EU Enlargement, Exchange Rate Variability and Labor Market Performance

by

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ABSTRACT

According to the traditional 'optimum currency area' approach, not much will be lost from a very hard peg to a currency union if there has been little reason for variations in the exchange rate. This paper takes a different approach and highlights the fact that high exchange rate volatility may as well signal high costs for labor markets. The impact of exchange rate volatility on labor markets in the CEECs is analyzed, 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 a removal of employment protection legislation.

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1. Introduction

The recent economic slowdown in the Central and Eastern European Countries (CEECs in the following) has been accompanied by high unemployment rates. Exceeding 13 per cent in 2001, unemployment had increased by one percentage point compared to the year before. The impact of unfavorable developments in the world markets does not explain it all. Longer-term effects of structural change in the candidate economies do also play an important role. The countries with largest expected increases in unemployment – Bulgaria, Poland and Lithuania – were among those with the highest levels, indicating a certain degree of hysteresis. The situation in the individual countries is, of course, highly differentiated, with Hungary and Slovenia at the lower bound and Slovakia, Poland and Bulgaria at the upper bound, with rates exceeding 18 per cent. Yet, in all candidate countries labor 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 in how far high exchange rate variability can be made responsible for these negative developments in CEEC labor markets. At first, we would like to comment briefly on the motivation behind our contribution. In earlier studies we have shown that intra-European exchange rate variability has increased unemployment and reduced employment, a finding that had an importing bearing on the evaluation of costs and benefits of EMU (see, e.g., Belke and Gros 2001). More recently, we could show in the context of a project for the European Commission that exchange rate variability might also have significant negative effects on the global level (Belke and Gros 2002a). Our first results indicate that transatlantic exchange rate variability does have a significant negative impact on labor markets in the EU, and possibly also in the US. We would argue that volatility matters because employment and investment decisions are characterized 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 (see, e.g., Belke and Goecke 2001). A third category of studies is related to the *emerging markets*. Here, we have investigated the Mercosur area (Belke and Gros 2002).

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 of floating exchange rates vis-à-vis the Euro

and of the opposition to euroization that could recently be observed in several CEECs. 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 exchange rate policies for selected CEECs on their way towards full membership in EMU. It should be kept in mind that our results are preliminary, not least because the issues we raise have not been discussed in this way in the literature so far, a surprising neglect in view of their high policy relevance. In the following, we perform an empirical analysis based on simple VARs for various measures of the variability of CEEC currencies, a topic that has received little attention so far.[1]

Ten of the thirteen EU candidate countries are quickly proceeding towards EU membership, which formally also implies membership in EMU.[2] 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 time frame is now quite clear: The earliest possible date of entry into the eurozone is year 2006, if the EU enlargement takes place in the course of year 2004. A large number of the candidate countries have indeed expressed willingness to proceed to the eurozone as quickly as possible. This paper argues that early entry strategies might be motivated with an eye to the benefits resulting from suppressed euro volatility. A recent comparison of the CEECs with the Club Med countries (whose qualification for EMU was also long in doubt) suggests that most of the candidate countries could satisfy the conditions in the medium-term and introduce the euro relatively quickly (Hobza 2002).

There are, however, two common objections to an early introduction of the euro in the CEECs. First, many officials in the EU, especially in financial circles, call for prudence and a slower-track approach that produces a higher level of real convergence prior to EMU enlargement. Even though

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[1] To our knowledge, there is no work in this area available up to now.

[2] It is important to stress the heterogeneity among the candidate countries. Clearly, Bulgaria and Romania are lagging behind and the EU/EMU membership is a longer-term issue for them. But also the more advanced candidates show a high degree of differences.

it is acknowledged that a monetary union is fully compatible with income differences among its members, too fast a compliance with the nominal convergence criteria is often conceived as a threat to real convergence. Besides this prevailing skepticism, a second objection deserves attention. After the forced exit from its pre-announced crawling peg arrangements, Poland joined its Viségrad partners (Czech Republic, Hungary and Slovakia) in using more flexible exchange rate arrangements. Does this tendency towards greater flexibility indicate that one should stop to discuss monetary integration in Eastern Europe? We would argue otherwise. The costs and benefits of fluctuating exchange rates in the CEECs deserve a closer look. The CEEC situation in recent years bears some resemblance to the situation in Western Europe in the early 1990s, when speculative attacks forced the major currencies participating in the European Monetary System to relax their exchange rate commitments (FRF, PTE) or abandon the system completely (ITL, GBP). Monetary union nevertheless started on schedule because policy makers consistently stuck, despite intense market pressure, to the policy choices required by the project of European monetary integration. It is thus conceivable that euroization or regular entry into EMU will one day again become a real option for the CEECs as well.

In section 2 we analyze briefly the status quo ante in terms of CEEC trade integration with the eurozone and in terms of the discussion on early euroization, since both aspects are important for the empirical analysis. In section 3 we construct a theoretical model to derive the impact of volatility on labor markets in the CEECs. We then present some first empirical results in section 4 and provide some robustness tests in section 5. Section 6 concludes with a discussion of the implications of our results for the design of future CEEC monetary relations with the eurozone.

