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OCA theory and EMU Eastern enlargement - An empirical application -

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Abstract

Already before the final introduction of the single European currency there have been negotiations on a further enlargement of the Eurozone to the East. The accession of 10 Central and Eastern European Countries (CEEC) to Euroland is likely to be realised within the next 10 years and it is an important issue to assess whether these candidates are better or worse suitable for EMU membership than the current participants. The theory of optimum currency areas provides several criteria and econometric tools for analysing a prospective monetary union. Building on methodologies developed with regard to the current EMU we use a structural VAR approach in order to identify economic shocks that hit the countries to be analysed in the past. Correlations of the shocks disclosed do shed light on the question whether a common monetary policy may be suitable for the respective economies. The few already existing studies on this issue for the region are all prone to the Lucas critique since they compare contemporaneous correlations in East and West. In order to correct for this flaw we use lagged time series instead.

JEL classification: E42, F33, F36
Keywords: OCA, EMU, Eastern enlargement, Shock analysis

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Criterion	Inflation	Interest	FX rate	Deficit	Debt
	2001	10Y ∗	Deviation ∗∗	2001	2001
Reference value	3.3	7.4	+/-15%	-3.0	60.0
Bulgaria	7.9	*5.2*	*-1.3*	*-0.9*	72.5
Czech Rep.	4.7	*5.6*	*-5.5*	-3.2	*29.0*
Estonia	5.8	*4.7*	*-1.2*	*1.1*	*6.2*
Hungary	8.5	*7.0*	*-4.4*	-3.2	64.4
Latvia	*2.5*	10.7	*2.6*	*-1.9*	*12.2*
Lithuania	*1.3*	7.9	*8.6*	*-1.4*	*29.0*
Poland	5.6	8.3	*-8.2*	-4.0	*38.0*
Romania	34.5	34.9	-33.3	-3.7	*31.2*
Slovak Rep.	7.3	7.8	*-1.8*	-7.2	*42.7*
Slovenia	8.5	—	*-7.4*	*-1.3*	*25.4*

Table 1: Maastricht convergence in CEEC
Source: Deutsche Bank Research (2002, p. 27)
∗ NA for some countries; approximated if necessary
∗∗ Maximum deviation from 3y mean within past 2 years

1 Introduction

The physical introduction of the Euro on January 1, 2002 has been a milestone on the way to an economically integrated Europe. Already before this step, the commission and governments of several Central and East European Countries (CEEC) have started negotiations on an enlargement of EU to the East.[1] For all the accession countries the introduction of the Euro will be - on the contrary to present members - a compulsory (Temprano-Arroyo and Feldman, 1999, p. 750). The first political accession wave is not to be expected before 2004 (Deutsche Bank Research, 2002, p. 23). After having entered EU the respective countries will have to join the EMS-II exchange rate system with horizontal fluctuation bands (Gulde et al., 2000, p. 3). Eventually, not before at least 2 years after EU accession, the participating economies will be incorporated in the Eurozone. As in the case of the already completed introduction of the Euro in the current EU, a prerequisite for EMU accession will be compliance with the Maastricht criteria. Table 1 shows data of the CEEC in comparison with the current threshold values according to Maastricht. It is obvious that the debt, deficit and exchange rate

[1]Currently there are negotiations with Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic and Slovenia. While the negotiations with the Czech Republic, Estonia, Hungary, Poland and Slovenia have started in 1998, the others are in progress since 2000 (see Temprano-Arroyo and Feldman, 1999, pp. 746-47 and Eikenberg and Zukowska-Gagelmann, 2001, p. 2)

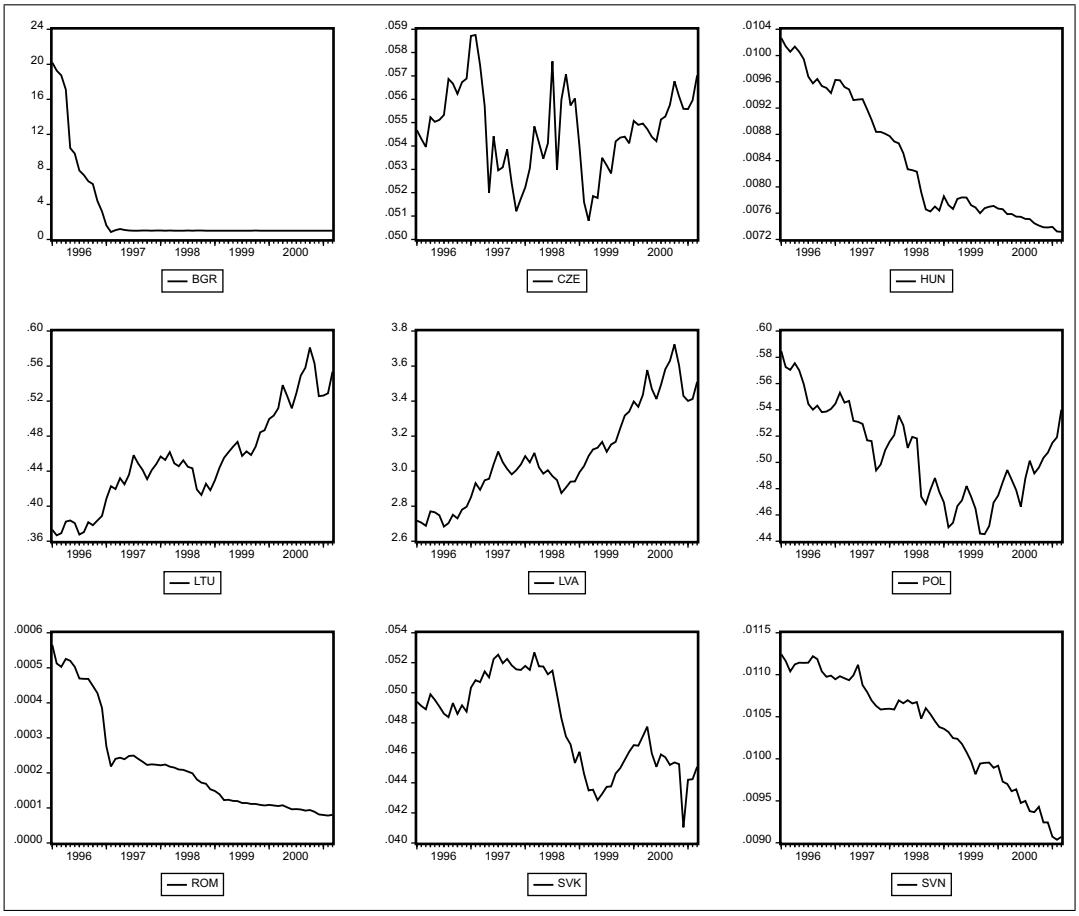

Figure 1: Nominal FX rates CEEC vs. DEM
Without Estonia; Source: IFS, own calculations (USD cross rates DEM per currency CEEC)

volatility criteria are fulfilled by most of the applicants (complying values in italics). On the contrary, the inflation criterion is only met by Latvia and Lithuania. Still, it is rather fair to state that the transition economies of the CEEC exhibit signs of convergence according to Maastricht.
Nevertheless, a look at the historical exchange rates between the CEEC currencies and DEM (see figure 1) shows some volatility. Although the movements in the exchange rates have often been influenced by central bank policies it is still not clear whether a fixation of those rates by EMU accession is desirable or whether a certain degree of flexibility is necessary. With currency unification the CEEC will lose the possibility of revaluation against the Euro. This break can bring along benefits but also costs. The most prominent cost factor in this context is the potential inability of the accession country to react to asymmetric shocks in terms of output stabilisation.

