Costs of Exchange Rate Volatility for Labour Markets: Empirical Evidence from the CEE Economies*

ANSGAR BELKE
University of Hohenheim, Stuttgart

RALPH SETZER
University of Hohenheim, Stuttgart

Abstract: According to the traditional 'optimum currency area' approach, little will be lost from a very hard peg to a currency union if there is little reason for using the exchange rate in response to economic shocks. This paper takes a different approach and highlights the fact that high exchange rate volatility may as well signal high costs for labour markets. The impact of exchange rate volatility on labour markets in the CEECs is analysed, finding that volatility *vis-à-vis* the euro significantly increases unemployment. Hence, the elimination of exchange rate volatility could be considered as a substitute for the removal of employment protection legislation.

I INTRODUCTION

The transition process from a centrally planned economy to a market economy in Central and Eastern Europe has been accompanied by a large decline in employment. While relative improvements have been recorded in some countries for the last two years, unemployment reduction has still been modest in relation to expectations. At the beginning of the transition process it was widely assumed that the sharp immediate increase in open unemployment would be of a temporary nature only. Most analysts expected that unemployment would soon stop rising and with economic recovery

unemployment would level off at a relatively low level (Nesporova, 2002). However, employment performance did not improve a great deal in most Central and Eastern European Countries (CEECs), though this was partly due to unfavourable developments in world markets. Besides, longer-term effects of structural change in the candidate economies have also played an important role. The countries with the largest expected increases in unemployment – Bulgaria, Poland and Lithuania – were among those with the highest levels. The situation in the individual countries is, of course, highly differentiated, with Hungary and Estonia at the lower bound and Slovakia, Poland and Bulgaria at the upper bound, with unemployment rates exceeding 15 per cent. Yet, in all candidate countries labour markets suffer from structural rigidities that, in combination with continued restructuring, will put a lower limit on reductions in the unemployment rates.

This paper investigates to what extent high exchange rate variability can be made responsible for the negative developments in CEEC labour markets. Previous studies have shown that intra-European exchange rate variability has increased unemployment and reduced employment, a finding that had an important bearing on the evaluation of costs and benefits of EMU (see, e.g., Belke and Gros, 2001). More recently, Belke and Gros (2002a) have shown in the context of a project for the European Commission that exchange rate variability might also have significant negative effects on labour markets at the global level. Their results indicate that transatlantic exchange rate variability does have a significant negative impact on labour markets in the EU, and possibly also in the US. The authors argue that volatility matters because employment and investment decisions are characterised by some degree of irreversibility in the presence of structural rigidities. Such decisions tend to be discouraged by exchange rate variability, as can be shown in a variety of economic models. A third category of studies is related to the emerging markets. Here, Belke and Gros (2002) have investigated the Mercosur area.

If similar results can be found for the currencies of the Central and Eastern European EU applicant countries, they would warrant a new look at the costs and benefits of joining EMU or of using early euroisation[1] as a strategy to fulfil the Maastricht criterion of exchange rate stability. The main purpose of this paper is thus to provide a sound basis for an (indirect) evaluation of the costs of the present exchange rate relations of CEEC currencies *vis-à-vis* the euro and of the benefits of individual time-paths of

---

[1] Euroisation is defined as the wholesale unilateral adoption of the euro (Nuti 2002, p. 434). For surveys on the costs and benefits of euroisation see Alesina and Barro (2001, pp. 381 ff.) and Nuti (2002).

exchange rate policies for selected CEECs on their way towards full membership in EMU. It is argued that early entry strategies might be motivated with an eye to the benefits resulting from suppressed exchange rate volatility.

The conventional view of EMU enlargement is to converge first, and durably, and then join. For the eight CEE Countries scheduled to join the EU in May 2004 the time frame for EMU enlargement is, thus, quite clear: EU admission also formally implies membership in EMU. Initially, however, the new EU members will have a right of derogation concerning the introduction of the euro. When can and should derogation be lifted, i.e. when should the euro be introduced in these countries? And how can it be ensured that the transition to the euro is smooth? The earliest possible date of entry into the euro zone is 2006, if the EU's new member states spend the prescribed two years in the ERM2 system immediately after EU accession.[2] A number of the acceding countries (e.g. the Baltic States and Slovenia) have indeed expressed a willingness to proceed to the euro zone as quickly as possible. Other countries such as the Czech Republic, Hungary and Poland are more sceptical concerning a rapid adoption of the euro.

Let us now provide a picture of the development of CEEC trade integration. In general, the CEECs are small, open economies. In most CEECs, external trade (imports and exports) accounts for above one-third of GDP, in countries such as Slovenia (67 per cent) or Estonia (58 per cent) the degree of openness even exceeds 50 per cent of GDP. Only Bulgaria (23 per cent), Romania (15 per cent) and, due to its larger size, Poland (26 per cent) have a somewhat smaller openness index (Buiter and Grafe, 2002). Boreiko (2002) demonstrates the importance of trade with EMU countries for the CEECs, relating imports and exports to the euro zone to total imports and exports in 1993-2000. His tables show clearly that most of the CEECs have already reached a high share of trade with the euro zone. In some cases – such as Hungary (0.70), Poland (0.67), Slovenia (0.67), Czech Republic (0.66) – the shares are close to the average of EMU intra-trade (around 0.67 in 1999-2000). The realisations for the other candidate countries are lower (Romania: 0.63, Estonia: 0.59, Slovak Republic: 0.54, Latvia: 0.52, Bulgaria: 0.50, Lithuania: 0.46). These differences in openness should be kept in mind for the empirical analysis, since they should, of course, influence the impact of euro exchange rate variability on the labour markets in the respective candidate country. The same is valid for the average degree of openness of the CEECs and the results expected from a pooled regression analysis.

[2] However, due to technical and logistic reasons, it can realistically be expected that the candidate countries will join the euro zone at the earliest in 2007 (see, e.g., Lavrac, 2003, p. 8ff.).

The rest of the paper proceeds as follows: In Section II we discuss a theoretical model to illustrate the negative relationship between exchange rate volatility and labour market performance. Section III defines our measure of exchange rate variability. Section IV presents and comments on the regression results. Section V concludes with a discussion of the implications of our results for the design of future CEEC monetary relations with the euro zone.

II MODELLING THE IMPACT OF EXCHANGE RATE VOLATILITY ON LABOUR MARKETS

Most economists would probably assume that exchange rate variability cannot have a significant impact on labour markets, given that the link between exchange rate variability and the volume of trade is known to be weak. However, we would argue that there are some qualifications to such a conclusion: in developing countries the level and variability of the exchange rate may be more important than in developed countries. There are several reasons why exchange rate volatility should have a strong negative impact on emerging economies and, hence, may constitute the basis for the fear of large exchange rate swings (Calvo and Reinhart, 2000).

First, the pattern of trade invoicing is different in emerging markets as compared to that in industrial countries. Following McKinnon (1999), primary commodities are primarily dollar invoiced. Since the emerging market economies exports generally have a high primary commodity content, exchange rate volatility should have a significant impact on the foreign trade of these countries. Additionally, capital markets in emerging markets are of an incomplete nature.[3] If futures markets are either illiquid or even non-existent, tools for hedging the exchange rate risk are simply not available in these countries. Another feature why emerging markets are on average more intolerant to large exchange rate fluctuations is due to the higher openness of these countries. When imports make up a large share of the domestic consumption basket, the pass-through from exchange rate swings to inflation is much higher (Calvo and Reinhart, 2000, pp. 18 ff.).