2. CEE accession candidates: the status-quo ante

Evaluating the costs and benefits of exchange rate stability for the CEECs does not require a substantially different approach compared with the present EU countries, since the former show a high degree of trade integration with the latter. However, the choices for the CEECs nowadays differ from those relevant for the EMU member countries a decade ago in an important respect:

Expressed in a textbook fashion à la Krugman and Obstfeld (2003, pp. 604 ff), the CEECs face an *existing and properly functioning currency union in their neighborhood*. This difference makes it even more urgent to assess the costs and benefits of joining that currency union. At the same time, important spillovers of the fulfilment of the Kopenhagen criteria for CEEC labor markets in the run-up to EU accession have already become manifest and should be taken into account when modeling CEEC labor markets. The EU's recent socio-political activities cause potential risks for properly functioning CEEC labor markets during a period of rapid structural change (see section 3.3). The CEECs can only cope with change if they stick to institutions that allow for some flexibility and/or – as claimed in this paper – if they succeed in reducing exchange rate volatility (see also section 3.3, and Chen and Zoega 2001).

Let us now provide a picture of the development of CEEC trade integration with the eurozone. Boreiko (2002) demonstrates the importance of trade with EMU countries for the CEECs, relating imports and exports to the eurozone 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 eurozone. 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; see also Belke and Hebler 2002a). The realizations 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 DM/euro exchange rate variability on the labor 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. However, studies for Latin America indicate that, in the case emerging markets, the analysis of the costs and benefits of regional exchange rate arrangements should not be confined to the impact of stable exchange rates on trade, but should be made in terms of overall macroeconomic stability (Belke and Gros 2002). This is valid especially for countries with fiscally 'weak' governments and/or a 'weak' banking system with extensive default risks. Hence, the degree of openness is not crucial for our analysis.

The conventional view of EMU enlargement is to converge first, and durably, and then join. But this conventional view, while probably appropriate for EU members, may not be well adapted to the new situation faced by some candidate countries after the Asian and Russian crises and after the introduction of the euro. Three candidates (Bulgaria, Estonia and Lithuania) and one non-candidate (Bosnia) have already become virtual members of the euro area, with euro-denominated currency boards. Kosovo and Montenegro have de facto opted for early euroization.[3] During the 2001 Autumn Conference of the Bundesbank on 'How to Pave the Road to E(M)U', representatives of the Czech and Hungarian central banks nevertheless strongly objected to unilateral euroization of their countries, in view of the remaining risk of speculative attacks (Habib 2001). Most relevant in our context, the elimination of substantial labor market regulation has been claimed to be a necessary condition for a unilateral euroization of Poland (Bratkowski and Rostowski 2001, Nuti 2002, p.438).

It is a generally accepted proposition that, for the CEECs, the most dangerous choice on their road to EMU would be an exchange rate system that combines capital mobility with 'fixed but adjustable' exchange rates (e.g., Begg et alia 2001). However, that is exactly the position the candidates will be in for at least two years, if they have to qualify for EMU according to the traditional Maastricht criteria. What then should the EU do to smoothen the transition process? It should reconsider its hitherto extremely negative position on unilateral euroization. This paper investigates an often alleged, but never proven benefit of euroization or some other hard peg for the CEE economies, namely the suppression of exchange rate volatility.[4]

3. Modeling the impact of exchange rate volatility on labor markets

In the following, we introduce a consistent model and develop testable hypotheses in order to investigate possible consequences of exchange rate volatility in the CEECs. The resulting hypotheses are then tested empirically. At first, however, we would like to elaborate on the motivation behind these efforts.

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[3] Due to better comparability with the present EU member countries, the following analysis concentrates on the EU candidate countries, however.

3.1 Motivation

The exchange rates between the G-3 currencies, those between CEEC and G-3 currencies and to a lesser extent, via cross rates, the intra-CEEC exchange rates are closely watched in the markets. Their gyrations, sometimes difficult to understand on purely economic grounds, are often perceived to be politically costly for the CEECs on their "way to the euro". The relevance of exchange rate variability as a proxy for investment risk in CEECs has already been emphasized (for a survey see Belke and Hebler 2002a, pp. 113 ff. and 181 ff.). Intuitively, joining EMU would be compatible with most of the CEECs structure of foreign trade and might not necessarily hamper their international competitiveness. However, this kind of hard peg does not shelter these CEE economies from exchange rate variability vis-à-vis the currencies of their other trade partners or from exchange rate variations between G-3 countries (Krugman and Obstfeld 2003, pp. 620 ff.). Reinhart and Reinhart (2001) claim that exchange rate and interest rate volatility have negative effects on economic growth in the developing world. Higher interest rate volatility may delay investment whereas higher exchange rate volatility may hamper emerging market trade.[5] Their results suggest that direct benefits to emerging market economies should have their origin in suppressed volatility of their *own* trade-weighted currencies (i.e., exactly the volatilities investigated here). According to a number of recent studies, a country should in this case prefer adopting a common currency to target zones (e.g., Rose 1999). In view of the possibility that some CEEC currencies, such as the Polish zloty, undergo large devaluations while Estonia and Bulgaria are caught in their currency board arrangements, it might even be argued that movements of the dollar-euro rate in the range of mark-dollar movements after 1971 would break the enlarged EU apart (Belke and Hebler 2002a, pp. 188 ff). However, this would be an argument about the appropriate exchange rate level (of the effective rate for, e.g., the Bulgarian lewa), rather than about volatility, which is the main issue in this paper.

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[4] For surveys on the costs and benefits of euroization see Alesina and Barro (2001, pp. 381 ff), and Nuti (2002).
[5] See Calvo and Reinhart (2000a, pp. 15 ff), and Reinhart and Reinhart (2001, p. 10).

