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Working Paper

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LICOS Discussion Paper, No. 106

Provided in Cooperation with:
LICOS Centre for Institutions and Economic Performance, KU Leuven

Suggested Citation: Fidrmuc, Jarko (2001) : The Endogeneity of the Optimum Currency Area Criteria, Intraindustry Trade, and EMU Enlargement, LICOS Discussion Paper, No. 106, Katholieke Universiteit Leuven, LICOS Centre for Transition Economics, Leuven

This Version is available at:
https://hdl.handle.net/10419/75001

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LICOS Discussion Paper

Discussion Paper 106/2001

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The Endogeneity of the Optimum Currency Area Criteria, Intraindustry Trade, and EMU Enlargement*

June 2001

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Abstract

This paper tests the endogeneity hypothesis of OCA criteria (Frankel and Rose, 1998) in a cross-section of OECD countries between 1990 and 1999. It is shown that intraindustry trade actually causes the convergence of business cycles, while there is no direct relation between business cycles and bilateral trade intensity. As far as intraindustry trade is positively correlated with trade, the OCA endogeneity hypothesis is confirmed, although the argumentation follows Krugman (1993). Finally, the endogeneity of OCA criteria implies a comparable degree of business cycle harmonization of CEECs with EU countries as for the current members for the medium term.

JEL-Numbers: F15, F41.
Key words: Optimum currency area, EMU, trade, business cycle, CEECs.

* I benefited from comments by Peter Backé, Kurt Pribil, Doris Ritzberger-Grünwald, Július Horváth, Bas van Aarle, Jürgen von Haagen Jan Fidrmuc, and the participants of the 2001 Annual Royal Economic Society Conference, University of Durham, April 9—11, 2001, as well as Kari Heimonen, Jukka Pirttilä, Wendy Carlin and other participants of the BOFIT Workshop On Transition Economics, Helsinki, April 19—20, 2001. The author appreciates the support of the LICOS, Centre of Transition Economics, K.U. Leuven. The views expressed in this paper are those of the author and do not represent the position of the Oesterreichische Nationalbank.

1 Introduction

Countries participating in a currency area have to face benefits and costs of a common currency. The benefits are directly related to transaction costs in countries' bilateral trade. Therefore, countries with intensive trade relations are likely to gain relatively more from the monetary integration. In addition, Frankel and Rose (1997 and 1998) hypothesize that business cycles are also becoming more similar across countries having close trade links. This hypothesis is supported by cross section estimations of the relation between the correlation of business cycles and trade intensity among OECD countries between 1959 and 1993. Moreover, Fatas (1996), Artis and Zhang (1995) and Hochreiter and Winckler (1995) show that a common European cycle has been emerging as predicted by the endogeneity hypothesis of OCA criteria.

Nevertheless, there remains a considerable doubt whether there is a causal relationship between trade links and correlation of business cycles of the involved countries. Kenen (2000) notes that the correlation of business cycles may increase with the intensity of trade links between these countries, but this does not necessarily mean that asymmetric shocks are reduced as well. Moreover, Hughes Hallett and Piscitelli (2001) show that a currency union may increase cyclical convergence, but only if there is already a sufficient symmetry in the shocks and institutional structure across the countries. Their findings thus support Krugman's (1993) discussion of the implications from the US currency union for the European Monetary Union (EMU). In Krugman's view, trade liberalization forces increased specialization according to comparative advantage of countries and possibly a divergence of business cycles in the EMU.

Indeed, Frankel and Rose' work lacks any relation to structural indicators which should also explain the similarity of business cycles, although they used them as arguments. Therefore, this paper tests the OCA endogeneity using bilateral levels of intraindustry trade between OECD countries in the 1990s. It is shown that intraindustry trade actually causes the convergence of business cycles between trading partners, while there is no direct relation between business cycle and trade intensity. As far as intraindustry trade is positively correlated with trade intensities, the OCA endogeneity hypothesis is confirmed, although the line of the argumentation follows actually Krugman (1993).

Finally, I ask whether the Central and Eastern European Countries (CEECs) should introduce the euro as soon as possible after accession to the EU or whether they should do so at a later stage. This question is addressed by applying the endogeneity hypothesis of OCA criteria to

five advanced transition economies (the Czech Republic, Hungary, Poland, Slovakia, and Slovenia). This paper applies the relation between the degree of trade integration, the shares of intraindustry trade, and the convergence in business cycles to CEECs and EU countries to predict the degree of business cycle harmonization of CEECs with EU countries in the medium term. Alternatively, these predictions can be interpreted as 'Indices of Endogenous Optimum Currency Area' (EOCA indices) similar to those introduced by Bayoumi and Eichengreen (1997).

The paper is structured as follows. The next section tests the endogeneity hypothesis of the OCA criteria. Section 3 applies the revealed relation between, on the one hand, correlation of business cycles, and, on the other hand, trade intensity for the computation of a potential correlation of business cycles (indices of endogenous optimum currency area) in selected CEECs. Finally, the last section concludes the paper.