How can one illustrate the transmission channel that could account for a negative relationship between exchange rate variability and labour market

---

[3] This argument is less important for countries with more efficient financial markets like The Czech Republic, Hungary and Poland. However, problems that erupted in the Czech and Hungarian banking sector over the last years indicate that these countries are still vulnerable to speculative attacks – especially in the context of an elimination of all capital controls as is required by the acquis communautaire (Begg *et al.*, 2001; National Bank of Hungary, 2002).

performance? The theoretical models that are used to describe this relationship typically start from the idea that, in order to export, one needs to sustain a sunk cost, due to irreversible investments in the underlying production process, set-up costs of distribution in the export markets, etc. A fully-fledged model is developed by Belke and Gros (2002a) to illustrate a mechanism that explains a negative relationship between exchange rate uncertainty and job creation. This model was originally based on the idea that uncertainty of future earnings raises the 'option value of waiting' on decisions, which concern *investment projects* in general (Dixit, 1989; Belke and Gros, 2001). In this framework, Belke and Gros (2002a) model the labour market more explicitly. When firms open a job, they have to incur sunk costs, which reflect the cost of hiring, training and the provision of job-specific capital. Moreover, wage payments are typically also sunk costs since firing restrictions and employment contracts prevent the firms from firing the workers too rapidly. If the exchange rate is uncertain, firms fear an unfavourable appreciation of the (domestic) currency in which case they incur heavy losses. With high uncertainty, firms may prefer to delay job creation, and this is even so if they are risk-neutral. The relationship between exchange rate uncertainty and (un-)employment should be particularly strong if the labour market is characterised by generous unemployment benefit systems, powerful trade unions, minimum wage restrictions or large hiring costs.

Implicit in these kinds of models is the assumption that the firm and the worker sign a binding employment contract for two periods (zero and one). Hence they cannot sign a contract that allows for the possibility of job termination in the first period whenever the exchange rate turns out to be unfavourable. In order to investigate whether uncertainty also leads to delays in the decision to fire, one should consider the scenario of a labour market in which the firm and the worker can sign a contract only for one period (and, hence, *firing becomes relevant*) and keep the option to terminate the work relationship whenever it becomes unprofitable. Hence, this alternative set-up allows for the *possibility of job destruction*. Based on this kind of set-up, it can be shown that there is also a negative impact of exchange rate uncertainty on employment in this case. The probability of job destruction is increasing in uncertainty. Moreover, this effect is more pronounced if the worker's fallback wage is higher. The overall adverse employment effects of these features have been confirmed empirically in various studies, and there are many other theoretical mechanisms to explain them (see, e.g., Nickell, 1997). Thus, we would expect that uncertainty has a negative effect on new hiring and a positive one on the amount of job firing.

These theoretical considerations show that it is difficult to maintain the hypothesis that exchange rate variability does not have a significant impact

on unemployment. Are we justified then to argue that this transmission channel is applicable to the CEECs? Obviously, the temptation to postpone job creation should be especially strong if a country is characterised by extensive labour market rigidities (and therefore higher sunk costs in the job creation process). Where do the CEECs stand in this respect? Labour markets of most of the current EU members are widely considered to be rigid enough to give leeway to the functioning of the mechanism explained in the model by Belke and Gros (2002a). A study launched by the World Bank (and summarised in Table 1) has assessed the flexibility of labour market institutions in six CEE Countries: the Czech Republic, Estonia, Hungary, Poland, Slovakia and Slovenia. According to their findings, based on a large scale of indicators for regular contracts, temporary contracts and collective dismissals, the CEE Countries generally opted for labour market institutions similar to those in Western Europe (Riboud, Sánchez-Páramo, Silva-Jáuregui, 2002). As in continental Europe, labour market rigidities include the exceedingly restrictive regulations on hiring and firing practices, as well as burdensome social insurance schemes. Employment stability protection like mandated severance payments and other regulations penalising employment termination in the CEECs is *even stricter* than in some EU Countries. Riboud *et al.* (2002) conclude that the CEECs range somewhere in the middle of the *labour market flexibility scale* compared to the EU Economies.

These results are consistent with findings by Belke and Hebler (2002) and Cazes (2002) who state that Central European Countries have adopted labour market institutions, institutional arrangements and legal frameworks that share many common features with present EU Member Countries. This trend clearly increases job creation costs. It is further supported by the fact that the CEECs are required, prior to their entry into the EU, to align their legislation with the *acquis communautaire*, which includes a number of provisions regarding labour market regulations. This kind of legislation has favoured employment protection while taxing employers heavily. Hence, the transmission channel from exchange rate variability to labour market performance that we have described seems to be relevant in the case of the CEECs also.

The next step is to address whether different measures of exchange rate volatility – both nominal and real effective volatility *vis-à-vis* the 31 most important trade partners and the bilateral volatility of the nominal and real euro exchange rate – have any ability to explain the residuals of unemployment regressions for CEE Economies. Up to now, the literature examining the link between exchange rate variability and labour market performance in emerging markets is rather thin. Hence, we begin by presenting and commenting on some initial results.

Table 1: *Labour Market Flexibility in the CEECs: How Large are the Costs of Job Creation and the Fallback Wage?*

	Employment Protection Legislation***				Unemployment Insurance		Taxes	
	Regular. Employment	Temporary Employment	Collective Dismissals	EPL Strictness****	Benefit Replacement Ratio	Benefit Duration (months)	Payroll Tax Rate (%)	Total Tax Rate (%)
Czech Republic	2.8	0.5	4.3	2.1	50	6	47.5	73.4
Estonia	3.1	1.4	4.1	2.6	10	3-6	33.0	63.3
Hungary	2.1	0.6	3.4	1.7	64	12	44.0	81.5
Poland	2.2	1	3.9	2	40	12-24	48.2	80.0
Slovakia	2.6	1.4	4.4	2.4	60	6-12	50.0	81.0
Slovenia*	3.4 (2.9)	2.4 (0.6)	4.8 (4.9)	3.5 (2.3)	63	3-24	38.0	69.1
CEEC average	2.7	1.2	4.1	2.4	48		43.4	74.7
EU average**	2.4	2.1	3.2	2.4	60		23.5	53.0
OECD average	2.0	1.7	2.9	2.0	58		19.5	45.4

* Numbers in brackets refer to the new labour code if approved.
** EU average without Luxembourg and Greece.
*** 1: minimum protection, 6: maximum protection.
**** Weighted average of the first three columns.

Table 1: *continued*

| | Passive Policies | | Active Policies | | Unions | | | |
	% of GDP	Spending per Unemployed	% of GDP	Spending per Unemployed	Union Density (%)*	Union Coverage Index**	Coordination-Unions	Coordination-Employers
Czech Republic	0.31	0.04	0.19	0.02	42.8	2	1	1
Estonia	0.08	0.01	0.08	0.01	36.1	2	2	1
Hungary	0.56	0.06	0.40	0.04	60.0	3	1	2
Poland	1.71	0.12	0.49	0.03	33.8	3	2	1
Slovakia	0.54	0.05	0.56	0.05	61.7	3	2	2
Slovenia	0.89	0.11	0.83	0.11	60.0	3	3	3
CEEC average	0.68	0.06	0.42	0.04	49.0			
EU average	1.73	0.26	1.16	0.16	44.4			
OECD average	1.43	0.23	0.92	0.14	39.6			

* Percentage of salaried workers that belong to a union.

