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Iulia Traistaru

Transmission Channels of Business Cycles Synchronization in an Enlarged EMU

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Iulia Traistaru

University of Bonn, Center for European Integration Studies (ZEI),
Walter-Flex-Str. 3 D-53113 Bonn, Germany

Tel.: +49-228-73 1886
Fax: +49-228-73 1809
E-mail: traistaru@uni-bonn.de

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Abstract

The accession of Central European countries to the European Union implies the possibility of euro area membership once the Maastricht nominal convergence criteria will be met. This raises the question about costs and benefits of an enlarged euro area. In particular, the prospects for structural and cyclical convergence in an enlarged euro area have been little investigated so far. How synchronized are business cycles between the Central European new EU countries (CE-EU-8) and current euro area members? How is business cycles synchronization transmitted across these countries? This paper investigates the degree of business cycles synchronization between the current and future euro area member states over the period 1990-2003 and analyses the similarity of economic structures and bilateral trade intensity as main transmission channels. Using band-pass filtered GDP data, I find that business cycles between the CE-EU-8 countries and euro area members are less correlated in comparison to the current euro area members. In the group of the CE-EU-8 countries, over the analyzed period, business cycles in Hungary, Poland and Slovenia were closer correlated with the economic activity fluctuations in the current euro area members. The econometric analysis indicates that similarity of economic structures and bilateral trade intensity were positively and significantly associated with business cycles correlations. This result is robust to different groups of country pairs and estimation techniques. These empirical findings suggest that, to the extent shocks are country – specific, a common monetary policy might have asymmetric effects in an euro area extended early to the new EU members. This policy implication needs however two qualifications: the cost of adopting a common monetary policy depends first, on the extent to which the exchange rate can be used as an efficient shock absorber and second, on the extent to which monetary policy can be used effectively to stabilizing economic activity. Furthermore, the relationship between similarity of economic structures, bilateral trade intensity, on the one hand, and, business cycles synchronization, on the other hand, is found endogenous suggesting that, in the long term, convergence of economic structures and trade growth are expected. If the adoption of the euro will be well prepared it will bring significant benefits to the new EU countries.

Key Words: Economic and Monetary Integration, Optimum Currency Area, Business Cycles, Sectoral Specialization

JEL Classification: E32, F15, F33, F41

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Contents

1 Introduction

Ten countries[1] joined the European Union (EU) on 1st May 2004. None of these countries has been allowed to opt-out from the Economic and Monetary Union (EMU). This implies that they are expected to adopt the euro at a time sooner or later after their EU accession. The strategies for the adoption of the euro vary across these countries. Some of them have recently made an explicit reference [2] to the time they target for the adoption of the euro. This is announced as early as 2007 (Cyprus and Slovenia) while others have indicated 2008 (Latvia), 2008– 2009 (Slovakia) or 2009-2010 (the Czech Republic, Hungary) as the time they would be ready to adopt the euro. Some countries have made a less explicit reference to the time for the adoption of the euro: as soon as possible (Estonia), as soon as the convergence criteria are fulfilled (Malta) or they made no explicit reference to the time for the adoption of the euro (Lithuania and Poland). When should the new EU members adopt the euro?

The objective of this paper is to inform the ongoing debate about the extension of the euro area to the new EU members. In particular, I provide empirical evidence about the synchronization of business cycles between the Central European new EU member states (CE-EU-8) and euro area members over the period 1990-2003. This evidence is relevant for the assessment of the cost of losing monetary policy as a tool to stabilizing cyclical fluctuations and thus for the assessment of the effects of extending a common monetary policy to the new EU countries.

Using data for the period 1990-2003 I find that, over the analyzed period, structural and cyclical differences between EU acceding countries and euro area members were significant. On average, other things equal, the more dissimilar economic structures were, the less correlated the business cycles were. On average, other things equal, the higher the bilateral trade intensity, the more correlated the business cycles.

The accession of the ten countries to the EU on 1st May 2004 has stimulated a growing academic and policy debate about when should the euro area be extended to the new EU members. This discussion takes two main avenues. The first line of discussion focuses on the nominal convergence, specifically the fulfillment of the Maastricht convergence criteria: high degree of price stability; sound fiscal situation - with respect to the budget deficit and the level of government debt; stable exchange rates; convergence of long-term interest rates. According to the latest available data (European Commission, 2004), in 2003 only Estonia and Lithuania fulfilled the convergence criteria with respect to price stability, budget deficit, government debt and interest rates. The stability of exchange rates is to be proved within the Exchange Rate

[1] Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia
[2] these references are made in the Convergence Programmes for 2004-2007 submitted by each of these ten countries in May 2004

Mechanism (ERM II). This challenge is significant in particular for countries with flexible exchange rates and less for the Baltic countries which have already fixed exchange rates[3].

The second line of the debate about the euro area enlargement is related to real convergence and has centered on assessing the costs and benefits of a common currency area. This discussion has been inspired largely by the Optimal Currency Area (OCA) literature flowing from Mundell (1961), Mc Kinnon (1963), Kenen (1969). The benefits from a common currency are related to the reduction of transaction costs and predictability of exchange rates. High levels of integration are associated with larger benefits for the participating countries. The costs of joining a common currency area relate to losing monetary policy as a stabilizing tool following external shocks. To the extent that participating countries are faced with common aggregate shocks the costs of losing independence of monetary policy is not important. Common shocks imply the co-movement of economic activity cycles which in turn is more likely if economic structures are similar.

The OCA literature suggests a number of policy relevant questions in relation to the euro area enlargement to the new EU members : How synchronized are business cycles between the new EU member states and the current euro area members? To what extent does the similarity of sectoral structures contribute to business cycles synchronization? Does more integration lead to more synchronization of economic activity?

This paper contributes to the discussion about benefits and costs associated with the extension of the euro area to the new EU countries. In particular, I investigate the effects of the similarity of economic structures and bilateral trade intensity between the current euro area members and the CE-EU-8 on the correlation of business cycles across countries. The contribution of this paper to the literature is threefold. *First*, it brings novel evidence about the degree of synchronization of business cycles between the current euro area members and the new EU member states. *Second,* this paper uncovers patterns of sectoral specialization and bilateral trade intensity in the current and new EU countries. *Third,* it assesses to what extent correlations of business cycles are explained by the similarity of economic structures and bilateral trade intensity.

The remainder of this paper is organized as follows. Section 2 discusses the theoretical framework used for the empirical analysis of business cycles synchronization. I next summarize related existing empirical evidence and stylized facts. Model specifications and estimation issues are discussed in section 4. Section 5 presents measures and data used for the empirical analysis. Summary statistics and a descriptive analysis of correlations of business cycles, bilateral sectoral specialization and trade intensity are discussed in Section 6. Section 7 presents the results of the econometric analysis and section 8 concludes.

[3] Estonia, Lithuania, and Slovenia have joined the ERM II on 27 June 2004.