For answering the question of the suitability of countries for a single currency the theory of optimum currency areas (OCA) offers several assessment criteria. There exist numerous analyses with regard to Western Europe while there are only few studies on the CEEC (e.g. Frenkel, Nickel and Schmidt, 1999 and Winschel, 2001) due to lack of reliable data and lots of structural breaks in the respective time series (Masson, 1999, p. 12). This paper aims at analysing the suitability of the CEEC for EMU accession with empirical methods of OCA theory while considering the flaws mentioned above.
The rest of the paper is structured as follows. Section 2 gives a brief insight into OCA theory. Section 3 presents empirical results for the CEEC building on related work. Section 4 concludes.

2 A brief look at theory

The seminal papers on optimum currency areas were published in the sixties of the past century under the era of Bretton Woods, which fixed the exchange rates of the major Western currencies. Accordingly, the respective authors compared the implications of fixed and floating rates without emphasising the link to currency unification. Mundell (1961), McKinnon (1963) and Kenen (1969) who formulated labour mobility, the degree of openness and diversification as basic assessment criteria for currency areas can be seen as founding fathers of OCA theory.
Later on, due to the abolishment of Bretton Woods in the seventies, OCA theory was merely absent in the academic discussion. Only in the eve of monetary unification in Western Europe at the beginning of the nineties, the theory experienced a renaissance. Positive and negative outcomes of potential monetary union have been discussed in more detail. A comprehensive introduction to costs and benefits of currency unification is given e.g. in De Grauwe (1997, pp. 5-84).

2.1 Costs of currency unification

Costs may arise on the macro level because while relinquishing floating exchange rates a country loses an instrument of reacting to upcoming disequilibria. Assuming that exchange rates respond sufficiently fast and exactly to fundamental changes, the policy decisionmakers will lose an important instrument of stabilisation.
The most prominent cost factor that has already been emphasised by Mundell (1961) and Kenen (1969) are shock asymmetries. Under the assumptions of price and nominal wage rigidity and money illusion (cf. Bofinger, 1994, p. 7), a shift in demand for products of a country B towards those of a country A will cause, c.p., inflationary pressure in A as well as unemployment in B (Mundell, 1961). Floating exchange rates might correct for these undesirable outcomes by devalu-

ation of currency B. Under an arrangement with fixed exchange rates, a central bank dilemma evolves since there will be no monetary policy being optimal for both countries at the same time. Thus, another adjustment mechanism such as factor mobility is needed to prevent substantial macroeconomic costs (Mundell, 1961).

Although the assumptions of the Mundellian model are very restrictive, it is still the base for a major line of empirical OCA research. The most prominent criticism is that nominal wages being at least partly flexible downwards can (partly) substitute for the adjusting function of labour mobility (Masson and Taylor, 1993, pp. 16-17). Perfectly flexible nominal wages would in turn make labour mobility unnecessary with regard to OCA assessment. Are, on the contrary, real wages rigid downwards, the floating exchange rate will lose its function as means of adjustment completely (Masson and Taylor, 1993, pp. 16-17 and Fenton and Murray, 1992, pp. 512-13). Thus, a fixation of exchange rates could from this point of view not cause macroeconomic costs.

Accordingly, an analysis in line with the Mundellian model should always be accompanied by a closer look at wage rigidities (nominal as well as real) in order to verify that other adjustment mechanisms than factor mobility are not available. However, this is not state of the art in all of the related studies.

Another mechanism correcting for upcoming disequilibria may be fiscal redistribution of funds from A to B (De Grauwe, 1997, pp. 9-10). If a currency union does not include fiscal unification and if the budget of the union is small in size, this possibility will be strongly restricted. This aspect is closely connected to shock asymmetry and gains importance when the participating economies are mainly hit by asymmetric shocks rather than by symmetric ones. If neither wage flexibility, factor mobility, nor fiscal transfers can correct for shocks, giving up floating exchange rates can bring along substantial costs.

Kenen (1969, p. 49) argues the degree of susceptibility of an economy to asymmetric shocks to depend heavily on its degree of diversification in production. A broadly diversified economy would experience fewer changes in its terms of trade than a highly specialised one since shocks hitting the country would affect just certain sectors of its economy. According to the law of large numbers, output, unemployment and price level would - on the aggregate level - show a lower variability than on a sectoral level. Bofinger (1994, p. 8) notes flexible exchange rates to become more and more ineffective as means of adjustment when the degree of diversification is growing. Thus, a diversified economy will consider a currency union being more advantageous than a specialised one.

Another potential cost factor concerns the public budget due to reduced seignorage. For a country with a history of high inflation joining currency union with more price-stable economies may reduce revenues derived from printing money. This is especially relevant for economies with an underdeveloped tax system that

makes an "inflation tax" desirable.[2] The resulting reduction of revenues will - under the assumption of no cuts in public spending - entail the need for higher budget deficits or for compensation paid by the union.
Costs may also be due to the Balassa-Samuelson-effect.[3] Divergent growth rates in the member states of a currency union may lead to persistent imbalances in national inflation rates. In the case of a monetary union of less and higher developed countries, the formers will - due to trade liberalisation and foreign competitive pressure - presumably experience higher inflation than the latters. It is assumed that in such a situation productivity grows primarily in the sector of tradeables. Resulting wage increases will nevertheless, due to reasons of competition, be comparable in the non-tradeables sector as well (cf. Halpern and Wyplosz, 2001, pp. 9-11). As the production of non-tradeables is not characterised by marginal products growing in the course of time, the price level in this sector will increase. For tradeables, the prices grow with a rate similar to the one abroad because of international competition. Thus, the overall CPI increases faster in the formerly poorer economies than in the other ones (Balassa-Samuelson-effect). Sell (2001, p. 3) notes that currency unification of countries with different inflation rates may be counterproductive as those with higher price level growth would tie up liquidity which would force the central bank to push money growth in order to avoid deflation in the higher developed countries.

2.2 Benefits of currency unification

Benefits can be derived mainly on the micro level and are related to money properties. With the domain of a currency the extent to which the money fulfills its basic functions grows (Ishiyama, 1975, p. 362). According to Cohen (1998, pp. 218-219), a growth of the domain enhances the money function as means of exchange (due to reduced transaction costs), as a store of value (because of reduced uncertainty) and as a measure of value (due to reduced information costs).
The introduction of a common currency reduces or even removes transaction costs such as exchange fees. Furthermore, companies will face lower costs e.g. in the field of multi currency book keeping (Fenton and Murray, 1992, p. 489). In addition, further positive effects may stem from holding reduced foreign currency reserves and from a lesser number of goods prices (Cohen, 1998, pp. 218-219). Alesina and Barro (2000, pp. 5-12) show formally reduced transaction costs to lead to higher output and consumption gains, thereby improving welfare.
Another important benefit induced by integration of several countries into a single currency area is the removal of exchange rate uncertainty (Tavlas, 1993, p. 668) which makes trade as well as foreign direct investment face less costs. If ex-

[2]For a detailed discussion see De Grauwe (1997, pp. 17-19) and Masson and Taylor (1993, pp. 6-7).

[3]Cf. e.g. Eichengreen and Ghironi (2001, pp. 4-11) as well as Eikenberg and Zukowska-Gagelmann (2001, p. 7).

change rates are not always explainable by market fundamentals, a rate fixation may improve capital allocation and thus enhance economic efficiency (Fenton and Murray, 1992, p. 490 and pp. 514-515). Furthermore, a currency union can contribute to reduce speculative attacks against the participating currencies (Bean, 1992, p. 32). Especially if the respective economies have already been linked by fluctuation bands[4], speculative market forces may test the peg by trading comprehensive currency volumes. The involved central banks can try to keep the FX rate within the fluctuation margin by support transactions as long as their reserves are large enough. If they are not, the market expectation will be a self-fulfilling prophecy.

Additionally, monetary unification reduces (under the assumption of imperfect capital markets) the possibility that speculative market forces drive the currency prices away from their fundamentally based value as the common central bank will presumably dispose of higher reserves than a single one on its own (Fenton and Murray, 1992, p. 500).