Though it is widely believed that exchange rate volatility reduces welfare, it is difficult to prove this in a formal setting (Csajbók et alia 2002). The problem is that appreciations or depreciations of the exchange rate in response to economic shocks (such as preference and technology shocks) generally are welfare improving relative to less exchange rate volatility in face of the same shock. Thus, exchange rate swings can smooth out abrupt changes in the terms of trade. However, exchange rate fluctuations not caused by economic shocks will indeed reduce the efficiency of financial markets (Neumeyer, 1998). For example, a high exchange rate volatility due to concerns about the ability to serve external debt or the solidity of domestic political institutions, entails considerable welfare costs.

Accordingly, concerning the connection between exchange rate volatility and trade, there are also two contradictory effects: first, higher exchange rate volatility increases the uncertainty of the profits of exporters (when they invoice in foreign currencies); second, it creates profit-making opportunities. The effect of volatility on trade thus depends on the degree of risk aversion and risk exposure of the agents (Lafrance and Tessier, 2000). Due to this ambiguity, skeptics would probably assume that exchange rate variability cannot have a significant impact on labor markets. 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 foreign trade of these countries.

Additionally, capital markets in emerging markets are of an incomplete nature.[6] If futures markets are either illiquid or even nonexistent, 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.).

Why would an increase in exchange rate volatility lead to a lower volume of trade? The theoretical models that are used in this context 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.

3.2 The model

We now develop a full-fledged model to illustrate a mechanism (apart from the spending channel in Reinhart and Reinhart 2001) that explains a negative relationship between exchange rate uncertainty and *job creation*.[7] This model has originally been based on the idea that uncertainty of future earnings raises the 'option value of waiting' with decisions which concern *investment projects* in general (Dixit 1989, Belke and Gros 2001). The model, which heavily relies on Belke and Kaas (2002), does not pretend to be close to reality. It is designed to convey the basic idea in a simple way. Moreover, our intention is to present a model that allows us to ask whether even a *temporary*, *short-run* increase in uncertainty can have a strong and lasting impact on employment and the unemployment rate, and in how far this impact depends on labor market parameters.

Consider a set-up in which there are *three periods* and a *single firm* active in an export-oriented industry decides about job creation. During the first two periods (called 0 and 1) the firm can open a job, hire a worker and produce output that is sold in a foreign market during the following periods. If the job is created during period 0, the worker is hired for two periods (0 and 1) to produce output

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[6] This argument is less important for countries with more efficient financial markets like Czech Republic, Hungary and Poland.

[7] For a similar model that analyses the effect of exchange rate uncertainty on investment and not explicitly on the labor

to be sold in periods 1 and 2. If the job is created in period 1, the worker is hired only for period 1 and output is sold in period 2.

To create a job, the firm pays a start-up cost c which reflects the cost of hiring, training and the provision of job-specific capital. After a job is created, a worker is hired and is paid a wage w above the worker's fallback (or reservation) wage $\underline{w}$ during every period of employment. The fallback wage measures (besides disutility of work) all opportunity income that the worker has to give up by accepting the job. In particular, it includes unemployment benefits, but it might also be positively related to a collective wage set by a trade union or to a minimum wage, both of which should raise the worker's fallback position. In general, we would argue that the fallback wage should be higher in countries that are characterized by generous unemployment benefit systems, by strong trade unions or by minimum wage legislation.

In every period in which the worker is employed, he produces output to be sold in the following period in a foreign market at domestic price p which has a certain component p^* (the foreign price) plus a stochastic component e (the exchange rate). We assume that the foreign price is fixed ('pricing to market'), and that the exchange rate follows a random walk. In period 1, the exchange rate e_1 is uniformly distributed between $-\sigma_1$ and $+\sigma_1$. The exchange rate in period 2, e_2, is uniformly distributed between $e_1-\sigma_2$ and $e_1+\sigma_2$. An increase in σ_i means an increase in uncertainty, or an increase in the mean preserving spread in period $i=1, 2$ (σ_i is proportional to the standard deviation of e_i). Uncertainty can be temporary (e.g. if $\sigma_1>0$ and $\sigma_2=0$) or persistent (if also $\sigma_2>0$). As will become apparent soon, however, the variability of the exchange rate during the second period has no influence on the result.

The wage rate w for the job is determined by the (generalized) Nash bargaining solution that maximizes a weighted product of the worker's and the firm's expected net return from the job. We assume that both the firm and the worker are risk-neutral. This assumption implies that risk-sharing issues are of no importance for our analysis. Thus we may assume realistically (but without loss of

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market, see Belke and Gros (2001).

generality) that the worker and the firm bargain about a fixed wage rate w (which is independent of realizations of the exchange rate) when the worker is hired, so that *the firm bears all the exchange rate risk*. A wage contract which shifts some exchange rate risk to the worker would leave the (unconditional) expected net returns unaffected, and has therefore no effect on the job creation decision. Of course, if the firm was risk-averse, the assumption that the firm bears all exchange rate risk would make a postponement of job creation in the presence of uncertainty even more likely.

