6. TESTING THE ENDOGENEITY OF TRADE AND FINANCIAL INTEGRATION AND SECTORAL SPECIALIZATION IN AN ENLARGED EURO AREA

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Abstract

In this study we analyzed the trade, financial and structural asymmetries between the core and periphery of the Euro Area, and between these countries and seven CEE economies, respectively. The study includes an investigation of the trade, financial integration and sectoral specialization transmission channels on the business cycle synchronization for 16 EU countries between 1998 and 2011. In order to test the endogeneity of the four variables, we used the three-stage least squares method for a simultaneous equations system. According to the results, we identified three arguments for endogeneity in an enlarged Euro Area with other CEE economies. Thus, most of the CEE economies recorded a higher correlation of the business cycles and a higher share of the intra-industry trade with the Euro Area advanced countries as compared to Portugal or Greece. Moreover, the group of the CEE economies is more commercially integrated as compared to the peripheral economies of the Euro Area. Also, the sectoral changes in the New Member States show a process of structural convergence with the advanced economies of the Euro Area core.

Keywords: trade integration; financial integration; specialization; business cycle synchronization; Euro Area; CEE economies
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I. Introduction

This study is an analysis of the issues related to the monetary integration and to its related costs in terms of endogeneity approach of the European Monetary Union. According to this view, the economies with a common currency will automatically have more synchronized business cycles and the common monetary policy will have quite symmetrical impact in the member states. Their cyclical correlation is influenced by three determining factors. The first one refers to trade integration, which tends to occur at the intra-industry level. The second factor takes into consideration the financial integration, an enhancing phenomenon under the terms of a common currency. The third factor is related to the sectoral gaps between the economies. Generally, the economies from a monetary union become structurally convergent, as a result of the competitive pressures generated by trade and financial integration. Therefore, the degree of synchronization of their business cycles will increase.

The conclusions of the endogeneity approach to a monetary union are incompatible with the traditional theory asserting that the opportunity to give up the own currency should be achieved *ex-ante* only, according to the related costs and benefits. The implications of the new theory are overwhelming, as the endogenous approach shows that a monetary union may be achieved even though all the criteria of the optimum currency area traditional theory are not met. Thus, a country joining a monetary union, even though it does not meet the criteria of an optimum currency area, will *ex post* lead to increasing trade and financial integration, and to further structural convergence, respectively, which will automatically enhance the correlation of the business cycles with the other economies. The analysis made for endogeneity is relevant both for the economies forming a monetary union and also for those having the option for the monetary integration. If an enlarged monetary union does not lose its endogeneity feature, then it would not be characterized by an increase in the asymmetrical shocks between the member countries.

In order to examine the endogeneity of a larger Euro Area (with several CEE economies, such as Bulgaria, the Czech Republic, Hungary, Poland and Romania), we organized this study into three parts. The first section presents the main results of the economic literature related to the the main factors of the business cycles synchronization. The analysis of the literature has had a special importance for the second part of the study, in which we have explained the methods used to test endogeneity on the basis of a system of simultaneous equations. This section includes both the identifying principles of the system and, also, the features of the 3SLS method used to estimate the model. The study also provides a comprehensive and exhaustive interpretation of the economic significance of the coefficients of simultaneous equations system, which allows for a better identification of direct, indirect and aggregate effects in the last section of the paper. The last part presents the results of the simultaneous equations system estimation and the degree of concordance with other results from the economic literature.

II. Economic Literature

The issue related to the endogeneity of the optimum currency area (OCA) criteria was approached, for the first time, by Frankel and Rose (1998). They insisted upon the *endogenous* features of the OCA criteria, starting from the idea that the countries which had the closest economic relations had the tendency to record a higher concordance among the business cycles. According to these economists, the currency unification will enhance the economic integration and will lead to a higher synchronization of the economic cycles. The most important factor which ensures the shock transmission among countries and which influences the synchronization among their business cycles is the bilateral trade.

Imbs (2004, 2006) estimated that trade was the main factor determining a simultaneous movement of the business cycles. The hypothesis of trade endogeneity was also confirmed by Calderón and others (2007), who estimated that most of the bilateral commercial exchanges generate a higher impact on the cyclical correlation of the advanced economies, as compared to the less advanced economies. Regarding the impact of the currency integration on the synchronization of the business cycles, the results are contradictory. On the one hand, Rose (2000), Frankel and Rose (2002) showed that the single currency led to higher business cycles convergence through the trade channel. On the other hand, Clark and van Wincoop (2001), and Baxter and Kouparitsas (2005), respectively, argued that the currency integration might represent both a support and an unstable factor for business cycle synchronization.

The synchronization of the business cycles is influenced both by the asymmetry degree of the shocks affecting those economies, and also by the macroeconomic policies implemented by each economy separately. One of the macroeconomic policies generating shocks within a monetary union is represented by the fiscal policy as long as the too weak rules of the Stability and Growth Pact have generated different fiscal behaviours of the member states. Darvas and others (2005) estimated the impact of the national fiscal policies on the correlation between the business cycles, and concluded that it was a higher synchronization between the macroeconomic evolutions during the periods of lower budget deficits. Another source of the economic shocks influencing the correlation between economies refers to the differences between their sectoral structures. Baxter and Kouparitsas (2005), and Böwer and Guillemineau (2006), respectively, established that the structural similarity supports the business cycle convergence, but the dependence relation is statistically weak. Akin (2006) showed that the differences between the economic structures had the tendency to be stable in time, so that the economies which were more advanced and more diversified from a sectoral point of view would record a higher business cycle correlation as compared to the emerging economies. Albu (2008) has identified a convergence of the long-run dynamics of structural changes with the EU-27, which is a condition for higher business cycle synchronization in an enlarged monetary union. Dobrescu (2011) proposed different methods to identify the causality between sectoral structure and economic growth.

As regards the impact of the financial integration on the synchronization of the business cycles, there are more divergent results in the economic literature.