A relevant point in this context is also the concern that after currency unification the reduced volatility of the FX market could be transferred to other macro variables, such as monetary aggregates, instead. Flood and Rose (1993, pp. 20-21) argue, employing an empirical analysis of different currency pricing models, that the decline in variability does not lead to higher variance in other relevant aggregates. Thus, they provide evidence for the hypothesis that reduced uncertainty in the currency market does not cause higher uncertainty in other markets.

Tavlas (1993, p. 680) emphasises that the effect of fixed exchange rates on bilateral trade is not determined a priori (also see Fenton and Murray, 1992, pp. 490-91). Although the possibility that exchange rate variability influences trade volume positively cannot be excluded theoretically (Eichengreen, 1993, pp. 1327-28 gives some motivation for this view) a recent empirical study by Rose and van Wincoop (2001) points to another connection. They estimate that intra-union-trade within the present EMU could grow by more than 50% after the introduction of the Euro. This estimate does of course represent the effect of all of the factors mentioned above, but still the result supports the view that a possible trade-reducing effect of low exchange rate volatility was either not existent in the sample analysed or overcompensated by other factors such as transaction costs.

Finally, removed uncertainty concerning future exchange rate movements reduces risk premia issuers of bonds have to pay (Kopits, 1999, p. 4). In the medium term this effect may be favourable especially for public debt issuers as it could reduce interest paid by the governments and lead to higher public investment or potentially lower taxes.

Further benefits of currency unification may result from enhanced central bank credibility (cf. Alesina and Barro, 2000, pp. 41-42 and Bofinger, 1994, pp. 20-22) and from stronger market integration (Eichengreen and Frieden, 2000, pp. 11-12

[4]This is in the present context the case for e.g. Hungary.

and Eichengreen, 1993, p. 1329). Besides economic reasoning, political considerations may be taken into account additionally when deciding about currency unification (Karmann, 2001, pp. 445-446).

2.3 Are costs and benefits relevant for an enlarged EMU?

Though in theory all of the costs and benefits mentioned above are easily justifiable their importance for the prospective currency union has to be assessed carefully before proceeding further. Building on the findings, one can then choose an empirical method for analysing OCA suitability.

At the first glance, shock asymmetries cannot be assessed and are, accordingly, to be analysed in more detail. The other criteria, like seignorage and the Balassa-Samualson-effect, are rather less important in the context we focus on. Reduced seignorage should not be a serious problem for the accession candidates after having joined the club. Since all the aspirants have to meet the Maastricht convergence criteria beforehand, potential conflicts between the deficit and inflation criteria would become obvious already before entering.

The impact of the Balassa-Samuelson effect on Euroland inflation is discussed in several recent papers. Rogers (2001) estimates the influence of different variables on inflation rates in Europe and concludes that the Balassa-Samuelson-effect will drive inflation in the CEE transition countries aspiring to join EMU considerably. Halpern and Wyplosz (2001, p. 19) come to a similar conclusion and estimate the potential yearly real appreciation due to the Balassa-Samuelson-effect in the CEEC to be around 3.5%. Since nominal appreciation will not be applicable after joining EMU, the price pressure will show up in a higher inflation rate. The influence of the Balassa-Samuelson-effect on inflation rates in a larger Euroland will nevertheless be presumably low. Sinn and Reutter (2000) estimate the minimum inflation rate (the one being necessary to avoid deflation in the most price-stable member country) to grow by only 0.19% after the joining of prospective EMU members.[5]

Before having a closer look at shock asymmetries, the question for adjustment mechanisms other than a flexible exchange rate has to be answered. Possible buffering channels may be labour mobility, wage flexibility and fiscal policy.

Labour mobility will presumably not be available in an EMU containing the CEEC as mechanism substituting for exchange rates (at least across present EMU Eastern frontiers). Present members (especially Germany) demand a transition period with mobility restrictions for the East (Deutsche Bank Research, 2001, pp. 24-25).[6] Sell (2001, p. 8) adds that labour mobility - in order to serve as means

[5]The countries included in the analysis are Denmark, Greece, Sweden, Turkey, the UK and the group of the first CEEC.

[6]Besides these aspects, the decision of an individual to choose residence within Europe also depends on factors such as cultural differences and language barriers (Sala-i-Martin and Sachs,

of buffering shocks - should be symmetric, which cannot be assumed for EMU and CEEC since welfare in EMU is higher than in the East. Thus, labour flows are expected to go primarily westwards. In line with these ideas, labour mobility cannot - at least in the medium term - be expected to correct for asymmetric shocks in an enlarged EMU. Accordingly, shocks should be symmetric. Still, we will pursue this issue in more detail later on.

A second buffering mechanism that under certain preconditions can substitute for the equilibrating function of exchange rates is wage flexibility. If wages would be rigid in real terms, as Fenton and Murray (1992, p. 513) suggest for the case of Western Europe, floating exchange rates could not create any benefit as buffer. On the other hand, Eichengreen (1993, p. 1332) notes that real wages in Western Europe could in fact be reduced by inflation - but the degree of elasticity would be much lower than e.g. in the US. A recent study (Blanchflower, 2001, pp. 8-15) analyses the interrelation between nominal wages and unemployment using a microeconometric method for country specific wage curve estimates and finds that unemployment rates influence nominal wages in CEEC negatively to a degree being comparable to EMU. Though the study does not analyse real wage flexibility[7], we can conclude that nominal wage flexibility is comparable in East and West. Furthermore, nominal flexibility automatically implies real flexibility. Thus, to assure that CEEC are not less suitable for EMU than its present members, shock asymmetry in the East must c.p. not exceed the one in the West.

The remaining instrument for buffering shocks in order to prevent or at least reduce macroeconomic costs is a fiscal transfer. Krugman (1993, p. 260) emphasises that Europe lacks a fiscal system being comparable to the US-American one and states that asymmetries comparable to the American ones will not be manageable with the budget of the EU. A detailed discussion of this aspect is provided by Sala-i-Martin and Sachs (1992) who highlight that country-specific fiscal policy would be inferior in comparison with union-wide tax policy.[8] A more empirically oriented approach has been taken by Sørensen and Yosha (1998) who estimate the fraction of shocks to GDP dampened by international transfers in certain EU economies in comparison with the US. Their results support the view that the capability of the EU of buffering shocks is much less developed than the one of the US. Eichengreen (1998, pp. 12-13) collects results of different related studies and tends to the view that European countries should be able to manage dampening a similar shock fraction as the US federal states by automatic stabilisers. Nevertheless he points out that the stability and growth pact may restrict this option and may make the introduction of further transfer systems

1992, p. 197).

[7] A regression directly adressing real wages can be found in IMF (2000, pp. 160-61). Indeed, it analyses the other direction, i.e. the influence of real wages on labour demand. Still, the results point to a similar functioning of labour markets in EMU and CEEC (IMF, 2000, p. 161).

[8] For the detailed argumentation see Sala-i-Martin and Sachs (1992, pp. 198-199).

necessary. Still, when enlarging EU, its fiscal structures will just be transferred to the new members. So the quality of the union will neither be improved nor worsened. The only critical case is the one of high shock asymmetries - but the resulting problem then is due to exactly the asymmetries and independent of the fiscal structure. Thus, the question to be answered here is not how the (existing) EMU is to be assessed regarding fiscal structure but how to assess the Eastern enlargement.
On the benefit side, the arguments having been valid for establishing the present EMU are theoretically also applicable to the Eastern enlargement. Transaction costs are supposed to be reduced. Since the CEEC do already trade intensely with EMU, this will be a major issue. Reduced uncertainty is a relevant point as well. Enhanced central bank reputation can partly also be applicable as CEEC with high past inflation will presumably experience monetary credibility gains and in analogy to the situation in the West, it can be assumed that the prospective common currency will enhance market integration, too. In this paper we will focus on the cost aspect of shock asymmetries in order to circumvent the problem of arbitrarily aggregating a number of different qualitative and quantitative assessments which would hardly be justifiable from a theoretical point of view.

