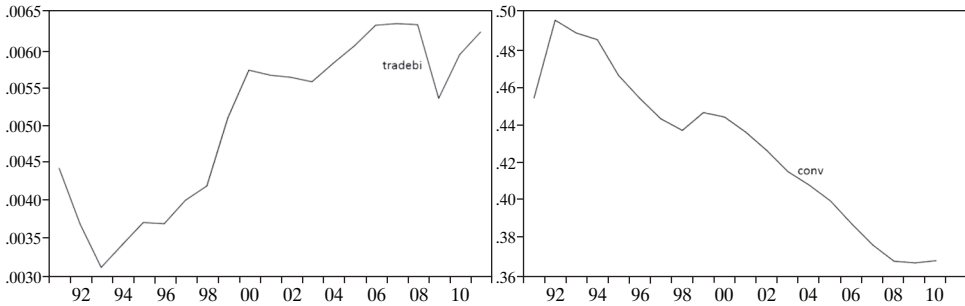
Variable	tradebi	cor(x)	kor(y)	ksi(x)	ksi(y)	Conv
Mean	0.005	0.884	0.915	0.301	0.265	0.043
Median	0.005	0.871	0.909	0.322	0.273	0.034
Maximum	0.006	0.942	0.944	0.380	0.285	0.074
Minimum	0.003	0.834	0.902	0.217	0.228	0.029
Std. Dev.	0.001	0.031	0.015	0.048	0.019	0.015
Skewness	-0.121	0.503	1.178	-0.475	-1.136	0.851
Kurtosis	1.464	2.202	2.560	2.206	2.598	2.423

Source: Own calculations based on data from: IMF Directions of Trade statistics; <http://www.rug.nl/research/ggdc/data/eu-klems-database>; <http://data.worldbank.org/topic> (20.03.2013).

Average value of bilateral trade among the Euro Area countries is slightly higher than in a case of the European Union. But correlation coefficients and pairwise Krugman Specialization Indices show slightly lower similarities between the Euro Area countries, when compared with the European Union. When we put those values against time, more developed conclusions may arise. In figure 7 data on average values of bilateral trade and convergence are presented.

Figure 7

Bilateral trade (1991–2011) and convergence (1991–2010) in the Euro Area countries



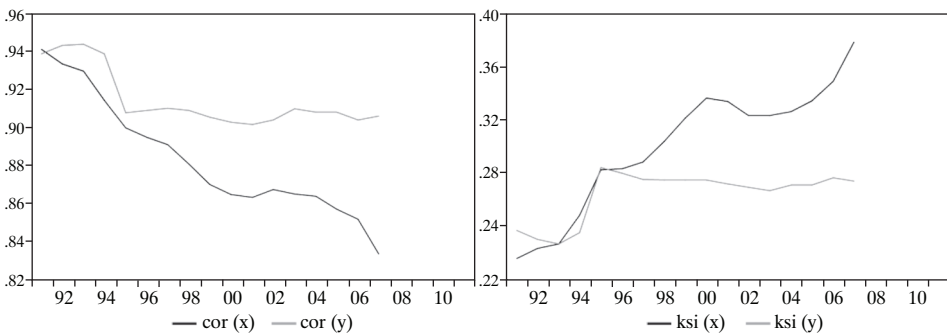
Source: Own calculations based on data from: *ibidem*.

International trade among the Euro Area countries is rather steadily growing, except for two periods. The first one starts in 1999, when average bilateral trade has started increasing and the second one starts in 2008, when trade took a slight drop. First episode characteristics can be explained by higher economic integration and formation of monetary union, and the second one by crisis and its impact on overall economic activity.

In figure 8 we can observe values of correlation coefficients and pairwise Krugman Specialization Index for both production and employment.

Figure 8

Correlation coefficient of economy structure (1991–2007) and pairwise Krugman Specialization Index (1991–2007) in the Euro Area countries



Source: Own calculations based on data from: <http://www.rug.nl/research/ggdc/data/eu-klms-database> (20.03.2012).