** 1: less than 25 per cent of salaried workers are covered by collective agreements,
2: between 26 and 69 per cent are covered, 3: 70 per cent or more are covered.

Source: Hobza (2002) and Riboud *et al.* (2002).

III DATA AND DEFINITIONS

In order to test empirically for the conjectured impact of exchange rate variability on labour-market performance, we employ a panel of ten Central and Eastern European Countries, namely Bulgaria (BG), Czech Republic (CZ), Estonia (EE), Hungary (HU), Latvia (LV), Lithuania (LT), Poland (PL), Romania (RO), Slovak Republic (SK), Slovenia (SL). We do not leave the two EU latecomers Bulgaria and Romania aside, because Bulgaria, at least, is often said to be a clear case for euroisation.

The nominal variability of the currency of each of the ten CEE Countries is measured by taking for each year the standard deviation of the 12 month-to-month changes in the logarithm of its nominal exchange rate against the currencies of their main trade partner countries. The construction of the real variability variable follows an analogous scheme. The nominal exchange rates are deflated with the CPI. The standard deviations based on bilateral rates are then aggregated in one composite measure of exchange rate variability (denoted by "VOL" below) using the weights that approximate the importance of these currencies in trade with the 31 most important trade partners for the period 1991-2002. The average trade weight of CEEC X with country Y (Y = Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, UK, Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia, Croatia, Belarus, Russia, Ukraine, Switzerland, US, Turkey) is calculated as 100 times the exports to country Y plus imports from country Y divided by total exports to the "world" plus total imports from the "world"). In our definition, the aggregate "world" corresponds to the sum of countries Y.[4] We did not use the annually changing trade weights since our volatility measure would then change to the same degree as the change in trade pattern varies.

Based on the monthly CPI series for the 30 most important trade partners, the nominal bilateral exchange rates *vis-à-vis* the US dollar of these 31 countries and the respective trade weights, we calculated the following volatilities of the exchange rate:
- 10 times 30 volatilities of the nominal bilateral exchange rate,
- 10 times 30 volatilities of the real bilateral exchange rate,
- 10 effective volatilities of the nominal exchange rate (weighted bilateral volatilities), and
- 10 effective volatilities of the real exchange rate (weighted bilateral volatilities).

[4] It should be noted that trade data for Euroland substitute the data for the single euro zone member countries from 1999 on.

It should be emphasised that the first two series refer to the exchange rate volatility "*vis-à-vis* the euro". This is calculated as the volatility *vis-à-vis* the DM from 1990:01 until 1998:12, and *vis-à-vis* the euro from 1999:01. We prefer to aggregate the individual standard deviations instead of using a standard deviation of an average or effective exchange rate because there is extensive evidence that CEEC exporters have priced to market. With an average exchange rate the zloty, for example, could remain constant because the depreciation against the euro would compensate the appreciation against the Bulgarian lewa. Polish firms would not necessarily be indifferent between a situation in which the average exchange rate is constant because the zloty/euro and the zloty/lewa are constant, and another in which the swings in these two bilateral rates just happen to cancel each other out.

We use monthly exchange rates to calculate volatility instead of daily volatility to ensure consistency throughout our entire sample period. Another reason to prefer this measure to shorter-term alternatives (e.g., daily variability) was that, while the latter might be important for financial actors, they are less relevant for export or employment decisions. The drawback of monthly exchange rates is that we had to use annual data to have a meaningful measure of variability. We are left with only eleven observations for each country.[5]

We use actual as opposed to unanticipated rates, since in order to be consistent with our model described in Section II, we assume that the exchange rate follows a random walk. Thus, *actual* and unanticipated exchange rate changes should be the same. We feel justified to make this assumption since extensive research based on work by Meese and Rogoff (1983) and Meese (1990) has shown that the random walk model outperforms other standard exchange rate models in out-of-sample forecasting. This still holds even when seemingly relevant economic variables are included.

Our sample covers the period 1990 to 2001 in order to exploit all available data information. However, in view of the financial turmoil in the first years of transition, our estimations mostly exclude at least the year 1990. The average exchange rate variability for each of the ten CEECs under investigation is plotted in Figure 1 (per cent per month). Peaks occur usually in the year 1998, with the two non-EU Acceding Countries Bulgaria and Romania as clear outliers with high double-digit realisations. Low volatility values typically appear at the end of the sample, especially in 2000 and 2001. Effective real volatility has decreased for countries that used exchange rate

---

[5] In principle one might employ option prices to extract implicit forward looking volatilities, but option prices are generally available only for the US dollar and sometimes against the DM, and even then only for limited periods.

arrangements close to fixed rates, but remained high for Poland and Romania and was quite high for Latvia and Lithuania (for a similar observation see Boreiko, 2002, pp. 14 ff.). In the case of the countries with macroeconomic instability and high inflation, an inspection of our data reveals that the variation in the bilateral real exchange rate is large and much higher than nominal exchange rate variability. This is somewhat surprising given the fact that PPP is usually closer to holding for countries with very high rates of inflation, which would suggest that real exchange rate variability should be smaller. However, it seems obvious that a high real exchange rate variability signals weak macroeconomic management, rather than an adjustment need of the real sector.

We limit our empirical analysis to the impact of exchange rate variability *on the unemployment rate*. This restriction is made for two reasons: First, if labour force is constant, the coefficients on unemployment and the growth rate in employment would be approximately equal in absolute value and of opposite sign. Hence, if employment were affected simultaneously, or (more likely) with some lag, this would be totally in line with our model. Second, we think that from a political point of view the unemployment rate is a much more interesting indicator since its rise and fall have a much higher importance in the political debate than the corresponding course for the employment rate. In addition, this variable is typically derived from reliable surveys. In contrast, employment data are often official and biased data. Hence, we focus solely on the unemployment rate as the statistically most reliable and politically most relevant indicator of the labour market stance in the CEECs. We use the unemployment rate in per cent at the end of the period.

As a cyclical control variable in the unemployment equations we include the real growth rate of the gross domestic product, in per cent. The development of wage costs is approximated by the real growth rate of average gross monthly wages in per cent. With the exception of Estonia, Latvia, Lithuania where we used Eurostat and national sources, the data for unemployment, GDP growth and wage costs are taken for the CEEC data set compiled by the Vienna Institute for International Economic Studies.

In order to convey a broad-brush view on the data set and some of the possible correlations four scatter plots are presented in Figure 1. It shows cross-plots of our measure for total economy unemployment against exchange rate volatility. All variables are averaged over the period 1990 to 2001.