3 Operationalising the theory

Several approaches for assessing OCA suitability of a prospective currency union have been considered. Most of them belong to two major lines of research. They either analyse past exchange rate movements or disclose economic shocks from past data and evaluate their correlations.
Based upon seminal work by Vaubel (1976, 1978) one strand of research analyses real exchange rate changes within the respective country group.[9] Since real exchange rates function as a shock buffer by changing relative prices, countries with volatile exchange rates are comparatively unsuitable for currency union. For example, Bayoumi and Eichengreen (1997c) analyse exchange rate volatilities and find asymmetries in output time series having positive influence on currency market pressure.
The compelling aspect of this method is that many cost criteria from OCA theory are included at the same time.[10] But there are some negative aspects, too. First, the method uses ex-post data to conclude for the future and, second, there is the Lucas critique that currency union and the need for exchange rate changes are not independent of each other (Vaubel, 1976, pp. 440-41). Nevertheless, this reasoning applies for all empirical methods so that it will not be discussed in more detail.

[9] A simple approach can also be found in Poloz (1990).

[10] Factor mobility, degree of diversification, fiscal integration and degree of openness are linked to real exchange rate volatility. For a detailed explanation, see Vaubel (1976, pp. 437-38).

Most importantly, one has to take into account that real variability is also influenced by nominal variability. The latter, in turn, can be controlled by speculative pressure or different central bank decisions in the respective countries (Vaubel, 1976, p. 459) so that OCA suitability estimates could be biased negatively.[11]
When analysing EMU and the CEEC accession candidates we face the fact that EMU countries have been linked by EMS for years while the CEEC experienced a variety of currency regimes. E.g. Lithuania had implemented a currency board against the USD which may have lead to higher volatility with regard to the Euro but does not tell anything about fundamental OCA criteria. Rose and Engel (2001, pp. 11-16) analyse empirical properties of real exchange rates in currency unions and find that the standard deviation of exchange rate changes can be explained by a highly significant negative coefficient of a currency union dummy while the adjustment speed is lower within a currency union. An interpretation of these results may be that nominal exchange rates are obviously an important means of adjustment. Still, total volatility of nominal rates and prices is not completely transferred to prices when fixing exchange rates. There are either other mechanisms (e.g. through the labour market) or there is excessive volatility in the exchange rates. The view that the latter is - at least partly - the case, is supported by Flood and Rose (1993, pp. 20-21) empirically. Thus, an exchange rate based analysis is likely to be misleading for our purposes.
An advanced exchange rate approach has been taken by Bayoumi and Eichengreen (1997b) who use a panel regression to construct an OCA index yielding a sorted order of the respective countries according to their OCA suitability. For this purpose they regress nominal exchange rate variability on OCA-relevant macro variables. This results in coefficient estimates they use to forecast the dependent country-specific variable which is then interpreted as an OCA index. The OCA suitability of the respective country is considered the better the lower the index is.
For their estimation, Bayoumi and Eichengreen use only industrial countries[12]. The respective coefficients are then applied to data of Western European EMU candidates. Such an approach might entail econometric problems, too. The panel analysis does not take into account that on the left hand side of the equation there are limited dependent (censored) as well as uncensored variables since the nominal exchange rates between EMS countries were bounded by fluctuation margins in the sample considered and e.g. the USD rate was not.

[11] Unnecessary volatility due to uncoordinated monetary policy is removed when entering monetary union. The same is valid for speculative movements. A comparison of floating (at least within certain margins) exchange rates with an existing currency area may not be too telling, accordingly. See Bayoumi and Eichengreen (1996, pp. 18-19), Bofinger (1994, pp. 13-14), Eichengreen (1992, pp. 141-43), Poloz (1990, p. 9).

[12] The panel includes data of the major European economies plus the USA, Canada, Japan, Australia and New Zealand from 1983-92.

Some papers[13] transfer the Bayoumi and Eichengreen (1997b) OCA index analysis to EMU accession candidates by applying the coefficient estimates to macro data of the Euro aspirants. This approach is questionable since it is not clear whether the relation estimated for the Western world is comparatively stable in the CEEC (cf. Bayoumi and Eichengreen, 1997a, p. 186). So, the assumption of a stable relationship without verification might be too unrealistic in this case.
The second way to determine OCA properties of a group of economies is an analysis of possible shock asymmetries among them employing output and price data. For a certain economy, monetary independence is only necessary if it faces asymmetric shocks with regard to its neighbours (Masson and Taylor, 1993, p. 17). If the economic shocks hitting potential members of a currency union are merely synchronous, surrendering country specific monetary policy will not have negative consequences. As expressed by Bayoumi and Eichengreen (1996, p. 2): "adjustment costs are a function of the symmetry of disturbances and the interregional mobility of labor".[14]
Bayoumi and Eichengreen (1996) provide a comprehensive survey of relevant empirical studies dealing with shock asymmetries.[15] Studies taking this approach for an analysis of the CEEC are Frenkel, Nickel and Schmidt (1999) and Winschel (2001).
Further OCA approaches include labour mobility surveys[16], cycle correlation studies (Bini Smaghi and Vori, 1992, pp. 7-8 and Christodoulakis et al., 1995), diversification analyses (Bini Smaghi and Vori, 1992, pp. 9-13 and Bayoumi and Prasad, 1995) or they study convergence amongst currency union aspirants.[17] Finally, there are approaches trying to aggregate different criteria (Schweickert, 2001 and Winschel, 2001).
As mentioned before, especially the cost potential due to possible shock asymmetries should be studied carefully. An adequate method to do so is a structural vectorautoregressive analysis which was first used for OCA issues by Bayoumi (1992) and Bayoumi and Eichengreen (1993).

[13] E.g. Cincibuch and Vávra (2000, pp. 8-9) as well as Eikenberg and Zukowska-Gagelmann (2001, pp. 9-11).

[14] Also cf. Eichengreen and Frieden (2000, p. 13).

[15] See also Bayoumi (1992), Bayoumi and Eichengreen (1992) and Bayoumi and Eichengreen (1993), Chamie, Deserres and Lalonde (1994), Erkel-Rousse and Mélitz (1995), Auria (1997) and Bruneau and De Bandt (1999).

[16] For different methodologies cf. e.g. De Grauwe and Vanhaverbeke (1991, pp. 7-9), Eichengreen (1992, pp. 145-48), Bini Smaghi and Vori (1993, p. 15) and Winschel (2001, p. 16).

[17] Cf. e.g. Rangvid and Sørensen (2000, exchange rate analysis), Bayoumi and Taylor (1992, SVAR model), Artis and Zhang (1995, business cycle convergence) and Angeloni and Dedola (1999, pp. 1-6, analysis of output and price growth).