2 Theoretical Framework

The theoretical framework for investigating benefits and costs of monetary unions is the Optimum Currency Area Theory (OCA) developed during the 1960s by the seminal contributions of Mundell (1961), McKinnon (1963) and Kenen (1969). The main outcome of the OCA literature[4] is the identification of the properties of an optimum currency area, including the mobility of labour, price and wage flexibility, economic openness, diversified production and consumption structures, similarity of inflation rates, fiscal integration and political integration. Later contributions during the 1970s (Corden 1972, Mundell, 1973, Ishihama, 1975, Tower and Willet, 1976) added to these properties similarity of cycles and shocks and correlation of incomes. If these properties were shared by the countries willing to form a currency union, the cost of losing the nominal exchange rate and monetary policy to adjust to idiosyncratic shocks would not be prohibitive.

A demand shock to one country's exports can be accommodated through a devaluation of the currency, a fall in real prices and wages or an increase in unemployment. Given the rigidity of prices and wages and the political and economic cost of rising unemployment, the exchange rate mechanism could be an important policy tool to maintain. On the other hand, countries with similar characteristics are more likely to respond similarly to external shocks and so they will need less an adjustment through exchange rates.

A number of examples from recent experiences of EU-15 member states suggest that nominal exchange rate adjustment was effective. The case of the 1982 devaluation in Belgium is documented by De Grauwe (2003), the French devaluation of 1982-1983 by Sachs and Wyplosz (1986) while Mongelli (2002) points out that the devaluation of the Italian Lira after the exit from the ERM in 1992 contributed to a sustained recovery of economic activity. The effectiveness of nominal exchange rates for adjustment to external shocks is however contested by others (see Krugman, 1991, 1993; Canzoneri, Valles and Vinals, 1996).

The cost from foregoing monetary independence is low for countries with significant co-movements of outputs and prices (Alesina, Barro and Tenreyro, 2002). The more correlated the business cycles are the more likely it is that country-specific shocks become correlated through an internationally correlated business cycle. In contrast, countries whose business cycles are imperfectly synchronized with other's could benefit from maintaining an independent monetary policy (Frankel and Rose, 1998).

Does deeper integration lead to more correlated business cycles? Two different views can be distinguished in the recent literature. On the one hand, Krugman (1993) argues that increased integration will result in increased specialization and this, in turn, to less synchronized business cycles. This view is supported by Kalemli-Ozcan, Sorensen and Yosha (2001) who show that

[4] For a recent survey of the OCA literature see Mongelli (2002)

increased capital market integration leads to better income insurance and increased specialization. On the other hand, Coe and Helpman (1995) and Frankel and Rose (1998) argue that trade integration is associated with more synchronized business cycles.

In summary, existing theories yield ambiguous predictions about the role of monetary and economic integration on business cycles correlations. The question of whether and to what extent sectoral specialization and bilateral trade intensity contribute to business cycles synchronization is an empirical one.

3 Empirical Evidence and Stylized Facts

Compared to the theoretical developments, empirical evidence of the OCA theory is more recent and is mostly related to the European Economic and Monetary Union. Two directions in the OCA empirical literature can be distinguished. The first one is inspired by recent developments in trade theory and economic geography and points to increasing specialization associated with monetary integration and thus increased vulnerability to asymmetric supply shocks (Krugman, 1993). The second line of research argues that trade integration and correlation of business cycles are endogenous (Coe and Helpman, 1995; Frankel and Rose, 1998).

Two main stylized facts come out from the empirical literature. The first stylized fact is that higher economic integration proxied with bilateral trade intensity is associated with higher correlations of business cycles (Clark and van Wincoop, 2001; Rose and Engel, 2002; Bergman, 2003; Calderon, Chong and Stein, 2003;). Second, similar economic structures are associated with higher correlations of business cycles (Clark and van Wincoop, 2001; Calderon, Chong and Stein, 2003). These studies are focused on industrial and developing countries. There is, however, no study investigating the international transmission of business cycles in the context of increased economic integration between the EU and Central and Eastern European countries (CEECs).

A number of studies estimate the degree of synchronization of business cycles between the EU and the CEECs. Boone, Maurel (1999) argue that economic cycles in CEECs are close enough to Germany and, albeit to a lesser extent, to the EU and suggest that this implies benefits for these countries once they join the euro area. They find that the percentage of business cycles fluctuations in CEECs explained by a German shock is high. Between 55 and 86 per cent of the fluctuation of the unemployment in CEECs is explained by a German shock. Babetsky, Boone, Maurel (2002) support this conclusion. Fidrmuc (2001) predicts that given the high level of intra-industry trade of CEECs vis-à-vis the EU, business cycles of CEECs and EU are likely to harmonize in the future assuming that membership in the euro area will further increase the intra – industry trade levels in CEECs.

However, a number of more recent studies highlight the rather different macroeconomic developments in the current EU and CEECs.

Artis et al (2003) analyse the syncronization of business cycles in the eight Central European acceding countries using GDP and industrial production data over the period 1990-2002. They uncover the business cycles using a band-pass filter based on two low-pass Hodrick-Prescott filters and applying dating rules described in Artis et al (2002) and calculate cross-correlations and measures of concordance. They find a low degree of concordance within the group of the acceding countries in comparison to that existing between the existing EU countries. The GDP data indicate a low synchronization of business cycles between the acceding countries and the Eurozone. However, the cyclical synchronization between Poland, Slovenia, Estonia, Hungary, the Czech Republic and Germany is found large. On the other hand, in comparison to countries taking part in previous enlargements (Ireland, UK, Greece, Spain, Portugal, Austria, Finland, Sweden), the acceding countries are less synchronized with German, France and Italy with the exception of Hungary, Poland and Slovenia.

Süppel (2003) assesses the degree of business cycles synchronization of individual EU acceding countries with the euro area aggregate and highlights the structural differences in economic growth dynamics between the EU-15 and the CEECs. Using data for 1996-2002, he finds that the CEECs had higher average growth and wider output fluctuations than the euro area and other EU countries. Furthermore, business cycles in the CEECs have been less synchronized with the euro area than those of the United Kingdom, Sweden and Denmark. Business cycle synchrony is country specific, with Hungary, Poland and Slovenia moving closer to the euro area and the Czech Republic and Slovakia showing important asymmetries with the euro area.

Darvas and Szapary (2003) find also that Hungary, Poland and Slovenia have the most synchronized macroeconomic activity with the euro area.

The above results on asymmetries of business cycles between the EU and accession countries are supported by a recent analysis presented in the EBRD (2003).

4 Model Specifications and Estimation Issues

The objective of this analysis is to uncover *first,* the extent to which business cycles are synchronized between the CE-EU-8 and the current euro area members and, *second,* the impact of sectoral specialization and bilateral trade intensity as explanatory factors of the correlations of business cycles across these countries.

The dependent variable in the estimated models is the bilateral correlation of the cyclical components extracted from quarterly real GDP over the analyzed period. The key explanatory

variables are an index of bilateral sectoral specialization and an index of bilateral trade intensity. Bilateral sectoral specialization is calculated as average using quarterly gross value added disaggregated on six sectors. Bilateral trade intensity is calculated as average over the analyzed period using bilateral trade flows.