2 The Optimum Currency Area Theory

2.1 Endogeneity of Optimum Currency Area Criteria

The theory of optimum currency areas (OCA), which was developed by Mundell (1961), McKinnon (1963), and Kenen (1969), has become particularly popular for analyses of the costs and benefits of monetary integration, in particular with reference to EMU. The basic point of the OCA theory is that countries or regions exposed to symmetric shocks, or possessing mechanisms for the absorption of asymmetric shocks, may find it optimal to adopt a common currency. This literature therefore focuses on assessing the symmetry of output shocks in monetary unions, and/or evaluating the absorption mechanisms, such as labor mobility or fiscal transfers.

In particular, the OCA theory discusses the following criteria: First, potential gains from the creation of an OCA are determined by the *degree of openness*. A country where trade within the OCA accounts for a high proportion in domestic output can profit from participating in a currency area. Second, the OCA theory stresses the importance of the *similarity of shocks and business cycles*. Asymmetric shocks and business cycles raise the need for country-specific adjustment policies; however, in a single-currency area, country-specific monetary policy is not possible.

Third, Mundell (1961) points at the *international factor mobility* (especially migration) as an alternative adjustment channel. High labor mobility facilitates adjustment to the adverse

effects of asymmetric shocks and thus reduces the pressure for exchange rate adjustments. Fourth, Kennen (1969) stresses the importance of *product diversification*. A country exporting highly diversified products is less vulnerable to sector-specific shocks. Therefore, countries with a large product spectrum are less likely induced to use the exchange rate as an adjustment tool. Fifth, Kenen (1969) also examines *fiscal transfers*, which can be used to counteract asymmetric shocks in a currency area.

Finally, the *degree of policy integration and similarity between rates of inflation* has been introduced to the OCA theory more recently (see for example Dixit, 2000). On the one hand, differences between rates of inflation cause a loss of competitiveness in high-inflation countries, which calls for external adjustments (see Carlin, Glyn and Van Reenen, 2001). On the other hand, a high degree of policy integration already before the creation (enlargement) of a currency area is likely to result in lower costs for the participating countries.

The stronger any of the listed linkages between countries participating in a currency area are, the more gains may be expected by the participating countries. Frankel and Rose (1998) show that the first two criteria are endogenous. Closer trade relations result in a convergence of business cycles. Further, similar business cycles create good preconditions for policy integration and the creation of a currency area. However, this view is not universally shared in literature. For example, Krugman (1993) points out that, as countries become to a higher degree integrated, they specialize more. Thus, these diverging expectations regarding the relation between business cycles and trade integration may be illustrated in Figure 1.

The monetary efficiency gains are generally expected to be positively related to the degree of economic integration, as illustrated by line GG in Figures 1.A and 1.B. However, the classical and alternative views of the relation between the degree of economic integration and the losses resulting from the participation in a common currency area differ with respect to the shape of the LL curve. The traditional optimum currency area theory expects a negative relation, while the alternative view predicts a positive relation between economic losses and the degree of economic integration. Still, there is a possibility that gains are higher than losses in the alternative view, when the GG line is significantly steeper than the LL line (see De Grauwe and Aksoy, 1999). Nevertheless, the potential gains from participation in a currency area are much lower in this case. Furthermore, the participating countries should be more integrated to achieve positive gains from monetary integration.

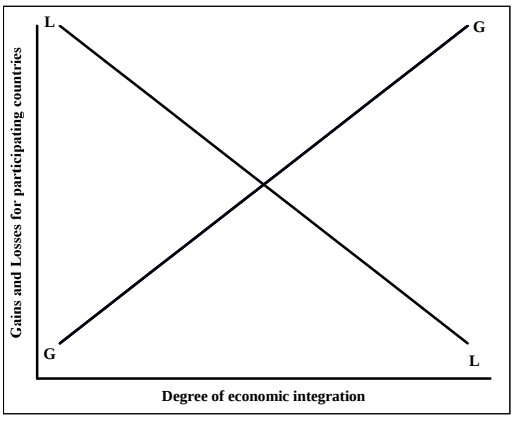
This discussion shows that we can relatively well describe when either the conventional or the alternative look at the OCA theory applies. The former is suitable when intraindustry trade is

high, while the opposite implies the latter case. Therefore, this paper discusses the structure of trade between the EU and the CEECs to establish whether the conventional view is appropriate for monetary integration of the CEECs, or whether the alternative view of OCA should be applied to these countries.

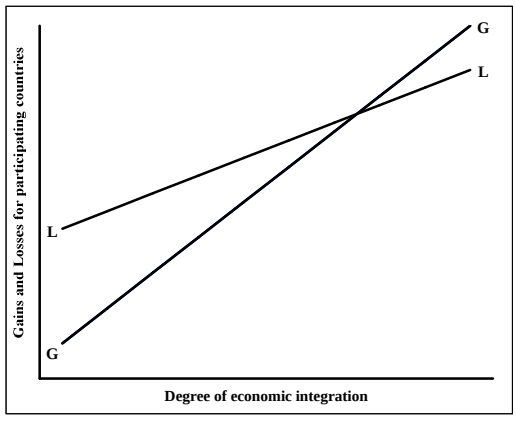
However, Kenen (2000) and Hughes Hallett and Piscitelli (2001) argue that Frankel and Rose's results should be interpreted cautiously. Kenen (2000) shows in a framework of the Keynesian model that the correlation between two countries' output changes increases unambiguously with the intensity of trade links between these countries, but this does not necessarily mean that asymmetric shocks are reduced as well. Therefore, it is important to keep in mind that it is not trade relation alone which causes the convergence of business cycles in an OCA. Indeed, Frankel and Rose's hypothesis underlines that bilateral trade is mainly intraindustry trade, although this indicator does not enter directly their analysis.

