Bernhard Mahlberg, Ralf Kronberger

Eastern Enlargement of the European Monetary Union: An Optimal Currency Area theory view

I. Introduction

On January 1st 1999, eleven member states of the European Union commenced stage three of European Monetary Union (EMU), fixed the exchange rates of their national currencies and introduced the Euro as their single currency. Two years later, on January 1st 2001, Greece became the twelfth member of EMU. On January 1st 2002, the national central banks together with the European Central Bank (ECB) began circulation of Euro notes and coins and started to withdraw national currencies. This was finished by the end of the February 2002 and since March 1st 2002, the Euro has been the only legal means of payment for almost 320 million people in the twelve EMU countries.

In 1989, the Communist regimes collapsed throughout the region of Central and Eastern Europe. Besides the subsequent

establishment of democracies in these societies, the Central and Eastern European countries (CEEC) started to transform their economies from planned to market systems. In addition, they have oriented their interests towards the European Union (EU). Since 1994, ten CEEC have applied for EU membership and, from 1998 the European Commission has been negotiating with the first group of five countries (the "Luxembourg Group"). At the Helsinki Council meeting in December 1999, the EU decided to start negotiations with the rest of the CEEC (the "Helsinki Group"). Last June in Gothenburg, the European Council set itself the goal of completing the negotiations with some of the candidate countries by the end of 2002. First accessions should start at the beginning of 2004. Part of the accession process is the ratification of the Treaty of Maastricht[1] and accordingly, the member states are obliged to participate in the European Monetary Union if they fulfill all criteria.[2] This is also valid for the CEEC. Consequently, the question of EMU preparedness in the CEEC is becoming more and more important.

The Maastricht criteria are not identical to the Optimal Currency Area criteria as derived from economic literature. This branch of literature dates from 1961 when Mundell introduced in his seminal paper the theory of Optimum Currency Area (OCA). An OCA is characterized by a group of countries for which forgoing the exchange rate mechanism, as an instrument of correcting asymmetric shocks, is compensated by other economic policy instruments. In this paper, we address the issue whether the CEEC are a part of a European OCA or not. One of the OCA criteria is the similarity of business cycles among the countries participating in a currency union. The business cycles of the CEEC, as measured by the development of the Gross Domestic Product (GDP) and the Industrial Production (IP) index, are analysed and compared with the cycles of EU member states.

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1 In this analysis candidate countries Cyprus and Malta are not dealt with.

2 The United Kingdom and Denmark are exempt due to an opt-out clause. Sweden is not a member, as it did not participate in the European Monetary System.

II. Accession Criteria for EU and EMU membership

In 1993, at the Copenhagen European Council, the EU defined the membership criteria, often referred to as the Copenhagen Criteria, which requires that every candidate country has to achieve:

- the stability of institutions guaranteeing democracy, the rule of law, human rights and respect for, and protection of, minorities (political criterion);
- the existence of a functioning market economy, as well as the capacity to cope with competitive pressure and market forces within the Union (economic criterion);
- the ability to take on the obligations of membership including adherence to the aims of political, economic and monetary union (acquis communautaire criterion).

Accession negotiations are under way with twelve countries, ten from Central and Eastern European Countries (Estonia, Latvia, Lithuania, Poland, the Czech Republic, Slovakia, Hungary, Slovenia, Romania, and Bulgaria). Negotiations started on March 31st 1998 with six applicant countries - Hungary, Poland, Estonia, the Czech Republic, Slovenia and Cyprus. On October 13th 1999, the European Commission recommended to open negotiations with Romania, the Slovak Republic, Latvia, Lithuania, Bulgaria, and Malta. This was endorsed by Member States at the Helsinki Summit on December 12th 1999, with negotiations starting in February 2000. The European Council in Gothenburg (June 15th and June 16th 2001) affirmed their objective to complete negotiations by the end of 2002. The countries should thus participate as full members in the European Parliament's elections of 2004. The European Council in its meeting in Laaken in December 2001 named ten candidate countries to become EU members in 2004. By the end of July 2002, eight of ten CEEC had at least 25 of the 31 chapters closed.[3]

The Single European Act of February 17th 1986 and the Treaty of Maastricht of February 7th 1992 are the legal basis of EMU. The Single European Act establishes the objectives of EMU and the Treaty of Maastricht lays down the criteria every country has to fulfill, if it wants to join EMU.

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[3] See http://europa.eu.int/comm/enlargement/negotiations/pdf/stateofplay_july2002.pdf.

The four criteria are (TEC, Article 121):

- the achievement of a high degree of price stability; a member state has a price performance that is sustainable and an average rate of inflation, observed over a period of one year before the examination, that does not exceed by more than 1.5 percentage points that of, at most, the three best performing member states in terms of price stability;
- the sustainability of government finances; the planned or actual government deficit no higher than 3% of GDP at market prices and government debt around 60% of GDP at market prices;
- maintenance within the normal fluctuation margins of the exchange-rate mechanism of the European Monetary System (EMS), for at least two years, without devaluing against the currency of any other member state;
- the durability of convergence and of its participation in the exchange-rate mechanism is reflected in, for one year before entry, average nominal long-term interest rates that do not exceed by more than 2 percentage points that of, at most, the three best performing member states in terms of price stability.

According to the third criterion, new EU members can join EMU after at least two years of participation in the exchange-rate mechanism. Therefore, the CEEC may only join the EMU after the beginning of their third year of EU membership and not immediately after their accession to European Union.

Currently, none of the CEEC fulfill all the Maastricht criteria. Only Latvia and Lithuania fulfill the criterion of price stability. In all other CEEC inflation lies above the reference value. With respect to government finances the situation is better. Government deficit to GDP is below 3% in Bulgaria, Estonia, Latvia, Lithuania, and Slovenia. The criterion of government debt is fulfilled even better, in the year 2000/01 almost all CEEC had less than 60% of government debt to GDP ratios. Bulgaria being the only exception. As the CEEC can not be members of the European Monetary System, the third criterion is not applicable. However, in considering the exchange rate fluctuation of CEEC's currencies, vis-a-vis the Euro in the last two years, volatility is more than +/- 15 % for almost all CEEC. Only Estonia meets this exchange rate stability requirement. Finally, none of the CEEC have interest rates lower than the reference value. The Estonian interest rate comes closest to the EU standard (see Table 1).

Table 1: Maastricht-Convergence Criteria - CEEC, 2001

	price stability	**government financial position**		**exchange-rate**	**long-term interest-rate levels**
	consumer price index, percent change [1]	government budget deficit to gross domestic product	government debt to gross domestic product [2]	deviation against the Euro less than +/- 15%, 1999 - 2001 [3]	lending rate, in percent [4]
		in percent of GDP			
reference values	**3.3**	**3**	**60**	**yes**	**7.0**
Bulgaria	7.5	0.9	76.9	no	11.4
Czech Republic	4.6	7.1	17.3	no	7.6
Estonia	5.9	0.3	5.3	yes	7.3
Hungary	9.1	4.3	55.7	no	12.0
Latvia	2.5	1.8	14.1	no	8.5
Lithuania	1.4	1.7	23.7	no	8.9
Poland	5.6	4.3	40.9	no	17.9
Romania	34.1	3.5	22.9	no	51.3 [5]
Slovak Republic	7.4	4.5	32.4	no	11.4
Slovenia	8.5	1.2	25.8	no	14.0

[1] HCPI for EU-15. [2] Data of 2000. [3] instead of participation in the exchange-rate mechanism of the EMS, only EU member states can be member of the EMS. [4] long term interest rates for EU-15. [5] Treasury Bill Rate

Source: *European Commission* (2001a) for inflation and log term interest rates of EU-15, *European Commission* (2001b) for inflation and deficit of CEEC, *European Commission* (2001c) for government debt of CEEC, and *IMF* (2001) for exchange rates and lending rates of CEEC.