Business cycles synchronization for different country-pairs

To what extent are business cycles in the CE-EU-8 correlated with those of the euro area members? In order to answer this question, I estimate the following model in which the correlation of business cycles between CE-EU-8 countries and euro area countries is taken as benchmark:

(1) $$CORR(Y_i^c, Y_j^c)_T = \alpha_0 + \alpha_1 EURO_{ij} + \alpha_2 AC_{ij} + \omega(i,j)_t$$

$CORR(Y_i^c, Y_j^c)_T$: the bilateral correlation of the cyclical components of output Y (real GDP) in countries i and j over the period T.

$EURO_{ij} = 1,$ if countries i and j are euro area members; $EURO_{ij} = 0$, for the other country - pairs (pairs of euro area members and the CE-EU-8 countries, pairs of CE-EU-8 countries);

$AC_{ij} = 1,$ if country i and j are CE-EU-8 countries and $AC_{ij} = 0,$ for the other remaining country-pairs

$\omega(i,j)_T$: the remaining error term

Given the extent of economic and monetary integration, I expect to find that business cycles between the euro area countries are more synchronized than those between the CE-EU-8 countries and the euro area countries. The predicted result for the correlations of business cycles between the CE-EU-8 countries is less clear.

The impact of bilateral sectoral specialization

The OCA literature points to similarity of economic structures as a factor fostering business cycles synchronization. What is the role of sectoral specialization in explaining correlations of business cycles? I investigate this question by estimating the following model with OLS:

(2) $$CORR(Y_i^c, Y_j^c)_T = \beta_0 + \beta_1 \ln(SPEC_{ij})_T + \varepsilon(i,j)_T$$

$\ln(SPEC_{ij})_T$: index of similarity of economic structures between countries i and j over the period T

$\varepsilon(i,j)_T$: the error term

In the above model, sectoral specialization is assumed exogenous. However monetary integration may lead to the convergence of economic structures of the participating countries. This implies that the estimates obtained with OLS might be inconsistent. If this is true, an instrumental variable (IV) estimation technique must be used. In order to test for endogeneity, I estimate the following system of simultaneous equations (3) and perform the Durbin-Wu-Hausman test suggested by Davidson and MacKinnon (1993)[5]:

$$CORR(Y_i^c, Y_j^c)_T = \beta_0 + \beta_1 \ln(SPEC_{ij})_T + \varepsilon(i,j)_T$$

$$\ln(SPEC_{ij})_T = \delta_0 + \delta_1 EURO_{ij} + \delta_2 \ln(POP_i * POP_j)_T + \delta_3 (\ln GDP_i * GDP_j)_{1996} + \delta_4 \ln DIST_{ij} + \\ + \delta_5 BORDER_{ij} + \xi(_{i,j})_T$$

Countries members of the euro area have more similar economic structures as a result of economic and monetary integration. I control for this by including a dummy variable $EURO_{ij}$ which takes value 1 if countries i and j are members of the euro area. Sectoral specialization is expected to depend on the size of the country. Larger countries are more likely to have more diversified economic structures in comparison to small countries. The variables used to control for size are population and real GDP. The variables are transformed in natural logarithms (the natural logarithm of the product of the population size of country i and country j calculated as average over the period T : $\ln(POP_i * POP_j)_T$; and the natural logarithm of the product of the real GDP in country i and country j in the reference year 1996: ln $(GDP_i * GDP_j)_{1996}$.

The closer geographically the countries are the more similar economic structures might be. The natural logarithm of the distance between the capitals of pairs of countries ($\ln DIST_{ij}$) and a dummy for countries sharing borders ($BORDER_{ij}$) are included as additional explanatory variables.

The impact of bilateral trade intensity

In the recent literature it is argued that increased trade relations lead to increased correlations of business cycles. To uncover whether and the extent to which bilateral trade increases the

[5] This test is based on including the residuals of each endogenous explanatory variables, as a function of all exogenous variables, in the regression of the original model.

correlation of business cycles between the acceding countries and the EURO AREA members I estimate the following model with OLS:

(4) $$CORR(Y_i^c, Y_j^c) = \phi_0 + \phi_1 \ln(TRADE_{ij})_T + \nu(i,j)_T$$

$\ln(TRADE_{ij})_T$: bilateral trade intensity between country i and country j over the period T

However, bilateral trade intensity and business cycles correlations are likely to be endogenous in the context of monetary integration. I therefore test and correct for the endogeneity of the bilateral trade intensity using the following system of simultaneous equations (5):

$$CORR(Y_i^c, Y_j^c) = \phi_0 + \phi_1 \ln(TRADE_{ij})_T + \nu(i,j)_T$$

$$\ln(TRADE_{ij})_T = \gamma_0 + \gamma_1 EURO_{ij} + \gamma_2 \ln(POP_i * POP_j)_T + \gamma_3 \ln(GDP_i * GDP_j)_{1996} + \gamma_4 \ln DIST_{ij} + \\ + \gamma_5 BORD_{ij} + \mu(i,j)_T$$

Similar to the case of sectoral specialization, I perform the Durbin-Wu-Hausman test and if this uncovers endogeneity I estimate Eq.4 using instrumental variables as shown above.

The impact of sectoral specialization and bilateral trade intensity

In the last set of model specifications I include both bilateral sectoral specialization and trade intensity as explanatory variables as shown in Eq. (5) below:

$$CORR(Y_i^c, Y_j^c) = \lambda_0 + \lambda_1 \ln(SPEC_{ij})_T + \lambda_2 \ln(TRADE_{ij})_T + \tau(_{i,j})_T$$

Further, I check for endogeneity, performing the Durbin-Wu-Hausman test as in the previous model estimations. The system of simultaneous equations (6) is the following:

$$CORR(Y_i^c, Y_j^c) = \lambda_0 + \lambda_1 \ln(SPEC_{ij})_T + \lambda_2 \ln(TRADE_{ij})_T + \tau(_{i,j})_T$$

$$\ln SPEC_{ij} = \delta_0 + \delta_1 EURO_{ij} + \delta_2 \ln(POP_i * POP_j)_T + \delta_3 (\ln GDP_i * GDP_j)_{1996} + \delta_4 \ln DIST_{ij} + \\ + \delta_5 BORDER_{ij} + \xi(_{i,j})_T$$

$$\ln(TRADE_{ij})_T = \gamma_0 + \gamma_1 EURO_{ij} + \gamma_2 \ln(POP_i * POP_j)_T + \gamma_3 \ln(GDP_i * GDP_j)_{1996} + \gamma_4 \ln DIST_{ij} + \\ + \gamma_5 BORD_{ij} + \mu(i,j)_T$$

5 Measurement and Data

The key variables used in this analysis are bilateral correlations of business cycles, sectoral specialization and trade intensity. This section explains the measuring of these three variables and the data set used for the empirical analysis.

Bilateral correlation of business cycles

Correlations of business cycles are calculated over the period T. I first extract for each country the cyclical component of real GDP using the Baxter – King filter[6] described in Baxter and King (1999). The filtering procedure uses the classical definition of a business cycle given by Burns and Mitchell (1946). It therefore isolates real GDP fluctuations lasting between 6 and 32 quarters (1.5 and 8 years). This detrending technique removes both the low frequency long-term trend growth and the high frequency irregular components and retains intermediate components, "business cycles".