Figure 1: Optimum Currency Area Theory

A: Conventional View of an OCA



B: Alternative View of an OCA



2.2 Trade Integration and Business Cycles

Frankel and Rose (1998) argue that, if intraindustry trade accounts for a high share in bilateral trade, its intensity increases the convergence of business cycles. They report a significant and positive relation between trade intensity and the correlation of business cycles as measured by various indicators of economic activity in a cross-section of OECD countries between 1959 and 1993. For empirical tests, the endogeneity hypothesis of the OCA criteria may be stated as

$$\mathrm{Corr}(Q_i, Q_j) = \alpha + \beta \log(TI_{ij}^T), \quad \text{where} \quad TI_{ij}^T = \frac{T_{ij}}{T_i + T_j}, \tag{1}$$

and where $\mathrm{Corr}(Q_i,Q_j)$ stands for the correlation of detrended (fourth differences of logs) indicator of economic activity and *TI* denotes the natural logarithm of the bilateral trade intensity between countries *i* and *j*. Trade intensity may be defined either in relation to exports, imports, or trade turnover.[1]

Table 1 reports several specifications of (1) for OECD countries between 1990 and 1999.[2] The OLS regression of bilateral economic activity on trade indicators may be inappropriate. Countries are likely to orient their monetary policy and fix the exchange rates towards their most important trading partners. The bilateral trade might already reflect the adoption of common exchange rate policy and not vice versa.[3] Therefore, the regressions have to be instrumented by exogenous determinants of bilateral trade flows. Such instruments are provided by the so called 'gravity models' including the log of distance between trading partners, a dummy for geographic adjacency and a dummy for the 12 member states of the EC, and the aggregate income as well as the income per capita (in logs) of the included countries.

Trade intensity is revealed to have a significant and positive effect on the correlation of business cycles. This result is robust to the selection of the indicator of economic activity and the particular definition of trade intensities. The business cycles of industrial production seems to be better explained by trade than the business cycles as defined by the correlation of countries' real GDP. This corresponds to the high share of tradables in the industry. However, the adjusted coefficient of determination is relatively low for all specifications of (1). As might be expected, the coefficients estimated for trade intensity indicators are slightly higher in the 1990s than in the previous decades as reported by Frankel and Rose (1998). This could indicate that the role of trade relations has increased recently.

[1] The country sample includes Switzerland, Norway, the US, Canada, Australia, New Zealand, Turkey, and Israel in addition to 14 EU countries (Belgium and Luxembourg are reported as a single region). I use industrial production and GDP indices according to the International Financial Statistics of the IMF, lines 66 and 99. The quarterly GDP is not available for Greece. Trade intensities were computed for the most recent year (1997).

[2] Some explanatory variables which will be used later (intraindustry trade) are not available for the earlier periods due to changes in trade statistics. Therefore, the analyses have to be restricted to the 1990s throughout the paper.

[3] Rose (2000), for example, documents positive effects of currency unions and negative effects of exchange rate volatility on bilateral trade.

Table 1: Trade Integration and Business Cycles

	Industrial Production			Real Gross Domestic Product		
	Exports (1.a)	**Imports (1.b)**	**Total (1.c)**	**Exports (1.d)**	**Imports (1.e)**	**Total (1.f)**
Constant	0.683	0.686	0.715	0.688	0.681	0.705
	(8.005)	(8.517)	(8.355)	(6.832)	(7.064)	(6.939)
Trade Intensity	0.084	0.084	0.091	0.086	0.083	0.090
	(5.378)	(5.632)	(5.683)	(4.655)	(4.780)	(4.782)
No. of observations	253	253	253	231	231	231
SER	0.287	0.284	0.284	0.326	0.331	0.327
Adjusted R^2	0.099	0.117	0.117	0.098	0.068	0.089

Note: The dependent variable is the index of correlation of detrended indicator of economic activity (fourth difference of logs) between trading partners. Trade intensity is measured as a share of bilateral trade aggregate in total trade aggregates of both countries as indicated by the columns' headers. The instrumental variables in the two-stage OLS include the log of distance, a dummy for geographic adjacency, a dummy for EC12, the log of aggregate income and the log of income per capita. Heteroscedasticity-robust t-statistics are in parentheses. Adjusted R^2 and standard errors of regression (SER) are computed using the structural residuals (not the second stage residuals).

