Is a € - Bloc Emerging in Central and Eastern Europe?

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No. 11

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This paper was in November 2000 awarded first prize in the Centre for European Studies´ competition for theses on European themes.

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CFE Working paper series is published by
Centre for European Studies at Lund Univerity

Editor: Magnus Jerneck
Layout: ASVS, Lund
ISSN: 1403-6754

This paper is also available in pdf-format at CFE´s homepage: www.cfe.lu.se

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Abstract

Strengthened trade and financial links with western Europe, as well as a political agenda focused on EU-membership, indicates a growing importance of the EUR in the exchange rate policies of the Central and Eastern European (CEE) countries. If official policy of a CEE country places a heavy weight on exchange rate stability vis-à-vis the EUR, that exchange rate will reflect the market's perception of its ability to conform to EMU monetary policy. This paper investigates the extent to which a EUR-bloc of CEE currencies moving closely with the EUR, as proxied by the DEM, over the short and the long run is emerging. Having established that all CEE exchange rates are non-stationary, we test the short run co-movements with the DEM using OLS on the first differences of the data, and long run co-movements, in a bivariate and a multivariate model, by testing for cointegration using the Johansen (1991) method. The results indicate a growing short-run importance for the DEM over the period 1990-99, while a significant long-run relationship is found only for a small number of currencies. We conclude that even though most of the CEE-currencies have not shared a long-run trend with the DEM over the period, the increased short-run dependence may indicate that this (lack of) long run relationship may be changing, and a EUR-bloc emerging.

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1. Introduction

Since the beginning of the transition process from central planning to an open market economy in the beginning of the 1990's, the Central and Eastern European (CEE) countries have strengthened their ties with the European Union (EU). The external dependence on trade and finance has grown, and so has the political will to become a part of the western European community.

As applicants for EU-membership, all CEE countries are expected to fully adopt all EU-treaties. EMU is part of the common institutional and legal system, the *acquis communitaire*, of the union and as it has been decided that no more opt-out clauses will be given, all future members are expected to join as soon as the Maastricht criteria are fulfilled. Transition arrangements are subject to the present membership-negotiations, but some countries, Estonia and Slovenia, have already stated their intention to join the EMU early. Other countries have gradually placed a higher importance on the Euro (EUR) in their respective exchange rate policies by, for instance, increasing its weight in the currency basket and/or decreasing the fluctuation band around its reference value, in order to facilitate future membership in the EMU.

The exchange rate of a fully convertible currency reflects the market's perception of the sustainability of the country's monetary policy. If official policy of a CEE country is to place a heavy weight on exchange rate stability vis-à-vis the EUR, the exchange rate of that CEE-currency will reflect the market's perception of its ability to conform to EMU-monetary policy. In that case the monetary integration should be reflected in a closer relationship between the EUR and the CEE currency.

But to what extent is monetary integration happening? To what extent are the prospective EU-members trying to stabilise the value of their currencies in terms of the EUR and to what extent are the actual exchange rate movements conforming to the stated intentions? This paper investigates the growing importance of the EUR in the exchange rate policies of the CEE countries and aims to test whether a EUR-bloc of CEE-currencies, moving closely with the EUR over both the long and short term, is emerging.

The paper is organised as follows: Section (2) shows the growing importance of the EUR, as proxied by the Deutschmark (DEM), in the CEE, in terms of trade, financial flows and political links. It also includes an

overview of the exchange rate policies in the CEE-countries during the transition period. Section (3) outlines the methodology with respect to the short and long run perspectives. We use Ordinary Least Squares (OLS) on the first differences of exchange rate data to investigate short-term relationship between the DEM and the CEE currencies, and cointegration to investigate the long-term relationship. The results and conclusions are then presented, and section (4) provides a summary of the study.

2. EUR-Influence in Central and Eastern Europe

Numerous papers have in recent years investigated why major international currencies gain influence in a region of countries.[1] There are strong indications that the EUR is growing in importance for the monetary policy of the CEE-countries. This section summarises the political and economic trends, indicating why the CEE-countries, at an increasing rate, are being incorporated in the EUR-sphere.

2.1. Political indicators

In the turmoil after the fall of the Berlin Wall in1989 the CEE countries found their economic infrastructure incapable of facing the challenges of an open economy. They therefore almost immediately after the communist meltdown tried to seek a closer relationship with the EU countries and distance themselves from the Soviet Union. This process started effectively in 1988 when Hungary signed the Trade and Co-operation Agreements (TCAs) (see Table 1) with the then European Community (EC). The political and economic integration was further institutionalised at the Copenhagen Council in 1994 when the EU countries agreed to grant all associated CEE countries membership, provided that they meet certain economic and political conditions. These are (1)"the existence of stable institutions guaranteeing democracy, the rule of law, human rights, and respect for the protection of minorities, (2) the existence of a functioning market economy and the capacity to cope with competitive pressure and market forces within the EU; and (3) the ability to take on the obligations of membership, including

Table 1. Political Indicators

Date	Event
1970	The EU signs the first nonpreferential trade agreement with the former Yugoslavia
1971	The Generalised System of Preferences (GSP) is created and the former Yugoslavia is granted GSP treatment.
1975	The EU signs a second nonpreferential trade agreement with former Yugoslavia. Romania is granted GSP treatment
1988-91	The EU signs Trade and Cooperation agreements (TCAs) with Hungary (1988), Poland (1989), and the former Czechoslovakia, Bulgaria and Romania (1990), and extends GSP treatment to all of them. In 1989, the EU launches the PHARE program, initially limited to Hungary and Poland but subsequently extended to other CEE-countries. The EU grants its first balance of payments support loan to a CEE country (Hungary).
1992	The EU signs Europe Agreements (EAs) with the former Czechoslovakia, Hungary and Poland
1993	Interim Agreements implementing trade aspects of EAs with Czechoslovakia, Hungary and Poland enter into force. The EU signs TCAs with each of the Baltic countries and Albania
1994	The EU signs EAs with Bulgaria and Romania. Interim agreements with these two countries enter into force. The EU signs TCA with Slovenia. The European Council of Copenhagen accepts the principle of, and lays down the general criteria for, EU membership of the CEE-countries. It also accelerates the trade liberalisation calendars envisaged in the EAs.
1995	EAs with Hungary and Poland enter into force. The EU signs free trade agreements with the Baltic countries. European Council of Essen launches "pre-accession strategy" for the CEE-countries, including the "structured dialogue", and asks the Commission to prepare White Paper on the harmonising of legislation in the CEE-countries with those of the EU. Hungary applies for EU membership.
1996	EAs with Bulgaria, Czech Republic, Romania and Slovakia enter into force. EAs with Baltic countries signed. European Commission presents White paper. Bulgaria, Romania, Slovakia and the Baltic States apply for EU membership. The European Council of Madrid asks the European Commission to submit opinions on membership applications soon after the end of the 1997 Intergovernmental conference (IGC), and announces that accession negotiations with countries receiving positive opinions will start six months after the end of the IGC.
1997	Slovenia signs EA and applies for EU membership.
1998	Following the proposals made by the European Commission in the Agenda 2000, the European Council of Luxembourg agrees to start accession negotiations with the Czech Republic, Estonia, Hungary, Poland and Slovenia in the spring of 1998. The pre-accession strategy for applicant CEE-countries is reinforced by the decisions to establish "accession partnerships" and increase pre-accession financial assistance.
1998-99	EAs with Baltic countries enter into force. Accession negotiations 1999 with the Czech Republic, Estonia, Hungary. Poland and Slovenia start.

Source: Feldman and Temperano-Arroyo, 1999

adherence to the aims of political, economic and monetary union" (Feldman and Temprano-Arroy, 1999, 14).

The three above-mentioned statements are to be seen as an invitation to the CEE countries to join the EU when they have reached an adequate level of political and economic development. The Commission added a further condition later on, which said that EU could absorb new members only if this could be done without decreasing the pace of European integration. (Feldman and Temprano-Arroy, 1999, 14).

The Luxembourg summit in 1997 also proved to be a step in this direction when a new instrument called "accession partnership" was created. This basically means a thorough mentorship including expertise and advice on how to improve political and economical structures whilst preparing for membership.

Although the temporary costs of transition in terms of unemployment and lack of production growth may be high, the CEE-countries have indicated a strong political will to become members of the EU. The political will to become fully integrated members of the western European community is, however, very much motivated by economic factors such as increased trade-relations and closer financial links.

2.2 Trade Development

Before the fall of the Berlin wall the COMECON strictly regulated the trade to and among the CEE countries. This was an exchange organisation rather than a trade organisation in that the countries exchanged goods rather than traded goods for money. The system broke down abruptly in late 1989 when the east bloc collapsed.

During the years of transition exports from the CEE states to the EU grew by almost 30% annually, between 1993 and 1997 (see table 2). As shown above, the EU responded quickly to the political and economical change in CEE. In the first half of the 1990´s favourable trade agreements, so-called "Europe Agreements" (EAs) were signed with 10 CEE countries (Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia) which facilitated trade with the EU.

Table 2 shows how export patterns have developed 1993-1997 and how high the annual growth rates of exports have been. The most "advanced" countries (according to the original order of negotiation for EU-membership), the Czech Republic, Estonia, Hungary, Poland and Slovenia also had the highest export share to the EU of the CEE countries in 1997.

Table 2:Exports from central and eastern Europe to the EU

	EU Share of exports 1993	EU Share of exports in 1997	Average annual growth rate of exports to EU (1993-97)
Bulgaria	48	45	19
Czech Rep	55	60	28
Estonia	49	62	84
Hungary	58	71	43
Latvia	32	49	36
Lithuania	67	45	21
Poland	69	64	17
Romania	41	57	34
Slovakia	33	47	32
Slovenia	63	64	10

Source: Direction of Trade Statistics, IMF, 1998 in Köhler – Wes (1999)

A recent study by the IMF (1998) as quoted by Köhler-Wes (1999) estimated that a 1 per cent increase in real GDP in the EMU 11 states would yield an increase in exports of 0.7-1.6 per cent in the CEE economies. In addition, the increase of GDP would be in the range of 0.2-0.5 per cent.

The CEE countries have similar shares of exports and imports with the EU (Köhler-Wes, 1999, 6). This indicates that the integration with the EU does not just go in one direction but that both imports and exports have been rising.