Bilateral sectoral specialization

The similarity of economic structures between countries i and j is proxyed with the following index used by Krugman (1991):

$$SPEC_{ij} = \sum_{k=1}^{n} \left| s_{ki} - s_{kj} \right|$$

s_{ki}: the share of sector k in total GDP in country i

The index takes values between 0 (perfect similarity) and 2 (maximum dissimilarity). The higher the index the less similar the economic structures of the two countries i and j are.

The index of bilateral sectoral specialization is calculated here on the basis of average sectoral shares over the period T.

Bilateral trade intensity

The bilateral trade intensity over the period T is proxied with the following index:

$$(TRADE_{ij})_T = \frac{1}{T}\left(\sum_{t=1}^{T} \frac{X_{ijt} + M_{ijt}}{F_{it} + F_{jt}}\right)$$

X_{ijt} : exports of country i to country j in year t

M_{ij} : imports of country i from country j in year t

[6] Baxter and King (1999) find that the cyclical component of US GNP obtained with this band-pass filter is superior to those obtained with other detrending methods

F_{it} : total trade flows of country i in year t

The data set

In this paper I use data for 10 euro area countries[7] and 8 Central European new EU countries[8] over the period 1990-2003. There are in total 153 country pairs, of which 80 represent pairs of euro area countries and CE-EU-8 countries, 45 country pairs between euro area members, and the remaining 28 country pairs are among the CE-EU-8 countries.

The correlations of business cycles are calculated using quarterly data for real GDP over the period 1990:1-2003:3. The bilateral specialization index is calculated using quarterly sectoral gross value added data for the same period, 1990:1-2003. For the cases of Portugal and Greece quarterly data was not available. For these two countries the specialization index was calculated using annual sectoral gross value added data for the period 1995-2000. Bilateral trade intensity is calculated using annual bilateral trade flows (exports f.o.b, imports c.i.f.) for the period 1990-2001 from the International Monetary Fund[9].

In addition to the data mentioned above used for measuring the three key variables, the following data are used for the instrumental variables included in the model specifications described in the previous section: annual averages for population over the period 1990-2002, real GDP in a reference year (1996) and bilateral distances between capital cities. Bilateral distances between capitals of country pairs is proxied with the fastest connection in km on road[10].

Detailed country-specific data information and sources are given in the Appendix.

6 Descriptive Analysis

Correlations of business cycles

Summary statistics of correlations of business cycles for the different country pairs are shown in Table 1.

Table 1 here

The average of the business cycles correlations for all country pairs is low, 0. 201. The average of business cycles correlations is the highest for the euro area country pairs (0.596) and the lowest for the CE-EU-8 country pairs (0.112). The average correlation of business cycles

[7] Belgium, Germany, Greece, Spain, France, Italy, the Netherlands, Austria, Portugal, Finland. Ireland and Luxembourg could not be included due to data limitations.
[8] The Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, Slovenia, Slovakia
[9] IMF DOT Database
[10] data was taken from Straßen & Reisen 2003/2004, and www. reiseplanung.de

between the euro area and CE-EU-8 countries is less than half that for the euro area countries (0.279) but more than double the average correlation for the CE-EU-8 countries. The variation of the business cycles correlations is the lowest for the euro area countries and the highest for the country pairs between euro area and the CE-EU-8 countries.

What country-specific characteristics of correlations of business cycles can be identified? Chart 1 shows average weighted correlations for each country with the euro area plotted against the weighted average correlations with the CE-EU-8 countries over the analyzed period.

Chart 1 here

Average correlations with the euro area countries are higher compared with average correlations with the CE-EU-8 countries. Correlations between euro area countries are higher compared with the correlations with the CE-EU-8 countries. Correlations between the CE-EU-8 countries are lower. Among the euro area countries, Belgium, Austria and the Netherlands have the highest average correlations with the euro area countries (0.558, 0.545, 0.502) and Portugal, Greece and Germany the lowest (0.280, 0.332, 0.310). The Netherlands, Germany, Belgium and Austria have the highest correlations with the acceding countries (0.064, 0.063, 0.061, 0.060) while Greece, France and Italy the lowest (-0.001, 0.038, 0.040). Among the acceding countries Poland, Slovenia and Hungary are the closest correlated with the euro area countries (0.402, 0.320, 0.178) while Lithuania, Slovakia and the Czech Republic are the least correlated (-0.293, -0.260, -0.093). Hungary, Slovenia and Estonia are the closest correlated with the CE-EU-8 countries (0.036, 0.032, 0.031) and the Czech Republic, Lithuania and Poland the least (-0.037, -0.019, -0.009).

Bilateral sectoral specialization

Table 2 shows summary statistics for bilateral sectoral specialization. The lower the index of sectoral specialization between two countries the more similar the economic structures are for those countries.

Table 2 here

The euro area countries are more similar compared to the sectoral specialization between the euro area and CE-EU-8 countries. The variation of sectoral specialization is the lowest for the euro area countries and the highest for the country pairs including euro area and CE-EU-8 countries.

Table 3 showing the sectoral shares differentials for the euro area and CE-EU-8 countries reinforces the summary statistics discussed above. Sectoral shares are calculated as shares of

sectoral gross value added in total GDP averaged over the period 1990:1-2003 using quarterly gross value added data.

Table 3 here

In comparison to the euro area countries, the CE-EU-8 countries have higher shares of agriculture, industry and commercial, trade, transport and communication services, while the shares of financial and public services are lower. The share of construction is only slightly higher in the acceding countries in comparison to the euro area countries. Table 3 indicates that an enlarged euro area, agriculture and industry will have higher shares in total GDP while financial, real estate and business services and public services will have lower shares.

Chart 2 shows country-specific average bilateral sectoral specialization indices[11] with the euro area and the CE-EU-8 countries.

Chart 2 here

The chart shows that euro area countries have quite similar economic structures while the economic structures of the acceding countries are more dissimilar both with respect to the euro area and the CE-EU-8 countries. Hungary, Slovenia, Estonia and Slovakia have the closest economic structures to the euro area. The most similar to the CE-EU-8 countries in the euro area group are Spain, Finland, Portugal, Austria, and Italy.

Bilateral trade intensity

Table 4 shows summary statistics for bilateral trade intensity.

Table 4 here

Average bilateral trade intensities are higher for country pairs between the euro area members compared to country pairs including the CE-EU-8. Bilateral trade intensity is the highest between the euro area countries and the lowest between the CE-EU-8 countries and euro area members. The variation of bilateral trade intensity is however the highest for the euro area country-pairs and the lowest for the CE-EU-8 – euro area country pairs.

Chart 3 shows country-specific average bilateral trade intensity[12] with the euro area countries and the CE-EU-8 countries.

Chart 3 here

The initial EU founders (France, Germany, Belgium, Italy, the Netherlands) and Spain have the highest bilateral trade intensity with the euro area. In comparison to this group of countries,

[11] Weighted averages calculated using population weights
[12] Average bilateral trade intensities are weighted averages calculated using population weights

Austria, Portugal and Greece have lower bilateral intensities with the euro area. Germany and Austria have higher bilateral trade intensities with the CE-EU-8 countries compared with the other euro area countries. Bilateral trade intensities of CE-EU-8 countries with the euro area countries are relatively low. With respect to the CE-EU-8 countries, bilateral trade intensities of these countries are also low except Slovakia and the Czech Republic.