2.3 Intraindustry Trade and Business Cycles

However, equation (1) does not use any structural variables to explain the similarity of business cycles, although trade structure (e. g. the level of intraindustry trade) may be viewed as a major adjustment force inducing the convergence of business cycles between trading partners. Frankel and Rose (1998), Krugman (1993) and Hughes Hallett and Piscitelli (2001) use structural arguments in favor as well as against the endogeneity hypothesis of OCA criteria. Therefore, I estimate the relation between the correlation of business cycles, trade integration, and the bilateral level of intraindustry trade,

$$\mathrm{Corr}\left(Q_i, Q_j\right) = \alpha + \beta \log\left(TI_{ij}^{T}\right) + \gamma IIT_{ij}, \qquad (2)$$

where Q and TI are defined in the same way as in the corresponding formulations of (1) and IIT_{ij} stands for intraindustry trade.[4] Equation (2) is again estimated by two-stage OLS. Note

[4] Intraindustry trade as measured by the Grubel-Lloyd indices, see equation (5), was computed for three-digit SITC commodity groups in 1998. When available, data according to Eurostat were taken. Intraindustry trade at the same level of disaggregation between non-EU countries was computed using the UN World Trade Data.

that the selected instrumental variables are also highly correlated with intraindustry trade (see Hummels and Levinsohn, 1995, Loertscher and Wolter, 1980).

In this specification (see Table 2), the coefficients of intraindustry trade are significant if estimated for the industrial production, although they are insignificant (but positive) for two specifications applying real GDP. By contrast, the coefficients of the bilateral trade intensity are close to zero (indeed, they have wrong signs in several specifications) and insignificant for both indicators of economic activity. This pattern is very robust with respect to the choice of instrumental variables and country sample. This indicates that trade intensities have no direct effect on the correlation of business cycles. Therefore, I drop TI_{ij} from estimated equations,

$$\mathrm{Corr}\left(Q_i, Q_j\right) = \alpha + \gamma IIT_{ij}, \tag{3}$$

which are reported in the last column of the particular blocks of Table 2. The coefficients of intraindustry trade are highly significant in both specifications of (3).

Table 2: Intraindustry Trade, Trade Integration, and Business Cycles

	Industrial Production				**Real Gross Domestic Product**			
	Exports	**Imports**	**Total**	**Only IIT**	**Exports**	**Imports**	**Total**	**Only IIT**
	(2.a)	**(2.b)**	**(2.c)**	**(3.a)**	**(2.d)**	**(2.e)**	**(2.f)**	**(3.b)**
Constant	0.259	0.468	0.379	0.499	0.444	0.578	0.543	0.476
	(1.598)	(4.325)	(2.576)	(11.934)	(2.361)	(4.381)	(4.038)	(9.636)
Trade Intensity	-0.085	-0.011	-0.042		-0.011	0.038	0.021	
	(-1.619)	(-0.323)	(-0.879)		(-0.188)	(0.913)	(0.468)	
Intraindustry Trade	0.335	0.207	0.257	0.187	0.195	0.103	0.095	0.175
	(3.597)	(3.043)	(3.047)	(6.554)	(1.812)	(1.304)	(1.095)	(5.324)
No. of observations	253	253	253	253	231	231	231	231
St. Error of regression	0.306	0.285	0.294	0.282	0.322	0.321	0.253	0.321
Adjusted R^2	-0.028	0.106	0.053	0.129	0.117	0.124	0.159	0.129

Note: The dependent variable is the index of correlation of detrended indicator of economic activity (fourth difference of logs) between trading partners. Trade intensity is measured as a share of bilateral trade aggregate in total trade aggregates of both countries as indicated by the columns' headers. The instrumental variables in the two-stage OLS include the log of distance, a dummy for geographic adjacency, a dummy for EC12, the log of aggregate income and the log of income per capita. Heteroscedasticity-robust t-statistics are in parentheses. Adjusted R^2 and standard errors of regression (SER) are computed using the structural residuals (not the second stage residuals).

As far as intraindustry trade is positively correlated with trade intensities, the endogeneity hypothesis of OCA criteria is confirmed by (2) and (3), although the line of the argumentation follows rather Krugman's (1993). Indeed, Table 2 shows that the coordination of the business cycles of trading partners is not driven by the simple aggregation of shocks, being transferred between the countries via direct trade channels, as argued by Kenen (2000). In contrast to this 'mechanic' view of an OCA endogeneity, equations (2) and (3) imply that it is the new structure of foreign trade and not the direct effect of bilateral trade, which causes the synchronization of countries' business cycles.

2.4 Sensitivity Analyses

Finally, the previous results are very robust with respect to the inclusion of other variables into (2). In particular, the countries wishing to participate in the EMU have tried to coordinate more their economic, fiscal and monetary policies during the 1990s. Therefore, a dummy for the EU countries which have qualified for the EMU in 1999 (that means the EU excluding Denmark, Greece, Sweden and the UK), denoted by *EMU*, is included. Furthermore, neighboring countries are likely to influence much more each other than other countries. Therefore, a dummy for geographic adjacency, *B*, is included as well. Larger countries may also influence the business cycle of smaller countries. Therefore, GDP difference, $|Y_i - Y_j|$, is expected to have a positive sign. Thus, the augmented version of equation (2) may be stated as

$$\mathrm{Corr}\left(Q_i, Q_j\right) = \alpha + \beta \log\left(TI_{ij}^{T}\right) + \gamma IIT_{ij} + \delta EMU + \lambda B + \theta \left|Y_i - Y_j\right|. \qquad (4)$$

Indeed, these variables exhibit the correct signs in nearly all specifications (see Table 3). Equation (4) shows that institutional changes matter as well. The eleven countries participating in the EMU have had correlation of business cycles higher by about 0.15 on average during the 1990s. This is relatively high as compared to the sample's mean of 0.25 (for both indicators of the economic activity).