Theoretically, a higher financial integration between two economies will provide their synchronized evolution. On the contrary, Kalemli-Ozcan (2003) argue that the economies which are highly financially integrated have the tendency to enhance their sectoral specialization, thus reducing their cyclical synchronization. Akin (2007) estimated that the degree of financial openness has a significant impact on trade integration and a weak impact on the cyclical correlation for all the economies included in the analysis, and a high impact on the large and advanced economies, respectively. Böwer and Guillemineau (2006) assessed that the bank assets have a statistically insignificant influence on the bilateral synchronization between economies. One of the studies which analysed the influence of all the previously listed factors on the business cycles synchronization was elaborated by Garcia-Herrero and Ruiz (2008), according to whom the structural convergence, trade integration, sectoral shocks and the common macroeconomic policies enhance synchronization, while the financial integration reduces it.

III. Methodology

In order to identify the main factors of the business cycles synchronization between the Euro Area core countries, its peripheral economies and some of the new member countries of the European Union, we used the most appropriate methodology for our research according to the recommendations from the economic literature. Because the trade integration, the financial integration and the sectoral specialization may be endogenous, we did not apply the individual regression to each equation or the OLS estimation method. The principles of the empirical methodology used within this study are similar to that used by Imbs (2004, 2006) and Dées and Zorell (2011), respectively, but our study has different structures of the equations. In this study, we used a 3SLS estimation method for a system of simultaneous equations. An advantage of the three-stage regression is that it allows for solving the problem of endogeneity which is characteristic to simultaneous equations. Moreover, not only the direct effects upon an endogenous variable (as in the case of a single equation), but also the indirect effects upon it may be identified by means of the simultaneous equations.

III.1. The Simultaneous Equations System

In order to estimate the relations between the trade integration (T), the financial integration (F), the degree of sectoral specialization (S) and the synchronization of the business cycles (ρ), for the pairs of economies (i, j) we used a system of four simultaneous equations, of the following structure:

$$\rho_{i,j} = \alpha_0 + \alpha_1 T_{i,j} + \alpha_2 F_{i,j} + \alpha_3 S_{i,j} + \alpha_4 I_{1,i,j} + \varepsilon_{1,i,j} \quad (1)$$

$$T_{i,j} = \beta_0 + \beta_1 F_{i,j} + \beta_2 S_{i,j} + \beta_3 I_{2,i,j} + \varepsilon_{2,i,j} \quad (2)$$

$$F_{i,j} = \gamma_0 + \gamma_1 T_{i,j} + \gamma_2 I_{4,i,j} + \varepsilon_{3,i,j} \quad (3)$$

$$S_{i,j} = \sigma_0 + \sigma_1 T_{i,j} + \sigma_2 F_{i,j} + \sigma_3 I_{3,i,j} + \varepsilon_{3,i,j} \quad (4)$$

Besides the four endogenous variables, the system of equations also includes four exogenous instrumental variables in order to achieve a proper use of the 3SLS estimation method. The instrumental variables will be different, even though they may have common elements. In order to estimate accurately the system of four simultaneous equations, it is compulsory to identify it accurately and to choose the most appropriate method for the simultaneous regression of the equations. A model with four simultaneous equations may be written under a structural form, as follows:

$$AY_t + BZ_t = e_t \tag{5}$$

where: Y_t is a (4x1) vector of the 120 observations for the 4 endogenous variables during the period 1998-2011, Z_t is a (5x1) vector of the observations for the 5 exogenous variables also including the instrumental variables, e_t is a (4x1) vector of the errors in the four equations, A is a (4x4) square matrix of the coefficients associated to the endogenous variables, and B is a (4x5) matrix of the coefficients associated to the exogenous variables. The errors of the model have the following characteristics: $E(\varepsilon_t)=0$, $var(\varepsilon_t)=\Sigma$ and they are not autocorrelated, $cov(\varepsilon_t, \varepsilon_s)=0$.

The system with four simultaneous equations (1)-(4) has the following structural form:

$$\begin{bmatrix} 1 & -\alpha_1 & -\alpha_2 & -\alpha_3 \\ 0 & 1 & -\beta_1 & -\beta_2 \\ 0 & -\gamma_1 & 1 & 0 \\ 0 & -\sigma_1 & -\sigma_2 & 1 \end{bmatrix} \begin{bmatrix} \rho_t \\ T_t \\ F_t \\ S_t \end{bmatrix} + \begin{bmatrix} -\alpha_0 & -\alpha_4 & 0 & 0 & 0 \\ -\beta_0 & 0 & -\beta_3 & 0 & 0 \\ -\gamma_0 & 0 & 0 & -\gamma_2 & 0 \\ -\sigma_0 & 0 & 0 & 0 & -\sigma_3 \end{bmatrix} \begin{bmatrix} 1 \\ I_1 \\ I_2 \\ I_3 \\ I_4 \end{bmatrix} = \begin{bmatrix} e_1 \\ e_2 \\ e_3 \\ e_4 \end{bmatrix} \tag{6}$$

Assuming that matrix A is non-singular (its determinant is non-zero), the system of simultaneous equations can be turned from the structural form into a reduced form, multiplying the equation (5) by the inverse of the matrix A, (A^{-1}), as follows:

$$Y_t = -A^{-1}BZ_t + A^{-1}e_t \tag{7}$$

$$Y_t = CZ_t + \varepsilon_t \tag{8}$$

where: $C = -A^{-1}B$ and $\varepsilon_t = A^{-1}e_t$.

In the reduced form of the system, the vector of endogenous variables is only expressed according to the vector of exogenous variables. Generally, it is impossible to identify only the parameters of a system of simultaneous equations, without sufficient restrictions on the coefficients included in matrices A, B, Σ. The system may comprise accurately identified equations, over-identified equations and non-identified equations. If a single equation is over-identified, then the entire model will be over-identified.