7 Empirical Results

How synchronized are business cycles between the CE-EU-8 countries and the current euro area members? Table 5 shows the results of the OLS estimation of Eq. 1. The first column shows the estimation results obtained using all country-pairs. As a robustness check, I estimate the same model excluding in three steps the following countries: Greece and Portugal; Germany; Poland.

Table 5 here

The estimated coefficients indicate whether and to what extent bilateral correlations of business cycles between the CE-EU-8 countries and euro area members differ when compared to the bilateral business cycles correlations between euro area countries and between the CE-EU-8 countries, respectively. The bilateral correlations of business cycles between euro area countries are significantly higher compared to the reference country-pairs group. When Greece and Portugal are excluded, the coefficient for the bilateral correlations of business cycles between the euro area countries is higher in comparison to the coefficient obtained with all country pairs suggesting that these two countries are less correlated with the CE-EU-8. Estimated coefficients for the bilateral correlations between euro area countries with respect to the reference country-pairs are also obtained when Germany and Poland are excluded. The bilateral correlations of business cycles between the CE-EU-8 countries are not significantly different from the bilateral correlations of business cycles between euro area and the CE-EU-8 countries except the case when Poland is excluded. In this later case, the bilateral correlations of business cycles between the CE-EU-8 countries appear significantly higher in comparison to the bilateral correlations for the reference group.

The next set of regressions uncover the impact of bilateral sectoral specialization and trade intensity on bilateral correlations of business cycles. I estimate the models described in section 4 for all country pairs (results are shown in Table 6) and as a robustness check excluding Greece and Portugal (see Table 8), Germany (see Table 10) and Poland (see Table 12) using first OLS and, after checking for endogeneity, an instrumental variables procedure (see Tables 7, 9, 11 and 13 for the estimations using instrumental variables).

Tables 6-13 here

The results are consistent to different groups of country-pairs and different estimation techniques and indicate that similarity of economic structures and higher bilateral trade intensity are associated with higher correlations of business cycles.

Columns 1 in the above tables show the results of the OLS estimations testing the impact of sectoral specialization on bilateral correlations of business cycles. The negative and significant estimated coefficients for the specialization index indicate that similarity of economic structures is associated with higher correlations of business cycles. As discussed above, sectoral specialization and business cycles correlations might be endogenous in the context of economic and monetary integration. The result of the endogeneity test indicate that this is indeed the case. I then re-estimate the model (1) using instrumental variables for the bilateral specialization index. The results of the estimations using instrumental variables are shown in Columns (2). The estimated coefficients for bilateral sectoral specialization are negative and significant and even higher.

Columns 3 in the above tables show the coefficients for the bilateral trade intensity estimated with OLS and indicate that the bilateral trade intensity is positively and significantly associated with the correlations of business cycles. As suggested by Frankel and Rose (1998) bilateral trade intensity and bilateral correlations of business cycles might be endogenous. The endogenity test indicates that this is indeed the case with the exception of the country pairs group excluding Greece and Portugal. The estimated coefficients of bilateral trade intensity using instrumental variables shown in columns (4) support the conclusion that the higher the bilateral trade intensity is the higher the bilateral correlations of business cycles.

The last set of regressions tests for the impact of bilateral sectoral specialization and trade intensity included in the same model. The OLS estimations shown in columns (5) of the above tables are in line with the previous results and indicate that similarity of economic structures and bilateral trade intensity are positively and significantly associated with bilateral correlations of business cycles. The estimated coefficient for sectoral specialization decreases when Germany is excluded. The performed Durbin-Wu-Hausman test indicates that the explanatory variables and the dependent variable are endogenous. I therefore re-estimate the model using instrumental variables for bilateral sectoral specialization and bilateral trade intensity. The estimated coefficients in the model using instrumental variables are shown in columns (6) and indicate that similarity of economic structures and bilateral trade intensity are positively and significantly associated with bilateral correlations of business cycles. However, when Germany is excluded the coefficient for bilateral sectoral specialization is no longer significant.

8 Conclusion

Countries wishing to join monetary unions should weight the benefits of lower transaction costs and elimination of exchange rates volatility between the participants and the costs of losing monetary policy as a stabilizing tool. On the one hand, the higher the degree of economic integration, the higher the benefits of joining a common currency area are. On the other hand, the more similar the countries are, the more similar their response to external shocks are, and thus the lower the cost of foregoing an independent monetary policy.

In this paper I investigated the bilateral correlations of business cycles between the CE-EU-8 countries and the current euro area members over the period 1990-2003. I find that asymmetries of business cycles between the CE-EU-8 and the euro area members are significant. Among these countries, average correlations of business cycles with the euro area are the highest in the cases of Poland, Slovenia, and Hungary. This result is similar to the findings of Artis et al (2003), Darvas and Szapary (2003) and Süppel (2003). In comparison with the current euro area countries, the CE-EU-8 countries have lower bilateral trade intensities and less similar economic structures. The results of the empirical analysis in this paper indicate that similar economic structures and bilateral trade intensity are positively and significantly associated with the bilateral correlations of business cycles, in line with previous studies on industrial countries (Clark and van Wincoop, 2001; Rose and Engel, 2002), and developing countries (Calderon, Chong and Stein, 2003).

This paper provides empirical evidence suggesting that an immediate extension of a common monetary policy to the new EU countries might have asymmetric effects. This policy implication needs however two qualifications: the cost of adopting a common monetary policy depends first, on the extent to which the exchange rate can be used as an efficient shock absorber and second, on the extent to which monetary policy can be used effectively to stabilizing economic activity. The relationships between similarity of economic structures, bilateral trade intensity, on the one hand, and, business cycles synchronization, on the other hand, are found endogenous suggesting that, in the long term convergence of economic structures and trade growth are expected. If the adoption of the euro will be well prepared it will bring significant benefits to the new EU countries.

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Table 1: Summary Statistics for Business Cycles Correlations between the euro area and CE-EU-8 countries, 1990:1-2003:3

Country pairs	Observations	Mean	Standard deviation	Min	Max
All pairs	153	0.2010	0.4078	-0.7225	0.9251
EURO_AC	80	0.2787	0.4067	-0.5521	0.9251
EURO	45	0.5960	0.2043	0.0987	0.9251
AC	28	0.1121	0.3816	-0.7225	0.9073

Source: Own calculations based on EUROSTAT data

EURO: Belgium, Germany, Greece, Spain, France, Italy, The Netherlands, Austria, Portugal, Finland

AC: the Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, Slovenia, Slovakia

Table 2 : Summary Statistics for Sectoral Specialization between the euro area and CE-EU-8 countries, 1990:1-2003:3

Country pairs	Observations	Mean	Standard deviation	Min	Max
All pairs	153	0.2450	0.1081	0.0660	0.5236
EURO_AC	80	0.2628	0.1264	0.0635	0.5236
EURO	45	0.1687	0.0651	0.0743	0.3329
AC	28	0.1852	0.0634	0.0660	0.2784

Source: Own calculations based on EUROSTAT data

EURO: Belgium, Germany, Greece, Spain, France, Italy, The Netherlands, Austria, Portugal, Finland