2.3 Financial Flows

At the beginning of transition most countries immediately lifted the restrictions on Foreign Direct Investment (FDI) inflows but did not adopt the same strategy when it came to outflows. This gradually changed early in the transition period, and today, most countries guarantee the free repatriation of both profits and FDI capital. The liberalisation rate of the CEE economies has been rapid. For instance, the treatment of trade credits has also been liberal and in most countries individuals are allowed to hold and operate foreign exchange accounts at local banks, a privilege that most OECD countries have accorded only at the last stages of capital account liberalisation (Köhler-Wes, 1999, 17). Thus, in general, the restrictions on outflow are tighter than those on inflow and the taxation on short-term transactions is

more onerous than on long-term transactions. There, are though, some glaring exceptions from this general picture; the Baltic States and Estonia in particular. These countries opted already at the very beginning of transition for very high capital account openness.

Table 3 shows the degree of liberalisation for each country as measured by the IMF's "liberalisation value" (ranging from 0 to 100, with 100 representing the maximum degree of liberalisation). The table indicates that the more advanced countries have also opened up their economies to a higher degree than the other countries in the group.

Table 3: Indices of capital account liberalisation (position as of December 1997)

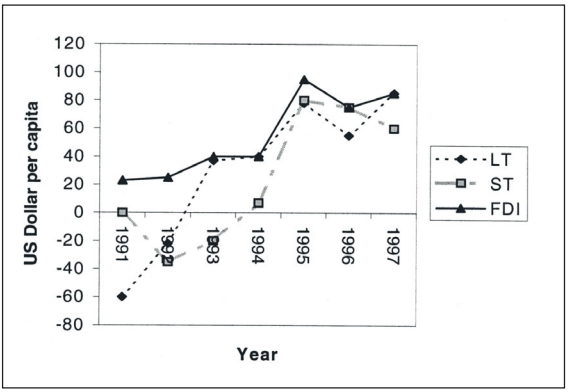
	Bulgaria	Czech Rep.	Estonia	Hungary	Latvia	Lithuania
Controls on direct investment	66.7	100.0	100.0	100.0	100.0	83.3
Controls on real estate investment	50.0	50.0	75.0	75.0	75.0	50.0
Controls on credit operations	37.5	62.5	100.0	75.0	100.0	62.5
Controls on portfolio flows	25.0	70.0	100.0	33.3	100.0	100.0
Overall index of liberalisation of the capital account	35.3	73.7	97.6	59.5	97.6	85.7

	Poland	Romania	Slovak Rep.	Slovenia	AVERAGE
Controls on direct investment	100.0	83.3	83.3	83.3	90.0
Controls on real estate investment	50.0	0.0	50.0	50.0	52.5
Controls on credit operations	75.0	0.0	50.0	37.5	60.0
Controls on portfolio flows	35.0	0.0	0.0	25.0	48.8
Overall index of liberalisation of the capital account	55.3	12.5	23.7	40.5	58.1

Source: Temperano and Feldman(1998); IMF (1997) in Köhler-Wes, 1999

Reducing the restrictions on capital flows facilitates an inflow of Foreign Direct Investment (FDI). Figure 1 summarises net capital flows to the CEEs as FDI, short term and long term capital transactions. The figure shows that there has been a strong upward trend in these flows but with initial disruptions, above all in the short-term flows. The trend of the long-term flows has, from the very onset and except for a slight downturn in 1995, been upward sloping. That trend was initially not supported by the short-term flows, which may depend on the restrictions placed upon such flows. The inflows of FDI have, for the entire period, been fairly stable, and have up to date constituted a significant proportion of all capital inflows. After the initial setbacks the net inflows of capital have since 1993 exceeded 3% of GDP for the region as a whole (Masson, 1999, 14).

Figure. 1. Average Foreign Direct Investment, Short Term and Long Term Flows to CEE (USD per capita)



Source; Masson (1999)

Figure 1, however, summarises net capital inflows from *all* states including the US and Japan. International capital flows are notoriously difficult to track. According to Agarwal (1997, 107), Germany is by far the biggest direct investor in the Central European countries. Between the periods 1987-90 and 1991-94 the CEE share of total German FDI outflows rose from 0.55% to 7.60%, which is an increase by 1,280% (Agarwal, 1997, 100).

There are, however, signs that the inflow of German investment will increase even further in this region in the future. According to Agarwal (1997, 109), "Central Europe appears to play the role of Hinterland for German and other EU investors, as South and Southeast Asia do for Japanese investors, and Latin America for US investors". Should the development in CEE follow that of other economically emerging regions, table 4 indicates that there should be room for more German direct investment in this region.

Table 4. Share of neighbouring regions in outward stock of FDI of Germany, EU, Japan and US 1990 and 1993 (percentages)

	1990	1993
South and Southeast Asian share in Japanese FDI	15.3	16.4
Latin American share in US FDI	14.2	15.5
CEE share in EU FDI	n.a.	1.3
CEE share in German FDI	0.2	2.3

Source: OECD (1996) in Agarwal (1997)

2.4 Summary of trends

Thus, there are strong indications pointing towards integration of the CEE states in the EUR-sphere: a political process, supported and motivated by an economical adjustment with an increasing degree of trade and financial flows between the two parties. A country that has large trade and financial flows with another country has an interest in decreasing exchange rate volatility vis-à-vis the currency of that country, in order to minimise uncertainty regarding the value of the flows. In addition, the added certainty of a stable exchange rate may improve future trade and investment flows.

The exchange rate reflects the credibility of a country's exchange rate policy in the eyes of the market. Therefore, a fluctuation in these rates reflects changes in how the market perceives the internal consistency of the country's policy mix, in particular with regard to inflation, money supply and exchange rate target. A change in the exchange rates of a CEE-currency that is tied to the EUR, reflects fluctuations in the market's perception of that country's ability to conform to EMU-monetary policy.

2.5 Exchange Rate policy in Central and Eastern Europe

The exchange rate regimes of the CEE countries differed widely initially and have evolved in different directions over time (see table 5). The facts in this overview of the exchange rate policies in the CEE-countries are taken from EBRD Transition Reports (1995, 1996 and 1997), Nuti (1996), Masson (1999) and Kopitis (1999).

Table 5. Currency Regimes in CEE (1990-1999)

		Monetary Policy	Basket/Target	Fluctuation Ban
Bulgaria/Lev	**Feb 1991**	Floating		
	Jul 1997	Fixed peg to DEM - Currency Board	DEM	0%
	Jan 1999	Fixed peg to EUR - Currency Board	EUR	0%
Czech Rep./Koruna	**Jan 1993**	Fixed peg to USD and DEM	USD 35%, DEM 65%	+/-0.5%
	Feb 1996	Fixed peg to USD and DEM	USD 35%, DEM 65%	+/-7.5%
	May 1997	Managed float	DEM (shadowing by inflation targeting)	
	Jan 1999	Managed float	EUR (shadowing by inflation targeting)	
Estonia/Kroona	**June 1992**	Fixed peg to EUR - Currency Board	DEM	
	Jan 1999	Fixed peg to DEM - Currency Board	EUR	
Hungary/Forint	**Jan 1991**	Fixed peg to USD and DEM	USD 50%, DEM 50%	
	May 1994	Fixed peg to USD and ECU	USD 30%, ECU 70%	
	Mar 1995	Crawling peg - monthly devaluation: 1.9%	USD 30%, ECU 70%	+/-2.25%
	Jan 1996	Crawling peg - monthly devaluation: 1.2%	USD 30%, ECU 70%	+/-2.25%
	Jan 1997	Crawling peg - monthly devaluation: 1.0%	USD 30%, DEM 70%	+/-2.25%
	Jan 1999	Crawling peg - monthly devaluation: 0.6%	USD 30%, EUR 70%	+/-2.25%
Latvia/Lats	**Feb 1994**	Fixed peg to SDR (informal)*	SDR	0%
Lithuania/Litas	**Apr 1994**	Fixed peg to USD - Currency Board*	USD	0%
Poland/Zloty	**Jan 1990**	Fixed peg to USD	USD	0%
	Oct 1991	Crawling peg - monthly devaluation: 1.8%**	USD 45%, DEM 35%, GBP 10%, FFr 5%, SFr 5%	0.5%
	May 1995	Crawling peg - monthly devaluation: 1.2%**	USD 45%, DEM 35%, GBP 10%, FFr 5%, SFr 5%	+/-7%
	Jan 1999	Crawling peg - monthly devaluation: 0.5%	EUR 55%, USD 45%	+/-12.5%
Romania/Leu	**Aug 1991**	Floating (dual exchange rates)****		
	Mar 1996	Floating (dual exchange rates)****		
	Jan 1997	Floating*****		
Slovakia/Korun	**Jan 1993**	Fixed peg to USD and DEM	DEM 60%, USD 40%	
	Jan 1996	Fixed peg to USD and DEM	DEM 60%, USD 40%	+/-3%
	Jan 1997	Fixed peg to USD and DEM	DEM 60%, USD 40%	+/-7%
	Aug 1998	Floating		
Slovenia/Tolar	**Oct 1991**	Floating (unofficial shadowing of the DEM)		
	Jan 1997	Floating (unofficial shadowing of the DEM)		

Source: Nuti (1996), EBRD Transition Report 1995, 1996 and 1997, Masson (1999)
** Lithuania and Latvia both floated their respective currencies before fixing them in terms of the USD and the SDR.*
*** The Polish Zloty was devalued by 7.4% in August 1993. The monthly crawl was thereafter resumed.*
**** The Polish Zloty was revalued by 6% in December 1995. The monthly crawl was thereafter resumed but gradually slowed down to 1% a month.*
***** Significant spread between official and free rates*

2.5.1 Bulgaria

Bulgarian monetary policy was initially to have a floating exchange rate. Deteriorating public finances, the slow reconstruction of the banking sector and the fear of government interference, however, made investors reluctant to invest in Bulgaria. Bulgaria came to experience severe price instability which was reinforced by the Asian crisis. This eventually forced the authorities to change exchange rate regime in July 1997 to a currency board with a peg between the Bulgarian *Lev* and the DEM. From the 1st of January 1999 the currency board is denominated in EUR instead of in DEM.