In this study, we assume that the instrumental variables I_1, I_2, I_3 and I_4 are different, resulting that the system of simultaneous equations will be over-identified, as all the four equations have this feature, according to the order condition. Taking into account both the over-identified feature of the system and also the need of instruments, then the 3SLS method (three-stage least squares) is applied instead of the OLS method. The 3SLS method, proposed by Zellner and Theil (1962), generalizes the 2SLS

regression method in order to take into account the correlations between the errors of the different equations in a system (the SUR method, seemingly unrelated regression). Unlike the two-stage regression method, which estimates the coefficients of the structural equations separately, the three-stage regression uses their simultaneous estimation. The 3SLS method implies the existence of homoskedasticity and the lack of errors autocorrelation in each equation in the system. If the structural errors of the equations are not correlated (the variance-covariance matrix of the errors in the system equations is diagonal), then the 3SLS estimation is identical with the two-stage estimation.

III.2. The Economic Significance of the Simultaneous Equations System

In this section, we performed a brief analysis of the parameters included in the system with four simultaneous equations (1)-(4). The first equation highlights the main factors influencing the correlation between the bilateral business cycles, according to the features of the optimum currency areas theory. Frankel and Rose (1998) estimated a positive sign of the coefficient α_1 within a single equation for which the OLS regression was used. However, the sign of this coefficient may be influenced by the nature of the bilateral trade. If the trade between the (i, j) economies is mostly intra-industry, then the shocks will be common, and the business cycles will be more synchronized. As a consequence, the sign of the coefficient α_1 will be positive. According to the economic theory, the coefficient α_2, associated to the financial integration, is positive, outlining the pozitive relation between the financial flows and the correlation between the macroeconomic evolutions. Under these circumstances, the (i, j) economies become more financially interconnected and they will respond quite symmetrically to certain global financial shocks. Imbs (2004) analyzed the coefficient α_3 associated to specialization in equation (1), finding that the business cycle synchronization could be affected by sectoral specializations divergence. The greater the sectoral differences between the economies, the more exposed to more asymmetrical shocks these economies are, and the synchronization of their business cycles is lower.

The following three equations of the system may be interpreted as indirect effects of the three channels - *the financial, trade and sectoral specialization integration* - on the bilateral cyclical correlation. Thus, in equation (2) of the system, the indirect effects of the financial and specialization integration on the synchronization of the business cycles appear, by means of the bilateral trade. In the case of the horizontal investments between the economies, the multinational companies will perform the same activity in both economies, so that the flows of goods between them will be reduced. As a consequence, the foreign horizontal investments may be interpreted as a substitute for trade, and in such a case the sign of the coefficient β_1 will be negative. If the flows of investments between the countries are vertical, the economies which produce the intermediary goods at lower prices are preferred, so that an enhancement of the bilateral trade will occur, and the sign of the coefficient β_1 will be positive. According to the economic theory (the Ricardian theory, the Heckscher-Ohlin model, the new theory of the international trade), the differences between the sectoral structures of activity will generate more bilateral commercial exchanges, so that the sign of the coefficient β_2 will be positive.

According to the third equation of the system, the degree of financial integration depends on the bilateral trade integration. Thus, the enhancement of trade tends to increase the financial relations between economies, and the coefficient γ_1 will be positive. As a matter of fact, a part of the foreign investment flows are attracted to the sectors focused on export, and this enhances both trade and financial relations.

The degree of sectoral specialization may be, in its turn, endogenous, as it can be influenced by trade and financial integration, as it results from the form of equation (4). Krugman (1993) formulated the "specialization hypothesis", according to which the enhancement of trade generates additional pressure in order to increase the efficiency of the traded products, by means of sectoral (inter-industry) specialization, based on the comparative advantages. Under these terms, the sign of the coefficient σ_1 will be positive. On the contrary, the new theory of the trade asserts that the economic integration will generate a lower inter-industry specialization and a convergence of the productive structures of the economies belonging to a common economic space. According to this approach, the relation between trade and specialization will be inverse, and the coefficient will become negative. As regards the impact of the financial integration upon specialization, the sign of the coefficient is *ex ante* ambivalent. The financial integration can favour specialization in different sectors of activity or it may generate the focus of activities in the same fields such as the country of origin of the capital flows. In the first case, the sign of the coefficient σ_2 will be positive, while in the second case the coefficient σ_2 will be negative.

III.3. The Analysis of the Data Series

The sample used in this study comprises the bilateral relations between sixteen economies of the European Union, including five Euro Area core countries (Germany, France, Italy, Austria, and the Netherlands), the four peripheral economies of the Monetary Union (Spain, Ireland, Portugal and Greece) and seven economies from Eastern and Central Europe (Bulgaria, the Czech Republic, Poland, Slovakia, Slovenia, Romania, Hungary). The number of bilateral relations included in the sample is 120, the reference period being 1998:1-2011:1. Among them, 36 refer to the pairs of countries consisting of EMU 12 economies, 21 of them refer to the pairs of countries including new EU economies only, and the others are pairs of countries with economies belonging to the Euro Area (EMU-12) and the CEE economies. The data series which were used refer both to the endogenous variables and also to the instrumental ones, which provide the statistical accuracy of the system consisting of four simultaneous equations. The source of the data was Eurostat and the estimates were made using the Eviews software. In this section, we analyzed the four endogenous variables explaining their calculation and their similarities between the core and peripheral countries of the Euro Area, and the seven CEE countries, respectively.

III.3.1. The Business Cycle Synchronization

The first endogenous variable (the synchronization of the business cycles) was calculated by applying the Pearson correlation of the business cycles for the (i, j) economies, determined by means of the principal component method. Initially, we extracted the business cycles from the real GDP data series with four univariate

methods (the Hodrick-Prescott, Band-Pass, Beveridge Nelson and Quadratic Trend filters), and then we kept their first principal component (PC1), the one which mostly catches the variation of the business cycles determined with the four methods. The real GDP data series for each economy are quarterly, being expressed in millions of euro, the base year is 2000 and seasonal adjustment was done by the Tramo-Seats procedure. During the entire period 1998:1-2011:1, the pairs of economies recording the highest correlations of business cycles were Germany-Italy, Austria-Ireland, Austria-France; in their cases, the coefficient was at least 95.5%, while the pairs of countries including Greece, on the one hand, and Italy, Portugal and Germany, on the other hand, were characterized by the absence of a correlation between the business cycles, their coefficients being lower than 20%.