Consider first the wage bargaining problem for a job created in *period 0* in which case the worker is hired for two periods. After the job is created (and the job creation cost is sunk), the (unconditional) *expected* net return of this job is equal to $E_0(S_0) = 2p^* - 2\underline{w} = 2\pi$ where $\pi = p^* - \underline{w}$ denotes the expected return of a *filled* job per period (we abstract from discounting). Denoting the bargaining power of the worker by $0<\beta<1$, the *firm's net return* from the job created in period 0 is[8]

(1) $$E_0(\Pi_0) = (1-\beta)E_0(S_0) - c = 2(1-\beta)\pi - c \ .$$

In order to make the problem non-trivial, the expected return from job creation in period 0 must be positive, i.e. we assume that $2(1-\beta)\pi - c > 0$. Implicit in our model is the assumption that the firm and the worker sign a *binding employment contract for two periods* (0 and 1). Hence job termination is not an option in case the exchange rate turns out to be unfavorable. In period 1 (after realization of the exchange rate) the conditional expected surplus from job continuation is $E_1(S_1) = \pi + e_1$ which may be negative if the exchange rate falls below $-\pi < 0$. In such circumstances, both the worker and the firm would benefit from termination. If a contract allowing for termination in period 1 could be signed, the unconditional expected surplus in period 0 would be larger (consequently both the worker and the firm would prefer to sign such a contract).[9] However, as the periods in question are rather short (a month, to be compatible with our empirical analysis), the assumption of a binding contract for two periods seems to be more appropriate. Once a binding contract for two periods is signed, the worker

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[8] The wage bargain leads to a wage rate maximizing the Nash product $(2w-2\underline{w})^{\beta}(2p^*-2w)^{1-\beta}$ whose solution is $w=(1-\beta)\underline{w}+\beta p^*$. Hence the expected net return for the firm is $2p^*-2w-c=(1-\beta)(2p^*-2\underline{w})-c$.

[9] Such a flexible contract implies that some exchange rate risk is shared between the worker and the firm. The reason why they both benefit is not, however, the risk-sharing aspect, but the fact that the flexible contract excludes continuation of unprofitable work.

always prefers continuation (since the contract wage exceeds the fallback wage), and the firm would incur losses if the exchange rate turns out to be unfavorable.

If the firm waits until *period 1,* it keeps the option of whether or not to open a job. It will create a job only if the exchange rate realised during period 1 (and so expected for period 2) is above a certain threshold level, or barrier, denoted by b. Given that employment in period 1 yields a return in period 2 only, this profitability barrier is defined by the condition that the (conditional) expected net return to the firm is zero:

(2) $(1-\beta)(p^* + b - \underline{w}) - c = 0$ or $b = c/(1-\beta) + \underline{w} - p^* = c/(1-\beta) - \pi$.

Whenever $e_1 \geq b$, the firm creates a job in period 1, and the conditional expected net return to the firm is $E_1(\Pi_1) = (1-\beta)(\pi+e_1)-c \geq 0$. Whenever $e_1 < b$, the firm does not create a job in period 1, and its return is zero. Hence, whenever both events occur with positive probabilities (i.e. whenever $\sigma_1 > b > -\sigma_1$)[10], the unconditional expected return of waiting in period 0 is given by:

(3) $E_0(\Pi_1) = [(\sigma_1 + b)/(2\sigma_1)]0 + [(\sigma_1 - b)/(2\sigma_1)][(1-\beta)(\pi + (\sigma_1+b)/2) - c]$,

where the first element is the probability that it will not be worthwhile to open a job (in this case the return is zero). The second term represents the product of the probability that it will be worthwhile to open the job (because the exchange rate is above the barrier) and the average expected value of the net return to the firm under this outcome. Given condition (2) this can be rewritten as:

(4) $E_0(\Pi_1) = (1-\beta)(\sigma_1-b)^2 / (4\sigma_1)$.

This is the key result since it implies that an increase in uncertainty *increases* the value of waiting, given that equation (4) is an increasing function of σ_1.[11] As σ_1 increases it becomes more likely that

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[10] We do not *a priori* restrict the sign of the barrier b. Hence one of these conditions is automatically satisfied, whereas the other is satisfied only if uncertainty is large enough.

[11] Formally this results from the fact that equation (4) is only valid whenever σ_1 exceeds b (otherwise the exchange rate could never exceed the barrier and the firm never creates a job in period 1) and whenever $-\sigma_1$ is lower than b (otherwise the exchange rate could never fall below the barrier and the firm always creates a job in period 1).

it is worthwhile to wait until more information is available about the expected return during period 2. The option not to open the job becomes more valuable with more uncertainty. The higher the variance the higher the potential losses the firm can avoid and the higher the potential for a very favorable realization of the exchange rate, with consequently very high profits. It is clear from (1) and (4) that the firm prefers to wait if and only if

(5) $(1-\beta)(\sigma_1-b)^2 / (4\sigma_1) > 2(1-\beta)\pi - c$.

As the left hand side is increasing in σ_1, the firm delays job creation if exchange rate uncertainty is large enough. The critical value at which (5) is satisfied with equality can be solved as [12]

(6) $\sigma_1^* = 3\pi - c/(1-\beta) + 2\sqrt{\pi(2\pi - c/(1-\beta))}$.

Whenever $\sigma_1 > \sigma_1^*$, firms decide to postpone job creation in period 0. Since σ_1^* is increasing in π (and thereby decreasing in the fallback wage $\underline{w}$), decreasing in the cost of job creation c and decreasing in the worker's bargaining power β, we conclude that a strong position of workers in the wage bargain (reflected in a high fallback wage or in the bargaining power parameter) and higher costs of hiring raise the option value of waiting and make a postponement of job creation more likely. Thus, *the adverse impact of exchange rate uncertainty on job creation and employment should be stronger if the labor market is characterized by generous unemployment benefit systems, powerful trade unions, minimum wage restrictions or large hiring costs*. The 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). What our simple model shows is that these features also *reinforce* the negative employment effects of contemporaneous and short spikes of exchange rate uncertainty. In sum, we retain *two conclusions* from the model. First, even a *temporary* spike in exchange rate variability can induce firms to wait with their creation of jobs (for exactly this reason, the level of the exchange rate at the same time loses explanatory power). Second, the relationship between exchange rate variability and (un-) employment should be particularly strong, if the labor market is characterized by rigidities that improve the bargaining

position of workers. A stronger fallback position of workers raises the contract wage, lowers the net returns to firms and induces firms to delay job creation in the face of uncertainty.