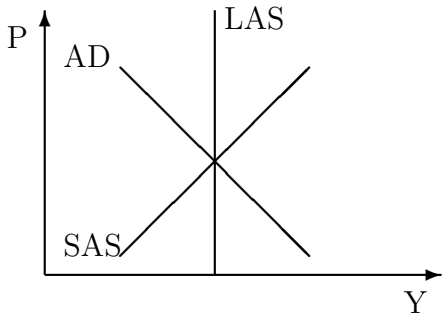

Figure 2: AS-AD diagram
Source: Bayoumi and Eichengreen (1993, p. 199)

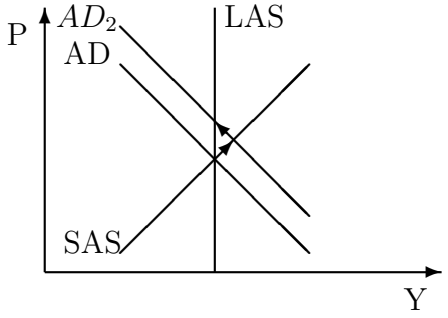

Figure 3: Demand shock in the AS-AD diagram
Source: Bayoumi and Eichengreen (1993, p. 199)

3.1 Theoretical framework of shock analysis

Suppose the concerned economies can be characterised by a common AS-AD model (Bayoumi and Eichengreen, 1993, p. 200). The aggregate demand curve has a negative slope coefficient in the price-quantity-diagram while aggregate supply has a positive slope in the short run and is vertical in the long run. This model is shown in figure 2 with Y denoting the aggregate output and P the price level.
In this model, a positive demand shock will result in a shift of the AD curve to the right while the other curves remain unchanged. In the short run, the AS and the AD curve will cross in a point characterised by a higher output and a higher price level than before. In the long run, the AS curve turns vertical and the equilibrium output sinks back to the original level. At the same time, the price level grows further until the system reaches a new equilibrium with higher prices and output unchanged (see figure 3).
A positive supply shock will on the contrary shift short and long run AS curves to the right by the same amount. Thus, in the short as well as in the long run

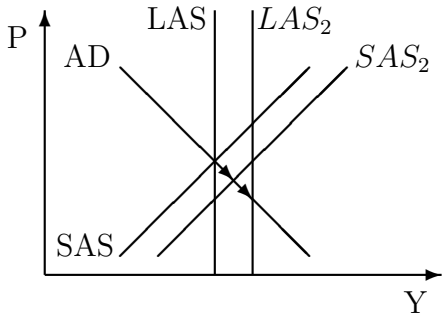

Figure 4: Supply shock in the AS-AD diagram
Source: Bayoumi and Eichengreen (1993, p. 199)

prices will decline while output grows (see figure 4).
Summing up, in the standard AS-AD model supply shocks change prices and quantities in the long run whereas demand shocks only influence prices while they are not affecting output in the long run. This property can be used to distinguish between two shock types in the econometric approach. One should notice that, accordingly, so far we can only distinguish between shocks influencing output (shock type 1) and not affecting output (shock type 2) in the long run. Interpreting the two shock types to be identified below as supply and demand innovations requires that the data meet all the assumptions of the model.

3.2 Isolation and evaluation of shocks

Assume that the first differences of the logs of price level P_t and output Y_t in the economies to be analysed follow a stationary stochastic process[18] of the form:

$$\Delta x_t = A_0\epsilon_t + A_1\epsilon_{t-1} + ... = \sum_{i=0}^{\infty} A_i\epsilon_{t-i} \tag{1}$$

with

$$\Delta x_t = \begin{bmatrix} \Delta y_t \\ \Delta p_t \end{bmatrix}$$

and

$$\epsilon_t = \begin{bmatrix} \epsilon 1_t \\ \epsilon 2_t \end{bmatrix},$$

which means that the changes of output Δy_t and prices Δp_t can be described by an infinite MA-process of independent exogenous shocks $\epsilon 1_t$ und $\epsilon 2_t$.

[18]The procedure used in what follows is mainly taken from Chamie, Deserres and Lalonde (1994).

The respective reduced VAR form of the model is therefore:

$$\Delta x_t = \Pi_1 \Delta x_{t-1} + ... + \Pi_p \Delta x_{t-p} + u_t \tag{2}$$

where u_t is the residual not explained by the regression in period t. The vector u_t is linked to the shock vector ϵ_t by the coefficient matrix A_0:

$$u_t = A_0 \epsilon_t. \tag{3}$$

The reduced AR representation can be estimated using OLS while the lag length is to be determined with the help of information criteria.[19] The regression yields an estimate of the variance-covariance-matrix Σ of error terms u_t:

$$E(u_t u_t') = \begin{bmatrix} \sigma_{11} & \sigma_{12} \\ \sigma_{21} & \sigma_{22} \end{bmatrix} = \Sigma. \tag{4}$$

Under the above mentioned stationarity condition the estimated AR process can be inverted into a Wold-representation (Hamilton, 1994, S. 108) as

$$\Delta x_t = u_t + C_1 u_{t-1} + ... = \sum_{i=0}^{\infty} C_i u_{t-i}. \tag{5}$$

The residuals estimated in the VAR are linear combinations of the underlying structural innovations. In order to evaluate the relation between the exogenous shocks the u_t have to be transformed into the respective ϵ_t. (3) implies

$$u_t u_t' = A_0 \epsilon_t \epsilon_t' A_0' \tag{6}$$

and, furthermore,

$$E(u_t u_t') = \Sigma = A_0 E(\epsilon_t \epsilon_t') A_0'. \tag{7}$$

Thus, an estimation of A_0 allows the $\hat{\epsilon_t}$ to be derived directly from the $\hat{u_t}$. For determining the estimated A_0 four restrictions are needed. First, we normalise the shock variances to unity and assume orthogonality of the different shock types:

$$E(\epsilon_t \epsilon_t') = I_2. \tag{8}$$

Combining (7) and (8) yields:

$$\Sigma = A_0 A_0'. \tag{9}$$

From (1), (3) and (5) we get furthermore :

$$A(1) = C(1) A_0 \tag{10}$$

[19] A detailed discussion of alternative criteria can be found in Luetkepohl (1993, p. 128 ff.).

where $A(1)$ is the matrix of long run effects of the structural shocks in (1) and $C(1)$ the long run coefficient of the shocks in the reduced MA representation (5). The theory described above implies the long run effect of a demand shock on output to be zero. In our context this means that the shock type 2 is neutral with regard to output growth in the long run. Accordingly, $A(1)$ must satisfy:

$$A(1) = \begin{bmatrix} a_{11} & 0 \\ a_{21} & a_{22} \end{bmatrix}.$$

(9) and (10) give:

$$C(1)\Sigma C(1)' = A(1)A(1)'. \tag{11}$$

The left hand side of this equation is completely known. Since $A(1)$ is triangular by assumption, $A(1)$ can be derived by Cholesky decomposition of the left hand side. Finally, (10) yields A_0 which enables us to calculate the structural shocks of type 1 and 2 from (3):

$$\hat{\epsilon}_t = \hat{A}_0^{-1} \hat{u}_t.$$

The shocks having been isolated according to the procedure described above have to be analysed according to OCA theory, in how far they occur symmetrically in the respective countries. If countries are hit by the same shocks at the same time, their suitability for currency union is better than if the shocks occur rather asymmetrically. A simple approach of assessing the degree of shock symmetry is therefore the calculation of the empirical correlation coefficients. A further method can be decomposing shocks into symmetric and asymmetric shares using a state space model. In OCA analysis this method has been used to our knowledge only by Chamie, Deserres and Lalonde (1994). Since modeling a Kalman filter for the present context proved to be highly sensitive to iteration starting values we decided to employ the simple correlation analysis.

3.3 Data

The data being necessary for the Bayoumi and Eichengreen (1993) approach include price and output time series. As proxy for total output we employ the industrial production (IP) index.[20] The respective data is available for all of the countries to be analysed on a monthly basis. Present EMU is represented in the sample by Austria, Belgium, Finland, France, Germany, Greece, Italy, Luxembourg, the Netherlands, Portugal and Spain. Enlargement candidates we consider are Bulgaria, the Czech Republic, Hungary, Latvia, Lithuania, Poland,

[20]This proxy has been used widely in the literature, e.g. by Bayoumi and Taylor (1992), Angeloni and Dedola (1999) and Winschel (2001). Though this is not a perfect measure we preferred this approach as it enables us to use data of high frequency.