Table 1 presents the strongest/weakest correlated ten pairs of economies, according to the estimates made for the business cycles. Among the new EU member countries, the most correlated are those which are characterized by quite a high level of economic development (as compared to the average of the CEE countries) – Slovenia and the Czech Republic, with a GDP per capita higher than 75% of the EU-27 average. As for the Euro Area core economies, four of their pairs show a correlation coefficient of at least 93.9%, and nine of them (out of ten) have a correlation of minimum 90%, which is a proof of the high economic interdependence among them. The Euro Area core is highly correlated with the most advanced two peripheral economies of the monetary union (Spain and Ireland). Generally, the pairs of weakly correlated economies include a less advanced economy from the periphery of the Euro Area (Greece and Portugal, with a GDP per capita of 83%, and 76%, respectively, of the European average) and Romania, with a GDP per capita of only 42% of the European average. Greece seems to be the economy which is the least synchronized with the other economies of the sample, being divergent both towards the first three economies of the Euro Area, and also towards the peripheral countries or the new CEE member countries.

Table 1

The Synchronization of Business Cycles

The strongest correlated pairs of economies		**The weakliest correlated pairs of economies**	
Germany-Italy	96.06%	Italy-Romania	40.80%
Austria-Ireland	95.85%	Germany-Romania	39.12%
Austria-France	95.53%	Greece- Netherlands	32.31%
Spain-Czech Republic	95.45%	Austria-Greece	32.11%
Austria-Spain	95.34%	Greece-Hungary	30.05%
Ireland-Spain	95.26%	Portugal-Romania	25.70%
France-Italy	95.21%	France-Greece	24.91%
Austria-Netherlands	94.99%	Greece-Italy	19.80%
Spain-Slovenia	94.48%	Greece-Portugal	19.29%
France-Netherlands	93.94%	Germany-Greece	14.12%

Source of data: Eurostat (2011), authors' estimates.

III.3.2. The Bilateral Trade Integration

The second endogenous variable (the intensity of bilateral trade) was determined by a method used in the economic literature by authors such as Eickmeier and Breitung (2006), and Abbott and others (2008), respectively. Initially, we calculated the intensity of bilateral trade for each year of the period 1998-2011 (as a ratio of the sum of bilateral exports and imports to the sum of the nominal GDPs of the two economies), and then we determined its arithmetic mean: $T_{i,j} = \frac{1}{n}\sum_{t=1}^{n}(\frac{Ex_{ij,t} + \mathrm{Im}_{ij,t}}{Y_{i,t} + Y_{j,t}})$

In order to explain the differences between the 120 pairs of economies, we distributed them into six groups, three of them describing the relations between the economies which are member to each group (the Euro Area core, the Euro Area periphery and the CEE), and the other three describing the relations between the previously described groups. According to Table 2, the Euro Area core economies are the most synchronized and the most trade-integrated, while the peripheral economies are the most divergent (according to the standard deviation), being interconnected with the core of the union in a similar way as the new member countries are. Thus, five of the most commercially interconnected ten pairs of economies consist of countries placed at the core of the monetary union, the trade integration being one of the ways in which the shocks between them are transmitted.

In 2010, six of the seven CEE economies (except for Bulgaria) directed at least 40% of their exports to the five core economies, the Czech Republic exporting approximately 51%. As a matter of fact, Germany is their main partner, and 32% of the Czech Republic's exports, 26% of Poland's and 23% of Hungary's exports are directed towards it. On the contrary, only Bulgaria exported approximately 10% to the peripheral countries, while the average of the others was approximately 4%. Also, there is a higher degree of trade integration between the economies included in the CEE group. Thus, Slovakia directs 32% of the total exports to the other six economies taken into consideration, and Hungary and the Czech Republic directs approximately 20% of the total exports towards them.

Table 2

The Relationship between Business Cycles Synchronization and Trade Integration

Pairs of economies	Obs.	Mean		Standard deviation		Maximum		Minimum	
		Business cycle correlation	Trade integration	Business cycle correlation	Trade integration	Business cycle correlation	Trade integration	Business cycle correlation	Trade integration
All	120	73.51%	0.72%	19.12%	1.00%	96.06%	7.38%	14.12%	0.03%
Euro Area core countries	10	93.20%	2.09%	2.42%	1.33%	96.06%	4.71%	88.83%	0.37%
Euro Area peripheral countries	6	59.20%	0.50%	27.16%	0.78%	95.26%	2.08%	19.29%	0.06%
Core-peripheral	20	71.89%	0.63%	28.64%	0.58%	95.85%	2.35%	14.12%	0.14%

Pairs of economies	Obs.	Mean		Standard deviation		Maximum		Minimum	
		Business cycle correlation	Trade integration	Business cycle correlation	Trade integration	Business cycle correlation	Trade integration	Business cycle correlation	Trade integration
countries									
CEE countries	21	78.22%	1.12%	10.30%	1.57%	91.37%	7.38%	58.12%	0.15%
CEE-core countries	35	72.41%	0.63%	14.28%	0.58%	91.61%	2.13%	39.12%	0.06%
CEE-peripheral countries	28	68.53%	0.15%	18.01%	0.15%	95.45%	0.74%	25.70%	0.03%

Source of data: Eurostat (2011), authors' estimates.

III.3.3. The Financial Integration

In order to identify the degree of bilateral financial integration (the third endogenous variable of the system), we used the average flows of foreign direct investments (FDI) between economies during the period 1998-2011. There is no agreement in the economic literature with reference to the variable used to outline this phenomenon. For example, Imbs (2004) used the differential between the shares of the net external assets in the GDP. Schiavo (2008) calculated the bilateral spreads between the short-term and the long-term interest rates. Böwer and Guillemineau (2006) used the bilateral bank flows as proxies of the financial integration. We opted for the bilateral flows of foreign direct investments, due to their direct and indirect influence upon the business cycles of the countries. For example, the CEE economies are sensitive to the FDI volume and volatility, which have a significant impact on trade, decisively contributing to their structural change. Under these circumstances, the shocks influencing the multinational companies in the countries of origin will be transmitted faster to the host and this will generate a higher synchronization of the business cycles.