Like in a case of European Union during the entire period similarities of economies structure was declining – downfall of correlation coefficient and rise in pairwise Krugman Specialization Index for both production and employment. This effect is especially strong for $ksi(y)$, which values remain stable since 1995. Explanation of differences in values of indices measured in production and employment is the same as for the European Union.

This results seem to support “Krugman’s View”. Ongoing economic and monetary integration reduces impediments to trade and investment, so that production is located where comparative advantage and economies of scale are at work. So in the future both the European Union and the Euro Area might be more exposed to asymmetrical economic shocks. In this circumstances one can expect lower business cycles synchronization. If government limits involvement in economy, specialization measured in terms of employment might go even further and lead to more asymmetrical distribution of economic shocks.

4. PANEL DATA APPROACH

In this section we will try to estimate equations of the following form using OLS with fixed effects:

$$mod = \alpha_0 + \alpha_1 bd + \alpha_2 mu + \alpha_3 m2 + \alpha_4 ge + \alpha_5 tradebi + \alpha_6 KOR + \alpha_7 conv + \varepsilon,$$

where:

mod – a vector of business cycles synchronization measure observations,

bd – a vector of budget deficit differentials,

mu – a vector of monetary union participation measure observations,

m2 – a vector of M2 growth differentials,

ge – a vector of government spending expenditures,

tradebi – a vector of bilateral trade measures,

KOR – a vector of observations of one of the measures of similarity or specialization and

conv – a vector of real GDP distances.

Firstly panel data approach has been used for all European Union countries. All used time series have proven to be stationary by Levin, Lin and Chu test. Results of estimation are presented in table 5.

Table 5
 Estimation results for European Union

	c	bd	mu	m2	ge	tradebi	cor(x)	cor(y)	ksi(x)	ksi(y)	conv	R2	P(F)	DW	Period
a	2,350	-0,168	-0,270	0,036	0,103	-29,529				-1,756	1,263				1996–2007
t	15,859	-5,391	-2,497	11,721	3,758	-6,029				-3,724	10,735	0,15	0,00	0,95	
p	0,000	0,000	0,013	0,000	0,000	0,000				0,000	0,000				
a	2,054	-0,164	-0,239	0,037	0,099	-27,445			-0,559		1,198				1996–2007
t	17,428	-5,272	-2,180	11,879	3,605	-5,632			-1,836		9,647	0,15	0,00	0,94	
p	0,000	0,000	0,029	0,000	0,000	0,000			0,067		0,000				
a	0,719	-0,164	-0,224	0,036	0,098	-28,374	1,286				1,275				1996–2007
t	2,124	-5,292	-2,058	11,670	3,582	5,850	-3,713				10,707	0,15	0,00	0,95	
p	0,034	0,000	0,040	0,000	0,000	0,000	0,000				0,000				
a	-1,286	-0,168	-0,260	0,035	0,104	-29,912		3,434			1,334				1996–2007
t	-2,447	-5,428	-2,418	11,368	3,805	-6,193		6,210			11,677	0,16	0,00	0,95	
p	0,015	0,000	0,016	0,000	0,000	0,000		0,000			0,000				
a	2,568	-0,044	-0,531	0,046	0,065	-39,627									1996–2011
t	40,329	-1,850	-5,860	17,758	2,862	-9,489						0,11	0,00	1,4	
p	0,000	0,064	0,000	0,000	0,004	0,000									
a	2,754		-0,326	0,042	0,036	-39,340	-0,561								1996–2007
t	9,849		-3,046	13,896	1,988	-8,428	-1,794					0,11	0,00	0,92	
p	0,000		0,002	0,000	0,047	0,000	0,073								
a	1,913		-0,354	0,042	0,035	-35,826			1,079						1996–2007
t	17,329		-3,313	13,873	1,932	-7,613			4,149			0,11	0,00	0,93	
p	0,000		0,001	0,000	0,054	0,000			0,000						