III. OCA Theory and EU Enlargement

A. Related OCA Research

The Optimal Currency Area (OCA) theory addresses the question whether a country benefits from joining a currency union. The establishment of a currency union has as a consequence the replacement of the national currency by a common currency. The exchange rate as an instrument to counteract asymmetric economic shocks is forgone. From this theory, criteria have been derived to help decide whether such a step is beneficial. The concept of the OCA goes back to *Mundell* (1961). Two countries, A and B, with a bilaterally fixed exchange rate are considered, where country B is hit by an asymmetrical negative demand shock. Prices and output in country B decrease, and unemployment results. According to Mundell, the adequate response for country B of monetary expansion would, under a fixed exchange rate regime, only be possible if country A would also adopt an expansive monetary policy. Absent the consensual monetary expansion labor mobility could also alleviate the problem. Workers moving from country B to A would reduce the excess supply of labor, reducing import demand in B and therefore reestablishing equilibrium in the current account.[4] Overall, fixed exchange rates or monetary union prove less advantageous, if countries face asymmetrical shocks and show little factor mobility. Since its introduction the OCA theory has been extended and several criteria added. Among others, *McKinnon* (1963) emphasized the meaning of the degree of openness for member countries and *Kenen* (1969) underlined the importance of product diversification.[5]

The main findings of the OCA theory show that when countries are different in economic structures, they are likely to face asymmetric shocks. In the absence of the exchange rate as an instrument, they need flexible labor markets (e.g. wage flexibility, labor mobility) so as to adjust for and prevent these shocks from leading to permanent unemployment. OCA theory also states that the cost of relinquishing the exchange rate instrument declines with

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[4] For an illustrative and detailed presentation of the Mundell approach, see *De Grauwe* (2000) 6 ff. For a critique on the Mundell see *Maes* (1992).

[5] For an overview of the theoretical and empirical OCA-literature see inter alia *Breuss* (1998) 183 ff; *Horvath* (2001b); and *Ishiyama* (1975).

the degree of openness of the country. For very open countries the exchange rate instrument loses much of its effectiveness to influence output and employment, and therefore to correct for asymmetric shocks. Thus, very open (and typically small) countries bear lower costs joining a monetary union than large, very closed economies. Conversely, the benefits of a single currency increase with the degree of openness of a country, because a larger proportion of trade involves exchange rate transactions (see also *De Grauwe/Aksoy* (1999)).

The empirical application of OCA theory has been well covered in economic literature. The preparedness of member states for European Monetary Union has been tested several times. Among others, *Bayoumi/Eichengreen* (1993) carried out an analysis of supply and demand shocks in the member states of the European Union using a technique developed by *Blanchard/Quah* (1989). A detailed list of related empirical research can be found in surveys, e.g. *Breuss* (1998), pp. 184 - 185.

In the last few years, OCA theory has also been applied to the CEEC to discuss the question of joining EMU. The main issues in this literature are the timing of monetary union membership and the proper interim exchange rate regime. In this section, we provide an overview of the studies recently written on the former.

Breuss (1999) was one of the first to deal with the preparedness of the CEEC. Due to a lack of sufficiently long time series data, he concentrated on a survey of the theoretical and empirical OCA-literature and the analysis of how far the CEEC fulfill the Maastricht criteria.

De Grauwe/Aksoy (1999) investigated the nature of the asymmetric shocks in the countries Czech Republic, Slovak Republic, Slovenia, Hungary, and Poland over the period 1992 to 1995. They used a panel data model to determine the extent to which output growth (measured by GDP and IP) and employment in the CEEC have differed from the European Union. The goal was to separate the common (international) and the country specific (asymmetric) sources of shocks in output and employment, through the application of static and dynamic models. The static model showed that the contribution of common shocks to total variability was generally higher than country specific shocks, thus changes in output and employment tend to be dominated by common shocks. This was most pronounced for employment changes and much less so for industrial production, where common and country specific

shocks were equally important. On average, changes in output and employment of the CEEC differ significantly from the EU. This difference lied in the time patterns of output and employment deviating substantially between the CEEC and EU countries. The dynamic model showed significantly different cycles for industrial production in all CEEC, except Slovenia. However, GDP and employment cycles had no significant time varying effects. They concluded that some Central and Eastern European countries were not part of an European OCA and that Slovenia represented the most ideal candidate for EMU.

Boone/Maurel (1999) analyzed the similarity of the CEEC business cycles to identify those countries that would not suffer from joining monetary union. The sample included five current EMU members, the EU as a whole, and the candidates of Czech Republic, Slovak Republic, Hungary, and Poland. Two criteria were used, the percentage of domestic business cycles explained by a common German or EU shock and the correlation of the domestic impulse responses. As a proxy for economic activity, time series data of monthly unemployment rates was used. The low quality of data was the weak point in this study. Labor market data from the CEEC is particularly unreliable.[6] To detrend the series, they applied the Hodrick Prescott filter. The analysis of the shocks was done in a two step process, first by identifying common shocks by computing ARMA regressions. The shock that affects Germany or the EU was the residual of the identified ARMA process. The second step was analyzing the extent to which the CEEC fluctuations were explained by the common shock by regressing the estimated unemployment series on the common shock. They found that the business cycles of the CEEC were similar enough to that of Germany and to a minor extent to that of the EU permitting an enlargement of the EMU. They showed that the percentage of CEEC business cycle fluctuations explained by a German shock was very high and the impulse responses were positively correlated. These findings suggest that the CEEC would not suffer from a common monetary policy.

Fidrmuc (2001) tested the endogeneity hypothesis of OCA criteria using the approach of *Frankel/Rose* (1998) in a cross-section of thirteen EU member states and five Central and Eastern candidate countries. According to the endogeneity hypothesis,

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[6] See *UNECE* (2001b) p. 14.

business cycles are becoming increasingly similar across countries as a consequence of close trade links, particularly high levels of intra-industry trade. Similar business cycles create good preconditions for policy integration and the creation of a currency area. These were evaluated using time series data from 1993 to 1999 for five central European countries Czech Republic, Hungary, Poland, Slovak Republic, and Slovenia, as well as of EU member states. Some caveats to this work are: First, the observation period was short relative to the length of the cycles. Second, the trade regime change has not taken place at one point in time but is continuous. The opening up of the markets in the CEEC vis-à-vis the EU took place sector per sector. Third, during the examination period different trade and exchange rate systems were in place which have influenced the data. This made it difficult to isolate the effects of individual regime shifts and draw accurate conclusions. Fidrmuc concluded that intra industry trade caused convergence of business cycles and an increase in bilateral trade intensity. Also, the OCA endogeneity hypothesis was supported, as intra industry trade is shown as positively correlated with total trade. The endogeneity of OCA criteria implied a comparable degree of business cycle harmonization of CEEC with EU countries as between current EU members over the medium term.