Our argument rests on the assumption that workers cannot be fired immediately if the exchange rate turns out to be unfavorable. Hence, sunk wage payments are associated with the decision to hire a worker. These sunk costs and, consequently, the impact of uncertainty on job creation become more important if there are high firing costs. However, as we argue in Belke and Kaas (2002), even if there are no firing costs and if workers can be laid off at any point in time, exchange rate uncertainty should have a direct impact on job destruction. Under the scenario of a labor market in which the firm and the worker can sign a contract only for one period and keep the option to terminate the work relationship whenever it becomes unprofitable, we show that *the probability of job destruction is increasing in uncertainty*. Thus, even if it were possible to fire these workers rapidly, the investment in hiring and training would still be lost if the firm does not decide to export after all. Hence, there is also a negative impact of exchange rate uncertainty on employment in this case. Moreover, this amount is more pronounced if the worker's fallback wage is higher. Therefore, the basic conclusions of the model presented here remain valid. A more elaborate labor market model of job creation and job destruction (e.g., following the model of Pissarides (2000, chapter 3) might further clarify these issues, but we would expect that uncertainty has a negative effect on new hiring and a positive one on the amount of job firing.

3.3 Does the model apply to the CEEC labor markets?

According to our model, the relationship between exchange rate variability and unemployment should be particularly strong if the labor market is characterized by rigidities that, e.g., improve the bargaining position of workers. Labor 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. Where do the candidates stand in this respect?

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[12] The other (smaller) solution to this equation is less than $|b|$ and is therefore not feasible.

Riboud, Sánchez-Páramo, Silva-Jáuregui (2002) have assessed the flexibility of labor market institutions in six CEE candidate countries: the Czech Republic, Estonia, Hungary, Poland, Slovakia and Slovenia.[13] According to their findings based on a large scale of indicators for regular contracts, temporary contracts and collective dismissals, these countries range somewhere *in the middle of the flexibility scale* compared to the OECD economies. They do not reach the levels of flexibility of the UK, Ireland and Denmark, but exhibit much greater flexibility than the Club Med countries, France and Germany.[14] As regards the unemployment insurance systems, the CEECs seem to be less generous than the OECD or the EU countries. They also spend less on both passive and active employment policies. In terms of the role of the unions in the wage negotiation process, the candidates range somewhere in the middle of the OECD countries. They have, however, extremely high payroll and other taxes, which exceed even the highest levels in the EU. Even more important in our context is the fact that they have strong employment protection legislation.

- Table 1 about here -

Moreover, the CEE candidate countries generally opted for labor market institutions similar to those in Western Europe. This may, to some extent, be explained by cultural and geographical proximity, but the manifest interests of West European employers' associations and trade unions certainly also play a role. This trend clearly increases the job creation costs and the fallback wage, as defined in our above model. 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 the labor market regulations. This kind of legislation has favored employment protection while taxing employers heavily (see Table 1). On the whole, thus, the candidate countries have introduced *similar rigidities that are troubling the EU countries* (Belke and Hebler (2001, 2002), Riboud et. al., 2002).[15] Employment decisions in the CEECs accordingly become more

[13] In order to allow for a comparison with the developed economies they made use of the OECD methodology (1994 and 1999).

[14] See our Table 1 and Riboud et. al. 2002, pp. 7 f. However, in terms of employment protection legislation, Slovenia belongs to those countries with the highest degree of inflexibility. This could change if the new proposed labor code is approved (Boeri and Terrell 2002).

[15] Belke and Hebler (2002) discuss the effect on employment in the CEECs of an adoption of the social standards of the EU. They explicitly draw an analogy between the policies vis-à-vis the East European countries and the policies

similar to investment decisions with high sunk costs under exchange rate uncertainty, as analysed in our model. Hence, the transmission mechanism that we have described in terms of an 'option value of waiting' appears to be relevant in the case of the CEECs as well. The next step is to ask 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 DM-euro exchange rate – have any ability to explain the residuals of unemployment regressions for CEEC economies. Up to now, the literature that examines the link between exchange rate variability and labor market performance in emerging markets is rather thin. Hence, it is legitimate to present and comment some first results.

4. Empirical analysis

4.1 The operational definition of exchange rate variability

The nominal variability of the currency of each of the ten CEEC countries which have applied for EU membership 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. For the construction of the real variability variable see the annex. We make use of *nominal* exchange rates, although it could be argued that *real* exchange rates are more important for trade and other real variables. Over a monthly horizon, however, real and nominal exchange rate changes are practically indistinguishable. 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 their 31 most important trade partners (for details see annex).

Based on the monthly CPI series for the 30 most important trade partners, the nominal bilateral exchange rates vis-à-vis the U.S.-dollar of these 31 countries and the respective trade weights (see annex), we calculated the following volatilities of the exchange rate:

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regarding East Germany and Southern Italy.

- 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).