AC: the Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, Slovenia, Slovakia

Table 3: Sectoral shares differentials in the euro area and CE-EU-8 countries , 1990-2003

in percent

NACE_6 sectors	EURO	AC	EURO + AC
a+b	3.13	6.36	4.84
c+d+e	23.54	29.56	26.74
f	6.02	6.06	6.06
g+h+i	22.48	25.94	24.33
j+k	23.01	14.87	18.70
l+m+n+o+p	21.81	17.48	19.49

Source: Own calculations based on EUROSTAT data

EURO: Belgium, Germany, Greece, Spain, France, Italy, The Netherlands, Austria, Portugal, Finland

AC: the Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, Slovenia, Slovakia

a+b: Agriculture, hunting and forestry; Fishing

c+d+e: Mining, quarring; Manufacturing; Electricity, gas, and water supply

f: Construction

g+h+i: Wholesale and retail trade; Repair of motor vehicles, motocycles and personal and household goods; Hotels and restaurants; Transport, storage and communication

j+k: Financial intermediation; Real estate, renting and business activities

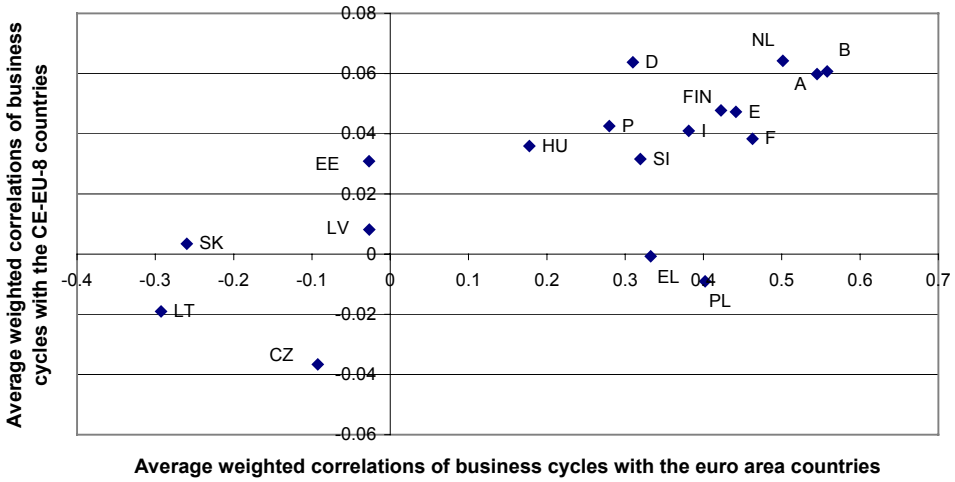
l+m+n+o+p: Public administration and defence, Compulsory social security; Education; Health and social work; Other community, social, personal service activities; Private households with employed persons

Table 4: Summary Statistics for Bilateral Trade Intensity between the euro area and CE-EU-8 countries, 1990:1-2003:3

Country pairs	Observations	Mean	Standard deviation	Min	Max
All pairs	153	0.0133	0.0268	0.0001	0.1833
EURO_AC	80	0.0035	0.0053	0.001	0.0271
EURO	45	0.0325	0.0407	0.0023	0.1833
AC	28	0.0102	0.0186	0.0001	0.0713

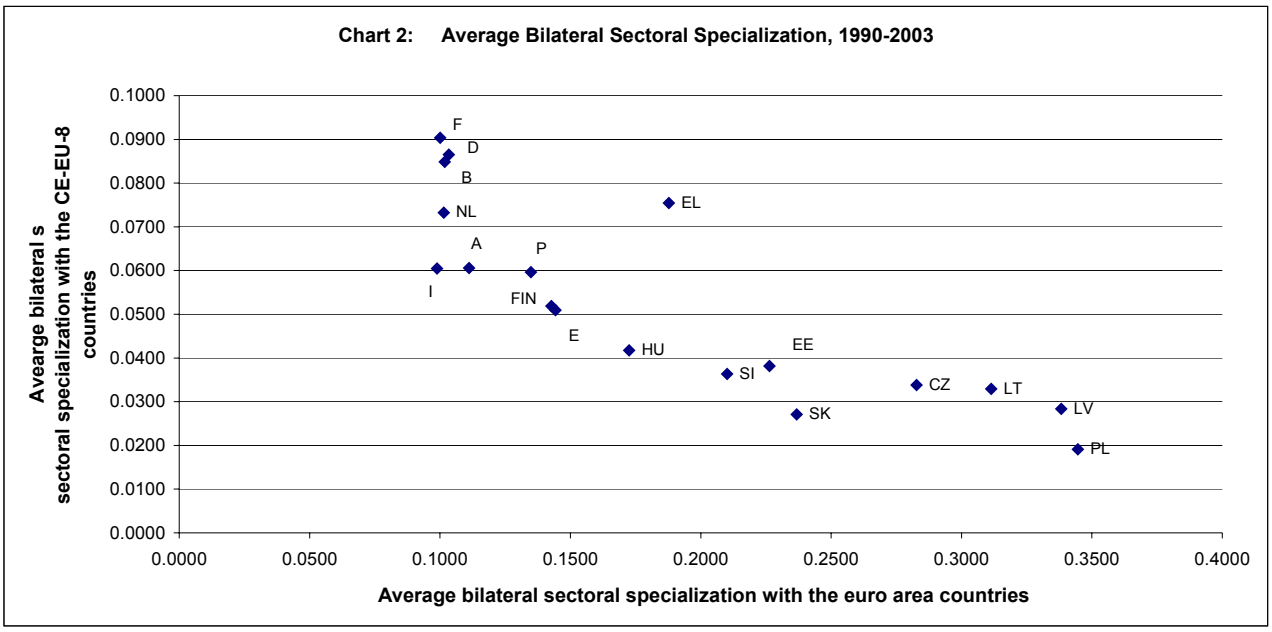
Source: Own calculations based on EUROSTAT data