However, the results for other additional variables are not very robust. The inclusion of the additional explanatory variables did not improve the goodness of fit either. Importantly, nevertheless, intraindustry trade is positive and significant in nearly all specifications. By contrast, trade intensities have a negative sign in nearly all augmented specifications. Thus, the sensitivity analyses further stress the importance of structural variables (both IIT_{ij} and *EMU*) for the harmonization of the business cycles between countries.

Table 3: Sensitivity Analyses

	Industrial Production			Real Gross Domestic Product		
	Exports	**Imports**	**Total**	**Exports**	**Imports**	**Total**
	(4.a)	**(4.b)**	**(4.c)**	**(4.d)**	**(4.e)**	**(4.f)**
Constant	-0.327	0.046	-0.214	0.257	0.610	0.484
	(-1.872)	(0.283)	(-1.060)	(1.131)	(3.361)	(2.127)
Trade Intensity	-0.185	-0.062	-0.138	-0.068	0.037	0.002
	(-3.891)	(-1.802)	(-2.796)	(-1.085)	(0.953)	(0.041)
Intraindustry Trade	0.415	0.220	0.328	0.245	0.081	0.136
	(5.165)	(3.796)	(4.277)	(2.428)	(1.257)	(1.631)
Dummy: Geographic	0.231	0.136	0.192	0.095	0.024	0.046
Adjacency	(3.083)	(1.910)	(2.540)	(0.968)	(0.260)	(0.477)
Dummy: EMU 11	0.163	0.154	0.164	0.153	0.139	0.145
	(3.950)	(3.760)	(3.947)	(2.722)	(2.533)	(2.608)
GDP Difference	0.020	0.022	0.023	-0.011	-0.015	-0.013
	(1.876)	(1.964)	(2.146)	(-0.910)	(-1.179)	(-0.978)
No. of observations	253	253	253	231	231	231
SER	0.269	0.275	0.272	0.325	0.325	0.326
Adjusted R^2	0.201	0.172	0.187	0.103	0.101	0.099

Note: The dependent variable is the index of correlation of detrended indicator of economic activity (fourth difference of logs) between trading partners. Trade intensity is measured as a share of bilateral trade aggregate in total trade aggregates of both countries as indicated by the columns' headers. Trade intensity and intraindustry trade are instrumented by the log of distance, a dummy for geographic adjacency, a dummy for EC12, the log of aggregate income and the log of income per capita. Heteroscedasticity-robust t-statistics are in parentheses. Adjusted R^2 and standard errors of regression (SER) are computed using the second stage residuals.

3 The Endogeneity Hypothesis of OCA Criteria and the EMU Enlargement

Since the beginning of the 1990s, the CEECs have aimed at future membership in the European Union. After ten years of economic reform, these countries have largely succeeded in adjusting their economies to market principles. As a result, the EU started membership negotiations with five CEECs in 1998, which were extended to all ten associated countries two years later.

As part of this enlargement agenda, several CEECs have already expressed their aspiration to join the euro area as soon as possible after accession. Furthermore, several authors discuss the possibility of adopting the euro as legal tender in some CEECs already before the full membership in the EU. This discussion has been started by Bratkowski and Rostowski (1999) and Coricelli (2000), but also Portes (2001) and Buiter and Grafe (2001) have addressed this

issue. Schoors (2001) and Wójcik (2000) provide a detailed discussion of the arguments for and against the so called euroisation.

By contrast, the European Union, including the Eurosystem, has outlined a three-step approach to the monetary integration of the candidate countries from Central and Eastern Europe, which is described in more detail by Kopits (1999) and Backé (1999). The applicants should first join the EU, then enter the exchange rate mechanism (ERM II) of the European Union and finally, after the fulfillment of the convergence criteria, accede to the Economic and Monetary Union.

Table 4: Similarity of Business Cycles of Selected Countries with Germany

	Industrial Production		Real Gross Domestic Product	
	1991-1999	**1993-1999**	**1991-1999**	**1993-1999**
Austria	0.79	0.81	-0.36	0.58
Belgium	0.26	0.25	0.02	0.88
Greece	0.34	0.48		
Spain	0.84	0.92	0.01	0.79
Finland	0.39	0.69	0.68	0.79
France	0.87	0.91	0.19	0.83
Ireland	0.38	0.44	0.19	-0.03
Italy	0.58	0.60	0.01	0.81
Netherlands	0.60	0.57	0.18	0.69
Portugal	0.59	0.56	0.01	0.78
Denmark	0.73	0.78	0.22	0.71
UK	0.46	0.56	0.41	0.76
Sweden	0.15	0.22	0.73	0.61
Czech Rep.		0.37		0.01[b]
Hungary	0.30	0.63		0.75[b]
Poland	0.23[a]	0.45[a]		0.38[b]
Slovakia		0.04		0.74[b]
Slovenia		0.77		0.80[b]

Notes: The similarity of business cycles is measured by the correlation of detrended indicator of economic activity (fourth difference of logs). a – Data according to the Vienna Institute for Comparative Economics (WIIW); b – Correlation of GDP growth according to IMF (2000).