As expressed by the simple scatter plots relating the average unemployment rate to the average volatility measure, the conjectured positive relationship between exchange rate volatility and unemployment is not so obvious in a cross-country perspective. What matters is that the overall

Figure 1: *Employment Performance and Exchange Rate Volatility*

(10 Central and Eastern European Countries, average 1992 – 2001)

NOMEFFVOL   REALEFFVOL
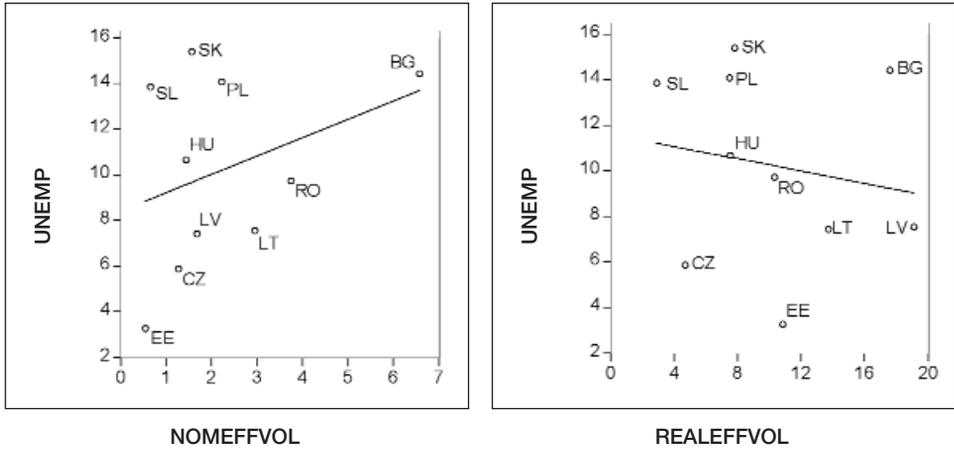
a) Effective nominal exchange rate volatility
b) Effective real exchange rate volatility

NOM_DMEUR_VOL   REAL_DMEUR_VOL
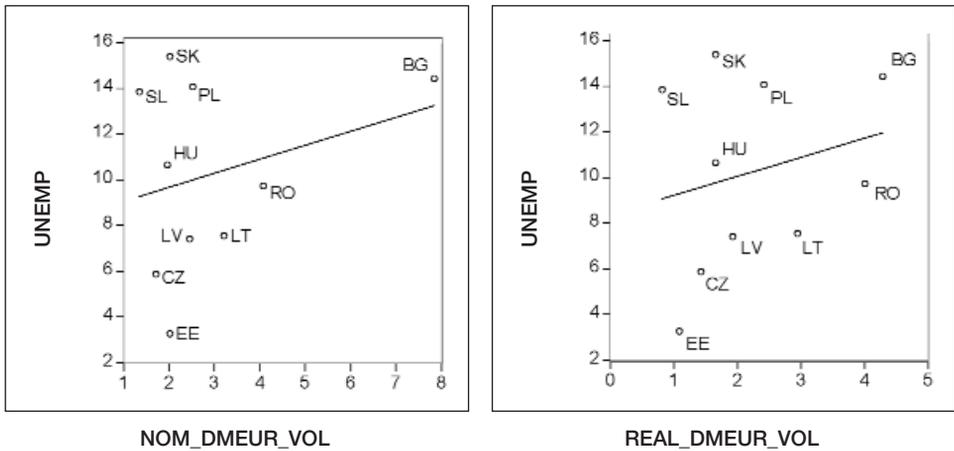
c) Nominal exchange rate volatility *vis-à-vis* the Euro
d) Real exchange rate volatility *vis-à-vis* the Euro

relationship in the figures is upward sloping (non-vertical and non-horizontal). Hence, we fit a very preliminary bivariate regression of the average unemployment rate on an average of four different measures of exchange rate variability. In three of these four cases, we cannot reject the hypothesis of a positive relationship according to the fitted regression lines. However, in order to investigate the validity of our hypothesis more deeply, we will conduct fully specified regressions in the following section. The example of Estonia shows that the introduction of a currency board does not shelter an economy from the negative impact of effective exchange rate variability. The same is valid with respect to Latvia, with its exchange rate fixed to the SDRs.

Our formal empirical analysis is based on tests of the non-stationarity of the levels and the first differences of the variables under consideration, i.e., the total economy unemployment rate, the different operationalisations of exchange rate volatility, and the real growth rate of average gross monthly wages.[6] The test applied is the first widely used panel data unit root test by Levin and Lin (1992).[7] The results indicate that only the unemployment rate has to be differenced once to become stationary. Our unit root tests reveal evidence of a stationary behaviour of the levels of exchange rate volatility and of real wage growth. Hence, we use the change in the unemployment rate, and levels of exchange rate volatility in the following pooled estimations.

IV EMPIRICAL MODEL AND RESULTS

Based on our theoretical arguments, we conjecture that, controlling for the usual key variables on the labour market,[8] we can show in a cross-country panel analysis of Central and Eastern European countries that exchange rate variability worsens labour-market performance. To test for a significant negative relationship between exchange rate variability and labour-market performance, we undertake a fixed effects estimation. By this, we account for different intercepts and, hence, different natural rates of unemployment

---

[6] The results of unit root tests for the employment protection legislation index are available on request. It should be kept in mind that the artificial and constructed character of these institutional variables can create serious problems for their correct empirical treatment. Hence, in cases of doubt about the order of integration we do not rely too much on the numerical results but stick to economic intuition when specifying our regression equations.

[7] This test represents a direct extension of the univariate ADF test setting to panel data. The results by Levin and Lin indicate that panel data is particularly useful for distinguishing between unit roots and highly persistent stationarity in macroeconomic data and that their unit root test for panel data is appropriate in panels of moderate size (between 10 and 250 cross-sections) as encountered in our study.

[8] We do this by allowing for country-specific constants in the unemployment regressions or by implementing real wage growth or a labour market protection legislation index.

estimated for each CEEC.[9] In the literature random effects models are sometimes additionally implemented, mainly because fixed effects models and country-dummies are costly in terms of lost degrees of freedom. We decided to dispense with a random effects estimation because it would only be appropriate, if we really believed that our sampled cross-sectional units were drawn from a large common population as is not the case here. The key distinction between fixed and random effects models is whether the individual effects should be treated as correlated with the x's or not. The former would speak in favour of the estimation of a fixed effects model. The latter would imply a random effects estimator. However, in our case there is practically speaking little reason to treat the individual effects as uncorrelated with the other regressors as assumed in the random effects model (Greene, 2003, pp. 293ff., and Hsiao, 2002, pp. 149ff.). In any case, we checked for possible problems with the fixed effects estimation by testing explicitly for random versus fixed effects by means of the Hausman specification test. The null hypothesis that random effects is the better option (i.e., unbiased) was rejected according to the chi-squared tables at the usual significance levels throughout our specifications. Hence, we feel legitimised to strictly stick to a fixed effects estimator.[10]

The empirical model we use can be described by the usual form:[11]

$$y_{it} = \alpha_i + x'_{it}\beta_i + \varepsilon_{it}, \tag{1}$$

with y_{it} as the dependent (macroeconomic labour market) variable, x_{it} and β_i as k-vectors of non-constant regressors (e.g., exchange rate variability) and parameters for $i = 1, 2, \ldots, N$ cross-sectional units and $t = 1, 2, \ldots, T$ as the periods for which each cross-section is observed. Imposing $a_i = a_j = a$, a pooled analysis with common constants is nested in this specification.

In order to test for significance of the impact of exchange rate volatility on labour-market performance in CEECs, we separate our analysis into *three logical steps*. We note that basing the analysis on *levels* of the unemployment rate as an endogenous lagged variable is problematic for, at least, two reasons. First, unemployment and employment time series might be plagued by non-stationarity problems (see Section III). This problem is less severe, though,

---

[9] Due to the limited availability of data for the CEECs with a maximum of 11 annual observations country-specific regressions are not (yet) an option.