Source: Own calculations based on data from: <http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG/countries> (20.03.2012); IMF Directions of Trade statistics; <http://www.rug.nl/research/ggdc/data/eu-klems-database> (20.03.2012); <http://data.worldbank.org/topic> (20.03.2012); <http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/themes> (20.03.2012); [http://elibrary-data.imf.org/FindDataReports.aspx?d=33061&c=169393](http://data.worldbank.org/topichttp://elibrary-data.imf.org/FindDataReports.aspx?d=33061&c=169393) (20.30.2012); <http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/themes> (20.03.2012).

Control variables show positive signs in case of M2 growth rates and changes in government expenditure, which is the result predicted by the economic theory – the smaller the differences in two countries' economic policy the lower the absolute value of their GDP growth rates. On the other hand differences in changes of budget deficit position have negative impact on business cycles synchronization. This result might come from the fact, that budget deficits reflect both expenditure and revenue side of government activity and due to that are strongly dependent on initial expenditure to revenue ratio. So even in case of countries with highly correlated GDP growth rates, might budget position changes react differently.

A monetary union dummy variable shows negative sign in all estimated equations. This might suggest that when countries form a monetary union *risk sharing* is prevailing. In such a case economic shocks of any nature are spreading more evenly among member countries. Also an impact of international trade on business cycles synchronization is positive. High negative value of regression coefficient, show that his impact is very strong. On the other hand, as preliminary data analysis has shown, that level of trade among European Union countries is very stable. So further increases in business cycles synchronization might be very hard to accomplish through trade. But as preliminary data analysis has shown, monetary union member countries tend to trade on average more with each other. So further monetary integration might lead to tighter GDP growth correlation, through channel of more internationally diversified national portfolios' structure, as well as through increases in trade volume.

Analyzing impact of structure similarities and convergence seem to be a little bit more problematic. This fact, is due to negative autocorrelation among those variables reflected in values of Durbin-Watson statistic (DW). In first four equations, we can see that obtained coefficients for structure correlation and pairwise Krugman Specialization Index for both production and employment have opposite signs to those predicted by the economic theory. Impact of convergence measured across countries have positive sign, which is an expected one – lower differences in GDP per capita yields higher business cycles correlation. When two countries converge in case of real GDP, their consumption and production structure might to. On the other hand higher level of GDP in catching up countries, can lead to further specialization. Of course as preliminary data analysis has shown, “the Krugman's View” and specialization seem to be the case of the European Union. Nevertheless impact of convergence on both

economy structure and specialization is undoubted. This fact can be seen in two last equations. When we leave out convergence sign of regression coefficients match the ones predicted by the economic theory. So definitely the more similar two economies are, the more synchronized their business cycles.

The same approach has been used for all Euro Area countries. All used time series have proven to be stationary by Levin, Lin and Chu test. Result of estimation are presented in table 6.

All conclusions for the European Union can be sustained for the Euro Area with one very important exception. If we turn to two last equations in table 6. we will see impact of specialization on both trade and monetary union participation – when pairwise Krugman Specialization Index for both production and employment is taken into consideration both of them become insignificant. This can be explained by higher exposal to asymmetric shocks in case of Euro Area countries. When specialization variable is considered, it is not the amount of trade among countries that is important for business cycles synchronization, but rather proportion of intra-industry trade in the whole international trade. With higher specialization trade structure is changing and countries tend to export goods they have comparative advantage in. So even with higher overall trade values, differences in the GDP growth rates might remain unchanged. Also if monetary integration opens possibilities for higher specialization positive impact of risk sharing on business cycles synchronization is outweighed, by area specific industry location. This also confirms “the Krugman’s View” on the future of Euro Area. Combining those findings with ones from the preliminary data analysis forms rather unpleasant perspective for future of Euro Area, which will experience lower and lower business cycles synchronization, if tendency is sustained.