Chart 1: Correlations of Business Cycles, 1990:1-2003:3



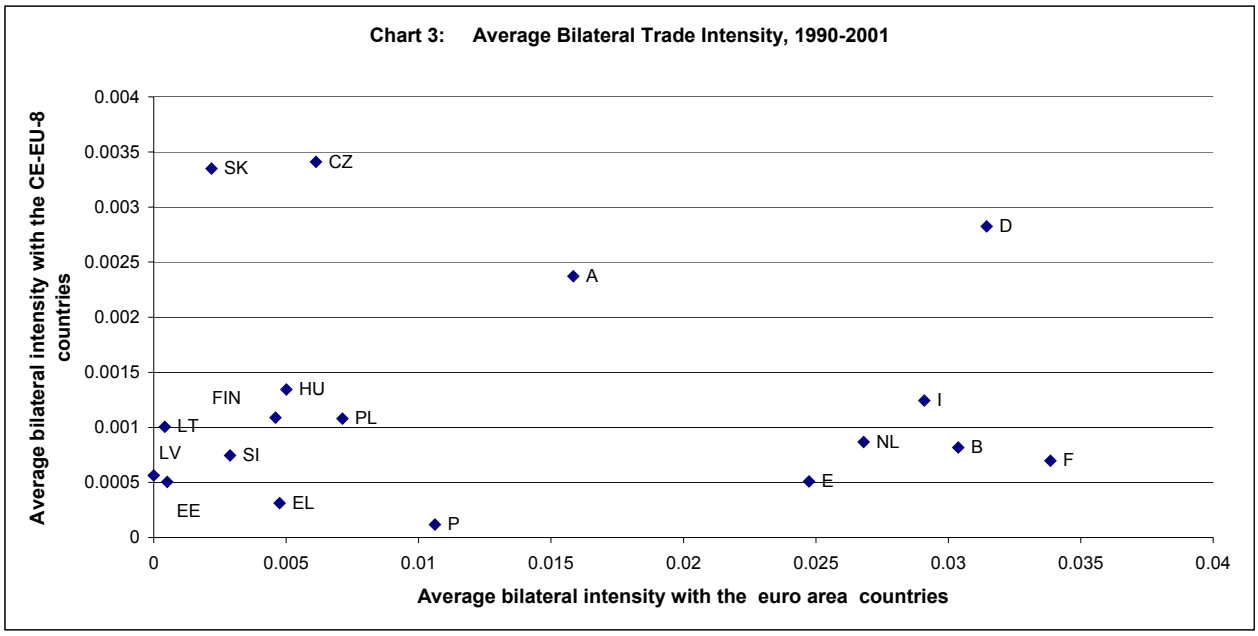
B = Belgium; D = Germany; EL = Greece; E = Spain; F = France; I = Italy; NL = the Netherlands; A = Austria; P = Portugal; FIN = Finland; CZ = the Czech Republic; EE = Estonia; HU = Hungary; LT = Lithuania; LV = Latvia; PL = Poland; SI = Slovenia; SK = Slovakia

Chart 2: Average Bilateral Sectoral Specialization, 1990-2003



B = Belgium; D = Germany; EL = Greece; E = Spain; F = France; I = Italy; NL = the Netherlands; A = Austria; P = Portugal; FIN = Finland; CZ = the Czech Republic; EE = Estonia; HU = Hungary; LT = Lithuania; LV = Latvia; PL = Poland; SI = Slovenia; SK = Slovakia

Chart 3: Average Bilateral Trade Intensity, 1990-2001



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Belgium; D = Germany; EL = Greece; E = Spain; F = France; I = Italy; NL = the Netherlands; A = Austria; P = Portugal; FIN = Finland; CZ = the Czech Republic; EE = Estonia; HU = Hungary; LT = Lithuania; LV = Latvia; PL = Poland; SI = Slovenia; SK = Slovakia

Table 5: OLS estimates for bilateral correlations of business cycles, various country-pairs

	Euro_10 + AC_8	**Euro_8, AC_8 Greece and Portugal excluded**	**Euro_9, AC_8 Germany excluded**	**Euro_10, AC_7 Poland excluded**
$EURO_{ij}$	0.5862*** (0.0491)	0.6382*** (0.0528)	0.6268*** (0.0502)	0.6612*** (0.0462)
AC_{ij}	0.1023 (0.0813)	0.0724 (0.0840)	0.1105 (0.0818)	0.2298** (0.0926)
Constant	0.0098 (0.0386)	0.0396 (0.0438)	0.0016 (0.0396)	-0.0652* (0.0348)
N	153	120	136	136
R^2	0.4021	0.4022	0.4245	0.5260

Robust standard errors in parentheses. *, **, *** denote significance at 10, 5 and 1 percent levels

Table 6: Estimates for bilateral correlations of business cycles, all country-pairs

	(1) OLS	**(2) IV**	**(3) OLS**	**(4) IV**	**(5) OLS**	**(6) IV**
ln $SPEC_{ij}$	-0.3462*** (0.0637)	-0.5810*** (0.1030)			-0.2015*** (0.0685)	-0.2223* (0.1269)
L n $TRADE_{ij}$			0.1078*** (0.0139)	0.1550*** (0.0193)	0.0843*** (0.0167)	0.1225*** (0.0263)
Constant	-0.3220*** (0.1028)	-0.6767*** (0.1642)	-0.8210*** (0.0867)	1.0921*** (0.1123)	0.3812** (0.1861)	0.5696* (0.3184)
Durbin-Wu-Hausman test		F (1, 150) = 12.86*** Prob >F =0.0005		F(1,150) = 13.66*** Prob >F = 0.0003		F(2,148) = 5.81*** Prob > F=0.0037
N	153	153	153	153	153	153
R^2	0.1620	0.0875	0.2310	0.1868	0.2749	0.2416

Cyclical components of real GDP obtained with the Baxter- King filter

Robust standard errors in parentheses. *, **, *** denote significance at 10, 5 and 1 percent levels

Table 7: Estimates for bilateral sectoral specialization and trade intensity, all country-pairs

	ln $SPEC_{ij}$	**ln $TRADE_{ij}$**
$EURO_{ij}$	-0.8507*** (0.0892)	1.5933*** (0.2832)
ln POP_i*POP_j	0.0094*** (0.0036)	-0.0181** (0.0085)
ln GDP_i*GDP_j	0.0830*** (0.0144)	0.2385*** (0.0648)
Ln $DIST_{ij}$	0.0865 (0.0562)	-0.7115*** (0.2288)
$BORDER_{ij}$	-0.2820*** (0.1094)	0.8774** (0.3758)
Constant	-3.8976*** (0.5096)	-6.2797** (2.4322)
N	153	153
R^2	0.4410	0.6014

Robust standard errors in parentheses. *, **, *** denote significance at 10, 5 and 1 percent levels

Table 8: Estimates for bilateral correlations of business cycles, Greece and Portugal excluded

	(1) OLS	**(2) IV**	**(3) OLS**	**(4) IV**	**(5) OLS**	**(6) IV**
ln $SPEC_{ij}$	-0.3338*** (0.0740)	-0.5543*** (0.1110)			-0.1845*** (0.0768)	-0.3532*** (0.1265)
Ln $TRADE_{ij}$			0.1150*** (0.0166)	0.1257*** (0.0206)	0.0935*** (0.0167)	0.0831*** (0.0255)
Constant	-0.3016** (0.1193)	-0.6366*** (0.1780)	0.8771*** (0.1029)	0.9398*** (0.1265)	0.4713** (0.2138)	0.1547 (0.3183)
Durbin-Wu-Hausman test		F (1, 117) = 10.48*** Prob >F =0.0016		F(1,117) = 0.69 Prob >F = 0.4069		F(2,115) = 3.00** Prob > F=0.0539
N	120	120	120	120	120	120
R^2	0.1530	0.0862	0.2489	0.2468	0.2870	0.2536

Cyclical components of real GDP obtained with the Baxter- King filter

Robust standard errors in parentheses. *, **, *** denote significance at 10, 5 and 1 percent levels