Romania, the Slovak Republic and Slovenia.[21]
The CPI time series we use (except for aggregate Euroland data) are taken from IFS, the IP index data for the accession candidates has been provided by Deutsche Bank Research. Aggregate Euroland data and IP series of the present EMU member countries are taken from BLOOMBERG.
The sample comprises data from January 1990 to March 2001. Before proceeding the analysis we have adjusted the time series by the multiplicative moving average method, taken their logs and differenced them once.
A major flaw of all previous analyses is that they use contemporaneous data and are thus subject to the Lucas critique. Obviously, there are interrelations between currency regime, cycle correlation and trade intensity. Artis and Zhang (1995) find that after the launch of EMS, cycle correlation of participating countries with Germany increased while correlations with the US declined. This could be a hint that structures are successively synchronised within the process of monetary integration which would mean some kind of endogeneity of the OCA criteria.
A similar result is provided by Rose (2000, pp. 14-16) and Rose and Engel (2001, p. 18) who analyse worldwide data samples and find countries with a common currency being cycle correlated slightly higher than economies with different means of payment. Frankel and Rose (1997 and 1998) find, furthermore, that cycle correlation is positively influenced by trade intensity (Frankel and Rose, 1998, pp. 1023-24) which implies that for countries a priori being no OCA currency unification might nevertheless entail positive net benefits due to reduced trade barriers such as transaction costs and uncertainty (Frankel and Rose, 1998, p. 1012). Finally, Rose (2000) shows by evaluating the effect of a common currency on bilateral trade that members of a single currency area are more closely integrated than countries with an own currency.
Altogether, the studies mentioned point to joint endogeneity of the OCA criteria trade intensity and cycle correlation. While the currency regime seems to be interrelated to trade intensity and cycle correlation, cycle correlation itself is obviously connected to trade intensity.
Endogeneities of OCA criteria reduce the power of a static suitability analysis. As Habib (2001, p. 4) states: they "contribute to confuse even more the already complicated balance of costs and benefits of a common currency". Thus, when analysing OCA properties of certain countries a critical aspect is the choice of reference values. Using data of a single currency area which has already been existent over a long period is not applicable according to the Lucas critique (see Bayoumi and Prasad, 1995, pp. 4-5).
To circumvent the Lucas critique in this paper we do not compare OCA criteria in CEEC and EMU contemporaneously but draw a comparison between the status quo in the CEEC and the state of EMU in the mid of the nineties. Since gradual transition processes into a single currency area may change shock correlations, we

[21]Estonia is excluded due to missing data.

should account for such endogeneities in our analysis. An evaluation of contemporaneous data in EMU and the CEEC cannot - though this is the conventional approach chosen in all of the quoted studies - shed much light on the question to be answered and would presumably bias the results for the accession countries unfavourably. Employing lagged time series we can conclude whether the transition economies are better or worse candidates for joining EMU nowadays than EMU countries themselves had been just before the introduction of the Euro.
The sample used for Western Europe is 1990:1 to 1995:12, for Central and Eastern Europe 1996:1 to 2001:1.[22] An exception is Bulgaria where the "outlier period" in the price level series until 1997:2 due to high inflation has been removed from the sample. The available IP series of Bulgaria does already end in 2000:2. The beginning of the CEEC sample has been set to 1996, though for most of their economies there are data available from 1993 on. Still, structural breaks due to the transition from central planning to market economy may influence the quality of the VAR negatively. So we decided to choose a shorter but later sample.

3.4 Econometric results

To employ the structural VAR method without error correction terms the data used have to be stationary. Thus, we use the ADF test in order to check for unit roots in the respective series.[23] If there was a trend in the series, we fitted a linear function of time to the data and subtracted it from the original series.[24] Furthermore, we normalised the series by subtracting their mean so that they fluctuate around zero. For all of the EMU time series the null hypothesis of a unit root could be rejected at conventional confidence levels. A noticeable feature of EMU CPI series - with the exception of Germany - is a negative time trend in the sample which may be interpreted as a sign of convergence towards lower inflation rates. For all of the CEEC series, except for the Czech Republic CPI, the null could also be rejected. Still, the power of the ADF test could be weakened due to the short samples and possible structural breaks (Bruneau and De Bandt, 1999, p. 10 and Artis and Zhang, 1998, p. 128). Thus, we treat the Czech CPI series nevertheless as stationary, but keep the ADF test result in mind.
For the estimation of structural shocks we employ the SVAR model described above. The lag length is chosen as in Bayoumi and Eichengreen (1993, p. 207) according to the Schwarz information criterion.[25] The Schwarz criterion suggested to use lag orders of 1 or 2. In order to remove residual autocorrelation a

[22] If longer time series were available, the additional data has been included in seasonal adjustment but not in shock identification.

[23] A detailed discussion of alternative unit root tests can be found in Banerjee et al. (1997, pp. 99-135).

[24] See, e.g., Blanchard and Quah (1989, p. 661).

[25] The Schwarz criterion is consistent and indicates - in comparison with Akaike - a relatively parsimonious lag order (Luetkepohl, 1993, p. 182).

general lag order of 2 was chosen.
After estimating the innovations of the two categories we calculated the correlations between type 1 and type 2 shocks of EMU countries and Germany as well as between CEEC and aggregate EMU. Germany has been chosen as reference since it is generally seen as the economic core country within EMU. Before determining the coefficients, the shock time series were smoothened by calculating 3 month MA. We consider this approach to be advantageous since it avoids a negative assessment of countries that are hit by the same shocks with a low number of lags. Furthermore, if a country is hit by a shock asymmetrically with regard to the core country but this shock is compensated by a reverse one in the succeeding month, this would not worsen currency union suitability. Still, the analysis of unsmoothened data would weigh this asymmetry higher than its impact is.
In the following, we concentrate on type 1 shocks. Integration into a single currency area enhances supranational economic policy coordination, especially by implementation of a single central bank. Thus, an ex-post analysis of type 2 shocks might underestimate currency union suitability. Country specific demand side shocks due to asymmetric national monetary policy cannot occur any more (Eichengreen, 1993, p. 1333). For the type 1 shocks affecting output in the long run, based upon production structures, this effect is less important. The countrywise product mix will presumably also be influenced by monetary union but this process can be supposed to take much more time than demand-side changes (Eichengreen, 1993, p. 1333).
Figures 5 and 6 show the estimated correlations of the respective country specific shocks with the innovations of the core country in the analysed sample. The further a country is located in the northeast of the graph, the higher are the shock correlations and the better is currency union suitability according to the shock criterion.
For the present EMU we find in accordance to many other related studies on Western Europe[26] a classification into a core zone consisting of Germany, Belgium, France, the Netherlands and Austria and a periphery comprising the residual countries. In comparison with the West, the correlations of the CEEC with EMU are not of equal size but almost all of the estimated correlations are positive. Amongst the countries whose accession would cause relatively low costs (according to the shock criterion) are Hungary, Lithuania, Poland, Latvia and Slovenia. If weighing type 1 shocks higher, Hungary, Bulgaria, the Czech Republic and the Slovak Republic appear to be relatively good candidates.

[26]E.g. Bayoumi and Eichengreen (1993), Chamie, Deserres and Lalonde (1994), Bayoumi and Eichengreen (1997b) as well as Frenkel, Nickel and Schmidt (1999).