[10] The results are not displayed here due to scarcity of place. However, they are available on request from the authors.

[11] Dummies for different exchange rate regimes are not included throughout the regressions since the impact of different exchange rate regime on the labour market is exactly the focus of our study.

since the unemployment rate is bounded by one from above and by zero from below. Second, one has to take account of the well-known problem of endogenous lagged variables in the context of panel analyses (group effects). This is usually achieved by taking first differences, which is a further reason why we conducted our analysis in these terms. Third, the theoretical interest is in a link between the level of exchange rate volatility and the *change* in the unemployment rate. According to this specification, a one-time shock in exchange rate volatility results in a permanent increase in the unemployment rate. This exactly mirrors the central persistence implication of the model which postulates that even a short-term increase in exchange rate uncertainty leads to less hiring and more firing. The dynamic implications of our specification are thus acceptable for temporary shocks, i.e. spikes, in exchange rate variability which were emphasised in our model.

In principle, our panel data set need not be applied to a *static* specification (in the following tables this corresponds to the first column for each volatility measure). Especially with respect to the well-known path-dependence of the unemployment rate, it is advisable to test for *dynamic effects* also. In order to capture the speed of adjustment of labour markets, we use the option to include lagged unemployment variables in the set of regressors throughout this paper. The corresponding setting with respect to a representative regression equation for one cross-section out of the whole system (described by the index i) can be described as follows:

$$y_{it} = \alpha_i + x'_{it}\beta_i + \delta y_{i,t-1}\, \varepsilon_{it} \tag{2}$$

However, for estimating our first-order model substantial complications have to be taken into account, due to the heterogeneity of the cross-sections analysed (Greene, 2000, pp. 582 ff.). The main problem to be treated here is the correlation of the lagged dependent variable (unemployment rate or level of employment) with the disturbance, even if the latter does not exhibit autocorrelation itself. While taking first differences enables one to get rid of heterogeneity, i.e., the group effects, the problem of the correlation between the lagged dependent variable and the disturbance still remains. Moreover, a moving-average error term now appears in the specification. However, the treatment of the resulting model is a standard application of the instrumental variables approach. The transformed model looks as follows:

$$y_{it} - y_{i,t-1} = (x_{it} - x_{i,t-1})' \beta_i + \delta(y_{i,t-1} - y_{i,t-2}) + (\varepsilon_{it} - \varepsilon_{i,t-1}) \tag{3}$$

Arellano (1989) and Greene (2003) for instance recommend using the differences $(y_{i,t-2} - y_{i,t-3})$ or the lagged levels $y_{i,t-2}$ *and* $y_{i,t-3}$ as instrumental

variables for $(y_{i,t-1} - y_{i,t-2})$ in order to derive a simple instrumental variable estimator. The remaining variables can be taken as their own instruments. Arellano (1989) gives some theoretical and empirical support in favour of preferring levels to differences as instruments. As our second step of analysis, we therefore implement this procedure within a dynamic framework (in the following tables this corresponds to the second column for each volatility measure). As a third step, we conduct robustness tests by also including variables representing labour-market rigidities. Throughout our regressions, we take the change in the unemployment rate as the regressand.

Throughout the paper we rely on Feasible Generalised Least Squares (FGLS) estimates of a model assuming the presence of cross-sectional heteroscedasticity and autocorrelation but without correction for con-temporaneous correlation.[12] One might argue that uncorrelatedness across our cross-sectional units (countries) is too strong an assumption because our model assigns the same parameter vector to all units in the common coefficients case, in which SUR estimates of a model with heteroscedasticity *and* cross-sectional correlation would be suitable. However, in view of the fact that correlations across countries might become relevant mainly in the case of *symmetric* shocks to the labour markets and that the probability of the latter might be small in our large sample (see, e.g., Babetski, Boone, Maurel, 2002), it is legitimate to apply an FGLS specification that assumes solely the presence of cross-section heteroscedasticity (Table 2). In order to be consistent in the sense of accounting for the possibility of symmetric shocks (i.e., contemporaneous correlation), we nevertheless refrain from considering this case and apply also the seemingly unrelated regression technique (SUR) in our regression analysis (Tables 3 and 4).

The structure for presenting the estimation results is the same for tables 2 to 4 with the exact specifications of the pooled estimation equations being described in the tables themselves. Half of the specifications include a lagged endogenous labour-market variable. All specifications contain contemporaneous real GDP growth with or without its lagged value as cyclical control, different measures of exchange rate variability and the estimates of the country-specific constants.[13] The number of lags of the relevant variables

---

[12] See Greene (2000, p. 592). Motivated by inspections of the country-specific residuals we include an AR error term in some of our specifications which enables us to get rid of autocorrelation problems in the time dimension. Following Greene (2000, p. 605), we prefer to impose the restriction of a common autocorrelation coefficient across countries in these cases.

[13] The inclusion of a cyclical control variable can itself be interpreted as a first robustness test. Due to lack of space, the country-specific constants, while interesting on their own, are not displayed in the tables.

were determined by the estimation itself. As in our previous studies, we limited possible lags to a number from 0 to 2 (annual data) and then tested down. Note that the number of observations in each case depends on the variables included and on their lags. The fit of each equation is checked by referring to the R-squared, the F-statistics and the Durbin-Watson time series test for autocorrelation of residuals.[14] Since the marginal significance level of the F-test of joint significance of all of the slope coefficients is in all cases clearly below 1 per cent, the p-value is not explicitly tabulated. However, the degrees of freedom can be easily read off the tables.[15]

Let us first turn to our basic regressions in Table 2 (based on the FGLS procedure) and Table 3 (based on SUR estimation) for a sample consisting of all the ten EU candidate countries.

It is remarkable that the estimated coefficients measuring the impact of exchange rate volatility on the unemployment rate are mostly significant and always display the expected sign. As studies for other regions suggest, the economic impact of exchange rate volatility seems to be *small but non-negligible*. The results are generally weaker for euro exchange rate volatility than for effective volatility. The euro volatility is only significant in the static specifications. However, there is no significant difference between the coefficients for nominal and real volatility. This is not surprising in view of the well-known fact that in the very short run changes in nominal and real exchange rates are highly correlated. The estimated fixed effects exactly mirror the differences in the natural rate of unemployment, as plotted in Figure 1, with Poland and the Slovak Republic clearly displaying the highest rigidities. A commonly accepted prior, the significance of contemporaneous GDP growth in determining the unemployment rate, is corroborated by all specifications. The available test statistics point towards correct specifications. Both features are also valid for the following tables. All in all, it seems that the ten CEECs are a group too heterogeneous to be characterised by a similarly strong impact of euro exchange rate volatility.

Hence, we *generalised* the specifications chosen above by estimating a *separate coefficient* of exchange rate volatility for each of the ten CEEC

---

[14] However, some caveats apply with respect to the application of the DW-statistics. The use of the DW is critical not only in cases of endogenous lagged variables, but its application in panels is generally problematic. Our estimations show that the DW changes its empirical realisation depending on the ordering of the cross-section identifiers. However, we are unaware of other easily available tests for panels, and the DW indicates for our panel that, in nearly all cases, we would not be able to reject the null hypothesis of no autocorrelation.