3.1 Trade Integration between EU and CEECs

Since the opening-up of Eastern Europe, the importance of EU countries for the CEECs' trade has increased dramatically. As of 1998, the European Union was the most important trading partner of all CEECs. The EU accounted for between 40% (Lithuania) and 70% (Hungary) of total exports of the CEECs.[5] These export shares are comparable to or even higher than intra-EU shares for nearly all EU Member States. On the import side, the predominance of the EU is only slightly weaker. Furthermore, the shares of exports and imports going to and coming from an 'enlarged EU,' which is the current EU plus the ten accession countries are even higher. According to this indicator, the enlarged Europe is the most important export market for Slovakia and the Czech Republic, followed by Portugal, the Netherlands, and Austria.

The CEECs are relatively open economies. The exports account for about one third of GDP in Hungary, and above 40% in the Czech Republic, Slovakia and Slovenia. Thus, these countries are relatively more open than nearly all EU countries. There are only few EU countries including Belgium, the Netherlands, and Ireland which are significantly more open than the smaller CEECs (export shares between 50% and 70% of GDP). Only Poland's exports are relatively lower at 17% of GDP, but this corresponds to the larger size of the Polish economy. Buiter (2001) notes that the CEECs are also relatively open if we compare their trade to GDP at purchasing power parities.

From the point of view of the conventional OCA theory, if intraindustry trade accounts for a high share in trade, then, *ceteris paribus*, business cycles are expected to become more similar across countries as illustrated by Figure 1.A. By contrast, increased bilateral trade intensity may lead to the divergence of business cycles if the increase in trade is mainly due to the increased specialization as predicted by the alternative view of an OCA (Figure 1.B). Therefore, intraindustry trade may be used to identify which model is more appropriate for a particular group of countries.

The growth of intraindustry trade, which is observed in intra-EU trade, also dominates the recent East-West trade developments. This would increase net gains from the integration of CEECs into the euro area. According to Fidrmuc (1999), the shares of intraindustry trade in the EU's trade with the Czech Republic, Slovenia and Hungary, as computed by Grubel-Lloyd indices, *IIT*,

[5] As estimated by gravity models, Fidrmuc and Fidrmuc (2000) show that the trade between the CEECs and the EU, as well as the trade between individual CEECs, has already reached its 'natural' level, corresponding to the economic size, the distance between these countries, and the stage of integration.

$$IIT = 1 - \frac{\sum_i |X_i - M_i|}{\sum_i (X_i + M_i)}, \tag{5}$$

where X_i and M_i denote exports and imports by three-digit SITC commodity groups i, were already comparable to or even slightly larger than in EU trade with e.g. Spain and Sweden (that is, about 60%) in 1998. Poland and Slovakia report somewhat lower levels of intraindustry trade at about 50%. These levels are comparable to those of Ireland and Portugal. However, the shares of intraindustry trade in EU trade with Estonia, Lithuania, Latvia, Romania, and Bulgaria have still remained slightly above the level of EU intraindustry trade with Greece and Turkey (below 35%).

The convergence of the trade structure between the EU and the CEECs implies that we can apply the conventional view of OCA (see Figure 1.A) at least to the Central European membership candidates (the Czech Republic, Hungary, Slovenia, and, to a lesser extent, also to Poland and Slovakia). Therefore, the application of the endogeneity of OCA criteria is restricted only to these countries in further analysis.

3.2 Observed Convergence of Business Cycles in the EU and the CEECs

There is a mixed evidence on the convergence of business cycles in the EU and the CEECs. On the one hand, the level of GDP grew slowly in relation to the Western European countries during the period of the central planning system. The divergence of Western and Eastern Europe speeded up in the 1970s and the 1980s. Therefore, the increasing welfare difference between market and central planning economies in Europe was one of the major reasons for the introduction of early reforms in Eastern Europe. Furthermore, there were also little signs of convergence between Central and Eastern European countries in this period of time. Estrin and Urga (1997) find only limited evidence of convergence in the former Soviet Union, as well as within various groups of Central European commanded economies. Even more surprisingly, Fidrmuc, Horvath, and Fidrmuc (1999) conclude that the Czech Republic and Slovakia did converge neither between 1950 and 1990, nor within a sub-sample from 1970 to 1990.