In order to estimate the degree of bilateral financial integration, we employed a method also used by Garcia-Herrero and Ruiz (2008), and Eickmeier and Breitung (2006), respectively, which involves the ratio of bilateral flows of investments to the sum of the GDP for two economies.

$$F_{i,j} = \frac{1}{n}\sum_{t=1}^{n}\left(\frac{ISD_{ij,t} + ISD_{ji,t}}{Y_{i,t} + Y_{j,t}}\right)$$

The seven CEE economies are characterized by a higher financial integration with the Euro Area core countries, as compared to the monetary union peripheral economies. Thus, at the end of 2009, the Netherlands, Austria and Germany made foreign direct investments in the CEE economies of approximately 65% of their inward FDI stock. Moreover, the investments coming from the Euro Area core economies towards the CEE economies had a significant role in their economic expansion, representing approximately 90% of their inward FDI during the period 2005-2008. Analyzing the level of the indicator for the bilateral financial integration of the six groups of countries, it results that the Euro Area economies are the most integrated, probably as a consequence of using a single European currency. The group of economy pairs from the Euro Area core shows the highest values of this indicator, and also the highest

dispersion, while the CEE countries are characterized by a lower financial integration with the Euro Area (Table 3).

Table 3

Statistics on the Degree of Financial Integration

Pairs of economies	Obs.	Mean	Standard deviation	Maximum	Minimum
All	120	0.07%	0.10%	0.47%	0.00%
Euro Area core countries	10	0.19%	0.14%	0.47%	0.01%
Euro Area peripheral countries	6	0.06%	0.07%	0.19%	0.01%
Core-peripheral countries	20	0.11%	0.13%	0.46%	0.01%
CEE countries	21	0.03%	0.04%	0.12%	0.00%
CEE-core countries	35	0.05%	0.08%	0.26%	0.00%
CEE-peripheral countries	28	0.02%	0.04%	0.17%	0.00%

Source of data: Eurostat (2011), authors' estimates.

III.3.4. The Sectoral Specialization

The fourth endogenous variable of the simultaneous equations system (the degree of sectoral specialization) outlines the bilateral structural differences. The higher they are, the more divergent the economic structures are, and those economies will respond more differently to certain external shocks, and the business cycles synchronization between them will decrease. The degree of specialization was calculated according to the method proposed by Krugman (1991) and largely used in the economic literature. This variable was calculated as the sum of the absolute differences between the shares of the various sectors of activity in the total value added, in the case of a pair of economies. In this study, we used a structure of economy with 31 sectors of activity (NACE 31), during the period 1998-2009. This structure includes a larger particularization of industry (17 branches of activity) and a smaller one of the services.

$$S_{i,j} = \frac{1}{T}\sum_{t}\sum_{n}^{N} abs(s_{n,i,t} - s_{n,j,t})$$

where: $s_{n,i}$ ($s_{n,j}$) represents the share of the sector of activity n in the total value added of the economy i (j). The number of the sectors of activity is 31, and the length of the interval is T=12 years.

The sectoral structure of an economy is decisively influenced by its degree of development. Generally, the new member countries are characterized by an economic structure which is different from that of the EU advanced economies, and also by significant sectoral changes. Once an economy reached a high level of development, the structural changes are much more limited. An analysis of the level of sectoral specialization for the six groups of pairs of economies (Table 4) shows that the Euro Area core countries are the most structurally convergent, being followed by the CEE pairs of economies.

Table 4

Statistics on the Sectoral Specialization

Pairs of economies	Obs.	Mean	Standard deviation	Maximum	Minimum
All	120	38.8%	10.9%	65.8%	16.9%
Euro Area core countries	10	25.7%	4.4%	31.7%	17.3%
Euro Area peripheral countries	6	39.5%	12.9%	58.1%	26.9%
Core-peripheral countries	20	39.3%	9.4%	55.9%	23.4%
CEE countries	21	34.3%	8.0%	46.5%	19.6%
CEE-core countries	35	41.0%	11.3%	63.4%	16.9%
CEE-peripheral countries	28	43.5%	10.4%	65.8%	27.8%

Source of data: Eurostat (2011), authors' estimates.

The importance of the development gaps is obvious in the case of the heterogeneous pairs of economies, consisting of the CEE economies, on the one hand, and the monetary union countries, on the other hand. The structural gaps between the core and the periphery of the Euro Area are relevant, corresponding to a quite high level of standard deviation.

Five of the most convergent ten pairs of economies, from a sectoral point of view, consist of economies from the Euro Area core, which are also characterized by high trade and financial integration and by high synchronization of the business cycles. The sectoral convergence is higher in the case of the new member countries which recorded a higher convergence of GDP per capita (Slovenia and the Czech Republic) and of those which have a common border. The most divergent pairs of economies are those including either Ireland, or Romania and Bulgaria, the last two countries being the least developed. Thus, Ireland has an economic structure which is approximately 66% different from that of Bulgaria and 64% different from that of Romania.

III.3.5. The Instrumental Variables

In this study, we use four vectors of instrumental variables (I_1, I_2, I_3, I_4), which improve the capacity to identify the system of simultaneous equations. Some of them are related to the significance of 'gravity' on the economic integration, others are related to development gaps between the integrated economies or to the economic importance of the pairs of economies. The four vectors are different, even though some of them may also include some common instrumental variables.