Horvath (2001a) developed the work of *Bayoumi/Eichengreen* (1983) and adopted the Blanchard Quah decomposition to identify supply and demand shocks to GDP for all the CEEC (with exception of Bulgaria and Romania) and the four largest EU members. He correlated the supply and demand shocks to analyze the extent of synchronization between the business cycles and used a uniform lag length of 2 and the first difference of the two variables (GDP and GDP deflator). These factors reduced the number of degree of freedom for tests of significance considerably. The applied method in this study does not seem to be ideal for the short time series available. He found that idiosyncratic shocks prevailed between the largest EU member states and the candidate countries, suggesting a potentially costly process of adjustment when these countries join the European Monetary Union.

Fidrmuc/Korhonen (2001) tested if the CEEC belong to an Optimal Currency Area with Europe using the same approach as *Horvath* (2001a). In contrast to *Horvath*, the sample was extended to the whole of the EU (except Luxembourg), three European non-EU member states, and selected non European countries. The

sample included nine of the ten CEEC (one country more than Horvath). They used quarterly data of GDP and GDP deflator, where available, or quarterly IP data. Some caveats to this study are: First, *Fidrmuc/Korhonen* mixed GDP and IP data so that they correlated the shocks found in GDP data with shocks found in IP data. Second, the data contained too few observations relative to the number of explaining variables. In addition to GDP or IP and inflation, they inserted three dummies for seasonal adjustment and chose four lags, leaving only a few degrees of freedom for tests of significance. Finally, *Fidrmuc/Korhonen* computed pairwise correlation coefficients for time series GDP and inflation for each CEEC with each of the EU countries, and compared correlation coefficients for time series with different lengths. Their main findings are that some accession countries showed a relatively high correlation of the underlying shocks with the Euro area. However, even for many advanced accession countries, the shocks remained significantly idiosyncratic.

Korhonen (2001) investigated the relationship between short-term business cycles in the CEEC and EU member states by applying vector autoregression models. His analysis was based on monthly time series data of industrial production and avoided having too few observations, relative to the number of explanatory variables. However, the data was less representative as industrial production accounts for less than half of production in the CEEC and the EU. A clear difference was found in the degree of correlation of candidate countries. For Hungary and Slovenia, Euro area shocks accounted for a large proportion of variations in industrial production, which indicates high integration. Also, the Czech Republic and Estonia were reasonable well integrated with the business cycle of the Euro area, while Lithuania and Romania appeared to have little integration. A lower level of integration implies that joining monetary union could result in larger costs, unless their business cycles converge closer with the Euro area.

Finally, *Boreiko* (2002) estimated the readiness of the ten CEEC for EMU or for unilateral Euro adoption using a fuzzy clustering algorithm based on variables suggested alternatively by the criteria of the Maastricht Treaty and OCA theory. The variables for the analysis on the basis of the OCA theory were the correlation in business cycles, the volatility of bilateral exchange rate of national currencies against the Deutsche Mark, the ratio of trade with the EU over trade with the world, and the differential of the CEEC's

inflation to the EU-15. Business cycles are extracted from monthly Industrial Production indices (except monthly unemployment for Bulgaria and quarterly GDP for Estonia) using the Hodrick-Prescott filter and, alternatively, the twelfth differences of the logs of the series. The correlation coefficients computed for the whole observation period of 1993 to 2001 were found to be low for the most of the CEEC. Hungarian and the Slovenian business cycles have the highest correlation with the German cycle to the extent of around 0.5. Correlations over subperiods of 1997 to 2001 and 1999 to 2001 identified substantial increases over time and this was interpreted as a tendency towards real convergence. However, these subperiods comprised, at most, of only one full business cycle and were consequently too short for sound conclusions concerning convergence to be drawn. The overall results of this analysis, according to OCA theory, showed the presence of three groups of accession countries. The highest converged group consisted of the Czech Republic, Hungary, Estonia, and Slovenia, followed by Latvia, Lithuania, and Romania and then Bulgaria and the Slovak Republic.

B. Measuring business cycles in the CEEC

1. Method

Several concepts and methods have been used to analyze business cycles. Four groups of methods can be distinguished: The direct measure of cycles from survey data, non-structural (or statistical) methods, structural (or theory based) methods, and multivariate methods. *Direct measurement* identifies business cycles by comparing the actual capacity utilization rate and the actual output with the degree of capital utilization and optimum output with the absence of tensions in the goods market. *Non-structural measures* include all methods that are based on statistical procedure rather than referring explicitly on an economic theory. The Hodrick-Prescott filter, as used in this paper, and the Beveridge Nelson decomposition are the most common examples of this type. In contrast the *structural methods* rely on specific economic theory and two broad groups can be distinguished within this category. First, multivariate structural methods combined with theoretical assumptions constitute the so-called Structural Vector Auto Regressions (SVAR), such as the approach developed by *Blanchard/Quah* (1989). Second, structural methods can be based on an aggregate production function. *Multivariate methods* of

business cycle analysis consist of multivariate versions of non-structural or statistical approaches, such as multivariate Beveridge-Nelson decompositions and multivariate Hodrick Prescott filter.[7]

For this paper the use of the *Blanchard/Quah* decomposition was considered. This approach (a SVAR method) decomposes variations in price level and activity into supply and demand shocks. Supply shocks are assumed to have permanent effects on output, whereas demand shocks have only transitory effects. Both supply and demand shocks have only transitory effects on the price level. A supply shock depresses the price level, whereas a demand shock increases it.

The drawbacks of the *Blanchard/Quah* decomposition are that it is incapable of distinguishing between shocks to the goods and money market. No distinction is made between endogenous and exogenous shocks. A shock introduced through stabilization policies will appear in the same way as an external demand shock. The approach has often been challenged with respect to its identification restrictions. VAR methods require long time series data to overcome the detrimental small sample properties of this method (*Licandro*, 1998). Large continuous time series of data for emerging and transition economies, such as the CEEC, do not often exist and frequently exhibit structural breaks. Too short time series, structural breaks and different orders of time series integration rendered this method inappropriate.[8] Moreover the study would be subject to the same drawbacks as *Fidrmuc/Korhonen* (2001).

The *Blanchard/Quah* method as well as the *Beveridge/Nelson* (1981) decomposition were considered for the analysis of our data set. The former method could not be applied since the inflation rates of the CEECs were not of the same order. The *Beveridge/Nelson* decomposition – a less sophisticated univariate time series decomposition – proved to be inappropriate due to similar reasons.

Therefore, the widely applied Hodrick-Prescott filter was selected to decompose the time series into its trend and cyclical

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[7] See *Chagny*/*Döpke* (2001) for a comprehensive survey on methods to identify business cycles.

[8] Real GDP must be integrated to the order of one (I(1)) and the GDP deflator integrated to the order of zero (I(0)) for applying the approach of *Bayoumi/Eichengreen*. A series is said to be integrated to the order of one, denoted I(1), if after taking the first difference a stationary process results.

components. The trend is identified by the following convex minimization.

$$\underset{\{t\}_t}{Min} = \sum_{t=1}^{N} (z_t - t_t)^2 + m \sum_{t=3}^{N} \left[(t_t - t_{t-1}) - (t_{t-1} - t_{t-2}) \right]^2$$

The first term contains the difference between the original series z_t and the trend τ_t, which is interpreted as the degree of adjustment. The second term indicates the degree of variability by means of the second differences of the trend τ_t. The coefficient μ reduces the acceleration of the trend. If μ equals zero, the original series and the trend are equal. If μ tends toward infinity the trend will become linear. We have chosen μ to be equal to 1600, which is standard for quarterly data analyses.