Several authors report increasing similarities of business cycles between the EU (mainly Germany) and the CEECs since the economic reforms have been introduced. In particular, Boone and Maurel (1998 and 1999) find a significant convergence between business cycles

(as measured by unemployment rates) in Germany and selected CEECs (the Czech Republic, Hungary, Poland and Slovakia). According to Boone and Maurel (1999), between 55% (Poland) and 86% (Hungary) of the CEECs' cycles (given by detrended unemployment) are explained by German shocks. This figure is lower than the estimate for the French-German interdependence of business cycles (91%), but higher than the estimates for the German influence on Spanish (43%) and Italian (18%) business cycles. Therefore, the authors conclude that the benefits from eventually joining the euro area could outweigh the costs in the CEECs.

Indeed, business cycles in several CEECs has become strikingly similar to the business cycle of the EU (as proxied by Germany) since 1993 (see Table 4). At the beginning of the 1990s, the business cycles in the CEECs were determined by the so-called transitional recession. Therefore, the correlation of business cycles was low between 1991 and 1999. The recovery in these countries has been strongly influenced by the growing exports to the EU. As a result, the business cycle of the EU has determined the developments in CEECs' economies since 1993. In particular, the correlation of growth of industrial production or GDP between Germany and Hungary (0.63 and o.75, respectively), and Germany and Slovenia (0.77 and 0.80, respectively), has been higher than the corresponding correlations of EU countries with Germany on average (0.60 and 0.68, respectively) during this time.

However, the period of about six years might be too short to conclude that the business cycles have already become similar. In particular, this period corresponds to only about one full business cycle. Moreover, this period was characterized by only few supply and demand shocks. Actually, the correlations of industrial production in Germany and that in the Czech Republic[6] and Slovakia have remained relatively low. In so far the Czech Republic and Slovakia are quite similar to other CEECs (see previous section), this indicates that country-specific shocks may still have significant effects on these economies. The difference between the Czech Republic and Slovakia, on the one hand, and the remaining CEECs, on the other hand, indicates that asymmetric shocks are still likely in the EU and the CEECs.

[6] In contrast to our results, Cincibuch and Vavra (2000) show that an alternative measure of similarity in business cycles – standard deviation of percentage changes in relative output in the Czech Republic and Germany – has declined during the reform period, meaning that the symmetry of business cycles has increased.

3.3 Indices of Endogenous Optimum Currency Area

The revealed trend to the unification of business cycles in Europe is not surprising. It fully corresponds to the endogeneity of OCA criteria. Therefore, I use equations estimated in the previous section to evaluate the potential correlation of business cycles in Germany and the CEECs given the current integration of these countries and the current level of intraindustry trade. Note that these correlations can be alternatively interpreted as indices of endogenous optimum currency area (EOCA indices) similar to those constructed by Bayoumi and Eichengreen (1997).

A comparison of Table 4 and Table 5 shows that the correlations of business cycles in Germany and in other EU countries were on average slightly higher in the 1990s than those predicted by the EOCA indices. However, this is not so surprising. First, the European Union has reached a significant progress in the coordination of the economic policy in the member states. As a result of the introduction of the single market in 1992 and the preparations for EMU in this decade, the similarity of business cycles within the EU countries has likely been higher in the 1990s than in the previous decades. Second, Germany was selected as a proxy for the EU because it is known to dominate the European business cycle (see Bayoumi and Eichengreen, 1993).

Using various specifications of equation (1), the correlation of industrial production and GDP in Germany and other EU countries is predicted at about 0.37 for both indicators on average. Actually, the corresponding correlations predicted for the CEECs (EOCA indices) are only slightly lower. The Czech Republic, Poland and Hungary could potentially reach correlations as high as 0.35 on average in the medium run, while Slovak and Slovene trade is less oriented towards Germany, resulting in a lower predicted correlation of about 0.24 on average.

Similarly, I use (3) to compute the EOCA indices in Germany and in selected countries, which are even higher than the previous figures (see Table 5). In fact, the Czech Republic is predicted to have a higher correlation of industrial production with Germany than all EU countries except for France, although this prediction still remains below the realized levels in several EU countries.

The comparison of predicted, or potential, business cycle correlations for selected Western and Eastern European countries shows small differences between both regions. Further coordination of economic policy in CEECs with the EU is likely to result in a fast convergence of business cycles. Thus, the CEECs face extraordinarily favorable preconditions for a fast convergence to the business cycle in the EU (or EMU). This expectation is based on

the high openness of the CEECs vis-à-vis the EU and the high shares of intraindustry trade in bilateral relations. Given first, the high potential gains from an OCA between the current EMU countries and the CEECs, as illustrated by the high importance of EU trade in the CEECs, and second, the currently observed convergence of business cycles in both regions (which is partly caused by the first observation), we can expect a strong tendency of the CEECs to join the EMU in the future.