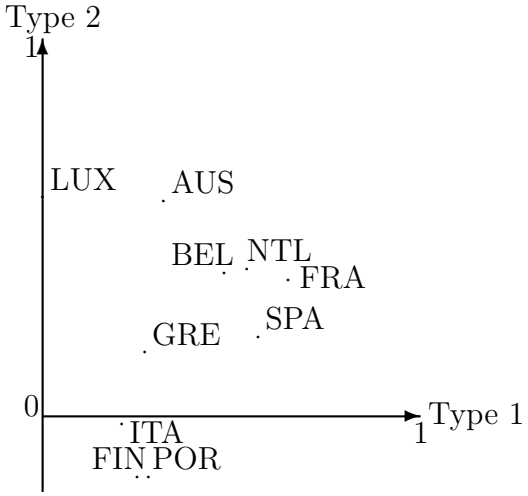

Figure 5: Shock correlations present EMU vs. Germany

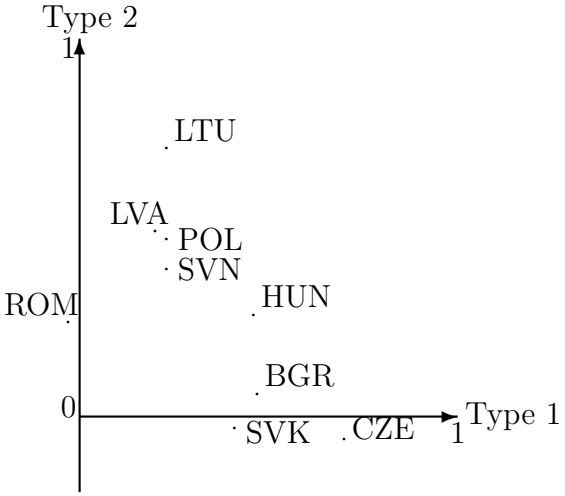

Figure 6: Shock correlations CEEC vs. EMU

Specification	Coefficients	t-Statistic	R^2_{adj}
N = 9	β_0 = -0.098395	-0.519299	
(incl. BGR)	β_1 = 0.015030	2.319587	0.353822
N = 8	β_0 = -0.189558	-1.067499	
(excl. BGR)	β_1 = 0.017196	2.903418	0.514894

Table 2: Regression 1-correlation on export

3.5 Interpretation

With regard to the type 1 correlations especially the Czech Republic, Bulgaria, Hungary and the Slovak Republic get an advantageous ranking, thus mirroring - with the exception of Bulgaria - the geographic position of those countries. Immediate EMU neighbours exhibit higher type 1 correlations than other countries, presumably due to higher trade intensity (figure 7, see also Winschel, 2001, p. 12 and Gulde et al., 2000, p. 24). A recent evidence for a statistically significant negative interrelation between distance and trade intensity (also known as gravity effect) is provided by Rose (1999, p. 13). Approximately, the assumption of an interrelation between trade and shock correlation can be tested using a simple linear regression (cross section data for all 9 countries in 1998) of the following form:

$$Cor1 = \beta_0 + \beta_1 Export + u. \tag{12}$$

Trade intensity, approximated by export[27] as percentage of GDP, has a statistically significant positive influence on type 1 correlation (see table 2). This result becomes more obvious when eliminating the outlier Bulgaria with regard to the low data quantity being available for this country. Thus we find some evidence for the McKinnon (1963) openness criterion.
Furthermore, the gravity hypothesis may be tested in a very simple way by the following regression:

$$Export = \beta_0 + \beta_1 D + u \tag{13}$$

with the dummy variable

$$D_i = \begin{cases} 1 & : \text{ country i borders to EMU} \\ 0 & : \text{ else.} \end{cases}$$

The result of this rough estimation (see table 3) supports the view that there exists the intuitively assumed interrelation between trade intensity and neighbourhood. Trade is higher with neighbouring economies. Thus, there is some

[27]Export ratio proved to be the most explanatory variable in comparison with import and the arithmetic mean of import and export ratio.

Coefficients	t-Statistic	R^2_{adj}
$\beta_0 = 21.17250$	5.845315	
$\beta_1 = 12.10150$	2.490226	0.393996

Table 3: Regression export on neighbourhood dummy

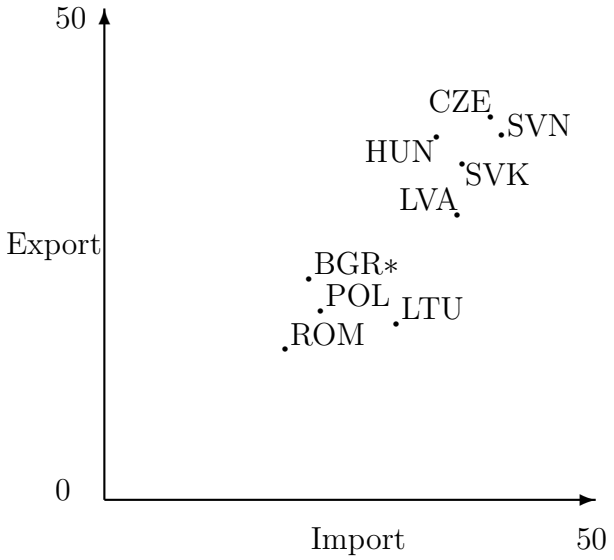

Figure 7: CEEC 1998: Trade with EU as % of GDP
Data source: European Parliament (1999, p. 52), IFS, own calculations
∗ January - September

evidence that output relevant shock correlation might be influenced by trade intensity and trade intensity itself by distance.

3.6 Dynamic behaviour after a shock

Based upon the infinite MA representations of the estimated VARs one can calculate the impulse response functions of the respective processes. Those functions represent the answer of price changes and production changes c.p. to a type 1 or type 2 shock. One should notice that the power of the impulse responses for determining OCAs may be reduced since it is not likely that they would remain unchanged after monetary unification. Still, they can give important information in how far the ex-post identified shocks may really be denominated as supply and demand innovations.
The impulse responses of Germany, France, Italy, Lithuania, Luxembourg, Aus-

tria, Romania and aggregate EMU show the expected shape. Here the economies react with persistently higher output growth and reduced inflation to shock type 1. Type 2 shocks cause short run fluctuations in output and persistent inflation acceleration. So for those countries we can name shock 1 and 2 supply respectively demand innovations. For illustration, the left hand panel of figure 8 shows the estimated impulse response functions of France.
Concerning the other economies (cf. the right hand panel of figure 8 for the impulse response functions of Finland), the resulting picture is insofar consistent as shock 1 pushes the country to a higher growth path and shock 2 accelerates inflation persistently while causing output fluctuations in the short run. The influence of type 1 shocks on prices is not always in line with the AS-AD model. Sometimes, the economies react with enhanced inflation to type 1 shocks.
The force of expression of the correlation analysis is nevertheless not reduced. Type 1 as well as type 2 shocks should exhibit a regionally synchronous development in an OCA. If shock 2 hits all of the economies contemporaneously, the inflation rate will grow everywhere. Thus, a common monetary policy should be suitable for all of the countries. Shock 1 causes higher productivity growth, while its impact on inflation is regionally diverse. Still, the estimated price responses may have been influenced by structural breaks in the sample due to discretionary central bank policies. In the West, the EMU candidates had to meet Maastricht and in the East the accession candidates exhibited heterogenous monetary and exchange rate policies as well. Accordingly, we cannot assume that the estimated MA coefficients will remain stable in the future. The important feature is therefore the impact on output growth which has the same direction in all of the countries.