In our analysis the cycle c_t is defined as the difference between the original time series, either GDP or IP, and its trend:

$$c_t = z_t - t_t$$

Cycles were identified by determining the turning points. The turning points have to be proceeded either by two subsequent negative or positive values of the level of growth.[9] Ideally, a whole set of variables, such as whole sale, investments, savings, etc. as suggested by *Moore* (1983)[10] would allow for a more sophisticated identification. However, due to a lack of data this was not possible.[11] Furthermore, business cycles of transition economies are harder to analyze as cycle length are often shorter and turning points are harder to identify due to phenomena such as two consecutive peaks. The *Sachs/Larrain* procedure was followed as closely as possible, so that an upturn was sustained as long as the next downturn could be separately identified by two consecutive negative values.

2. Data

This paper uses quarterly time series data of Gross Domestic Product (GDP) at constant 1995 prices and Industrial Production (IP) Indices of CEEC and EU member states. Data availability and quality is well known to be difficult, and as such time series of both

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9 *Sachs/Larrain* (1995) 670 ff.

10 *Breuss* (1984) was one of the first to identify the Austrian business cycle by similar methods.

11 According to *Tichy* (1976) 45 ff. GDP is easily justifiable as a single business cycle indicator as changes in GDP reflect changes in many of the variables suggested by NBER.

indicators are used.[12] The results obtained from the two indicators are different due to factors like the sensitivity to external trade. Industrial sectors usually operate in more competitive markets, because their products are typically tradable. They are more strongly related to EU countries through trade and have to react more quickly to changes in the economies of the EU. Therefore, variations in the IP are expected to have higher correlation than GDP business cycles. The IP is less representative than GDP as it incorporates only 25 to 41 percent of the economic activities in the CEEC (1999 data, see *UNECE* (2001a), p. 106).

The main source of data for the Central and Eastern European candidate countries is the United Nations Economic Commission for Europe (UNECE), which has provided data of different lengths for different countries.[13] The IP data for the EU countries were obtained from the OECD (database "Main Economic Indicators"). IP data for Denmark and Luxembourg was obtained from Eurostat, as the OECD does not provide IP data for these countries. GDP data is also from Eurostat. GDP for the CEEC was measured in national currencies and for EU countries in million Euro. Other sources, such as the OECD, Eurostat and national statistical offices were considered as sources of data for the CEEC but the data was limited in its use. OECD data for the Czech Republic and Slovakia has substantial differences compared with data from other sources and Eurostat could only provide data for six of the ten CEEC. Availability and consistency were problems with data from national statistical offices.

Available quarterly GDP data for accession countries usually spans from 1994 or 1995 to the end of 2000 or 2001. Quarterly IP time series for the CEEC start uniformly at the beginning of 1993.[14] For most countries, the data therefore omits the period of recession related to transformation in the accession countries. We have used EU GDP data for the last ten years for consistency with the accession countries, even though for some EU countries longer time

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[12] Cross correlations between GDP and IP are not applied. Correlations are only applied within the two subsets.

[13] This data set comprises not only GDP and IP time series but also data on the components of GDP at the spending side of national accounts (consumption, investment, ...) of all candidate countries except Slovenia.

[14] Quarterly IP data is used to facilitate the computation of correlations between the GDP and IP cycles.

series data is available. For Germany, Ireland, Portugal and Sweden consistent quarterly GDP data is available from 1991, 1997, 1995, and 1993, respectively. Quarterly GDP data of Greece and Luxembourg was not available from Eurostat.

3. Empirical Results

In this paper we deconstruct quarterly GDP data of eight Central and Eastern European Candidates (CEEC) and twelve members of the European Union (EU) in their trend and cyclical components by applying the Hodrick-Prescott filter.[15]

The GDP data for Bulgaria could not be used because of a 29% decline in GDP between the end of 1995 and beginning of 1997 which was identified as structural break in the time series. Furthermore, in the years before and after this structural break, GDP alternated between short periods of increases and decreases, which could not be interpreted as the upswings and downswings of normal business cycles of a market economy. It has been concluded that the transformation process has not been completed in this country before the beginning of observation period but were still continuing and we have therefore decided to exclude Bulgaria from our analysis. For Romania, quarterly GDP data was only available from 1998:1 to 2000:3. This is clearly too short to enable business cycle analysis. Quarterly GDP time series of Luxembourg and Greece were not available and Irish GDP data was available from 1997. These three EU countries have also been excluded from our analysis.

The logarithm of GDP was used. A deconstruction of the main components of GDP has also been undertaken to explain the cycle of the GDP. All data was seasonal adjusted by using the Tramo Seats method.

Additionally, the paper deconstructs quarterly Industrial Production (IP) index data for all Central and Eastern European candidates, except Bulgaria, and fourteen EU members with the Hodrick-Prescott filter. Bulgarian IP data suffered from a similar problem as GDP data. The data showed a reduction of around 60 percent of industrial production in 1996, constituting a structural break. Before and after this break, as with the GDP data, very short periods of increases and declines were found, which did not reflect normal business cycles. Therefore this data was excluded from our

[15] The computations were done using the computer software package E-Views 4.0.

analysis. Luxembourg was also excluded because of the small size of its economy. In general, deconstructions were started at the beginning of the time series. The only exceptions to this were Latvia and Lithuania where a strong decline of the Industrial Production index was observed at the beginning of the observation period. This decline was interpreted as the residual part of recession as a result of economic transformation and not as a downswing of a business cycle. Therefore the deconstruction was started in 1994 and 1995 for Lithuania and Latvia respectively. All data was seasonally adjusted using the Tramo Seats method.

The results of the Hodrick Prescott decomposition are shown and will briefly be discussed country by country. The relationship between the cycles of the CEEC and EU countries will be discussed with reference to the OCA theory.

a.) Business Cycles in the CEEC Candidate Countries

Figure 1 and Figure 2 show the time of beginning and ending and the length of the business cycles derived from our analyses of GDP and IP in the CEEC. The length of GDP and IP cycles differ across countries, with peaks and troughs occurring at different times. As shown below, cycles in transition countries tend to be shorter than in fully developed market economies, possibly due to more frequent endogenous policy shocks caused by the stabilization of their economies. We can also observe that within individual countries GDP and IP cycles differ. The only common movement observed is the downswing in the second half of 1998 caused by a crisis in Russia influencing all cycles except Slovenian GDP. The Slovenian economy is relatively less intertwined with the Russian economy than many other eastern European economies. In Table 2, we show the correlation of the GDP and IP business cycles with each other and with cycles of the main components of GDP. The business cycles are analyzed on a country by country basis to explain the underlying relationships.