It should be emphasized 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 (Greece: from 2001:01). 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 (see Belke and Hebler 2002a, pp. 44 ff). With an average exchange rate the zloty, for example, could remain constant because the depreciation against the DM 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/DM and the zloty/lewa are constant, and another in which the swings in these two bilateral rates just happen to cancel each other out. Volatility vis-à-vis a trade partner is defined simply as the standard deviation of the 12 monthly changes in the logarithm of the national exchange rate against the currency of the respective trade partner.

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 over 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.[16]

We use *actual* exchange rate changes instead of unanticipated ones, but at the monthly horizon the anticipated change is usually close to zero given the small interest rate differentials in Europe. Hence, actual and unanticipated changes are comparable (Deutsche Bundesbank 1996, pp. 67 ff, Gros and Thygesen 1992, p. 102, Peeters 1997, pp. 5 ff). The original sample ranges from 1990 to 2001. However, in view of the financial turmoil in the first years of transition, our estimations

[16] 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.

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 Bulgaria and Romania as clear outliers with high double-digit realizations. 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 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. For these countries a high real exchange rate variability signals weak macroeconomic management, rather than an adjustment need of the real sector. This is especially valid for countries close to hyperinflation (Romania and Bulgaria until 1997). However, we do not leave these two outliers aside, because Bulgaria, at least, is often said to be a clear case for euroization. Our analysis is thus based on eight candidate countries with stable macroeconomic environments and two economies with rather unstable ones (CEEC-10).

4.2 Data and stylized facts

In order to test empirically for the conjectured impact of exchange rate variability on labor-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). It is based on monthly data ranging from January 1990 to 2001.

Note that we limit our empirical analysis to the impact of exchange rate variability *on the unemployment rate*. If employment were affected simultaneously, or (more likely) with some lag, this would be totally in line with our model. Our theory predicts that increased uncertainty delays investment and hiring. Hence, unemployment should be affected immediately through 'non-hiring', since – following our model – the rise in unemployment cannot be caused by firing. As long as the labor force is growing, unemployment rises. In addition, this variable is typically derived from

reliable surveys in the CEECs. 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 labor market stance in the CEECs.

The sample we use is based on annual data and ranges from 1991 to 2001. All relevant variables are explained in the annex. 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 employment against exchange rate volatility. All variables are averaged over the period 1990 to 2001.

- Figure 1 about here -

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 cannot be rejected in a cross-country perspective. In all the diagrams, the Baltic states, Bulgaria, the Czech Republic and Romania are located near the 45 percent line and, hence, seem to fit with our theory. 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 operationalizations of exchange rate volatility, and the real growth rate of average gross monthly wages.[17] The test applied is the first widely used panel data unit root test by Levin and Lin (1992).[18] 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

[17] 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.

[18] 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

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.

4.3 Pooled Estimation

4.3.1 Empirical model

Based on our theoretical arguments, we conjecture that, controlling for the usual key variables on the labor market,[19] we can show in a cross-country panel analysis of Central and Eastern European countries that exchange rate variability worsens labor-market performance. To test for a significant negative relationship between exchange rate variability and labor-market performance, we undertake a fixed effects estimation. By this, we account for different intercepts and, hence, different natural rates of unemployment estimated for each CEEC.[20] 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 such an exercise, because our sampled cross-sectional units could not be drawn from a large population. Moreover, following our main argument in section 3, there is no reason to assume the country-specific constants in the (un-)employment equations as random *a priori*.

The empirical model we use can be described by the usual form:[21]

$$y_{it} = \alpha_i + x'_{it}\,\beta_i + \varepsilon_{it}, \tag{7}$$

with y_{it} as the dependent (macroeconomic labor 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 $\alpha_i = \alpha_j = \alpha$, a pooled analysis with common constants is nested in this specification.

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and 250 cross-sections) as encountered in our study.

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

[20] 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.

[21] Dummies for different exchange rate regimes are not included throughout the regressions since the impact of different

In order to test for significance of the impact of exchange rate volatility on labor-market performance in CEECs, we separate our analysis into *three logical steps*. Furthermore, 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 4.2). This problem is less severe, though, 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 by taking first differences, which is a further reason why we conducted our analysis in these terms.

In principle, our panel data set can not only 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* as well as is done, e.g., by Belke and Fehn (2002). In order to capture the speed of adjustment of labor 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:

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

However, for estimating our first-order model substantial complications have to be taken into account, due to the heterogeneity of the cross-sections analyzed (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

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exchange rate regime on the labor market is exactly the focus of our study.

treatment of the resulting model is a standard application of the instrumental variables approach. The transformed model looks as follows:

$$(9) \qquad y_{it} - y_{i,t-1} = (x_{it} - x_{i,t-1})'\beta_i + \delta(y_{i,t-1} - y_{i,t-2}) + (\varepsilon_{it} - \varepsilon_{i,t-1})$$

Arellano (1989) and Greene (2000) 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 favor 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 labor-market rigidities. Throughout our regressions, we take the change in the unemployment rate as the regressand.

4.3.2 Estimation procedure

Throughout the paper we follow Belke and Fehn (2002) and rely on Feasible Generalized Least Squares (FGLS) estimates of a model assuming the presence of cross-sectional heteroscedasticity and autocorrelation but without correction for contemporaneous correlation.[22] 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 labor 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 (Tables 2, 5 and

[22] 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.

8). 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 the seemingly unrelated regression technique (SUR) in the other fifty percent of our regression analysis (Tables 3, 6, 9 and 10).