2.5.2 Czech Republic

After the peaceful split between the Slovak Republic and the Czech Republic, in February 1993, the *Koruna* was also split into two different currencies which both were subject to occasional revaluations and devaluations. Finally, in May 1993, in order to stabilise the currency, the government pegged the Czech *Koruna* to a basket containing DEM (65%) and USD (35%). But substantial inflows of capital during 1995 under a fixed rate regime made it increasingly difficult for the Czech National Bank (CNB) to control inflation. This led the CNB to widen the fluctuation band around the central parity from +/ - 0.5% to +/ - 7.5% at the end of 1996. On the 26 of May 1997, due to strong, speculative attacks during the Asian crisis, the government was forced to allow the currency to float.

2.5.3 Estonia

The Estonian authorities decided already in June 1992 to peg the *Kroona* to the DEM and created a currency board, which has been maintained throughout the period. Thus, Estonia can be said to automatically participate in the Euro currency area from the very beginning. Today, the *Kroona* is pegged to the EUR.

2.5.4 Hungary

The value of the Hungarian *Forint* was strongly influenced by the fiscal policy. Since the Hungarian public finances were characterised by large indebtedness the exchange rate in particular was effected by changes in the expectations of fiscal stance. The deterioration of the fiscal position led to an increasing downward pressure on the peg to the DEM and USD. In order to cool inflation expectations down and correct external imbalances, the authorities began eliminating the budget deficit and introduced a crawling peg. The central rate against the basket is devalued daily at a pre-announced rate. The cumulative monthly rate of devaluation was reduced from 1.9% in 1995 to 0.8% in January 1999 in several steps. Today Hungary still has a crawling peg with a currency basket containing USD30% and EUR 70%. Before Jan 1, 1999 the basket contained the DEM instead of the EUR. The bandwidth in which the spot rate may fluctuate is +/- 2.25% and the midpoint is devaluted by 0.6% every month against the basket. Hungary was less affected by the Asian turmoil in 1997 but suffered some setbacks

from the Russian crisis in 1998. For instance, the exchange rate hit the bottom of the band in October 1998 but this development was successfully reversed with a significant rise in the short-term interest rate. In comparison with the Czech Republic, this shows that a country with some exchange rate flexibility could be in a better position to fight off outside financial shocks. (Kopitis, 1999, 26)

2.5.5 Latvia

The Latvian authorities initially floated and thereafter pegged the *Lats* informally to the SDR in 1994. Today there is no immediate intention to repeg the *Lats* to the EUR. Like the other two Baltic States, Latvia offers complete and effective current account and capital account convertibility.

2.5.6 Lithuania

Like the Latvian authorities, the Lithuanian authorities floated, then pegged the *Litas* to the USD and introduced a currency board in 1994. Lithuania is currently considering switching the peg from the USD to the EUR.

2.5.7 Poland

Poland began the post-communist era with a fixed rate linked to the US dollar, which was maintained only 17 months until May 1991 when the currency was linked to a currency basket. From October 1991 until the 16 May 1995 the *Zloty* followed a daily crawling devaluation at a pre-announced monthly rate (1.8%, then 1.2% per month). Since then the *Zloty* has been floating within a 7% band around a baseline of daily crawling devaluation. The band has been widened several times to increase flexibility. Today the bandwidth is around +/- 12.5% against a basket of currencies containing EUR (55%) and USD (45%).

2.5.8 Romania

Romania has experienced the slowest transition of the CEE-economies. The country is one of the few in eastern Europe in which people today have lower average life expectancy than before the revolution in 1989. The *Leu* has been floating but the authorities retained the option to intervene (and have done so several times) in order to stabilise the exchange rate. The fiscal mismanagement in combination with lack of a credible exchange rate

has led to severe inflation and monetary disorder. Romania was, together with Bulgaria and Albania, the country in the former east-bloc that suffered the most in every aspect from the fall of socialism, as these countries were the most "planned" economies.

2.5.9 Slovakia

Slovakia shared monetary policy within the Czech and Slovak Federative Republic (CSFR) up until the split between these two countries in 1993. Thereafter, Slovakia has chosen a monetary policy similar to the Czech Republic. In July 1993, seven months after the split, mainly due to concerns about competitiveness, the authorities decided to peg the Slovak *Koruna* to the DEM and USD, which was followed by an immediate 10% devaluation of the peg. The fluctuation band around the central parity was then +/- 3% but was changed to +/- 7% in late 1996. This action was intended to discourage speculative inflows of foreign capital. Partly due to the Russian crisis in August 1998 monetary policy was once again changed and the *Koruna* has been floating since then.

2.5.10 Slovenia

Slovenia, which was close to macroeconomic balance in 1990, tried to adopt a more flexible monetary policy immediately after the collapse of central planning. The country has been able to maintain its original monetary policy with a managed float. The unofficial objective of monetary policy has been to enable the *Tolar* to shadow the DEM.

2.6. Conclusions

From the outset the transition economies had a choice between adopting a strict or a more flexible exchange rate regime. Some countries started with a flexible exchange rate policy whilst others chose to anchor their policies with a fixed exchange rate at first. Over the period several changes in exchange rate regime have occurred and today a wide range of exchange rate arrangements is represented among the CEE countries.

The question is whether a general trend in exchange rate stabilisation vis-à-vis the EUR is occurring. In order to evaluate the extent to which the prospective EU-members are trying to stabilise the value of their

currencies in terms of the EUR and the extent to which they have been successful in doing so, a more formal approach is needed.

3. Testing for the Emergence of a EUR-bloc

Testing the possible emergence of a EUR-bloc requires detecting change in patterns over the transition period as a whole.

3.1 The Short and the Long Run

It is important to distinguish between short-run and long-run relations. The short-run relation is the extent to which the fluctuations in the value of a particular currency can be explained by the fluctuations in the value of another currency. In the absence of long-term trends in any of the variables, this relation is testable by simple OLS techniques on the levels of the series. If, however, there are long term trends in one or more of the variables in a model, the variables are non-stationary, and there will be a difference between the short- and the long run. OLS on the levels of the series is then no longer an appropriate test method for either the short or long run relationship between two or more variables. The coefficients of the regression no longer converge in probability as the sample size increases and the distributions of the t-test diverge so that there are no correct critical values for the conventional significance test (Phillips (1985) as referred by Hendry (1986, 203). This has the important implication that OLS on the levels of non-stationary variables may detect statistically significant relations between two independent variables, a so-called "spurious regression".[2]

A series is said to be stationary if its expected value and population variance is independent of time and if the population covariance between its values at time t and $t+s$ depends on s but not on time (t). If in a model such as:

$$(1) \qquad \gamma_t - \mu = \varphi(\gamma_{t-1} - \mu) + \varepsilon$$

$\varphi=1$, deviations from the trend μ caused by an innovation ε, become permanent. (1) becomes a random walk and can wander arbitrarily far from the starting point, should enough time pass. As t increases, the variance of γ

approaches infinity. If, however, $\varphi<1$ the series will revert to its mean and the variance of y is finite.

A non-stationary series that can be made stationary by differencing once is called integrated of order one, *I(1)*, and one that can be made stationary by differencing twice, integrated of order two, *I(2)*. A stationary series is called integrated of order zero, or *I(0)*. Likewise a trend-stationary series is a series that can be made stationary by extracting a time-trend.[3] There are substantial differences between *I(0)* and *I(1)* series. An *I(0)* series has a mean and a tendency to return to this, so that there is a fluctuation *around* the mean. Autocorrelations decline rapidly as lag increases and the process gives low weight to events in the medium to distant past. The process can be said to have "finite memory" (Granger 1986, 214). An *I(1)* process (without a drift) will be relatively smooth and wander widely, and only occasionally will it return to an earlier value. Autocorrelations have a value close to one and an innovation to the process will thus affect all later values and the process can be said to have "indefinitely long memory" (Granger 1986, 214).

If, in a model such as:

$$(2) \qquad X_t = AY_t + \varepsilon$$

X_t is *I(0)* but Y_t is *I(1)*, then the value of A (the coefficient of Y_t) is forced to be near zero. Most economic variables *have* changed radically in the mean and variance over time, which has profound consequences for the statistical properties of estimators and tests (Hendry 1986, 201).

Consequently, when time series in a model are non-stationary, the appropriate way of dealing with the short-term relation is by using OLS on the first differences of the series (should they be first-order integrated), and with the long-term relation by testing whether or not they are *cointegrated*, i.e. share common trends. Thus, in order to test *any* relation it is necessary to start with a test for non-stationarity, which can be thought of as a pre-test to avoid spurious regressions situations.

3.2 Test for Unit Roots

If a series is *I(1)* it is said to contain a "unit root". The unit root test is based on the following regression:

$$\Delta \ln E_{it} = \beta_0 + \beta_1 t + \beta_2 \ln E_{it-1} \quad (3)$$

where E_{it} is the exchange rate between the currency *i* and the numeraire currency (in our case, the SDR) in period *t* (the "value of currency *i*"), and $\Delta lnE_{it} = lnE_{it} - lnE_{it-1}$. The data are taken from the IMF's *International Financial Statistics* (1999, subject code "..aa.."), and the data set is monthly, spanning a period from 1990 to 1999 for a group of ten CEE countries.[4] The test is the Dickey - Fuller (DF) test for the hypothesis that ΔlnE_{it} is non-stationary, i.e. that the levels contain unit roots. It is based on Dickey-Fuller t-statistic on the null-hypothesis of a unit root, $\beta_2 = 0$ (Dickey-Fuller 1979). Since (3) can be rewritten as:

$$lnE_{it} = \beta_0 + \beta_1 t + (1+\beta_2)\, lnE_{it-1}$$

if $\beta_2 = 0$ the rewritten equation becomes a simple random walk with a drift, where variance is not independent of time, and the series is consequently non-stationary. In order to remove any serial correlation, the right-hand side of equation (3) may be supplemented by $\Sigma_{i=1}^{k} \alpha \Delta lnE_{it-1}$. Sufficiently high values of *k* will remove any residual autocorrelation and secure an approximate white noise-error term in the ADF-regression. When lagged differentials are added, the test of the augmented equation becomes the Augmented Dickey-Fuller (ADF)-test. To test for unit roots in the differences of the series, that is if the variables are integrated of the second order, the same equation is run, with $\Delta^2 lnE_{it}$ as dependent variable and ΔlnE_{it-1} replacing lnE_{it-1}.