Table 5: Indices of Endogenous Optimum Currency Area of Selected Countries with Germany

	Industrial Production				**Real Gross Domestic Product**			
	(1.a)	**(1.b)**	**(1.c)**	**(3.a)**	**(1.d)**	**(1.e)**	**(1.f)**	**(3.b)**
Austria	0.42	0.44	0.41	0.43	0.42	0.44	0.40	0.41
Belgium	0.43	0.43	0.44	0.43	0.43	0.43	0.43	0.41
Greece	0.24	0.22	0.26	0.24	0.24	0.22	0.26	0.24
Spain	0.38	0.38	0.40	0.41	0.38	0.38	0.39	0.39
Finland	0.29	0.29	0.28	0.34	0.28	0.29	0.28	0.32
France	0.46	0.46	0.47	0.45	0.46	0.46	0.46	0.43
Ireland	0.27	0.30	0.22	0.28	0.26	0.30	0.21	0.27
Italy	0.43	0.44	0.44	0.39	0.43	0.44	0.44	0.37
Netherlands	0.44	0.46	0.45	0.41	0.44	0.45	0.44	0.39
Portugal	0.30	0.30	0.30	0.36	0.30	0.30	0.29	0.35
Denmark	0.34	0.35	0.34	0.38	0.34	0.35	0.34	0.37
UK	0.43	0.42	0.45	0.43	0.43	0.42	0.44	0.41
Sweden	0.35	0.34	0.36	0.36	0.35	0.34	0.35	0.35
Czech Rep.	0.36	0.36	0.36	0.43	0.36	0.36	0.35	0.41
Hungary	0.33	0.33	0.33	0.38	0.32	0.33	0.33	0.37
Poland	0.36	0.37	0.35	0.33	0.35	0.37	0.34	0.31
Slovakia	0.26	0.27	0.24	0.34	0.25	0.27	0.24	0.33
Slovenia	0.23	0.23	0.23	0.36	0.22	0.23	0.22	0.35

Notes: Indices of Endogenous Optimum Currency Area are computed according to particular specification of (1) and (3) as indicated by columns' headers.

4 Conclusions

This paper examines the endogeneity hypothesis of OCA criteria originally introduced by Frankel and Rose (1997 and 1998). On the one hand, this issue has significantly influenced the shape of the European monetary integration. On the other hand, there is considerable doubt whether there is a causal relationship between trade and business cycles. By contrast, Krugman (1993) argues that integration is likely to support the specialization of participating countries according to the comparative advantage. Indeed, Krugman finds empirical support for his arguments in the specialization pattern and business cycles of the US regions. Furthermore, Kenen (2000) and Hughes Hallett and Piscitelli (2001) demonstrate that the trade links alone do not ensure the convergence of business cycles if countries are not sufficiently similar.

This paper addresses the importance of structural variables for the harmonization of business cycles. In particular, intraindustry trade is shown to cause the convergence of business cycles in OECD countries. Furthermore, econometric analyses reveal that there is no direct relation between business cycle and trade intensity if regressions are augmented by additional structural variables. As far as intraindustry trade is positively correlated with trade intensities, the OCA endogeneity hypothesis is confirmed, although the line of the argumentation follows actually Krugman (1993).

This result is robust with respect to the definition of trade intensity and the selection of the indicators of economic activity for comparison of business cycles. The sensitivity analysis reveals that the preparation of the EMU has already had positive effects on the synchronization of business cycles in the participating countries in the 1990s. This confirms the importance of the structural variables for the convergence of business cycles.

Furthermore, this paper addresses a controversial issue of the current enlargement agenda. The future enlargement of the euro area by Central and Eastern European countries has initiated an intense academic and political discussion, although the membership negotiations between the EU and the associated countries have just started. This discussion is characterized by a multitude of different policy proposals, ranging from the immediate adoption of the euro in some countries (mostly in Poland and in Estonia) to suggestions that the CEECs should not give up exchange rate flexibility in order to support their growth and convergence to the EU.

The contribution of this paper to the discussion focuses on five associated countries (the Czech Republic, Hungary, Poland, Slovenia, and Slovakia). On the one hand, this paper confirms earlier findings, e.g. that the CEECs have rapidly converged to the EU countries in

terms of business cycles and trade integration. In particular, business cycles in several CEECs (Hungary, Slovenia and, to a lesser extent, Poland) are strongly correlated with the business cycle in Germany, in the period since 1993. In this respect, it may seem that Hungary, Slovenia and possibly Poland, not however the Czech Republic and Slovakia, have made headway towards constituting an optimum currency area with the EU.

On the other hand, this paper shows that the observation period is still too short to conclude that the business cycles have already become similar. In particular, this period has been characterized by only few supply and demand shocks. Furthermore, the business cycle in the Czech Republic is not correlated with that in Germany. As the Czech Republic is quite similar to other CEECs, this indicates that country-specific shocks may still have significant effects on these economies.

To shed more light on this ambiguous result, I compute the potential correlation of the business cycle in Germany and in the CEECs using Frankel and Rose's (1998) relation between the degree of trade integration and the convergence of the business cycles of trading partners. These figures may be alternatively interpreted as 'EOCA indices' following Bayoumi and Eichengreen (1997).

As a result, the high degree of trade between the EU and the CEECs represents a sound base for business cycle convergence, and thus for a fulfillment of OCA criteria in the medium and long run. These results do not fully confirm the hypothesis that the CEECs constitute an optimum currency area with the EU already now, but it seems that they will fulfill OCA criteria to the same degree as current EU-members in future.

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