[15] The numerator degrees of freedom can be calculated as the number of explaining variables less one and the denominator degrees of freedom corresponds to the numbers of observations minus the number of regressors.

Table 2: *Impact of Exchange Rate Variability on the Change in the Unemployment Rate FGLS Estimates for 10 CEECs (fixed effects)*

Regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Instrument for the change in unemployment rate (−1)	/	−0.12***	/	−0.25***			/	−0.04	/	−0.04
Real GDP growth rate	−0.28***	−0.23***	−0.27***	−0.13***	−0.19***	−0.20***	−0.28***	−0.25***	−0.23***	−0.23***
Measures of exchange rate volatility:										
Effective volatility of nominal exchange rate			0.12***	0.07	0.16***					
Effective volatility of real exchange rate	0.08***	0.06**	/	/	/	/	/	/	/	/
Volatility of national currency *vis-à-vis* euro (DM) (nominal exchange rate)						0.20***	0.08**			
Volatility of national currency *vis-à-vis* euro (DM) (real exchange rate)						/	/	0.01	0.17***	0.07
Common AR-error assumed					X	X				
Fixed effects:										
_BG	−0.53	0.75	−0.37	3.04	−0.77	−2.86	0.08	0.36	−0.35	0.07
_CZ	0.55	1.31	0.71	1.65	0.55	0.50	1.15	1.22	0.91	1.09
_EE	0.75	1.39	1.42	1.81	1.37	1.30	1.66	1.97	1.32	1.82
_HU	0.26	0.88	0.57	2.72	0.05	−0.01	0.73	0.13	0.49	−0.03
_LV	−0.05	1.06	0.76	2.26	0.65	0.58	0.96	1.28	0.68	1.10
_LT	−0.04	1.33	1.27	3.10	1.64	1.52	1.45	2.08	1.12	1.86
_PL	1.36	2.60	1.58	4.09	0.96	0.88	1.77	1.61	1.31	1.37
_RO	−0.28	0.49	0.02	2.11	−0.45	−0.59	0.26	0.10	−0.26	−0.17
_SK	1.19	2.67	1.56	3.99	0.74	0.71	1.72	1.81	1.41	1.65
_SL	0.76	2.16	0.88	3.69	0.45	0.40	1.03	0.86	0.68	0.74
Weighted statistics:										
R²	0.50	0.51	0.56	0.48	0.38	0.40	0.56	0.45	0.54	0.45
F-statistics	7.76	5.92	10.30	5.98	4.07	4.31	9.70	4.73	9.14	4.67
Durbin-Watson	1.68	2.13	1.75	1.93	1.94	1.95	1.61	2.04	1.68	2.02
Total panel observations	97	81	101	91	91	91	97	81	96	81
Sample	1991-2001	1993-2001	1991-2001	1992-2001	1991-2001	1991-2001	1991-2001	1993-2001	1991-2001	1993-2001

The term $(y_{i,t-1} - y_{i,t-2})$ is instrumented by the change of the unemployment rate lagged two periods.

Table 3: *Impact of Exchange Rate Variability on the Change in the Unemployment Rate SUR Estimates for 10 CEECs (fixed effects)*

Regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Instrument for the change in unemployment rate (–1)	/	–0.28***	/	–0.20***				–0.02		–0.01
Real GDP growth rate	–0.29***	–0.18***	–0.27***	–0.15***	–0.27***	–0.21***	–0.25***	–0.25***	–0.26	–0.25***
Measures of exchange rate volatility:										
Effective volatility of nominal exchange rate	0.08***	/	0.08***	0.04***		0.14***	/	/	/	/
Effective volatility of real exchange rate		0.03**	/	/			/	/	/	/
Volatility of national currency *vis-à-vis* euro (DM) (nominal exchange rate)					0.10***		/			
Volatility of national currency *vis-à-vis* euro (DM) (real exchange rate)								–0.03	0.07	–0.02
AR-error assumed							0.10***			
Fixed effects:										
_BG	–0.41	3.41	0.08	2.62	–1.14	–0.69	0.24	0.51	0.26	0.51
_CZ	0.61	1.82	0.76	1.50	0.75	0.91	1.04	1.26	1.14	1.24
_EE	0.90	1.85	1.51	1.81	0.84	1.76	1.46	2.02	1.61	2.01
_HU	0.34	3.06	0.66	2.28	–0.08	–0.07	0.64	0.19	0.74	0.17
_LV	0.08	2.33	0.86	2.03	–0.09	0.95	0.84	1.34	0.96	1.32
_LT	0.14	2.93	1.38	2.92	0.18	2.21	1.32	2.17	1.45	2.14
_PL	1.47	4.64	1.70	3.58	1.06	1.02	1.57	1.71	1.76	1.68
_RO	–0.19	2.39	0.21	1.78	–0.63	–0.57	0.11	0.22	0.32	0.18
_SK	1.30	5.11	1.62	3.42	0.88	1.01	1.57	1.84	1.70	1.82
_SL	0.84	4.26	0.95	3.11	0.64	0.41	0.81	0.90	1.01	0.88
Unweighted statistics:										
R²	0.44	0.48	0.47	0.34	0.23	0.21	0.49	0.33	0.47	
Durbin-Watson	1.63	2.00	1.74	1.87	1.81	2.29	1.57	1.90	1.53	
Total panel observations	97	90	101	91	87	86	96	81	97	81
Sample	1991-2001	1992-2001	1991-2001	1992-2001	1991-2001	1991-2001	1991-2001	1993-2001	1991-2001	1993-2001

The term $(y_{i,t-1} - y_{i,t-2})$ is instrumented by the change of the unemployment rate lagged two periods.

Table 4: *Estimations Based on Cross-Section Specific Coefficients of Effective Exchange Rate Volatility (SUR, Fixed Effects)*

Regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Instrument for the change in unemployment rate (–1)	-0.31***	-0.28***		-0.30***		-0.36***		-0.3***
Real GDP growth rate		-0.19***	-0.18***	-0.13***	-0.23***	-0.11***	-0.17***	-0.15***
Measures of exchange rate volatility:								
Effective volatility of nominal exchange rate			X	X				
Effective volatility of real exchange rate	X	X						
Volatility of national currency *vis-à-vis* euro (DM) (nominal exchange rate)							X	X
Volatility of national currency *vis-à-vis* euro (DM) (real exchange rate)					X	X		
Country-specific coefficient of exchange rate volatility X:								
_BG	0.09**	0.02	0.09***	-0.01	0.08***	-0.01	0.12***	-0.08
_CZ	0.19***	0.23***	0.73***	0.74***	0.66***	0.82***	0.73***	0.82***
_EE	0.06	-0.03	-0.36	-0.39**	0.24	0.13	-0.83***	-0.09
_HU	0.10	0.05	0.99***	0.52*	0.42	0.54*	1.93***	1.12***
_LV	0.13***	0.13***	0.35**	0.54***	-0.78***	-0.86**	-0.19	-0.62
_LT	0.08	-0.02	0.04	0.06	0.97	1.12**	0.28	0.54
_PL	0.02	-0.07	0.46**	0.12	0.69***	0.40**	0.73***	0.35*
_RO	-0.05	-0.03	0.45***	0.30***	0.33***	0.31***	0.42***	0.28***
_SK	0.18***	0.17**	1.08***	0.98***	1.67***	1.73***	1.46***	1.36***
_SL	0.03	0.04	0.57***	0.12	-0.01	-0.12	0.40**	-0.10
Unweighted statistics:								
R^2	0.46	0.54	0.52	0.60	0.55	0.62	0.58	0.60
Durbin-Watson	1.70	2.14	1.64	2.11	1.60	2.07	1.80	2.18
Total panel observations	97	90	96	89	97	89	96	89
Sample	1991-2001	1992-2001	1991-2001	1992-2001	1991-2001	1992-2001	1991-2001	1992-2001