As can be seen in table 6, (the natural logarithm of) all variables are integrated of the first order and none of the second order. Thus, in order to study the short-run relationship between the CEE currencies and the EUR we use OLS on the first differences of the variables, which, since there are no unit roots in the differences, are stationary, and then proceed to investigate the long run by testing for cointegration.

Table 6. DF/ADF Test for Unit Roots

Model: $\Delta \ln E_{it} = \beta_0 + \beta_1 t + \beta_2 \ln E_{it-1} + \Sigma^{k}_{i=0} \alpha \Delta \ln E_{it-1}$

Currency	Number of Unit Roots	t	k
Bulgaria/Lev	1	-2.754	0
	2	-11.234***	0
Czech Rep./Koruna	1	-2.181	0
	2	-10.254***	0
Estonia/Kroona	1	-1.164	0
	2	-8.215***	0
Hungary/Forint	1	-2.588	0
	2	-11.628***	0
Latvia/Lats	1	-2.613	1
	2	-7.219***	0
Lithuania/Litas	1	-2.774	0
	2	-5.763***	1
Poland/Zloty	1	-0.653	0
	2	-10.309***	0
Romania/Leu	1	-1.685	0
	2	-10.674***	0
Slovakia/Koruna	1	-0.472	0
	2	-8.856***	0
Slovenia/Tolar	1	-2.411	3
	2	-9.579***	1
Germany/DEM	1	-2.295	0
	2	-9.273***	0
USA/USD	1	-2.456	1
	2	-9.434***	0
Russia/RR	1	-3.022	1
	2	-6.511***	0
UK/GBP	1	-1.461	1
	2	-8.513***	0
France/FFr	1	-2.482	0
	2	-10.162***	0

Note: t is the DF/ADF t-statistic for the null hypothesis of one unit root

*(i.e. $\Delta \ln(E_i)$ is stationary) or two unit roots(i.e. ($\Delta^2 \ln(E_i)$ is stationary). ***/**/* = rejection of the null-hypothesis of unit root in levels/first differences at 1/5/10%-level (McCinnon's critical values). k is the number of lags of the dependent variable in the DF (k=0) or ADF (k>0).*
All variables are the log of the levels.
Data: IMF - International Financial Statistics (1999):Monthly Data

3.3 The Short Run Relationship - Correlated fluctuations of the Individual Currencies

In order to draw conclusions from the behaviour of the CEE-currencies over the past decade, since the convertibility, we use the DEM as a proxy for the EUR. Not only is the German economy by far the most important in the EMU-area (35% of total GDP in the area (The Economist (1999)), but also the pegging within the Exchange Rate Mechanism (ERM) has, at least after 1993, limited intra-ERM fluctuations. If a EUR-bloc is developing in CEE one would expect the influence of the DEM in the determination of the value of the CEE-currency to be increasing relative other international currencies.

To investigate the short-run relationship, we use a simple model that determines the change in the value of the particular CEE-currency as a function of three "international currencies", the DEM, the US Dollar (USD) and the Russian Rouble (RR).[5] This model is used by, among others, Frankel/ Wei (1993) to investigate the relative importance of the Japanese Yen (JPY) in determining the South East Asian currencies[6].

The model is expressed as:

$$\Delta E_i = \alpha + \beta_1 \Delta E_{usd} + \beta_2 \Delta E_{dem} + \beta_3 \Delta E_{rr} + \varepsilon \quad (4)$$

where the change in the value of each currency is the logarithm of the first differences. The model allows us to investigate the short-term link between the individual CEE-currency and the DEM, versus the link to the other currencies in the model. In the case of a perfect basket peg, OLS will uncover the correct weights attached to each currency in the basket, assuming of course that all relevant currencies are included. The weight will be inferred statistically from the observed movements. With this specification, the constant will capture any trend appreciation or depreciation, not accounted for by movements in any of the determinant currencies relative to the numeraire. As such the constant will permit a "crawling peg".

When the currency is perfectly pegged to a basket, the choice of numeraire makes no difference in the estimation of the weights. If it is not, however, the choice will affect the interpretation of the error term (Frankel/ Wei 1992, 297). Here we have used the SDR as numeraire, as it is readily

available for all countries in the study.[7] As described above, most of the CEE countries have had to or chosen to change exchange rate policy at least once over the decade since convertibility. In order to account for such changes as well as changes in the composition of individual baskets, and without losing too many observations available for each period, we also split the sample and run the regression for two sub-periods, 1990-95 and 1995-99.

Most basket-peggers, such as for example the Southeast Asian countries, keep the weights in the basket secret. (Frankel/Wei 1992, 297) The reason is presumably that secret weights allow governments to devalue secretly when they so wish. The drawback to this is that secrecy undermines the credibility of the exchange rate commitment. The CEE-countries have chosen to emphasise the credibility aspect and can be considered as relatively open about their policies. Poland and Hungary, for example, have practised a policy of openly devaluing their respective currencies on a monthly basis, and have also announced officially the weights in the basket. Still, since the OLS-technique does not discriminate between "official" and "actual" policy, should there be a discrepancy, it is preferable to infer policies by observing actual behaviour, rather than relying on official pronouncements.

3.3.1 The unrestricted model

The results of applying equation (4) to the CEE-countries are shown in table 7.

Table 7. The importance of the DEM, USD and RR in the exchange rate policies of the CEE

Model: (3) $\Delta E_t = \alpha + \beta 1 \Delta E_{usd} + \beta 2 \Delta E_{dem} + \beta 2 \Delta E_{rr} + \varepsilon$

										Correction for:		Wald Coefficient Test: FFR=GBP=0
Country/Currency	**Time Period**	**Constant**	**USD**	**DEM**	**RR**	**FFR**	**GBP**	AdjR²	#Obs	AC	HS	F-Statistic
Bulgaria/Lev	1990:01-1995:09	0.013***	0.468*	0.267	0.008			0.014	27			
	1995:10-1999:07	0.067**	-2.691	3.015	0.032			0.061	39			
	1990:01-1999:07	0.052	-0.339	1.112	-0.026			0.175	64	*		
	1990:01-1999:07	0.054*	-0.217	-0.969	-0.009	2.356	-0.675	0.179	64	*		1.16
Czech Rep./Koruna	1990:01-1995:09	-0.001	0.198*	0.540***	0.007			0.651	20			
	1995:10-1999:07	0.001	0.296	1.056***	-0.027			0.283	39	*		
	1990:01-1999:07	0.001	0.368	0.895***	-0.029			0.302	57	*		
	1990:01-1999:07	0.001	0.425	0.885**	-0.029	0.025	-0.182	0.288	57	*		0.51
Estonia/Kroona	1990:01-1995:10	0.000	0.023	0.942***	0.002			0.845	25			
	1995:10-1999:08	0.000	0.019	0.975***	-0.003			0.912	39			
	1990:01-1999:07	0.000	0.008	1.000***	0.005			0.922	64	*		
	1990:01-1999:07	0.000	0.032	1.119***	-0.002	-0.169*	0.038	0.888	64	*		2.11
Hungary/Forint	1990:01-1995:10	0.0170**	1.100**	0.800**	-0.016			0.451	27		*	
	1995:10-1999:08	0.010***	0.300**	0.600***	0.011			0.421	39		*	
	1990:01-1999:07	0.013***	0.730**	0.635***	-0.005			0.311	66			
	1990:01-1999:07	0.013***	0.730***	0.602**	-0.006	0.027	0.027	0.286	66			0.07
Latvia/Lats	1990:01-1995:11	-0.010	-0.082	-0.95	0.061			0.162	27			
	1995:10-1999:09	0.000	-0.039	0.03	0.003			0.540	39	*		
	1990:01-1999:07	-0.001	0.036	-0.45	0.014			0.024	66		*	
	1990:01-1999:07	-0.001	0.031	-0.728	0.012	0.286	0.049	-0.003	66		*	0.15
Lithuania/Litas	1990:01-1995:11	0.025	1.444	-0.63	0.123			0.061	27			
	1995:10-1999:09	0.000	0.864***	-0.037	0.005			0.953	39	*		
	1990:01-1999:07	0.004	1.271***	-0.221	0.093*			0.355	58			
	1990:01-1999:07	0.001	1.477***	0.696	-0.133**	-0.93	-0.616*	0.391	58	*		2.47*
Poland/Zloty	1990:01-1995:12	0.015***	0.175	0.084	0.012			-0.103	27			
	1995:10-1999:10	0.006**	0.283	0.525**	0.014			0.030	39		*	
	1990:01-1999:07	0.010**	0.260	0.316	0.017			0.006	66			
	1990:01-1999:07	0.010***	0.249	-0.287	0.011	0.613	0.101	0.037	66		*	1.29
Romania/Leu	1990:01-1995:12	0.055***	0.840	0.224	0.050			-0.030	27			
	1995:10-1999:10	0.035*	-0.010	1.151	0.083			0.085	39	*		
	1990:01-1999:07	0.050***	0.453	0.672	-0.017			0.081	64	*		
	1990:01-1999:07	0.047***	0.449	-0.187	-0.018	0.836	0.299	0.071	64	*		0.67
Slovakia/Koruna	1990:01-1995:13	0.01	0.705*	0.887**	-0.100			0.263	20			
	1995:10-1999:11	0.002	0.541***	0.793***	0.030			0.493	39		*	
	1990:01-1999:07	0.003	0.485***	0.781***	0.008			0.311	59			
	1990:01-1999:07	0.003	0.485***	0.109	0.008	0.738***	-0.052	0.383	59			4.23**
Slovenia/Tolar	1990:01-1995:13	0.011**	-0.023	1.085***	0.046*			0.590	27			
	1995:10-1999:11	0.004***	-0.042	0.943***	-0.014			0.760	39			
	1990:01-1999:07	0.010**	-0.014	0.950***	-0.031**			0.732	64	*		
	1990:01-1999:07	0.009**	-0.016	0.978***	-0.031**	-0.031	0.000	0.722	64	*		0.02

Note: All currencies are measured in terms of SDR. "AdjR²" refers to the R² value adjusted for degrees of freedom. ""/"**"/"***" = "significant at the 99/95/90% level".*
Autocorrelation (AC) adjusted for by adding AR() terms.Heteroscedastisity (HS) corrected for using White's (1980) heteroscedastidity consistent covariance matrix (HCCM) estimator.
Data: IMF - International Financial Statistics (1999):Monthly Data

The importance of the respective determinant currencies is in line with official policies over time. The appearance of a significant, positive value on

the constant for Poland and Hungary is in accordance with their stated policy of pre-announced devaluation of the *Zloty* and the *Forint*. In addition, the Bulgarian *Lev*, the Romanian *Leu* and the Slovenian *Tolar* have experienced devaluation in both sub-periods relative to the determinant currencies, something that has not been official policy. Likewise, the coefficients of the determinant currencies generally correspond with a priori expectations. Estonia and Lithuania, for example, both display highly significant and positive coefficients, reflecting the currency board pegs to the DEM and the USD respectively. Those countries which have had a policy of basket pegging or managed floating with a reference basket, the Czech Republic, Hungary, Slovakia and possibly Poland, show significant, positive coefficient values for both the USD and DEM. Romania and Bulgaria, both of which have had floating currencies over most of the period (Bulgaria switched to a currency board in 1997) show no significant relation to either the USD or the DEM, and the adjusted R^2 values are very low in both cases, reflecting the poor explanatory power of the basket-model in these cases.