Figure 1: Lengths of GDP-cycles

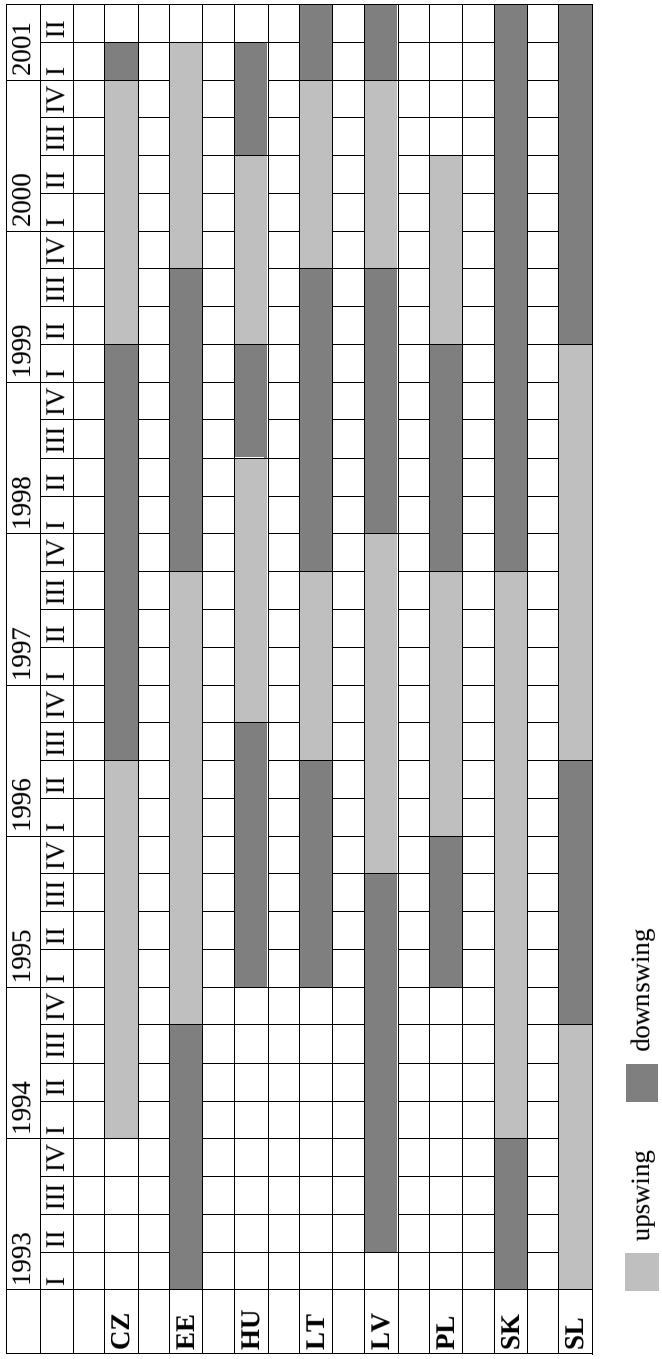

Figure 2: Lengths of IP-cycles

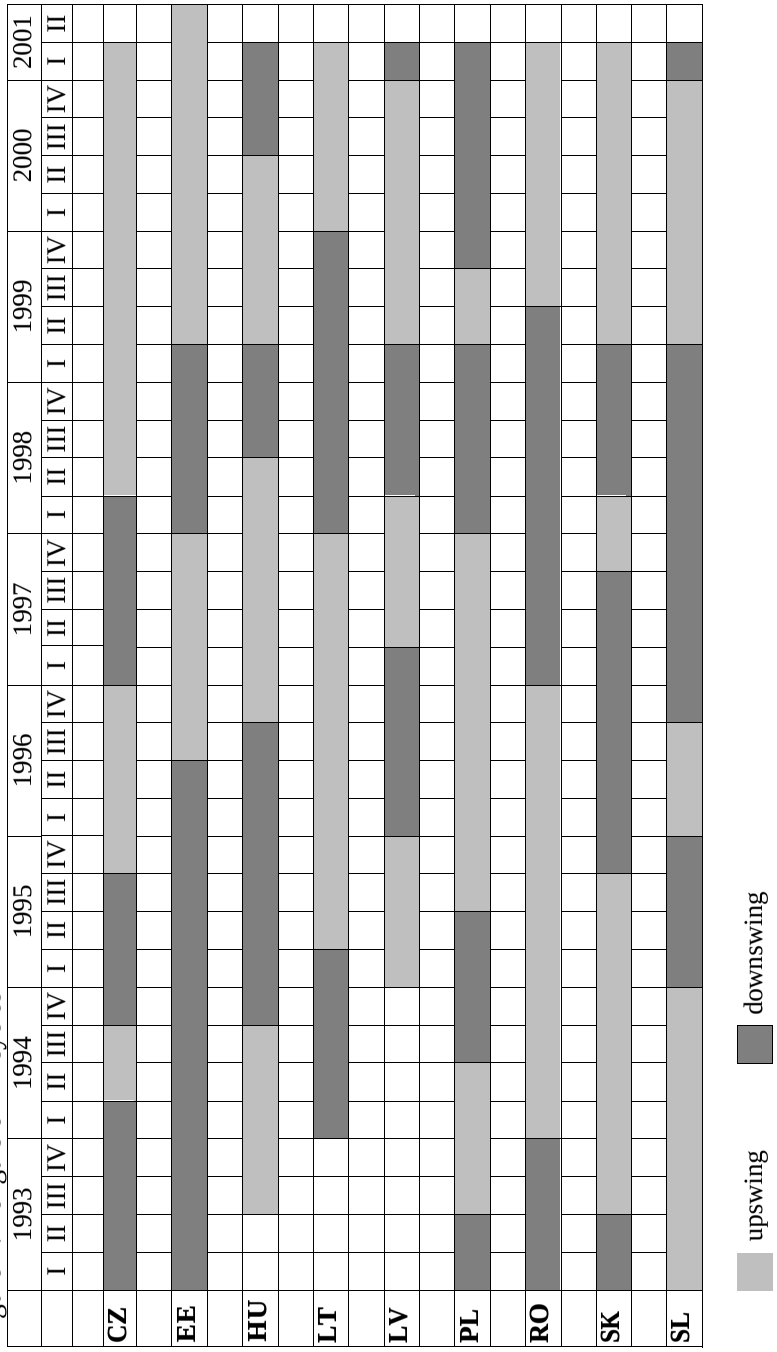

Table 2: Correlations of GDP cycle, IP cycle and GDP-component-cycles

	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Slovak Republic	Slovenia
	correlation coefficients with GDP cycles							
private consumption	0.77	0.72	0.07	0.29	0.60	0.49	0.84	--
public consumption	0.24	-0.16	-0.24	-0.04	0.65	0.56	0.48	--
capital formation	0.93	0.84	0.19	0.29	0.74	0.56	0.61	--
Exports	0.51	0.63	0.15	0.69	0.79	0.31	-0.16	--
industry production	0.24	0.88	0.81	0.79	0.73	0.65	0.34	0.36

For the *Czech Republic*, one and a half GDP business cycles can be identified (two upswings from 1994:1 to 1996:2 and from 1999:2, one downswing from 1996:3 to 1999:1). The downswing took place during a currency and financial crisis in 1997 and the subsequent crisis in Russia in the second half of 1998. These cycles are strongly correlated with the cycles of investment and private consumption and, to a lesser extent, exports. The high correlation of investment was expected, as the investment to GDP ratio is the highest of all CEEC. The recession 1997 and 1998 was caused mainly by the reduction in investment caused by their sensitivity to financial crisis, the main reason for the downswing. The correlation with the consumption cycle is high because this is the largest GDP component. The business cycles derived from industrial production indices are different from GDP business cycles and their correlation is low because industrial production data does not contain investment and consumption activities as well as production activities of branches not included in the industrial sector. The industrial production business cycles are strongly correlated with the export cycle because industrial sectors are particularly exposed to external trade, as products are mainly tradable goods.