The vector I_1 includes six instrumental variables. The first one (*border)* refers to the border effect, caught by means of a dummy variable, which takes the value 1 for the pairs of economies with a common border and the value 0 in the other case. 23 of the 120 pairs of economies included in this study have a common border. Theoretically, they have more synchronized economic cycles, as they are more trade and financially integrated. The second variable (*distance*) refers to the geographic distance between the economies. There are two ways in which the bilateral distance can be measured: the simple distance, which uses a city from each of the two economies, usually their capital city or the financial centre and the weighted distance, which takes into

consideration the main cities from each economy. The latter was calculated according to the distances between the largest cities of the two economies, weighted by their share in the total population of that economy. In this study, we used the second method, proposed by Head and Mayer (2002). Theoretically, the greater the distance between the economies, the lower the synchronization of the business cycles. The third variable (*euro*) catches the impact of the common currency on the business cycles synchronization. A single currency leads to enhancement of trade and financial integration, and to a higher correlation between the business cycles, respectively. The variable will take the value 1 for the pairs of economies which are Euro Area members and the value 0 if at least one of the countries of a pair does not belong to the Euro Area. Among the 120 pairs of economies included in this study, 37 include economies which are members of the European monetary union. The fourth variable (*GDP*) captures the impact of the economic magnitude on the bilateral business cycles correlation. From a theoretical point of view, the pairs of developed economies register a higher synchronization. This variable was calculated as an arithmetic mean of the GDP for each pair of economies in the period 1998-2010. The fifth variable (*gap*) illustrates the relationship between the development gap and the correlation of business cycles. The variable is calculated as the mean of the absolute bilateral difference in terms of GDP per capita (at purchasing power parity), during the period 1998-2011. The last instrumental variable included in vector I_1 is sectoral specialization. The vector I_2 includes three instrumental variables, which are also components of the vector I_1. The first one (*border*) outlines the positive effect of the common border on the bilateral commercial exchanges. The second one (*euro*) catches the importance of a common currency for trade integration, while most of the analysis supports the existence of a significant influence. The third one (*GDP*) reveals the impact of the market size on the bilateral trade. The vector I_3 consists of two instrumental variables – *distance* and *gap*. The vector I_4 consists of three variables, two of them being *distance* and *gap (-1)*, the third variables being *euro*.

IV. Empirical Results

In order to identify the system of simultaneous equations, we used the data series of the financial, trade and sectoral specialization integration and of the instrumental variables (*distance*, *GDP*, and *gap*) expressed in logarithm. Under these circumstances, the estimated coefficients of the system will have the significance of the endogenous variables elasticity in relation to the exogenous variables. Initially, we made a simple analysis based on the correlation between the endogenous variables of the system, although it had a low informative value under circumstances of simultaneity. Nevertheless, it can anticipate certain results of the estimation, in terms of complexity of relations between the channels through which influences are transmitted to the bilateral business cycles. According to the results in Table 5, it reveals a positive but very low correlation between the degree of bilateral business cycles synchronization and the financial, and trade integration, respectively. The correlation with the degree of sectoral specialization is negative, outlining an increase in the business cycle correlation for the pairs of countries characterized by a structural sectoral convergence. The degree of bilateral trade integration shows a positive

correlation with the financial integration and a negative correlation with the degree of specialization, according to the economic literature. If there is a quite low negative correlation between specialization and trade, there is no correlation between specialization and integration.

Table 5

The Correlation of Endogenous Variables

	ρ	T	F	S
ρ	1.00			
T	0.29	1.00		
F	0.31	0.47	1.00	
S	-0.36	-0.43	-0.14	1.00

Most of the elasticity coefficients have the anticipated signs, taking into account the economic literature, the economic theory and the development gaps between the economies included in this study. Initially, we analyzed the channels of direct influence on the business cycles, outlined by the first equation, and afterwards we presented the significance of the indirect influence channels, through trade, financial integration and sectoral specialization. According to the results in Table 6, the enhancement of the degree of bilateral trade integration has generated an increase in the business cycles synchronization degree, as an effect of the bilateral intra-industry trade. As a consequence, we have a confirmation of the results obtained by Frankel and Rose (1998), so that the shocks which are specific to a certain sector of activity in a certain economy will be transmitted more symmetrically to its trade partner, generating a higher bilateral synchronization. In other words, the trade integration between the economies included in the sample generated more symmetrical shocks. The coefficient α_1 is 0.063, which is very close to those obtained in economic literature. Although the intra-industry trade is specific to the advanced economies, such as those from the Euro Area core, the CEE economies also significantly improved during the analyzed period.

In order to support this assumption, we have calculated the index of intra-industry trade of the 16 economies with the EU-27. According to it, four of the CEE economies (Slovakia, Poland, the Czech Republic and Hungary) registered in 2010 a higher share of intra-industry trade as compared to France, Italy and the Netherlands. Thus, approximately 80% of the trade of these economies with the EU-27 was intra-industry trade, Bulgaria and Romania alone with shares lower than 70% (62.3%, and 67.9%, respectively).

As a consequence, there will be a higher symmetry of the sectoral shocks affecting the CEE economies and the advanced economies in the Euro Area, the asymmetry being rather generated by the peripheral economies of the monetary union.

As for the financial integration, measured by the bilateral flows of FDI, it had a negative but statistically insignificant influence (according to the results in Table 6). Nevertheless, the absence of a direct impact may be balanced by indirect effects of investments on the business cycles synchronization, as these flows influence the degree of trade integration and the sectoral economic structure.

Table 6

The Results of the System of Simultaneous Equations (3SLS Method)

Dependent variable	Correlation of business cycle	T (Bilateral trade integration)	F (bilateral financial integration)	S (sectoral specialization)
Constant	0.77 [5.61]	-3.88 [-4.10]	-4.93 [-6.18]	-1.57 [-6.69]
T	0.06 [2.03]	-	0.62 [4.44]	-0.27 [-7.74]
F	-0.02 [-0.74]	0.48 [5.79]	-	0.11 [2.89]
S	-0.15 [-2.20]	-2.40 [-5.39]	-	-
Instrumental variables	border; distance; Euro; gap; GDP product, S	border; euro; GDP product	distance; gap	distance; gap(-1); euro
Adjusted R-squared	0.12	0.45	0.35	0.07

Source of data: Eurostat (2011), authors' estimates with Eviews software; [ ] – t-statistics.