We also allow for the possibility of some effect of two other major currencies: the Pound Sterling (GBP), since it is the most important European currency outside the EMU and once played a role as the world's international currency, and the French Franc (FFr) to allow for the possibility that the DEM is not the most important currency inside the EMU, and possible effects of less than perfect correlation between the FFr and the DEM. The results shown in the fourth row for each currency in table 7, clearly demonstrate that none of these historically important currencies have any importance for the CEE-currencies (with the exception of the Slovakian *Koruna*, which appears to be correlated with the FFr rather than with the DEM, and some relatively weak relation between the Estonian *Kroona* and the FFr and the Lithuanian *Litas* and the GBP).

A final, and important, observation is that the Russian Rouble (RR), which once was the dominant foreign currency in the region, no longer has any significant impact on the exchange rate movements in CEE. This is clearly a reflection of the declining importance of the Russian Federation as a trading partner and investor, but also reflects the political agenda of the transition countries in CEE to focus on integration with Western Europe. Also, the high volatility of the Rouble makes it an unsuitable target for an exchange rate peg.

A word of caution is also in place. The number of observations for the sub-periods are rarely higher than 40, which may explain the lack of significant values in some cases, notably Poland, where one would expect to find one. Latvia has had a currency board and a peg to the SDR, and the lack of significant results is due to the (almost complete) absence of movements in the value of the *Lats* in terms of SDR since 1994.

3.3.2 The restricted model

In order to see how the individual currencies are weighted in the hypothesised baskets, we have to impose the restrictions that the coefficients of the determinant currencies sum to unity. As can be seen in table 8, where the restriction that the weights of the three initial currencies sum to unity is tested, only in the case of Lithuania (1991-99, and for the sub-period 1995-99) and Latvia (1995-99) can this restriction be rejected.

Table 8. Wald Coefficient Test of Restriction:

(F-Statistic of Null-Hypothesis: $\beta_{usd}+\beta_{dem}+\beta_{rr} = 1$)

Currency	Period: 1990-95	1995-99	1990-99
Bulgaria/Lev	0.28	0.02	0.01
Czech Rep./Koruna	2.37	0.22	0.34
Estonia/Kroona	0.04	0.01	0.09
Hungary/Forint	1.28	0.52	0.59
Latvia/Lats	2.39	370.83***	10.43***
Lithuania/Litas	0.00	6.29**	0.00
Poland/Zloty	1.73	0.12	1.31
Romania/Leu	0.01	0.02	0.01
Slovakia/Koruna	0.73	2.23	1.10
Slovenia/Tolar	0.06	0.30	0.30

****/**/* = Rejection of restriction at 1/5/10 % level*

We then proceed by running the restricted regression (5) for the same periods and countries (except for Lithuania and Latvia). The estimates are shown in table 9.

$$(5) \qquad \Delta E_i = \alpha + \beta_1 \Delta E_{usd} + \beta_2 \Delta E_{dem} + (1 - \beta_1 - \beta_2)\, \Delta E_{rr} + \varepsilon$$

Table 9. The importance of the DEM, USD and RR in the exchange rate policies of the CEE-countries (Restricted Model)

Restricted Model: $\Delta E_i = \alpha + \beta_1 \Delta E_{usd} + \beta_2 \Delta E_{dem} + (1 - \beta_1 - \beta_2) \Delta E_{rr} + \varepsilon$

Country/Currency	Time Period	Constant	USD	DEM	RR	AdjR^2	#Obs	Correction for: AC	HS
Bulgaria/Lev	1990:01-1995:09	0.013***	0.498***	0.392***	0.000	0.059	32		
	1995:10-1999:07	0.060**	-1.606	2.583**	-0.001	0.068	39		
	1990:01-1999:07	0.053	-0.199	1.222	-0.001	0.170	62	*	
Czech Rep./Koruna	1990:01-1995:09	-0.001	0.345***	0.655***	0.000	0.525	23		
	1995:10-1999:07	0.003	0.017	0.983***	0.000	0.232	40	*	
	1990:01-1999:07	0.003	0.164	0.837***	-0.001	0.225	63	*	
Estonia/Kroona	1990:01-1995:10	0.001	0.046	0.954***	0.000	0.793	30		
	1995:10-1999:08	0.001	0.009	0.991***	0.000	0.921	40		
	1990:01-1999:07	0.001	0.031	0.969***	0.000	0.861	70	*	
Hungary/Forint	1990:01-1995:10	0.007	0.587***	0.410***	0.003	0.352	31		*
	1995:10-1999:08	0.015***	0.416***	0.584***	0.000	0.466	40		*
	1990:01-1999:07	0.014***	0.526***	0.474***	0.000	0.298	71		
Poland/Zloty	1990:01-1995:12	0.024***	0.577***	0.425***	-0.002	-0.022	31		
	1995:10-1999:10	0.013*	0.434***	0.567***	-0.001	0.088	40		*
	1990:01-1999:07	0.019***	0.522***	0.479***	-0.001	0.089	71		
Romania/Leu	1990:01-1995:12	0.100***	1.251***	-0.239	-0.012	0.285	31		
	1995:10-1999:10	0.020	-0.197	1.196**	0.001	0.02	40	*	
	1990:01-1999:07	0.066***	0.673**	0.329	-0.002	0.05	71	*	
Slovakia/Koruna	1990:01-1995:13	0.012	0.349**	0.653***	-0.002	0.203	23		
	1995:10-1999:11	-0.008	0.360***	0.639***	0.001	0.586	40		*
	1990:01-1999:07	0.001	0.370***	0.630***	0.000	0.316	63		
Slovenia/Tolar	1990:01-1995:13	0.023***	-0.006	1.060***	-0.054	0.663	31		
	1995:10-1999:11	0.005	-0.007	1.007***	0.000	0.751	40		
	1990:01-1999:07	0.014***	-0.026	1.027***	-0.001	0.648	71	*	

Note: All currencies are measured in terms of SDR. "AdjR^2" refers to the R^2 value adjusted for degrees of freedom.
*"**/**/*" = significant at the 99/95/90% level. Autocorrelation (AC) adjusted for by adding AR() terms.*
Heteroscedastisity (HS) corrected for using White's (1980) heteroscedasticity consistent covariance matrix (HCCM) estimator.
Data: IMF - International Financial Statistics (1999):Monthly Data

The coefficient can be interpreted as reflecting the relative importance of the determinant currencies in the hypothetical basket. The restricted model offers a better reflection of the relative importance of the determinant currencies and the switch in weights that has occurred over the period. For Hungary and Poland the restricted model clearly reflects the crawling basket-peg, which both countries have practised. Hungary switched to a crawling from a fixed peg in 1995, as is reflected by the significance of the constant in the second period but not the first. Poland has had a crawling peg throughout most of the period which is also reflected in the significance of the constant

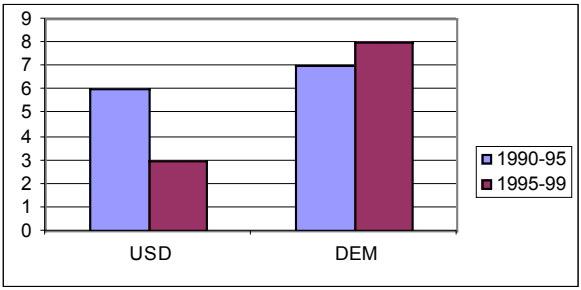
in both periods. The model also captures the significance of the Czech Republic's initial peg to *both* the USD and the DEM, which was abandoned in 1997 in favour of a managed float, and desired long-term stability vis-à-vis the DEM. The estimates support the view that this "implicit shadowing" has been very strong in the second period. Equally interesting is the Slovenian *Tolar,* which officially has been floating. Strongly significant estimates which are *in*significantly different from one, and relatively high R^2-values, indicate that the *Tolar* has been virtually pegged to the DEM.

3.3.3 The Short Run Relationship - Conclusions

What evidence is there for the emergence of a EUR-bloc? One can get an indication by comparing the relative weights of the DEM and the other currencies in the model in the two sub-periods and investigating the gradual switch in "allegiance" from one currency to another. One can also see whether the weights of the individual currencies increase or decrease from the first to the second period. Both of these methods indicate a growing importance for the DEM.

Although overall both the USD and the DEM, but not the RR, seem to have influence in the region, there has been a shift *away* from the USD towards the DEM. In the period 1990-95 the USD had a weight significantly different from zero at 90% level for 6 currencies, whereas the DEM had a weight different from zero for 7 of the currencies. In the period 1995-99 the same was true in only 3 cases for the USD, as opposed to 8 for the DEM (see figure 2). For the period as a whole the USD had a weight significantly different from zero for 5 currencies, the DEM 7 (according to the restricted model).