In *Estonia* we identified two complete business cycles (two upswings from 1994:4 to 1997:3 and from 1999:4, two downswings from 1993:1 to 1994:3 and 1997:4 to 1999:3). Further investigation shows strongly positive correlation with the cycles of the investment, private consumption, and export as well as mild negative correlation with government expenditure cycle. The correlation with exports is particularly meaningful, as Estonia is a small open economy. Russia used to be an important trade partner, until 1998, with over 10 percent of total exports. The cycle derived from industrial production is similar to the cycle derived from GDP and the two are highly correlated (around 0.88). The IP business cycles demonstrate similar correlations to GDP with the other variables examined.

Two and a half business cycles (two upswings from 1996:4 to 1998:2 and 1999:2 to 2000:2, three downswings from 1995:1 to 1996:3, from 1998:3 to 1999:1 and from 2000:3) were identified during the observation period in *Hungary*. The GDP business cycle

is not correlated with any of its components.[16] A correlation of 0.8 indicates that the industrial production cycle is similar to the GDP cycle. The IP cycle is also relatively less correlated with the cycle of the components of GDP, in a similar way to in the Czech Republic.

The *Latvian* economy went through two complete cycles, with two upswings (from 1995:4 to 1997:4 and from 1999:4 to 2000:4) and two downswings (from 1993:2 to 1995:3 and from 1998:1 to 1999:3). The volatility of the business cycle is higher than in other countries and there is a high correlation with the export cycle. Similar to Estonia, exports play a major role in the Latvian economy and Russia used to be an important trade partner until 1998. Exports are highly dependent on the development of the Russian economy. Correlations with cycles of other GDP components are low or even slightly negative (e.g. government expenditure cycle). The IP cycle is highly related to the GDP cycle, with a correlation of 0.79.

For *Lithuania* we found also two complete cycles (two upswings from 1996:3 to 1997:3 and from 1999:4, two downswings from 1995:1 to 1996:2 and from 1997:4 to 1999:3). Exports have the highest relative correlation although government expenditures and investment are also highly correlated with the GDP cycle (above 60 percent). The IP cycle and the GDP cycles are correlated with 0.73. The IP cycle is quite strongly correlated with the export cycle. The influence of exports on the business cycle is high because Lithuania is a small open economy, with a high proportion of exports to GDP. Like for the economies of the other two Baltic states the exports to Russia used to be particularly important until 1998.

The analysis of *Polish* GDP revealed two complete business cycles (upswings from 1996:1 to 1997:3 and from 1999:2, downswings from 1995:1 to 1995:4 and from 1997:4 to 1999:1). We also found high correlation with the investment cycle, the government expenditure cycle and the private consumption cycle. The correlation with the export cycle is low, as Poland has the lowest of proportion of exports to GDP of all CEEC due to its large domestic market. The business cycles drawn from industrial

[16] This is a relatively uncommon phenomenon for an industrialized economy and maybe be influenced by the transition to a market economy or statistical anomalies.

production indices and from GDP have slightly lower correlation than in the Baltic states and Hungary.

As mentioned before, for *Romania*, a lack of quarterly GDP data meant that only industrial production business cycles could be derived. We have identified two business cycles from the available data, two upswings (from 1994:1 to 1996:4 and from 1999:3) and two downswings (from 1993:1 to 1993:4 and from 1997:1 to 1999:2). The recession in 1997 to 1998 can be explained by war in the former Yugoslavian countries and, to a lesser extent, the crisis in Russia.

In the *Slovak Republic*, we found a strong downswing after separation from the Czechoslovak Republic (1992), one upswing afterwards, and a second downswing from the end of 1997 to the end of the observation period. The GDP cycle is highly positively correlated with the investment and private consumption cycles and has slight negative correlation with export cycle. The Slovak industrial production business cycle is mildly correlated with the GDP cycle and the other variables for the same reasons as in the Czech Republic.

For *Slovenia*, a sharp decline was found in the GDP business cycle in 1992, at the beginning of the observation period, which is clearly a consequence of its separation from Yugoslavia and their short war. Following this downturn, a further one and a half cycles, with one upswings (from 1996:3 to 1999:1) and two downswings (from 1994:4 to 1996:2 and from 1999:2), were identified. Due to the lack of data, we can not analyze the various components of GDP for correlations. In Slovenia, the GDP business cycle was not influenced by the Russian crises, whereas the IP cycle was affected. The business cycles derived from industrial production and GDP are not highly correlated (36 percent) for similar reasons to the Czech Republic and Slovak Republic. The remarkably low relationship between the IP and GDP business cycles is interpreted as a sign of high state of development within the economies.

b.) Do the business cycles of the CEECs and the EMU members correlate?

In this section we investigate the relationship between the business cycles in the CEEC candidate countries and the EU member states to show the preparedness of the CEEC for joining EMU. According to Mundell OCA criteria, countries could benefit from joining a currency union if their business cycles are highly

correlated. We have computed the correlation coefficients of both the GDP and IP business cycles between the CEEC and the EU countries. The boundary between relatively high and relatively low correlation lies at 0.5.

Table 3 shows the correlation of the GDP business cycles in the CEEC and the EU member states. According to the results of our analysis the business cycles in most of the CEEC are more or less strongly related to other CEEC, but only correlated to a minor extent with members of EMU. Only the cycles of the three Baltic states and Poland are strongly correlated with Finnish cycle. This is probably due to their short geographical distance and resulting significant levels of trade with Finland. Only the Hungarian business cycle is positively correlated with the cycles in the EMU countries Belgium, France, and Italy. The correlation with the German business cycle is also quite high but slightly lower than 0.5. On this basis, Hungary is the highest integrated candidate country. However, its integration can be judged as not strong enough to be a part of a European OCA. This result confirms the results of *Fidrmuc/Korhonen* (2001) which also identifies Hungary having the most synchronized business cycle. The Czech, Slovak and Slovenian business cycles are not positively correlated with cycles in any EMU member states. Negative correlations with a few EMU countries are displayed by the Czech and Slovak Republics. The Polish and Slovak business cycles, as well as the cycles of the three Baltic states, are related to the cycles of the EU member United Kingdom and negatively correlated with the one in Sweden, but these countries are not EMU members.

From these results, we conclude that none of the GDP business cycles of the CEEC are correlated enough to identify them as a part of a European OCA. Consequently, these countries would be unlikely to benefit from joining the European Monetary Union, as accession would cause high adjustment costs.