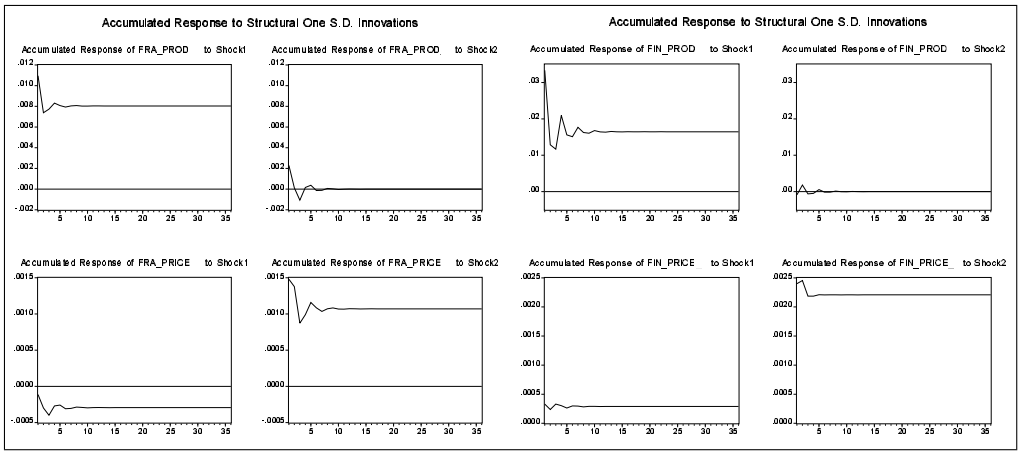

Figure 8: Impulse response functions: France and Finland

Year	EMU	CEEC∗	EMU + CEEC∗
1993	0.553000	0.492000∗∗	0.519000∗∗
1994	0.529000	0.454000	0.497000
1995	0.500000	0.405000	0.468000
1996	0.470000	0.357000	0.439000
1997	0.448000	0.341000	0.418000

Table 4: Coefficients of variation of national unemployment rates
∗ without Estonia
∗∗ without Slovak Republic
Data source: IFS (own calculations)

3.7 A closer look at labour markets

As mentioned above, an analysis of shock asymmetry should be completed by a look at labour mobility. Although there does not seem to exist sufficient mobility between East and West (see section 2.3), at least flexibility within the two groups may be useful as means of adjustment. According to Bini Smaghi and Vori (1993, p. 15) and Winschel (2001, p. 16), variability of national unemployment rates at time t may be used as proxy for mobility. Table 4 gives a survey of the development of the respective coefficients of variation over time. Relatively high values represent strong divergencies in national rates and point to low mobility and missing wage flexibility. All three series exhibit a negative trend, showing that variation declined in time. Additionally, the CEEC coefficients were, in comparison with EMU, lower. But still, the dispersion has been considerably higher than in e.g. the US (Winschel, 2001, p. 36, quotes a value of 0.21 for the USA in 1998). Thus, the assumption that labour is insufficiently mobile in Europe in order to correct for shock imbalances seems to be supported. This result enforces the importance of the shock analysis.

3.8 Shock convergence in the West

In order to study the impact of the ongoing currency integration on shock correlations we apply the SVAR method to Western European data in the sample 1996:1 to 2001:3.[28] In comparison with the results for the first half of the 90ies, there has been an evident concentration of the countries within a small bounded area in the coordinate plane. Figure 9 shows the changes in the estimated shock correlations within EMU between the samples 1990:1 to 1995:12 and 1996:1 to 2001:3. The position of the respective economies in the second period is marked by a dot while the shift is symbolised by a line. Evidently, the peripheral coun-

[28]Luxembourg time series do, due to data problems, already end in December 1998.

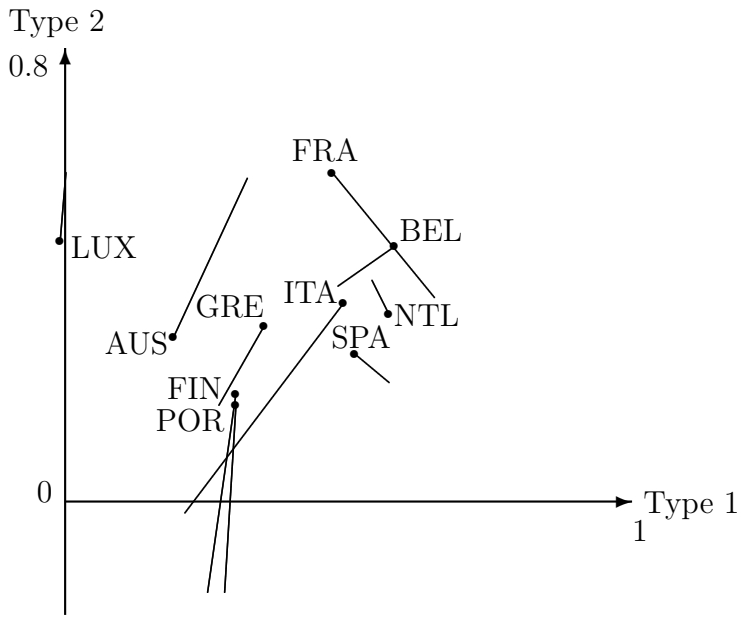

Figure 9: Changes in shock correlations: Western Europe

tries Finland, Greece, Italy and Portugal improved their position substantially. France was lower correlated with Germany with regard to type 1 shocks, but higher considering type 2 shocks. The only exception is Austria, exhibiting a strong reduction in both correlations with Germany. This observation may not be directly explainable by fundamentals.

Still, this short glance at convergence should be interpreted with caution as ECB's establishment in 1999 represented a structural break in the middle of the sample. A VAR estimation assuming a process stable in time could therefore be problematic. For a detailed shock convergence analysis we suggest to employ data not before January 1999. Unfortunately, there are so far only few observations so that the resulting estimations are not supposed to be reliable. Especially seasonal adjustment should be newly calculated (which is not advisable with data of just 3 complete years). As long as there are sufficiently long time series this approach might be used for assessing convergence behaviour after monetary unification. Still, it becomes obvious that the impact of changing structures on shock correlations can supposed to be high enough not to be ignored like all quoted studies on the CEEC did so far.

4 Conclusions

In this paper, we have assessed EMU suitability of the CEEC using a shock asymmetry analysis approach. Employing a structural VAR model, we identified economic shocks that hit the economies and evaluated their correlations.
The major contributions of the present paper are the choice of the reference area and the analysed sample. Present EMU, being itself in the state of transition in the observed period, is an adequate measure for comparison. Usage of data taken from long-existing currency unions such as the USA cannot be telling in the present context due to OCA criteria endogeneities. The sample choice largely turns out the effects of differing starting points on the way to currency unification. Again, the results from the convergence analysis in section 3.8 make clear that this aspect should not be ignored when studying shock correlations.
Although the scatter plot of the CEEC in the shock-1-shock-2 correlation diagram is concentrated more closely to the point of origin than those of EMU, from today's point of view one cannot judge the CEECs as worse accession candidates than present EMU members with regard to the aspect analysed in this paper. Concerning type 1 shocks, all CEECs except for Romania, are at least as closely correlated with EMU as Finland, Greece, Italy and Portugal with Germany six years ago. If correlation within present EMU is used as benchmark, there may just be doubts on Romania's EMU suitability. Still, this country does not belong to the first wave group so that its accession is not to be expected in the short run. If type 2 shocks are taken into consideration additionally, there emerges a clear picture: Western Europe exhibited in the first half of the 90ies a classification into the core countries Germany, France, Belgium, the Netherlands and Austria (plus the also quite high correlated Spain) and the remaining (periphery) countries. In the second half of the 90ies the CEEC did not prove to be as strictly categorised. Correlations with EMU were partly lower than those of EMU countries vs. Germany in the years before. Most strongly correlated concerning both shock types with EMU in the sample analysed was Hungary; the Czech Republic, Bulgaria and the Slovak Republic were especially with regard to the long-run-relevant type 1 shocks correlated with EMU. From the results above one cannot deduce that the CEEC are systematically less suitable for EMU than its present members. The results of the convergence analysis point to endogeneity of the analysed criterion. Again, this may be taken as positive aspect concerning assessment of OCA suitability of the CEEC. All in all, the findings for the CEEC derived in the present paper are more positive than e.g. in Frenkel, Nickel and Schmidt (1999) or Winschel (2001).
Future shock correlation research should also correct for the impact of changing structures by using lagged samples in the reference zone. When enough data are disposable, the SVAR method employed in this paper could also be used - similar to the Bayoumi and Taylor (1992) approach - to assess structural convergence of possible accession candidates.

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