The *sample* has been chosen to be a maximum of 1990 to 2001 in order to exploit all available data information. The structure for presenting the estimation results is the same throughout all tables with the exact specifications of the pooled estimation equations being described in the tables themselves. Half of the specifications include a lagged endogenous labor-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.[23] The number of lags of the relevant variables were determined by the estimation itself. Like 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.[24] Since the marginal significance level of the F-test of joint significance of all of the slope coefficients is in all cases clearly below one percent, the p-value is not explicitly tabulated. However, the degrees of freedom can be easily read off the tables.[25]

4.4 Summary of results

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

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[23] 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 for their own's are not displayed in the tables.

[24] This is done in strict accordance to Belke and Fehn (2002). 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 realization 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.

[25] 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.

- Tables 2 and 3 about here -

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 our 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 DM/euro exchange rate volatility than for effective volatility. 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. If at all, the DM/euro volatility is significant in the static specifications. 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 in the lead. 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 characterized by a similarly strong impact of DM/euro exchange rate volatility.

Hence, we *generalized* the specifications chosen above by estimating a *separate coefficient* of exchange rate volatility for each of the ten CEEC 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 labor 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 as follows.[26]

- Table 4 about here -

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 case of the static specification also in

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

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 impacted 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 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 DM/euro volatilities of the CEEC currencies are implemented. If one correlates these results with our considerations with regard to openness vis-à-vis the eurozone, it becomes obvious that the Czech Republic, Hungary and Poland as the economies which are most open to trade with the eurozone are among the best performing countries with respect to 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 euroization, and Latvia have two entries each. Lithuania, Slovenia and, somewhat surprising, Estonia display one significant coefficient of exchange rate volatility. With the exception of "non-performing" Slovenia, these results closely correspond to our expectations based on the country-specific degrees of openness described in section 2. However, according to Figure 1, Slovenia reveals one of the lowest degrees of exchange rate volatility. This makes plausible why Slovenia's high degrees of openness towards the eurozone and of labor market rigidities do not lead to more significant entries in Table 4. Let us now finally turn to some robustness tests of the empirical results gained so far.

5. Robustness tests

Finally, we test for robustness of the results gained so far. In the *first step*, we limit the sample to a group of CEECs whose members are rather homogenous with respect to labor market regulation,

namely the Viségrad countries Czech Republic, Hungary, Poland and the Slovak Republic (Hobza 2002). As before, we apply both the FGLS (Table 5) and the SUR estimation procedure (Table 6).

- Tables 5 and 6 about here -

As expected, the results become *more consistent* as compared with Tables 2 and 3. Again, all estimated volatility coefficients display the correct sign and are now, with the exception of column 5, throughout significant on the usual significance levels. Based on the realizations of the test statistics, we cannot reject a correct specification of the empirical model. However, the *magnitude* of the estimated volatility coefficients and their *significance levels increase dramatically*. Most remarkable, we can now clearly reject the hypothesis that the volatility of the CEEC currencies vis-à-vis the DM respectively from 1999 on the euro does not have an impact on the unemployment rate in the Viségrad countries.

A second test for robustness includes the indicators of strictness of employment protection legislation (mentioned in section 3) in the regressions. In our model we conjectured that the positive impact of exchange rate volatility on unemployment should be increasing in the degree of labor market rigidities. Hence, in order to keep the analogy to our model, it seems advisable to combine them as *interaction variables* with the exchange rate volatility variable. Implementing interaction variables we have to use a common constants instead of a fixed effects model in order to avoid multicollinearity problems. The reason is that country-specific constants would capture differences in labor market relevant legislation and thereby reflect different levels of the natural rate of unemployment. Remember from section 3.3 that strictness variables are available for the Czech Republic, Estonia, Hungary, Poland, the Slovak Republic and Slovenia (see Table 7). Hence, the pool that forms the basis for the second type of robustness tests comprises only these six countries, that is the Viségrad countries together with Estonia and Slovenia.

- Table 7 about here -

The robustness regression results based on the inclusion of these interaction variables are listed in Tables 8 (estimated with FGLS) and 9 (estimated with SUR). This second robustness test also performs quite well. All coefficients of the interaction variables are significant, the majority of them

even at the 1 percent significance level. The orders of magnitude of the coefficients, stay roughly the same as in the reference model (Tables 2 and 3). Again, the specifications seem to be correct, judged by the usual residual and goodness-of-fit criteria. In contrast to Tables 2 and 3, the significance of the volatility of the CEEC exchange rates against the DM/euro is remarkable. Hence, we cannot reject the hypothesis, that labor markets in the Viségrad countries and Slovenia would profit from an elimination of exchange rate volatility vis-à-vis the euro. Note that Estonia is an exception from this conclusion in view of her already hard peg to the euro.

- Tables 8 and 9 about here –

As a third and final robustness check we implemented a measure for *real wage growth* (*WAGE*, see annex for details) into the regression equations 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 labor costs. The respective results based on the SUR procedure are displayed in table 10.[27] The estimated coefficient of the wage growth variable shows the expected sign and is, with one exception, significant at the 5 percent level. Compared with the baseline estimations, the pattern of the results does not change much. The slight changes might be due to the neglect of Lithuania for which no wage growth indicator was available.

- Table 10 about here -

Finally, and in order to exclude the possibility of reverse causation, the exogeneity of the volatility and robustness variables with respect to the change of the unemployment rate has been checked by extensive Granger causality tests in the same fashion as in our previous studies of other world regions (see, e.g., Belke and Gros 2001, 2002).[28]

[27] Those based on the FGLS estimation procedure are consistent as well and are available on request.
[28] They are not presented here due to lack of space, but they are available on request.