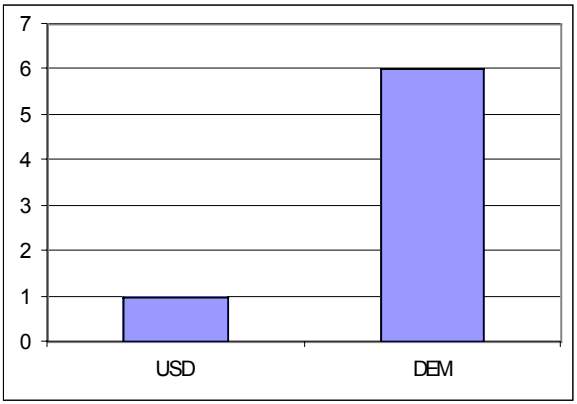
Figure 2. Number of CEE currency baskets with significant weights for the USD and the DEM.



Note: The left hand scale indicates the number of CEE currency baskets for which the DEM/USD has a significant weight at the 90% level.

The importance of the DEM is also confirmed by the fact that for 6 of 8 currencies tested in the restricted model, there has been an increase in the weight of the DEM whereas for the USD this has only happened for one currency (the Slovakian *Koruna*). (Figure 3)[8]

Figure 3. Number of CEE currency baskets for which the weights have increased for the USD and the DEM from 1990-95 to 1995-99



To summarise we can conclude that: (1) The estimates correspond to what one would expect from official policy. (2) Both the USD and the

DEM have had a significant influence on the value of the CEE currencies. (3) However, the role of the DEM has increased over the period at the expense of the USD. (4) The RR has lost all significance in CEE.

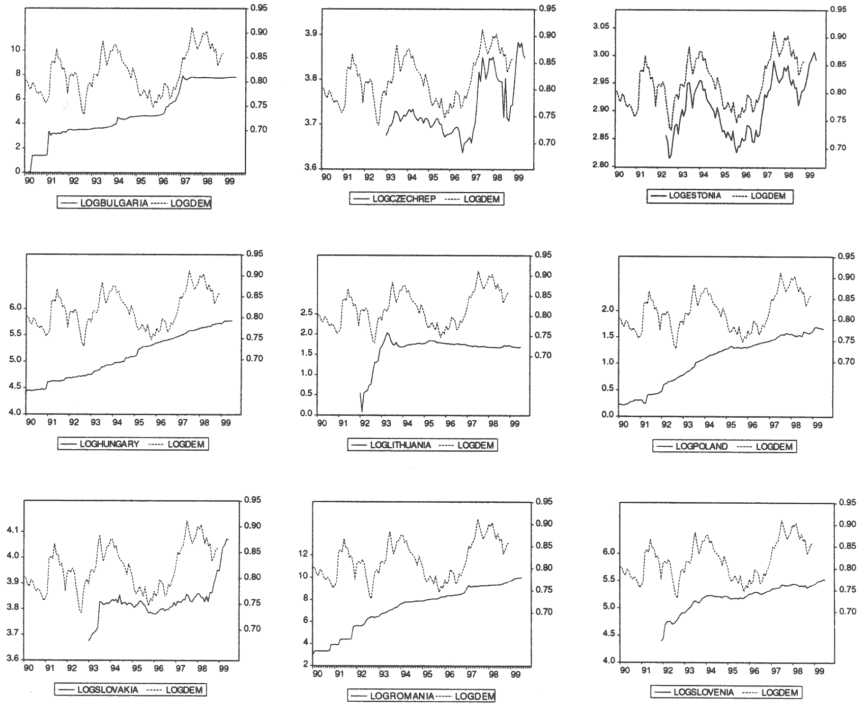
Thus, judging by the increasing influence of the DEM in determining short-run fluctuations in the CEE exchange rates, there are signs of an emerging EUR-bloc in the region. But this is not the same as establishing a long-run trend-relationship among the currencies. Having established that the DEM has gained influence over the CEE-currencies, we proceed by investigating the existence of any long-term relationship and whether the currencies move together as a group, influenced by the DEM (and thus to be influenced by the EUR). The issue is whether or not the currencies are cointegrated.

3.4 The Long Run Relationship – Cointegration among Currencies

OLS-regression on the first differences can be said to capture the effects of movements in the determinant on fluctuations around a trend (should the levels of the time-series be non-stationary) in the dependent variable. Cointegration of a system of two or more currencies signifies, on the other hand, that they *share* one or more long-run trends; they are all tied to at least one long-run equilibrium path. One or more linear combinations of these variables are stationary even though individually they are not. By analysing only first differences any long-term trend-relationship is lost.

Figure 4 below shows the movements of the logarithmic value in terms of the SDR of the individual CEE-currencies together with those of the DEM.

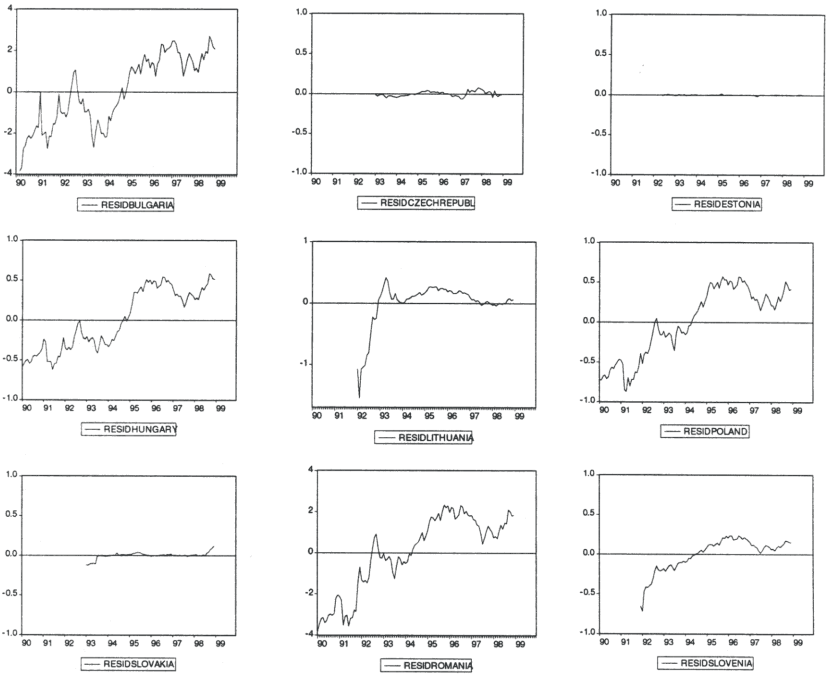
Figure 4: The movements of the CEE currencies and the DEM. (Dual scale - DEM right hand scale)



The diagram illustrates the different policies adopted by the various governments. The Estonian *Kroona* and Czech *Koruna* appear to have followed the DEM relatively closely, which has also been the objective of the respective exchange rate-policies of the countries. The graph also illustrates the gradual deviation from the DEM-path of a number of currencies. For some, notably the Polish *Zloty* and the Hungarian *Forint*, this has been explicit policy (crawling peg for most of the period) whereas for others, such as the Romanian *Leu* and the Bulgarian *Lev* (independently floating for most of the period), it has not.

A better way of illustrating the potential cointegration of two currencies is by looking at the error term of a linear regression, the "disequilibrium error". (Perman, 1991, 4) Figure 5 shows the error term for the CEE-currencies against the DEM (established using OLS and including a constant).

Figure 5: The Disequilibrium error (for the linear relationship between the logarithm of the CEE-currency and DEM)



In the short run the divergence between the two currencies will fluctuate, but if the linear combination is stable there should be a limit to the divergence, and the error term should be stationary. For the Romanian *Leu*, the Bulgarian *Lev*, the Polish *Zloty* and, possibly, the Hungarian *Forint*, divergence does not appear limited. For the other five currencies, however, the possibility of a limit to divergence cannot be excluded, but a higher degree of certainty requires more formal methods.

3.4.1 Previous tests of cointegration

Cointegration has been used frequently to investigate exchange rate relationships. It has been used to test, among other things, market efficiency and various models for the determination of exchange rates, such as the monetary model.[9]

The efficiency of currency-markets and cointegration is a matter of academic dispute. Granger (1986, 218) stated that one should not assume cointegration in asset markets and since Engle and Granger's (1987) article on cointegration the concept has been used frequently to explore the efficiency issue. MacDonald and Taylor (1989) find strong evidence of cointegration among a group of OECD-countries using the Engle-Granger method of testing the residuals for stationarity. Likewise, Baillie and Bollerslev (1989) find cointegration among seven OECD-countries using the Johansen (1988) technique. Their results are refuted by Diebold et al (1994) on grounds that the method fails to allow for a drift in the estimated model, which, as is shown by Johansen (1991) *should* be included unless there is strong prior evidence of the contrary. This is also conceded by Baillie and Bollerslev (1994), who still argue that a form of cointegration may still exist among currencies with "long memory", i.e. an error-correction term which responds only slowly to shocks so that deviations from equilibrium become more persistent; so-called "fractional cointegration".[10]

Other tests for cointegration have focused on structural models in the determination of long-run movements in exchange rates. Choudhry and Lawler (1997) for example, test the validity of the monetary model of exchange rate determination in the case of the Canadian float 1950-62 using the Johansen technique and find support in the interpretation of the model as describing a long-run equilibrium relationship.[11]

Yet another focus has been on common long-run movements and the potential emergence of currency blocs, such as a "Yen-bloc". Aggarwal and Mougoue (1992) focus on the potential cointegration of Southeast Asian currencies with the *Yen*, in an attempt to shed some further light on this issue, and find cointegration. Tse and Ng (1995) point to some weaknesses of these results by arguing that the inclusion of the Hong Kong *Dollar*, which is pegged to the numeraire used in the test (the USD), makes it possible to obtain one cointegrating vector simply by assigning the value one to that exchange rate and zero to the other variables in the system.

Their own study shows that if the Hong Kong *Dollar* is excluded, there is no cointegration among the Southeast Asian currencies and the *Yen*, but that this changes when the East Asian currencies (the Korean *Won* and the Taiwan *Dollar*) are included in the system.

3.4.2 The Cointegration Test

Like Aggarwal/Mougoue and Tse/Ng our focus is here on *common long-run movements*. The purpose is to establish whether or not the CEE-exchange rates, individually or as a part of a system of currencies, are tied to one (or more) long-run equilibrium path(s) together with the DEM, which would indicate the formation of a EUR-bloc. Two approaches will be used: firstly we will study each CEE-currency individually together with the DEM (bivariate model), and secondly we will view the currencies as systems.