The sectoral specialization had a negative influence on the bilateral synchronization, the coefficient of elasticity between them being quite close to that estimated in the economic literature. As a consequence, the increase in structural similarity between the 16 economies during the analyzed period generated a higher convergence of revenues and of business cycles. Analyzing the influence of the three direct factors included in equation (1), it results that the bilateral business cycles of the 16 economies were sensitive to the structural changes and to the sectoral divergences between them. Thus, a decrease by 1 percent in the structural divergence causes an increase by 0.15 percents in the bilateral business cycle correlation, at a statistic significance threshold of 5%. As a consequence, the evolution of the economies of the sample was more influenced by the internal shocks induced by the structural convergence process and less influenced by the shocks coming from another economy, through financial and trade channels.

The financial integration and sectoral specialization have also an impact upon the cyclical synchronization through bilateral trade. Thus, the coefficient β_1 has a positive value, which is significant at the statistic threshold of 1%, as the increase by 1% in the financial integration leads to 0.57% increase in the bilateral trade relations. It results that the bilateral flows of foreign investments created trade in the case of the 120 pairs of economies, which corresponds to some vertical investments between the member countries, this aspect supporting the existence of intra-industry trade, as it resulted from the analysis of equation (1). As a matter of fact, the vertical flows of FDI constitutes the pattern which is specific to the pairs of economies between which development gaps are found, which reflect the comparative cost advantages for the emerging economies.

The coefficient of elasticity between trade integration and sectoral specialization, (β_2), is negative and higher than unit, its value being close to that estimated by Imbs (2006). Thus, the decrease by 1% in sectoral specialization results in an increase by

2.40% in bilateral trade integration, this proving to be the main factor of bilateral trade. As a consequence, a decrease in the development gaps between economies during 1998-2011 was accompanied by an increase in similarity of economic structures, this phenomenon generating the enhancement of bilateral trade, especially along with using the Euro currency, and with the CEE economies' accession to the European Union, respectively. The convergence of economic structures represents one of the basic conditions for a sustainable process of real convergence, which allows the CEE economies to reach the EU standards.

The third equation of the system reveals the positive and statistically significant impact of trade integration upon foreign direct investments, the result confirming the analysis made by Baldwin and Seghezza (1996), according to which the trade openness led to an increase in investments (including the foreign ones) and in technological complexity of the exports ("trade induced investment-led growth" hypothesis). Thus, an increase by 1% in the bilateral trade relations resulted in an increase by 0.62% in the degree of financial integration. The R squared adjusted coefficient is 35%, thus showing a good representation of the foreign investments' dependence on the bilateral exchanges.

According to equation (4), the trade and financial integration has an indirect impact upon the business cycles synchronization, through the degree of sectoral specialization. According to the results, the process of structural convergence between the analyzed pairs of economies was generated by the enhancement of bilateral trade and not by the flows of bilateral foreign investments, which have rather induced a sectoral specialization between the economies. The elasticity coefficient associated to trade is -0.27, this value being higher (in absolute terms), but with the same sign as that estimated by Imbs (2006). Under the circumstances of intra-industry trade, identified in equation (1) and supported by the results of the equation (2), it is natural that the partner economies record a decrease in sectoral divergence. As for the financial integration, an increase in foreign investment flows enhanced the sectoral specialization, the coefficient of elasticity between them being 0.11, statistically significant at the 1% threshold. Consequently, the "specialization hypothesis" supported by Krugman was only validated in the case of financial integration and it was rejected in the case of bilateral trade integration.

IV.1. Direct, Indirect and Aggregate Effects

The objective of this section is to find the aggregate influences of trade, financial integration and sectoral specialization on the business cycle correlation, in terms of direct channels outlined in equation (1) and of indirect ones, according to equations (2)-(4). The results in Table 7 are presented in groups for each factor of influence of cyclical evolutions. As a consequence of the estimates in equation (1), the trade integration has a positive direct impact on the synchronization of the business cycles at the statistic significance level of 5%. The trade's indirect effects on the cyclical correlation are the result of the interaction with the financial integration (equation 3) and with the sectoral specialization (equation 4). On the one hand, the trade generates a positive impact on the financial integration, which does not have a significant direct influence on the synchronization of the business cycles, and the product between the coefficients α_3 and γ_1 is not statistically significant. On the other

hand, the bilateral trade relations induce a decrease in sectoral specialization, and, consequently, an increase in synchronization of the business cycles. The intensity of the trade's indirect effect is half of the direct one, and has the same sign. As a consequence, the total effect of bilateral trade ($\alpha_1+\alpha_2\gamma_1+\alpha_3\sigma_1$) is greater than the direct effect, and is significant at a statistic significance level of 1%.

Table 7

The Aggregate Effects of Trade, Financial Integration and Sectoral Specialization

Trade integration channel (T)		
Direct effect	α_1	0.06**
Indirect effects	through F: $\alpha_2\gamma_1$	-0.01
	through S: $\alpha_3\sigma_1$	0.04**
Aggregate effect	$\alpha_1+\alpha_2\gamma_1+\alpha_3\sigma_1$	0.09***
Financial integration channel (F)		
Direct effect	α_2	-0.02
Indirect effects	through T: $\alpha_1\beta_1$	0.03*
	through S: $\alpha_3\sigma_2$	-0.01**
Aggregate effect	$\alpha_2+\alpha_1\beta_1+\alpha_3\sigma_2$	0.00
Sectoral specialization channel (S)		
Direct effect	α_3	-0.15**
Indirect effects	through T: $\alpha_1\beta_2$	-0.15**
Aggregate effect	$\alpha_3+\alpha_1\beta_2$	-0.30***

Note: ***, **, * significant at 1%, 5%, and 10%, respectively, with Chi-square test.

Source of data: Eurostat (2011), authors' estimates.