The term $(y_{i,t-1} - y_{i,t-2})$ is instrumented by the change of the unemployment rate lagged two periods. X denotes volatility for which country-specific coefficient is estimated.

candidates in order to allow for heterogeneity with respect to the impact of volatility. According to our model, this heterogeneity might stem from different degrees of labour market rigidities and/or from different levels of volatility experienced in the past. Allowing for *different volatility coefficients* for each CEEC, we might be able to identify those countries which drive our results. The results from the SUR procedure are reported in Table 4.[16]

For effective volatilities and based on the SUR estimates, it turns out that unemployment rates in the Czech Republic, Latvia and the Slovak Republic, and in the case of the static specification also in Bulgaria, are significantly influenced by effective real exchange rate variability. If one turns to effective nominal exchange rate volatility, the pattern changes insofar as now the coefficient of volatility is additionally significant for Hungary and Romania in both the static and the dynamic specification. Estonia, Poland and Slovenia are identified as those CEECs that are also affected by effective nominal exchange rate variability, according to one specification. However, the results do not seem to be driven by the degree of exchange rate volatility experienced by a single CEEC, since the countries that display persistently higher effective volatility (such as Poland, Romania, Latvia and Lithuania) do not display a bulk of significant coefficients of volatility, with the exception of Latvia. Hence, the often stressed heterogeneity among the candidate countries becomes obvious too with respect to the impact of exchange rate volatility.

However, the pattern becomes more significant and consistent when the bilateral euro volatilities of the CEEC currencies are included. If one correlates these results with our considerations with regard to openness *vis-à-vis* the euro zone, it becomes obvious that the Czech Republic, Hungary and Poland, as the economies which are most open to trade with the euro zone, are among those countries for which the results are most in line with our main hypothesis. These countries are joined by Romania and the Slovak Republic with four entries as well. Bulgaria as the outlier in terms of volatility and, hence, a candidate for euroisation, and Latvia have two entries each. Lithuania, Slovenia and, somewhat surprisingly, Estonia display one significant coefficient of exchange rate volatility. With the exception of Slovenia, these results closely correspond to our expectations based on the country-specific degrees of openness described in Section I. However, according to Figure 1, Slovenia reveals one of the lowest degrees of exchange rate volatility. This is a plausible reason why Slovenia's high degrees of

---

[16] Those based on FGLS lead to strikingly similar conclusions and are available on request.

openness towards the euro zone and of labour market rigidities do not lead to more significant entries in Table 4.[17]

V SUMMARY AND OUTLOOK

The results of this paper suggest that the high degree of exchange rate variability observed from time to time in the CEECs has tangible economic costs. Our earlier studies on intra-EMS, transatlantic and Mercosur exchange rate variability have already indicated that reductions in exchange rate variability could yield substantial benefits for small open economies. It is fully possible that the same applies for most of the CEECs. It was argued that this result is due to the fact that all employment decisions have some degree of irreversibility. We investigated both effective and bilateral euro exchange rate variability since we were interested in the costs of exchange rate variability in general (effective volatilities) and in evaluating one partial benefit of euroisation – the elimination of the exchange rate risk – in particular (bilateral volatilities *vis-à-vis* the euro). In general, our results are rather strong in that we find that exchange rate variability in many cases has a significant impact on the unemployment rate. Moreover, the data confirm the expectation that economies with relatively closer ties with the euro zone, such as the Czech Republic, would show a stronger impact of euro exchange rate variability. The estimated impact coefficients were in most of the cases smaller if we pooled all of the ten CEECs. This systematic correlation between openness and the strength of the impact of exchange rate volatility on trade corresponds to the general finding of the literature, which is that for emerging markets this channel is much more important.

What are the implications of the results concerning the labour market impact of euro volatility for the debate on exchange rate policy in the CEECs?

---

[17] As a final step, we corroborated our analysis by extensive robustness checks. In the first step, we limit the sample to a group of rather homogenous countries with respect to labour market regulation, namely the Visegrád Economies: Czech Republic, Hungary, Poland, and the Slovak Republic. The *magnitude* of the estimated volatility coefficients and their *significance levels increase dramatically*. A second robustness check which includes indicators of strictness of employment protection legislation as interaction variables in the regressions also performs quite well. All coefficients of the interaction variables are significant, the majority even at the 1 per cent significance level. As a third and final robustness check we implement a measure for real wage growth in order to check whether the result of a significant relationship between exchange rate volatility and the unemployment rate found in this paper is driven by a missing third variable related to labour costs. Compared with the baseline estimation, the pattern of results did not change a great deal. We also check for the exogeneity of the volatility and robustness variables with respect to the change of the unemployment rate by extensive Granger causality tests. Due to lack of space, the results are not presented here, but are available upon request.

Given the preliminary character of our analysis, one certainly has to be cautious in terms of policy conclusions. However, our main result could be read as support for the policy conclusion that fixing exchange rates against the euro should bring significant benefits. A common argument against reducing exchange rate variability is the position that economies need some safety valve somewhere. In other words, would the suggested gains from suppressing exchange rate variability be lost, if the volatility reappeared elsewhere, for example in higher interest rate variability? We would argue that it is not possible at present to say whether the volatilities of other variables will go up or down with efforts to limit CEEC exchange rate fluctuations. But research by Rose (1999) and others indicates, for example, that official action can reduce exchange rate variability simply by holding the variability of fundamentals such as interest rates and money constant. Policy co-ordination between the central banks could thus keep the volatility of a CEEC currency *vis-à-vis* the Euro under control. The same is, of course, valid with respect to entering EMU.

Furthermore, it is now widely considered a stylised fact that exchange rates are disconnected from fundamentals (e.g., Obstfeld and Rogoff, 2000 and the July 2002 issue of the *Journal of Monetary Economics*). The constant threat of speculative attacks on emerging market currencies can actually cause a co-movement of variables that does not exist for developed economies. Referring to the CEE Countries, we cannot entirely rule out the possibility that variability in the exchange rate in the 1990s has been caused by variability in monetary policy. If this were the case, the cost of exchange rate volatility reported here should be considered the cost of erratic monetary policy. We are nevertheless confident that for the Central and Eastern European EU candidate countries the general 'disconnect' between exchange rates and fundamentals also holds in the short run and is even extended to (domestic) interest rates, which for emerging markets are determined by shocks coming from international financial markets. Even if the 'disconnect' did not hold, the results gained in this paper would be of interest, since they then should fuel the debate on the relation between monetary policy rules and exchange rate variability. In this event one might come to the conclusion that, for some of the CEECs and other countries in similar situations, that monetary integration with the euro area would be the optimal monetary policy strategy.

REFERENCES

ALESINA, A. and R. J. BARRO, 2001. "Dollarisation", *American Economic Review*, Papers and Proceedings, Vol. 91, pp. 381-385.