The test uses the Johansen (1991) approach. The method expresses the data as a Vector Autoregressive (VAR) system. A VAR is a system of equations, which all share the same right hand variables, the impact matrix, which include exogenous variables and lagged values of the endogenous variables. Formally this can be expressed:

$$\mathbf{y}_t = \mathbf{A}_1\mathbf{y}_{t-1} + \ldots + \mathbf{A}_n\mathbf{y}_{t-n} + \mathbf{B}\mathbf{x}_t + \varepsilon$$

where $\mathbf{y}_t$ is a vector of endogenous variables, $\mathbf{x}_t$ is a vector of exogenous variables, $\mathbf{A}_t$ and $\mathbf{B}$ are matrices of coefficients, and ε is a vector of innovations which are correlated with each other but not with their own lagged values or the lagged values of $\mathbf{y}_t$ or $\mathbf{x}_t$. VARs are commonly used in forecasting systems of time series that are related with each other.[12]

A system consisting of N (non-stationary) endogenous variables will have N-X independent linear combinations, *cointegrating vectors* (C.V.s), and X common trends. If there is no C.V. in the system, there are N different trends and consequently no linear relationship among the variables; each variable will "wander off" in its own direction and they do not "hang together" over time. If, on the other hand, there is one or more C.V.s in the system, a stationary long-run relationship(s) is indicated.

Cointegrating vectors can be thought of as representing constraints that an economic model imposes on the variables in the system in the long run. The more cointegrating vectors there are, the "more stable" the system.

(Dickey et al, 1991, 65) If there are *N* C.V.s and no common trends, the system is stationary. None of the variables have a trend. If there is one common trend and *N-1* C.V.s there are *N-1* directions where the variance is finite and one direction where it is infinite. If there are *N-1* C.V.s. there will be one, unique common equilibrium trend. However, if there is only one C.V. the system can wander off in *N-1* independent directions, and thus it is stable in only one direction. Consequently, when variables are cointegrated there exist one or more *direction(s)* where a meaningful long run (economic) relationship among them exists. The fewer the number of C.V.s. the less robust the long run relationship. Preferably, one would like to have one, unique steady state equilibrium. (Dickey et al, 1991, 65)

The Johansen tests determine the number of C.V.s in the system. It uses the maximum likelihood approach to estimate the "trace statistic" (the likelihood ratio), with which the null-hypothesis that the rank (the number of C.V.s in the system) of the impact is less than or equal to r_0, where $r_0 < N$, is tested against the alternative that the impact matrix is of full rank (there are *N* C.V.s, and none of the series is actually integrated). The Johansen (1991)-approach differs from that of Johansen (1988) in the sense that the earlier procedure does not allow for a drift in the system. It is now generally agreed that a drift *should* be included unless there is clear evidence of the contrary (Diebold et al (1994, 732).

Cointegration is essentially a long-run concept. If data in a series are highly correlated, there are few "long-run" observations. If the "long-run" is long relative to the sample size, that is, if the "correction term"[13] is close to, but less than one, and consequently it takes a long time before the effect of a shock is eliminated, the only way to increase the power of the test (and to be able to discriminate between situations where the correction term is *equal* to one, and series are *not* cointegrated and situations where the term is *close to*, but less than one, and the series *are* cointegrated) is to increase the number of long-run observations. Improving the power of the test therefore requires *prolonging* the time-span of data, rather than merely *switching* to more frequently observed data (Hakkio and Rush, 1991). In principle it would be no different to test the long-run property of the data with 240 monthly observations than with 20 annual observations. We therefore use the same period and the same monthly observations from IFS used in the previous short-run test. Furthermore, we allow for a drift in the VAR, as suggested in Johansen (1991, 1553) and include four lags. Latvia is not

included in the test as it has been pegged to the numeraire, the SDR for most of the period.[14] As is explained by Tse and Ng (1997, 110) in their criticism of Aggarwal and Mougoue's inclusion of the Hong Kong *Dollar* (pegged to the USD) in the system of Southeast Asian currencies, a C.V. can be obtained by assigning the value of 1 to the currency pegged to the numeraire and zero to the others.

3.4.3 Cointegration in a bivariate model

Table 10 shows the test results for a bivariate model with the individual CEE-currencies and the DEM. The likelihood ratio test rejects the null hypothesis of no C.V.s in only three cases: for Estonia, Lithuania and Slovenia. This indicates that only for these three currencies has there been a stable long-run relationship with the DEM over the period as a whole.

Table 10.
Johansen (1991) cointegration test for individual CEE-currencies with DEM

Currency	Likelihood ratio test of at most R cointegrating vectors: H_0: r=0	H_0:r≤1	Indicated number of C.V.:s
Bulgaria/Lev	7.38	1.20	0
Czech Rep./Koruna	9.62	1.99	0
Estonia/Kroona	28.79***	2.57	1
Hungary/Forint	5.26	0.06	0
Lithuania/Lit	23.72***	2.18	1
Poland/Zloty	9.06	3.11	0
Romania/Leu	14.19	3.54	0
Slovakia/Korun	14.68	2.90	0
Slovenia/Tolar	44.04***	2.95	1

*Note: ***/**/* denotes rejection of null hypothesis at 1/5/10% level.*
r is the dimension of the space of the impact matrix, i.e. the number of C.V.s in the system
Data:IMF - International Financial Statistics (1999): Monthly Data

3.4.4 Cointegration in a system of currencies

We then turn to the issue of whether the value of the currencies have been moving in groups together with the DEM. We consider four systems of currencies (countries):

1. Poland, Hungary, the Czech Republic, Estonia and Slovenia,
1b. Estonia, Slovenia and the Czech Republic,
2. Lithuania and Slovakia, and
3. Bulgaria and Romania.

Systems 1,2,3 coincide with the three main groups in the membership-negotiations with the European Union, leaving out Latvia which is in Group 2.[15] The results of the short-run tests indicated that a group of currencies that follow the DEM particularly closely could be made up of the Czech *Koruna*, the Estonian *Kroona* and the Slovenian *Tolar*. This sub-group is also tested separately as system 1b.

We then run the test for the four different systems *with* and *without* the DEM, to see whether the inclusion of the DEM improves the robustness of the result, i.e. yields additional cointegrating vectors. The results are shown in table 11 below.

Table 11
Johansen (1991) Cointegration test for systems of CEE-currencies with the DEM

System of currencies	No. of Currencies	Likelihood ratio test of at most R cointegrating vectors: H_0:r=0	H_0:r≤1	H_0:r≤2	H_0:r≤3	Indicated number of C.V.:s
Group 1	5	109.45***	61.75***	35.45**	13.94	3
Group 1 with DEM	6	156.52***	92.69***	53.91**	27.72	3
Group 1b	3	27.90	6.30			0
Group 1b with DEM	4	63.62***	28.40			1
Group 2	2	18.87**	0.34			1
Group 2 with DEM	3	42.04***	13.36			1
Group 3	2	14.16	1.42			0
Group 3 with DEM	3	20.19	6.98			0

Group 1: Estonia, Czech Republic, Slovenia, Hungary, Poland
Group 1b: Estonia, Czech Republic, Slovenia
Group 2: Lithuania, Slovakia
Group 3: Romania, Bulgaria

*Note: ***/**/* denotes rejection of null hypothesis at 1/5/10% level.*
r is the dimension of the space of the impact matrix, i.e. the number of C.V.s in the system
Data:IMF - International Financial Statistics (1999): Monthly Data

For system 1 three cointegrating vectors and for system 2 one cointegrating vector is found, implying that the currencies in the systems share common long-run movements. For system 3, consisting of Romania and Bulgaria, there is no evidence at all of cointegration. For none of the above systems does the inclusion of the DEM produce "a richer pattern of cointegration" (Tse and Ng, 1997, 113) by yielding an additional cointegrating vector, although the first two systems remain cointegrated.[16] The sub-group 1b is not cointegrated, but this changes when the DEM is included in the system. The inclusion of the DEM yields one cointegrating vector, and the three variables consequently share two common long run trends.

3.4.5 The Long Run Relationship - Conclusions

In the bivariate test, the Estonian *Kroona*, the Lithuanian *Litas* and the Slovenian *Tolar* stand out as the only individual CEE-currencies to exhibit a common long-run trend with the DEM (one C.V. each). This is not surprising. All three countries have been able to maintain a stable exchange rate-policy throughout most of the period. The Estonian *Kroona* has been pegged to the DEM in a currency board since 1992 and although Slovenian policy has not been an official targeting of the DEM, both the short- and the long-run tests show that its unofficial "shadowing" has stuck to the DEM rather closely. The Lithuanian *Litas* has been targeted against the USD and not the DEM, and consequently there should be no a priori reason to expect the two to share a long-run path. But considering that the fluctuations between the USD and the DEM have been relatively low in comparison to the fluctuations between the DEM and the CEE-currencies, the successful peg to the USD, as indicated in the short-run tests, would undoubtedly improve stabilisation of the *Litas* versus the DEM as well.[17] In this context it is interesting to note that the Lithuanian authorities are considering repegging the Litas to the EUR. The evidence presented here would support such an action. The lack of cointegration in the other relations indicates that, for example, the Polish and Hungarian policies of managed float with an automatic daily devaluation have allowed a gradual divergence in the exchange rate with the DEM. Likewise, the Romanian and Bulgarian floating exchange rates have permitted both currencies to drift away from the DEM. The Czech and the Slovak *Korunas* have both been fixed over much of the decade (both of them to both the USD and the DEM) but

were forced to abandon the regimes (the Czech Republic in 1997 and Slovakia in 1998) due to sizeable external imbalances, which explains the divergence of late, and possibly the lack of cointegration.

Viewed as systems, there is for none of the three main systems any evidence that the inclusion of the DEM adds robustness to the cointegration. Consequently the common long-run movements appear to be primarily among the individual groups of CEE-currencies, rather than among a system dominated by the DEM. Only for the sub-group 1b of currencies that have been following the DEM very closely (as indicated by the results of the short-run test) does the robustness increase in a system including the DEM. This is hardly surprising, as both the Estonian *Kroona* and the Slovenian *Tolar*, two of the three currencies to be individually cointegrated with the DEM, are included in the group. As such only this sub-group can safely be said to exhibit more robust long-run common movements together with the DEM than without.