Table 3: Correlation matrix of GDP business cycles in the CEEC´s candidate countries and in the EU (to be continued)

	CZ	EE	HU	LV	LT	PL	SK	SL	AT	BE
Czech Republic (CZ)	1	-0.12	-0.38	-0.19	-0.06	0.08	0.50	-0.11	-0.10	-0.11
Estonia (EE)		1	-0.04	0.94	0.83	0.83	0.51	0.03	-0.12	0.41
Hungary (HU)			1	-0.07	-0.13	-0.18	-0.46	0.34	0.24	0.61
Latvia (LV)				1	0.85	0.90	0.49	0.01	-0.23	0.43
Lithuania (LT)					1	0.74	0.62	-0.08	-0.28	0.17
Poland (PL)						1	0.56	-0.02	-0.18	0.46
Slovak Republic (SK)							1	-0.29	-0.34	-0.15
Slovenia (SL)								1	0.01	0.40
Austria (AT)									1	0.21
Belgium (BE)										1
Denmark (DK)										
Finland (FI)										
France (FR)										
Germany (DE)										
Italy (IT)										
Netherlands (NL)										
Portugal (PT)										
Spain (ES)										
Sweden (SE)										
United Kingdom (UK)										

Table 3 (continued): Correlation matrix of GDP business cycles in the CEEC's candidate countries and in the EU

	DK	FI	FR	DE	IT	NL	PT	ES	SE	UK
Czech Republic (CZ)	0.28	-0.28	-0.57	0.23	0.24	-0.71	-0.30	-0.82	-0.15	0.31
Estonia (EE)	0.27	0.76	-0.09	0.18	0.29	0.37	0.15	0.34	-0.44	0.55
Hungary (HU)	0.23	0.13	0.75	0.46	0.57	0.18	-0.01	0.36	0.77	0.32
Latvia (LV)	0.27	0.84	-0.15	0.08	0.20	0.37	0.28	0.40	-0.52	0.57
Lithuania (LT)	0.16	0.79	-0.19	0.01	0.20	0.09	0.40	0.21	-0.45	0.44
Poland (PL)	0.36	0.68	-0.25	0.16	0.19	0.25	0.23	0.21	-0.60	0.61
Slovak Republic (SK)	0.26	0.25	-0.62	-0.01	0.16	-0.42	0.03	-0.39	-0.57	0.46
Slovenia (SL)	0.16	0.16	0.14	0.31	0.20	0.11	-0.15	0.16	0.18	-0.01
Austria (AT)	-0.11	-0.38	0.67	0.33	0.28	0.45	-0.38	0.39	0.43	-0.21
Belgium (BE)	0.38	0.43	0.39	0.59	0.59	0.35	-0.06	0.34	0.25	0.64
Denmark (DK)	1	0.25	-0.06	0.44	0.50	-0.07	0.25	0.02	-0.01	0.56
Finland (FI)		1	-0.04	0.04	0.24	0.27	0.52	0.36	-0.31	0.46
France (FR)			1	0.30	0.30	0.55	-0.08	0.61	0.66	-0.11
Germany (DE)				1	0.45	-0.02	-0.36	0.03	0.26	0.41
Italy (IT)					1	-0.03	-0.04	0.06	0.52	0.64
Netherlands (NL)						1	0.08	0.86	-0.02	-0.17
Portugal (PT)							1	0.34	-0.13	0.02
Spain (ES)								1	0.12	-0.12
Sweden (SE)									1	-0.03
United Kingdom (UK)										1

Furthermore, our results show the cycles of the *Czech Republic* and the *Slovak Republic* are positively correlated with each other. The reason for this is historical, as they were part of a common federal state until 1991. The Czech business cycle is not related to any other business cycle of CEEC. The Czech economy is a small open economy with external trade oriented towards the EU and with only a small proportion of exports to its former CMEA partners. The *Hungarian* cycle is slightly negatively correlated with the Slovakian cycle, with a coefficient of just below 0.5, and not correlated with cycles of any other CEEC. The *Slovenian* business cycles are not found to be correlated with any other candidate country, largely due to their distinctive economic policies during the transition period and in the last few years.[17] Their economic policy has been characterized by steady reform, thus avoiding shocks, combined with prudent exchange rate policy and balanced budgets. Moreover, the Slovenian economy is less connected to the Russian economy, being geographically further away and was therefore less influenced by Russian crises. Of the CEEC, the Czech, Hungarian and Slovenian economies are the most advanced and relatively more oriented towards the industrialized countries in the EMU. This is probably the reason for their low correlation with the business cycles of other CEEC. However, even these countries do not have sufficiently similar economic structures to EMU countries or synchronized GDP business cycles.

Our results also show another group of countries for which the cycles are more or less strongly correlated together. This group consists of the three Baltic states (Estonia, Latvia, and Lithuania), Poland and the Slovak Republic. All these countries also have positive correlation with the cycle of the EMU country Finland and the EU member United Kingdom, as well as negative correlation with the cycle of the non EMU country Sweden.[18] These countries are considered to be at a similar state of economic development, with similar structures, and consequently have synchronized GDP

[17] If the correlation coefficients of Slovenian GDP cycle had been computed only with EU members for which GDP data is available for the same length as the Slovenian time series, these results would be different and the Slovenian cycle would have been related to Belgium, Germany, and Spain.

[18] The Slovak cycle is not directly related with the Finish cycle, but the Slovak Republic belongs to this group because of its strong synchronization of its cycle with that in the Baltic states.

business cycles and equally high GDP per capita. This is a group of less advanced countries compared to the first group of the Czech Republic, Hungary and Slovenia with lower GDP per capita, different economic structures and cycles lesser synchronized with the cycles of EMU member states. As no statistical relationship with the larger EMU economies has been identified, it is unlikely these countries could benefit from joining EMU at the moment. However, the *Estonian*, the *Latvian* and the *Lithuanian* cycles are particularly strongly correlated with each other because these countries were previously part of a single country and this connection still influences their development. These three countries would benefit now from forming a currency union with each other.[19]

Table 4 displays the relationship of the IP business cycles in the CEEC's candidate countries with that in the EU member states. As expected, the correlation coefficients are higher on average than the correlations of the GDP business cycles, due to the higher level of international trade in industrial products. These results reveal that IP business cycles in most candidate countries are correlated with the industry cycle in Germany, the largest economy in European Monetary Union. In contrast to the GDP cycle, the IP cycle correlations indicate that these countries might benefit from forming a currency union with Germany. The only two exceptions are Romania and Lithuania, which is due to their relatively lower levels of trade integration with EMU member states. According to Mundell OCA theory, these countries are the only candidates, which should definitely remain outside of EMU. These results confirm the findings of *Korhonen* (2001).

[19] A third group of countries with similar business cycle consisting of Romania and Bulgaria may have been identified if sufficient data were available.