Table 6

Estimation results for Euro Area

	c	bd	mu	m2	ge	tradebi	cor(x)	cor(y)	ksi(x)	ksi(y)	conv	R2	P(F)	DW	Period
a	0,563	-0,124	-0,412	0,036	-0,005	-21,399	1,722				1,179	0,16	0,00	1,02	1996-2007
t	1,065	-2,647	-3,152	8,152	-0,104	-3,727	3,376				4,934				
p	0,287	0,008	0,002	0,000	0,917	0,000	0,001				0,000				
a	-2,792	-0,133	-0,497	0,035	0,008	-21,028		5,285			1,378	0,18	0,00	1,03	1996-2007
t	-3,295	-2,876	-3,913	8,214	0,158	-3,719		6,072			6,265				
p	0,001	0,004	0,000	0,000	0,875	0,000		0,000			0,000				
a	2,316	-0,121	-0,471	0,038	-0,006	-19,883			-0,299		0,809	0,16	0,00	1,02	1996-2007
t	14,099	-2,563	-3,499	8,545	-0,108	-3,436			-0,684		3,179				
p	0,000	0,011	0,001	0,000	0,914	0,001			0,494		0,002				
a	2,961	-0,129	-0,504	0,037	0,004	-21,356					1,160	0,17	0,00	1,02	1996-2007
t	13,387	-2,770	-3,936	8,511	0,070	-3,738					5,278				
p	0,000	0,006	0,000	0,000	0,944	0,000					0,000				
a	2,257		-0,356	0,051	0,021	-29,252									
t	23,428		-3,447	12,244	1,062	-6,454						0,12	0,00	1,2	1996-2011
p	0,000		0,001	0,000	0,288	0,000									
a		-0,013	0,014	0,054	0,089	-9,412					5,901	0,02	-	1,00	1996-2007
t		-0,267	0,113	12,099	1,596	-1,584					14,830				
p		0,789	0,910	0,000	0,111	0,113					0,000				
a		0,030	-0,003	0,063	0,155	0,087			3,702						
t		0,595	-0,025	14,403	2,762	0,014			13,283						
p		0,552	0,980	0,000	0,006	0,989			0,000						

Source: Own calculations based on data from: ibidem.

CONCLUSIONS

Generally business cycles synchronization is tighter in the Euro Area than in the whole of European Union, but its changes over time exhibit the same tendencies. Since year 2000 in both cases business cycles synchronization (measured by average correlation coefficient of GDP growth rates) has been rising due to monetary integration and increases in international trade value and mostly due to recent crisis, which affected all European economies. On the other hand European economies tend to be less and less similar over time, which is proven by lowering of structure correlation coefficient and pairwise Krugman Specialization Index for both production and employment. What is more, economies similarities in production seem to be dropping at higher phase than those in employment. This can be explained by lower productivity growth in some sectors, due to impediments in intersectional labour mobility. Moreover real convergence seems to have positive impact on economies specialization and structure divergence. This fact is especially strongly visible in case of Euro Area. Lack of trade barriers and common currency have positive impact on business cycles synchronization. Unfortunately they also have strong positive impact on specialization which leads to lower portion of intra-industry trade in overall trade and further structure divergence. Both these effects outweigh *risk sharing* and trade influence on business cycles synchronization. All this data seem to support “the Krugman’s View” and bring strong argument for deterioration of business cycles synchronization in the future.