It should be noted that for some currencies, such as the Bulgarian *Lev*, a certain degree of stabilisation vis-à-vis the DEM has been achieved only after time. For those currencies, long-run stabilisation may show up for sub-periods from 1995 and later, and onwards. However, as previously pointed out, cointegration is essentially a long-run concept, and its usefulness becomes more limited when periods are shortened. Of the studies discussed above in 3.4.2 almost all use periods of at least seven years, and regularly 12-15 years (The exception is the Baillie/Bollerslev-data, which span only five years). Consequently, although desirable, a cointegration-study for the latter part of the 1990s and onwards will have to be postponed until a longer data-span is available.

3.5 Macroeconomic Imbalances and the Sustainability of Exchange Rate policies

The fact that most currencies have not been cointegrated with the DEM over the period as a whole is not surprising, considering the macroeconomic imbalances that have had to be corrected gradually since convertibility was established. As those imbalances are corrected one would expect sustainability of the exchange rate policies of the countries in the region, in which a growing role for the EUR has been the trend, to increase.

For a currency to maintain a stable exchange rate there needs to be an exchange rate-commitment defining the desired relationship to the reference currencies. Should the currency be pegged to one reference-currency and to that only? Or should the reference-currency merely be a weighted part of a currency-basket? Should there at all be a policy relating to any particular reference-currency? Regardless of the choice of policy, its realisation is in the long run dependent on the credibility of the commitment, which in turn is entirely dependent on the economic sustainability of the policy. A commitment to a fixed or crawling exchange rate can anchor inflation expectations and serve as discipline on fiscal and monetary policies. But inconsistencies in fiscal, monetary and exchange rate policies will eventually make the commitment unsustainable, which often very quickly results in abrupt shifts in investor demand, out of the local currency into international currency. The pursuit of an exchange rate target does imply constraints on the behaviour of domestic nominal variables. Credit expansion (monetary base growth net of the increase in external assets of the central bank (Köhler and Wes (1999, 14)) can never systematically exceed the growth of money demand at the target exchange rate, without the central bank eventually running out of reserves, and being forced to abandon the peg. Similarly, inflation cannot systematically exceed that of the reference currency-country, without the loss of competitiveness eventually making the exchange rate regime incredible.

A common factor for all of the three currencies found to be cointegrated with the DEM is steadily falling inflation rates and improved public sector balances. The countries fare particularly well relative to the other countries in the region. Estonia has brought inflation down from 954% per annum in 1992 to 10.6% in 1998, Lithuania from 1,161% to 5.1% and Slovenia from 93% to 8.0%. Estonia and Slovenia have experienced a rising rate of inflation during only one year (1994) and Lithuania during none (EBRD (1997, 118) and Masson (1999,5)). All other CEE countries in this study have experienced rising inflation in two or more years. All three countries also meet the Maastricht-criteria with the respect to stable government finances: fiscal deficit of less than 3% of GDP and total government debt of no more than 60% of GDP (Köhler and Wes (1999,12). The budget deficit/surplus was in 1998 for Estonia 1.1% (a surplus), for Lithuania -3.0% and for Slovenia -1.2%, and the level of government debt as percentage of GDP was 5.6% (Estonia), 22.2% (Lithuania) and 24.1% (Slovenia). These indicators are,

together with those of Latvia and the Czech Republic, the lowest in the region.

Macroeconomic stability has not arrived at the same speed in all countries of the region. The variables of the countries mentioned above are in many ways in the lead in a general trend towards stability. This results in the (hardly surprising) conclusion that a consistently pursued exchange rate policy supported by sustainable macroeconomic policies, most notably consistent monetary policies, permits long-term exchange rate stability. The fact that inflation has been falling in the region as a whole, from 510% in 1992 to 15.6% in 1998, having picked up slightly in 1996-97 mostly due to the resurgent hyperinflation in Bulgaria and Romania, that the government budget balances have fallen from an average deficit of 4.5% of GDP in 1993 to 2.75% in 1998, and that total debt has stabilised at 35.36% of GDP, can be taken as evidence of a general trend.[18] Should this trend continue other countries with a policy of exchange rate stability relative to the EUR may follow the path of those three already found cointegrated with the DEM. The increasing short-run dependence on the DEM may then indicate a change in this (lack of) long-run relation and the emergence of a sustainable EUR-bloc.

4. Conclusions regarding the emergence of a EUR-Bloc in CEE

There are a number of factors which suggest a growing importance of the EUR in the exchange rate policies of the Central and Eastern European countries. Trade and financial links have strengthened over the period since convertibility was established for the currencies. Likewise the political agenda of the transition countries in the CEE have been increasingly focused on integration with Western Europe and consequently future membership of the EMU. This paper investigates the growing importance of the EUR, as proxied by the DEM, in the exchange rate policies of the CEE countries and tests whether a EUR-bloc of CEE-currencies moving closely with the EUR over both the long and short term, is emerging.

The tests for short-run co-movement show that, although both the DEM and the USD have had a significant influence on the value of the CEE currencies over the period, the role of the DEM has increased over the period at the expense of the USD. This is shown by (a) a shift in the *balance* away from the USD towards the DEM in the significance attached to the determinant currencies, and (b) increased *weight* for the DEM from period one (1990-95) to period two (1995-99).

Any close long-run relationship with the DEM over the period is, on the other hand, harder to detect. Only for three countries is there evidence of individual cointegration with the DEM over the period, and viewed as systems, only the sub-group made up of those currencies with the highest degree of short-run co-movement with the DEM, display a more robust cointegration when tested together with the DEM.

The fact that most currencies have not been cointegrated with the DEM over the period as a whole is not surprising, considering the macroeconomic imbalances that have had to be corrected gradually since convertibility was established. As those imbalances are corrected one would expect increased sustainability of the exchange rate policies of the countries in the region, in which a growing role for the EUR has been the trend. The fact that the three countries whose currencies *have* been cointegrated with the DEM are all characterised by relatively few macroeconomic imbalances, only underlines this point. A test covering a later period would be desirable, but as a cointegration test for such a short period is inappropriate, that test will have to wait until longer data-spans become available.

The increased weight of the DEM in the hypothesised baskets of the average CEE-currency, as indicated by the short run-tests, does, however, indicate an increasingly close relation between the CEE-currencies and the DEM. The evidence provided in the tests presented here shows that even though most of the CEE-currencies have not shared a long-run trend with the DEM over the period, the increased short-run dependence can be interpreted as an indication of a change in this (lack of) relationship, and gives reason to believe that a EUR-Bloc may be emerging.

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1 see, for instance, Frenkel-Wei, 1993 and Fries et al, 1998

2 See Granger/Newbold (1974)

3 For an overview of the concept see Phillips and Xiao (1998).

4 Convertibility for each individual country was achieved at different times, and this reflects the availability of the data. For the individual countries the test periods are: Bulgaria 1992:07-1998:12, the Czech Republic 1993:03-1998:12, Estonia 1992:08-1998:12, Hungary 1992:07-1998:12, Latvia 1992:07-1998:12, Lithuania 1992:11-1998:12, Poland 1992:07-1998:12, Romania 1992:08-1998:12, Slovakia 1993:02-1998:12, Slovenia 1992:08-1998:12.

5 The Russian Rouble can hardly be called an "international currency" today, its status even as "national currency" seriously rivalled by the USD. Nevertheless we include it for historical reasons.

6 Frankel and Wei run OLS regressions on the first differences of the individual Southeast Asian currencies on the USD, the JPY and the DEM (in terms of the SDR) and impose the constraint that the three weights sum to unity. They conclude that the Southeast Asian currencies are linked to the USD rather than the JPY.

7 The Special Drawing Rights (SDR) is calculated daily by the IMF as the value of a basket of currencies, which is given in terms of the USD. The currencies' weights in the basket reflect their relative importance in international trade and reserves. Since the latest change in January 1996, the SDR valuation basket weights are: USD 39%, DEM 21%, JPY 18% and 11% each for the GBP and the FFr. (IMF International Financial Statistics (IFS) Database 1999). This reflects a slight increase in the weight of the DEM and JPY (from 19% and 15% respectively) at the expense of the USD, the GBP and the FFr (from 42%, 12% and 12%).

8 The restricted model excludes the Lithuanian and Latvian currencies, for which the restriction does not hold. As indicated by the unrestricted model, and by official policy, one can expect the USD to have a significant weight for the Lithuanian *Litas* in at least the second period, and possibly both the USD and the DEM to be significant for the Latvian *Lats* which is pegged to the SDR (although no indication of this is found in the unrestricted model).

9 A necessary condition for currency-market efficiency is that spot exchange rates should embody all relevant information, and consequently it should be impossible to forecast future rates of one exchange rate as a function of another. If two or more series are cointegrated there exist one or more long-run relationships, from which the series tend to return over time. Thus knowing the (stationary) linear combination which makes the series hang together over time it would be possible to predict one exchange rate from the others in the system and this is *not compatible* with market efficiency.

10 see also section 3.1 above

11 The monetary model is based on the view that all long-run movements of nominal exchange rates are the result of changes in the nominal money supply.

12 For an overview of VARs see Enders (1995, 269-355)

13 Refers to the φ coefficient in the relation: $Y = X + \varepsilon_{t,}$ where $\varepsilon_t = \varphi\varepsilon_{t-1}$.

14 The Latvian *Lats* has been pegged to the SDR since 1993, while our test period cover the period 1992:07-1998:12.

15 : At the time of writing, the countries in Group 2, had been "promoted" up into Group 1 by the EU Commission in recognition of the increased efforts of those countries in speeding up the convergence process for accession to the EU.

16 Tse and Ng find that a system including the JPY together with the Korean *Won* and the Taiwan *Dollar* has one cointegrating vector, but that the addition of the ASEAN currencies (which, as a group, are not cointegrated with the JPY) into the system yields an additional cointegrating vector, a "richer pattern of cointegration"

17 The standard deviation of the equilibrium error of a linear combination of the DEM is 0.04 for the USD as compared to an average of 0.5064 for the CEE-countries.

18 The Data is taken from EBRD transition report (1997) and Köhler/Wes (1999) and represent the unweighted average fort the nine CEE-countries in the study.