ARELLANO, M., 1989. "A Note on the Anderson-Hsiao Estimator for Panel Data", *Economics Letters*, Vol. 31, pp. 337-341.

BABETSKI, J., L. BOONE and M. MAUREL, 2002. "Exchange Rate Regimes and Supply Shocks Asymmetry: The Case of the Accession Countries", *CEPR Discussion Paper*, No. 3408, London.

BEGG, D., B. EICHENGREEN, L. HALPERN, J. VON HAGEN and C. WYPLOSZ, 2001. "Sustainable Regimes of Capital Movements in Accession Countries", *CEPR Policy Paper*, No. 10, London.

BELKE, A. and D. GROS, 2001. "Real Impacts of Intra-European Exchange Rate Variability: A Case for EMU?", *Open Economies Review*, Vol. 12/3, pp. 231-264.

BELKE, A. and D. GROS, 2002. "Monetary Integration in the Southern Cone", *North American Journal of Economics and Finance*, Vol. 13, pp. 323-349.

BELKE, A. and D. GROS, 2002a. "Designing EU-US Monetary Relations: The Impact of Exchange Rate Variability on Labour Markets on both Sides of the Atlantic", *The World Economy*, Vol. 25, No. 6. pp. 789-813.

BELKE, A. and M. HEBLER, 2002. "The New Social Dimension of the EU: Labour Market Impacts for the Accession Countries", *Constitutional Political Economy*, Vol. 13, pp. 313-353.

BOREIKO, D., 2002. "EMU and Accession Countries – Fuzzy Cluster Analysis of Membership", Paper presented at the conference *Monetary Union: Theory, EMU Experience, and Prospects for Latin America*, organised by Banco Central de Chile, Österreichische Nationalbank, and the University of Vienna, April 14-16, Vienna.

BUITER, W. H. and C. GRAFE, 2002. "Anchor, Float or Abandon Ship: Exchange Rate Regimes for the Accession Countries", *Banca Nazionale del Lavoro Quarterly Review*, No. 221 (June) , pp. 1-32.

CALVO, G. A. and C. M. REINHART, 2000. "Fixing for Your Life", NBER Working Paper, No. 8006, Cambridge/MA.

CAZES, S., 2002. "Do Labour Market Institutions Matter in Transition Economies? An Analysis of Labour Market Flexibility in the Late Nineties", *International Institute for Labour Studies*, Discussion Paper No. 140.

DIXIT, A., 1989. "Entry and Exit Decisions under Uncertainty", *Journal of Political Economy*, Vol. 97, pp. 620-638.

GREENE, W. H., 2000. *Econometric Analysis*, 4th ed., New Jersey

GREENE, W.H., 2003. *Econometric Analysis*, 5th ed., New Jersey.

HOBZA, A., 2002. "CEE Candidate Countries on the Way to the Euro zone", Background Study for WRR, 10 June 2002, *Centre for European Policy Studies*, Brussels.

HSIAO, C., 2002. *Analysis of Panel Data*, Cambridge.

LAVRAC, V., 2003. "Dynamics of Inclusion of Accession Countries in the Monetary Union: Some Institutional Aspects", Paper presented at the conference *Institutions in Transition*, organised by the Institute of Macroeconomic Analysis and Development (IMAD), 12-14 June, Kranjska Gora.

LEVIN, A. and C.-F. LIN, 1992. "Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties", University of California, *UCSD Discussion Paper*, No. 92-23, May, San Diego,.

MEESE, R., 1990. "Currency Fluctuations in the Post-Bretton Woods era", *Journal of Economic Perspectives*, Vol. 4, No. 1, pp.117-134.

MEESE, R. and K. ROGOFF, 1983. "Empirical Exchange Rate Models of the Seventies: Do They Fit Out of Sample?", *Journal of International Economics,* Vol. 14, No.2, pp. 3-24.

McKINNON, R., 1999. "The East Asian Dollar Standard, Life after Death?", Paper prepared for the World Bank Seminar *Rethinking the East Asian Miracle*, July 1999.

NATIONAL BANK OF HUNGARY, 2002. "Adopting the Euro in Hungary: Expected Costs, Benefits and Timing", National Bank of Hungary, *National Bank of Hungary Occasional Paper*, No. 24.

NESPOROVA, A., 2002 "Why Unemployment Remains So High in Central and Eastern Europe?", International Labour Organisation, *ILO Employment Paper*, No. 43, Geneva.

NICKELL, S., 1997. "Unemployment and Labour Market Rigidities: Europe versus North America", *Journal of Economic Perspectives*, Vol. 11, pp. 55-74.

NUTI, M., 2002. "Costs and Benefits of Unilateral Euroisation in Central Eastern Europe", *Economics of Transition*, Vol. 10, No. 2, pp. 419-444.

OBSTFELD, M. and K. ROGOFF, 2000. "The Six Major Puzzles in International Macroeconomics: Is There A Common Cause?", *NBER Macroeconomics Annual*, pp. 339-390.

OESTERREICHISCHE NATIONALBANK, 2002. *Focus on Transition*, 1/2002, Vienna.

OESTERREICHISCHE NATIONALBANK, 2002a. *Internal Data Bank*, Vienna.

RIBOUD, M., C. SÁNCHEZ-PÁRAMO and SILVA-JÁUREGUI, 2002. "Does Eurosclerosis Matter? Institutional Reform and Labour Market Performance in Central and Eastern European Countries in the 1990s", *World Bank Social Protection Discussion Paper*, No. 0202.

ROSE, A. K., 1999. "One Money, One Market: Estimating the Effect of Common Currencies on Trade", NBER Working Paper, No. 7432, Cambridge/MA.

VIENNA INSTITUTE FOR INTERNATIONAL ECONOMIC STUDIES, 2002. "Countries in Transition 2002", *WIIW Handbook of Statistics*, Vienna.

ANNEX

Data Sources: Oesterreichische Nationalbank (2002), Oesterreichische Nationalbank (2002a), Vienna Institute for International Economic Studies (2002), Estonia, Latvia, Lithuania: Eurostat and national sources.

CPI: Index of consumer prices.

GDP: Gross domestic product, real growth rate, per cent.

UNEMP: Unemployment rate in per cent, end of period.

WAGE: Average gross monthly wages, real growth rate, per cent.

XR: specified national currency [n.c.] units) per US dollar, monthly average, nominal, bilateral exchange rates *vis-à-vis* other countries than the US calculated via cross rates.

XRR: specified national currency [n.c.] units) per US dollar, monthly average, real (deflated with CPI), bilateral exchange rates *vis-à-vis* other countries than the US calculated via cross rates.

VOLXREFF: effective volatility of nominal exchange rates (3 bilateral volatilities calculated for each CEEC, effective volatilities were generated by multiplying each of the 3 bilateral volatilities with the respective trade weight).

VOLXRREFF: effective volatility of real exchange rates (30 bilateral volatilities calculated for each CEEC, effective volatilities were generated by multiplying each of the 30 bilateral volatilities with the respective trade weight).

The following country codes apply throughout the study: BG (Bulgaria), CZ (Czech Republic), EE (Estonia), HU (Hungary), LV (Latvia), LT (Lithuania), PL (Poland), RO (Romania), SK (Slovakia), SL (Slovenia).