Table 9: Estimates for bilateral sectoral specialization and trade intensity, Greece and Portugal excluded

	ln $SPEC_{ij}$	**ln $TRADE_{ij}$**
$EURO_{ij}$	-0.9753*** (0.0956)	1.3048*** (0.2747)
$lnPOP_i*POP_j$	0.0089** (0.0037)	-0.0140* (0.0073)
ln GDP_i*GDP_j	0.0938*** (0.0151)	0.2976*** (0.0644)
$lnDIST_{ij}$	0.0413 (0.0691)	-1.1656*** (0.2336)
$BORDER_{ij}$	-0.2709** (0.1171)	0.4518 (0.3723)
Constant	-3.8170*** (0.5396)	-4.5151* (2.5346)
N	120	120
R^2	0.4666	0.6829

Robust standard errors in parentheses. *, **, *** denote significance at 10, 5 and 1 percent levels

Table 10: Estimates for bilateral correlations of business cycles, Germany excluded

	(1) OLS	**(2) IV**	**(3) OLS**	**(4) IV**	**(5) OLS**	**(6) IV**
ln $SPEC_{ij}$	-0.3371*** (0.0688)	-0.5804*** (0.1102)			-0.1864** (0.0782)	-0.1929 (0.1464)
ln $TRADE_{ij}$			0.1065*** (0.0160)	0.1620*** (0.0245)	0.0827*** (0.0204)	0.1286*** (0.0352)
Constant	-0.3256*** (0.1119)	-0.6980*** (0.1761)	0.8212*** (0.1040)	1.1498*** (0.1485)	0.3949* (0.2275)	0.6570 (0.4052)
Durbin-Wu-Hausman test		F(1,133) = 11.82*** Prob>F = 0.0008		F(1,133) = 11.92*** Prob > F= 0.0007		F(2,131) = 4.65** Prob > F = 0.0112
N	136	136	136	136	136	136
R^2	0.1479	0.0709	0.2106	0.1535	0.2453	0.2046

Cyclical components of real GDP obtained with the Baxter- King filter

Robust standard errors in parentheses. *, **, *** denote significance at 10, 5 and 1 percent levels

Table 11: Estimates for bilateral sectoral specialization and trade intensity, Germany excluded

	ln $SPEC_{ij}$	**ln $TRADE_{ij}$**
$EURO_{ij}$	-0.8241*** (0.0896)	1.5793*** (0.2972)
$lnPOP_i*POP_j$	0.0124*** (0.0034)	-0.0171* (0.0089)
ln GDP_i*GDP_j	0.0682*** (0.0154)	0.2332*** (0.0715)
$lnDIST_{ij}$	0.0995* (0.0586)	-0.7020*** (0.2398)
$BORDER_{ij}$	-0.2889** (0.1163)	1.0040** (0.4510)
Constant	-3.7504*** (0.5150)	-6.2631** (0.4510)
N	136	136
R^2	0.4568	0.5580

Robust standard errors in parentheses. *, **, *** denote significance at 10, 5 and 1 percent levels

Table 12: Estimates for bilateral correlations of business cycles, Poland excluded

	(1) OLS	**(2) IV**	**(3) OLS**	**(4) IV**	**(5) OLS**	**(6) IV**
ln $SPEC_{ij}$	-0.5054*** (0.0584)	-0.8713*** (0.1163)			-0.3709*** (0.0727)	-0.5216*** (0.1700)
ln $TRADE_{ij}$			0.1010*** (0.0139)	0.1685*** (0.0197)	0.0626*** (0.0173)	0.0877*** (0.0310)
Constant	0.5889*** (0.0913)	-1.1522*** (0.1811)	0.8269*** (0.0868)	1.1661*** (0.1139)	-0.0190 (0.1964)	-0.1051 (0.4167)
Durbin-Wu-Hausman test		F(1,133)= 25.33*** Prob >F= 0.0000		F(1,133) = 24.73*** Prob > F = 0.0000		F(2, 133) = 10.67*** Prob>F = 0.0001
N	136	136	136	136	136	136
R^2	0.3232	0.1537	0.2574	0.1846	0.3836	0.3208

Cyclical components of real GDP obtained with the Baxter- King filter

Robust standard errors in parentheses. *, **, *** denote significance at 10, 5 and 1 percent levels

Table 13: Estimates for bilateral sectoral specialization and trade intensity, Poland excluded

	ln $SPEC_{ij}$	**ln $TRADE_{ij}$**
$EURO_{ij}$	-0.7610*** (0.0100)	1.8850*** (0.3222)
$lnPOP_i*POP_j$	0.0087** (0.0037)	-0.0168* (0.0088)
ln GDP_i*GDP_j	0.0650*** (0.0165)	0.1944*** (0.0741)
$lnDIST_{ij}$	0.0698 (0.0581)	-0.7415*** (0.2425)
$BORDER_{ij}$	-0.3075** (0.1251)	0.8470** (0.4377)
Constant	-3.3845*** (0.5427)	-5.2578* (2.6712)
N	136	136
R^2	0.4037	0.6182

Robust standard errors in parentheses. *, **, *** denote significance at 10, 5 and 1 percent levels

Appendix

A1: Time Coverage for Gross Domestic Product and Sectoral Gross Value Added Data

Country	Gross Domestic Product (GDP) quarterly, 1995 prices, million Euro	Gross Value Added (GVA), NACE_6 sectors, quarterly, 1995 prices, million national currency
Belgium	1990:1-2003:3	1990:1-2003:2
Germany	1991:1-2003.3	1991:1-2003:3
Greece	1990:1-2003:3	1995-2000[a]
Spain	1990:1-2003:3	1990:1-2003:3
France	1990:1-2003:3	1990:1-2003:2
Italy	1990:1-2003:3	1990:1-2003:2
The Netherlands	1990:1-2003:3	1990:1-2003:3
Austria	1990:1-2003:3	1990:1-2003:2
Portugal	1995:1-2003:3	1995-2000[a]
Finland	1990:1-2003:3	1990:1-2003:2
The Czech Republic	1994:1-2003.2	1994:1-2003:2
Estonia	1993:1-2003:3	1993:1-2003:2
Hungary	1995:1-2002:4	1995.1-2002:2
Lithuania	1993:1-2003:3	1995:1-2003:2
Latvia	1993:1-2003:3	1990:1-2003.2
Poland	1995:1-2003:2	1995:1-2002:2
Slovenia	1992:1-2003:2	1992:1-2003:2
Slovakia	1992:1-2003:3	1994:1-2003:2

[a]: annual data
Data source: EUROSTAT

A2: Codes and Description of the NACE_6 Sectors

Codes	**Sector Description**
a + b	Agriculture, hunting, and forestry; Fishing
c + d + e	Mining and quarrying; Manufacturing; Electricity, gas and water supply
f	Construction
g + h + i	Wholesale and retail trade, repair of motor vehicles, motorcycles and personal household goods; Hotels and restaurants; Transport, storage and communication
j + k	Financial intermediation; Real estate, renting, and business activities
l + m + n+ o +p	Public administration and defence, compulsory social security; Education; Health and social work; Other community, social, personal service activities; Private households with employed persons.

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Zentrum für Europäische Integrationsforschung
Center for European Integration Studies
Rheinische Friedrich-Wilhelms-Universität Bonn

Walter-Flex-Strasse 3
D-53113 Bonn
Germany

Tel.: +49-228-73-1732
Fax: +49-228-73-1809
www.zei.de