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STRESZCZENIE

Dalsza integracja gospodarcza i monetarna w Europie jest obecnie w stanie zawieszenia z powodu kryzysu, a także pytań dotyczących ewentualnego wykluczenia Grecji z Unii. W takich warunkach szczególnie ważne jest przyjrzenie się, czy zintegrowana Europa zdoła poradzić sobie z przyszłymi problemami oraz czy integracja gospodarcza i monetarna może być pomocna, czy raczej będzie stanowić problem. Głównym celem niniejszego opracowania jest sprawdzenie, do jakiego stopnia cykle koniunkturalne są zsynchronizo-

wane w strefie euro oraz Unii Europejskiej oraz, jakie są główne determinanty synchronizacji cykli koniunkturalnych. W tym celu podejmowane są następujące kroki: po pierwsze, odnosimy się do teorii optymalnego obszaru walutowego, aby zobaczyć, jakie warunki wymagają spełnienia, jeśli Unia Europejska i strefa euro będą mogły zastosować wspólną politykę monetarną w odpowiedzi na wstrząsy gospodarcze. Następnie przedstawione są wszystkie konieczne wyjaśnienia metodologiczne. Zastosowana jest analiza danych wstępnych w celu określenia, jak kształtowały się cykle koniunkturalne i ich determinanty w ostatnich 20 latach, a także analiza danych panelowych w celu sprawdzenia, jak owe determinanty wpływają na synchronizację cykli koniunkturalnych. Głównym ustaleniem niniejszego opracowania jest to, że chociaż w Unii Europejskiej i strefie euro postępowała synchronizacja cykli koniunkturalnych, postępowała również specjalizacja – dywergencja w strukturze produkcji. W przyszłości może to spowodować, że cykle koniunkturalne będą słabiej zsynchronizowane.

SUMMARY

Further economic and monetary integration in Europe is currently on hold due to the economic crisis and even questions about a possible Greece exile. Especially in those conditions it is important to see whether integrated Europe can handle future problems and if economic and monetary integration can be helpful or rather more problematic. The main aim of this paper is to check to what degree business cycles are synchronized in the Eurozone and the European Union and what the main determinants of business cycles synchronization are. To achieve it, the following steps are taken. Firstly, we turn to optimum currency area theory to see what conditions need to be met if the European Union and the Euro Area can use common monetary policy to deal with some economic shocks. Then all necessary methodological explanations are put. Later on, the preliminary data analysis is employed to see how business cycles and their determinants have been acting during the last 20 years. Finally, panel data analysis is used to check how those determinants actually influence business cycles synchronization. The main finding of the article is that even though business cycles synchronization has been progressing in the European Union and the Euro Area, so has the specialization – divergence in production structure. This may result in less synchronized business cycles in the future.

РЕЗЮМЕ

Дальнейшая экономическая и валютная интеграция в Европе в настоящее время приостановлена вследствие кризиса, а также вопросов, касающихся возможного исключения Греции из ЕС. В этих условиях особенно важным является ответ на вопрос о том, сможет ли интегрированная Европа справиться с будущими проблемами, а также то, может ли принести пользу европейская интеграция, или же – наоборот – скорее всего осложнит ситуацию. Главной целью настоящего исследования является проверка того, до какой степени синхронизируются циклы деловой активности в зоне евро и Евросоюза, а также то, каковы основные детерминанты синхронизации циклов деловой активности. Для этого были предприняты следующие шаги: во-первых, мы придерживаемся теорий оптимального валютного пространства (зоны), чтобы увидеть, какие требования необходимо выполнить, если Евросоюз и зона евро будут вести совместную валютную политику в ответ на экономические потрясения. Затем представлены все необходимые методологические обоснования. Далее применён анализ предварительных данных с целью определения того, каким образом формировались циклы деловой активности и их детерминанты на протяжении последних 20 лет. Под конец применён анализ данных панелей с целью проверки того, как эти детерминанты влияют на синхронизацию циклов деловой активности. Основным выводом исследования является то, что, несмотря на то, что в Евросоюзе и в зоне евро прогрессирует синхронизация циклов деловой активности, прогрессирует также специализация – расхождения в структуре производства. В будущем это может привести к тому, что синхронизация циклов деловой активности будет ослабевать.