As regards the bilateral financial integration, it does not have a significant direct impact on the cyclical correlation, but an indirect one through the trade and sectoral specialization channels. Thus, the vertical flows of foreign direct investments (deduced according to the analysis of equation 2) lead to the enhancement of intra-industry trade relations and, consequently, the enhancement of the correlation between those economies. Considering the specialization channel, the financial integration tends to induce a higher structural divergence, and this will decrease the previous indirect effect. Even though both indirect effects are statistically significant, the aggregate impact of the financial flows ($\alpha_2+\alpha_1\beta_1+\alpha_3\sigma_2$) is zero, with an extremely high probability.

The sectoral specialization has an inverse relation with the cyclical correlation, so that the process of structural convergence (i.e. sectoral specialization decrease) between the pairs of economies generated the enhancement of synchronization of the business cycles. The indirect effects of specialization occur through the bilateral trade channel, according to equation (1). Thus, the decrease in the revenue gaps between the economies determined a higher similarity of the sectoral structures, which led to higher intra-industry trade and to higher correlation between economic evolutions. The indirect effect will increase the direct effect of specialization, and the aggregate impact of specialization ($\alpha_3+\alpha_1\beta_2$) will be twice the initial influence. Under these circumstances, we may conclude that, during the period 1998-2011, the bilateral business cycles were influenced to a greater extent by the internal factors, specific to sectoral changes and to a lower degree by trade and financial integration.

V. Conclusions

The originality of this study consists not only in identifying asymmetries between the Euro Area core, its periphery and seven CEE economies, but also in the complex assessment of the interdependences between trade, financial integration, structural specialization and bilateral business cycles synchronization. The results are in accordance with certain economic theories and the studies in the literature analyzing the effects of the monetary integration, but these results depend on the development gaps between the economies included in the sample. The good news for the new member states of the European Union is that the evolution of these countries can validate the endogeneity hypothesis that will increase the benefits of a single currency. Thus, the seven CEE economies are strongly commercially and financially integrated especially with the Euro Area core countries, which led to more similarities between the sectoral economic structures. However, there is some bad news, influenced by the experience of some peripheral Euro Area countries, such as Greece or Portugal. Their synchronization with the Euro Area has increased only temporarily, because their structural and competitiveness divergences as compared to core countries still remained persistent.

References

Abbott, A. Easaw, J. Xing, T. 2008. Trade integration and business cycle convergence: is the relation robust across time and space? *Scandinavian Journal of Economics* 110, pp. 403-417.

Akin, C. 2006. Multiple Determinants of Business Cycle Synchronization, *George Washington University*, Department of Economics, pp. 2-44.

Albu, L.L., 2008. Trends in structural changes and convergence in EU. *Romanian Journal of Economic Forecasting*, 9(1), pp. 91-101.

Baldwin, R.E. and Seghezza E. 1996. Trade-Induced Investment-Led Growth, *NBER Working Paper* 5582, pp. 1-19.

Baxter, M. Kouparitsas, M.A. 2005. Determinants of business cycle comovement: A robust analysis. *Journal of Monetary Economics* 52(1), pp. 113-157.

Böwer, U. and Guillemineau, C. 2006. Determinants of business cycle synchronisation across Euro Area countries. *European Central Bank Working Paper Series* 587, pp. 3-68.

Calderón, C. Chong, A. Stein, E. 2007. Trade Intensity and Business Cycle Synchronization: Are Developing Countries Any Different? *Journal of International Economics* 71(1), pp. 2-21.

Clark, T. and van Wincoop, E. 2001. Borders and business cycles. *Journal of International Economics* 55, pp. 59-85.

Darvas, Z. Rose, A. K. Szapáry, G. 2005. Fiscal Divergence and Business Cycle Synchronization: Irresponsibility is Idiosyncratic. *NBER Working Papers* 11580, pp. 1-32.

Dées, S. and Zorell, N. 2011. Business Cycle Synchronisation. Disentangling Trade and Financial Linkages. *European Central Bank Working Paper Series* 1322, pp. 3-35.

Dobrescu, E. 2011. Sectoral Structure and Economic Growth. *Romanian Journal of Economic Forecasting*, Vol. 3, pp. 5-36.

Eickmeier, S. and Breitung, J. 2006. How synchronized are new EU member states with the Euro Area? Evidence from a structural factor model. *Journal of Comparative Economics* 34(3), pp. 538-556.

Frankel, J.A. and Rose, A.K. 1998. The endogeneity of the optimum currency area criteria, *Economic Journal* 108, pp. 1009-1025.

Frankel, J.A. and Rose, A.K. 2002. An Estimate of the Effect of Common Currencies on Trade and Income. *European Economic Review* 46(2), pp. 1125-1151.

Garcia-Herrero, A. and Ruiz, J.M. 2008. Do trade and financial linkages foster business cycle synchronization in a small economy? *Moneda y Credito* 226, pp. 187-226.

Head, K. and Mayer, T. 2002. Illusory Border Effects: Distance Mismeasurement Inflates Estimates of Home Bias in Trade. *CEPII Working Paper* 1, pp. 4-30.

Imbs, J. 2004. Trade, finance, specialization, and synchronization. *Review of Economics and Statistics* 86, pp. 723-734.

Imbs, J. 2006. The real effects of financial integration. *Journal of International Economics* 68, pp. 296-324.

Kalemli-Ozcan, S. Sørensen, B. E. Yosha, O. 2003. Risk sharing and industrial specialization: Regional and international evidence. *American Economic Review* 93, pp. 903-918.

Krugman, P. 1991. *Geography and Trade*, Cambridge: MIT Press.

Krugman, P. 1993. Lessons of Massachusetts or Euro Area, in Giavazzi, T. and Torres, F., eds.), *Adjustment and Growth in the Economic and Monetary Union in Europe*, New York: Cambridge University Press, pp. 241-261.

Rose, A. 2000. One money, one market: The effects of common currencies on trade. *Economic Policy* 30, pp. 7-46.

Schiavo, S. 2008. Financial integration, GDP correlation and the endogeneity of optimum currency areas. *Economica* 75, pp. 165-189.

Zellner, A. and Theil, H. 1962. Three-Stage Least Squares: Simultaneous Estimation of Simultaneous Equations. *Econometrica* 30(1), pp. 54-78.