Table 4: Correlation matrix of IP business cycles in the CEEC's candidate countries and in the EU (to be continued)

	CZ	EE	HU	LV	LT	PL	RO	SK	SL	AT	BE
Czech Republic (CZ)	1	0.73	0.17	0.89	0.67	0.67	0.19	0.63	0.33	0.12	0.44
Estonia (EE)		1	0.25	0.73	0.43	0.77	-0.01	0.40	0.27	0.26	0.56
Hungary (HU)			1	0.03	-0.16	0.28	-0.09	0.28	0.53	0.86	0.39
Latvia (LV)				1	0.64	0.62	0.05	0.42	0.36	0.04	0.45
Lithuania (LT)					1	0.11	0.18	0.67	0.10	-0.20	0.16
Poland (PL)						1	0.11	0.36	0.38	0.35	0.65
Romania (RO)							1	0.51	0.13	-0.35	0.14
Slovak Republic (SK)								1	0.33	0.20	0.49
Slovenia (SL)									1	0.54	0.52
Austria (AT)										1	0.51
Belgium (BE)											1
Denmark (DK)											
Finland (FI)											
France (FR)											
Germany (DE)											
Greece (GR)											
Ireland (IE)											
Italy (IT)											
Netherlands (NL)											
Portugal (PT)											
Spain (ES)											
Sweden (SE)											
United Kingdom (UK)											

Table 4 (continued): Correlation matrix of IP business cycles in the CEEC's candidate countries and in the EU

	DK	FI	FR	DE	GR	IE	IT	NL	PT	ES	SE	UK
Czech Republic (CZ)	0.45	0.28	0.32	0.60	-0.37	0.25	0.53	0.13	0.01	0.08	0.42	0.12
Estonia (EE)	0.37	0.39	0.31	0.67	-0.41	0.05	0.35	-0.28	-0.23	0.28	0.29	-0.05
Hungary (HU)	0.38	0.63	0.34	0.76	-0.09	0.42	0.43	0.12	-0.60	0.34	0.39	0.17
Latvia (LV)	0.32	0.20	0.48	0.51	-0.21	0.06	0.41	-0.05	0.09	0.18	0.29	0.15
Lithuania (LT)	0.09	0.08	0.15	0.30	-0.24	0.11	0.30	0.07	0.28	-0.06	0.30	0.02
Poland (PL)	0.47	0.26	0.34	0.51	-0.37	-0.01	0.49	0.08	-0.11	0.28	0.29	0.29
Romania (RO)	0.27	0.00	-0.64	-0.06	-0.64	0.04	0.21	0.39	-0.01	-0.58	0.47	0.16
Slovak Republic (SK)	0.42	0.41	-0.02	0.54	-0.42	0.32	0.64	0.48	0.06	0.01	0.69	0.24
Slovenia (SL)	0.62	0.50	0.47	0.58	-0.16	0.12	0.32	0.07	-0.50	0.29	0.51	0.41
Austria (AT)	0.36	0.58	0.57	0.68	0.16	0.30	0.38	0.04	-0.51	0.64	0.35	0.23
Belgium (BE)	0.58	0.58	0.39	0.65	-0.35	0.27	0.58	0.12	-0.22	0.46	0.63	0.36
Denmark (DK)	1	0.58	0.21	0.56	-0.53	0.27	0.58	0.18	-0.27	0.29	0.70	0.15
Finland (FI)		1	0.36	0.77	-0.46	0.35	0.48	0.03	-0.38	0.40	0.65	0.01
France (FR)			1	0.47	0.28	-0.02	0.24	-0.18	-0.10	0.72	0.07	0.34
Germany (DE)				1	-0.30	0.47	0.51	-0.01	-0.41	0.35	0.49	0.03
Greece (GR)					1	-0.05	-0.37	-0.16	0.10	0.24	-0.53	0.01
Ireland (IE)						1	0.44	0.17	-0.09	-0.07	0.28	-0.28
Italy (IT)							1	0.54	0.05	0.39	0.70	0.35
Netherlands (NL)								1	0.32	-0.13	0.31	0.37
Portugal (PT)									1	-0.19	-0.27	-0.19
Spain (ES)										1	0.33	0.35
Sweden (SE)											1	0.34
United Kingdom (UK)												1

Again, the CEEC can be divided into three groups. The first consists of the two most advanced countries Slovenia and Hungary. Their IP business cycles are related together and to that of Austria, Finland and Germany. The Slovenian cycle is also positively correlated with Belgium and Denmark and, to a minor extent, France. This country seems to be the best prepared country, among the CEEC, for membership in the EMU. This result confirms the findings of *De Grauwe/Aksoy* (1999), who also identified Slovenia as the closest country to the EMU, with respect to the synchronization of shocks.

A second group consists of five countries whose business cycles are correlated with the Czech one. The three Baltic states, as well as Poland and the Slovak Republic belong to this group. Almost all of their IP business cycles are correlated to Germany and also, to a higher or lesser extent, to Belgium. Some of them are also positively correlated with Italy. This group can be described as medium advanced countries, with their IP cycles not so strongly correlated with each other as their GDP cycles.

The third group consists of Romania and Bulgaria. The Romanian business cycle correlates with different countries than the rest of the CEEC. It does not positively correlate with other candidate countries (except the Slovak Republic) or with EMU members, but has negative correlation with the French, Greek, and Spanish cycle. In this way, Romania can not be said to belong to a European Optimal Currency Area. Bulgaria also probably belongs to this group, but analysis of its business cycles is limited due to a lack of data. These countries could be described as the least developed countries, furthest away from being a part of a European OCA.

IV. Conclusions

In this paper we have discussed whether the CEEC could be part of a European Optimal Currency Area (OCA) with the current member states of the European Union (EU). This would mean increased economic benefits from joining the European Monetary Union (EMU). Criteria derived from OCA theory can be used to determine whether a group of countries may benefit from forming a monetary union. One of the OCA criteria is the similarity of business cycles among the participating countries. Therefore this paper extracted business cycles for the CEEC from Gross Domestic

Product (GDP) and Industrial Production (IP) time series data and computed the respective cross correlation coefficients with that of the EU member states. The results have been interpreted in the light of the OCA-theory.

Our analysis did not result in clear-cut conclusions concerning membership of a European OCA. In analyzing GDP business cycles we found only some evidence that the three Baltic states (Estonia, Latvia, and Lithuania) could benefit from forming their own currency union. We found little evidence for the preparedness of the candidate countries to join EMU. The analysis of IP data revealed that all of the business cycles in the candidate countries (except in Romania and Lithuania) are related to the German cycle, with some correlation to other EMU members. Most EU member states industry cycles are also correlated with the German cycle. We conclude therefore that a large group of countries, with cycles correlating with Germany, might belong to a European OCA and could therefore benefit from joining EMU. However, Lithuania and Romania clearly do not belong to a European OCA.

It should be considered that the former communist countries of Central and Eastern Europe are still transition economies. Only Hungary, Poland, Slovenia, and the Slovak Republic have managed to re-achieve their 1989 levels of GDP after their transition related recessions. The change over to market economies is therefore not yet complete. Our investigations are based on data affected by far-reaching economic change and political reforms and it follows that interpretation of the results should be drawn with caution. It should also be noted that the economic importance of the CEEC in terms of the EU economy is quite small. The total GDP of the ten CEEC is 10.6 percent of GDP for the EU-15.[20] For the CEEC, it is more difficult and risky to join EMU than for the EU member states. According to the Maastricht Treaty, these countries have to become EMU members and each candidate country has to participate in the European Exchange Rate Mechanism II (ERM II) for at least two years. Moreover they have to fulfill all other Maastricht convergence criteria. None of the CEEC fulfill all of these at the moment. For the European Union to achieve its goal to admit the candidates in time for the next European Parliament elections (2004), the candidates would join EMU, at the earliest, in 2006.

[20] Cf. *EUROSTAT* (2001).

This raises the question of whether this change within a relatively short period will not be too costly for the CEEC, in terms of output.

The Mundell OCA criteria are necessary, but should not be applied in isolation. A rather simplified method was used in our study, due to the limited availability and quality of data. This enables us only to analyze the current situation based on past experiences of the CEEC. The analysis itself does not allow for predictions on the future preparedness of the CEEC with respect to join the EMU.

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