6. Summary and outlook

The results of this paper suggest quite important policy conclusions. Our earlier studies on intra-EMS, transatlantic and Mercosur exchange rate variability 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. The data from the past suggest that exchange rate variability had a statistically significant negative impact on the unemployment rate in a number of CEEC candidate countries, among them the Viségrad countries – a rather homogenous group with respect to labour market rigidities – and the outliers Bulgaria and Romania. We have argued that this result is due to the fact that all employment decisions have some degree of irreversibility. We have investigated both effective and bilateral DM/euro exchange rate variability because we were interested in the costs of exchange rate variability in general (effective volatilities) and in evaluating one partial benefit of early euroization – the elimination of large parts of the exchange rate risk – in particular (bilateral volatilities vis-à-vis the DM/euro). In general, our results are rather strong in that we find in many cases, corroborated by extensive robustness tests, that exchange rate variability 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 labor market impact of DM/euro volatility for the debate on exchange rate policy in the CEECs? Our main result could be read as support for the policy conclusion that fixing exchange rates against G-3 currencies should bring significant benefits, the most natural candidate in this respect being the euro. 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 recent 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.

If our hypothesis is corroborated empirically by further studies, the issue of 'euroization' should come high on the agenda. The reason is that the credible reduction of unanticipated exchange-rate fluctuations, e.g. by the adoption of a single currency, has effects very similar to the removal of employment-protection legislation and other direct restrictions of hiring and firing.[29] This conclusion runs counter to the traditional argument in the Optimum Currency Area literature, according to which labor market flexibility is a substitute for exchange rate flexibility. In our view, giving up on exchange rate flexibility can work as a substitute for labor market flexibility.

We would argue that fixing the exchange rate might be beneficial *if* the underlying policies are compatible with this choice. In view of our results, the euroization of, e.g., Estonia would probably not pose any problem, in contrast to Bulgaria. Besides the benefits identified in this paper, Estonia would gain in terms of transaction costs. The resulting expansion of trade with the EU should reinforce the tendency of a decline in the nominal effective exchange rate volatility that has been observed since the introduction of the Estonian currency board. Euroization provides an anchor for longer-term expectations in financial markets and reduces exchange rate variability that is generated by financial shocks. For Estonia the classical criteria of the Optimum Currency Areas approach apply insofar as the economic structure of the country is similar to that of the EU average. However, even those countries, such as Bulgaria and Romania, that are far away from fulfilling the requirements for EU membership in general and the Maastricht fiscal criteria in particular, would benefit from entering the Euro area. In that way they could import sensible macroeconomic policies

[29] Reducing exchange rate volatility would be most beneficial for the entry of new firms, in particular for promising high-risk ventures; see Belke and Fehn (2002) and Chen and Zoega (2001).

and gain the confidence of financial markets. Since the alternatives are hyperinflation and/or enormous risk premia on foreign debt, the benefits of a stable currency can by far outweigh any potential costs of not being able to react to asymmetric shocks with exchange rate changes. This is all the more valid in view of the fact that there is already widespread use of foreign currencies in the CEEC countries (Gros 2001, Nauschnigg 2002, Stix 2002). However, the existence of partial unofficial euroization is generally regarded as an important condition for official euroization since otherwise (e.g., if a CEEC would have raised a large part of its foreign debt in US-dollars) the swings of the euro-dollar-exchange rate would raise the volatility of foreign debt service in real terms. In this respect, recent evidence conveys the picture of an increasing share of euro deposits in Bulgaria's and Romania's broad money (M2). Moreover, a significant de-nomination of medium- and long-term external debt with an increasing share of euro area currencies has taken place in Bulgaria. This lets the euro peg appear to be suitable for Bulgaria and Romania (Habib 2001, pp. 29 ff.).

In sum, we maintain that the high degree of exchange rate variability observed from time to time in the CEECs has tangible economic costs. This does *not* imply that the *middling countries*, i.e. those with moderate inflation rates and fiscal deficits, should euroize immediately. Since some of these countries have rather large current account deficits they are vulnerable to speculative attacks. Moreover, the CEECs are in an intense process of structural change whose outcome is difficult to foresee. Some of them need flexibility in their real exchange rates for some time ahead. The costs and benefits of different exchange rate regimes are finely balanced and must therefore be considered case by case (Gros 2001).

This contribution did not take a stance on what exactly drives exchange rate volatility. Instead, it was simply assumed in the model that the exchange rate follows a random walk process. One possible explanation is that exchange rate volatility is driven by variability of monetary policy (i.e., of short-term interest rates). However, for some highly indebted CEECs, developments in international financial markets might be of greater relevance. Both exchange and interest rates tend to shoot up when foreign finance is no longer available or when the markets' assessment of the

country's political and economic future changes. In these cases, it would be clearly inadequate to explain exchange rate volatility with variations in domestic interest rates.

It is now widely considered a stylized 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). Based on further estimations (which are available on request) we find additional support for this hypothesis, using the second statistical moment of interest rates and various series of monetary aggregates. But the constant threat of speculative attacks on emerging market currencies can actually cause a co-movement that does not exist for developed economies.[30] 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. Even that way 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., Barro, R. J. (2001): Dollarization, in: American Economic Review, Papers and Proceedings, Vol. 91, pp. 381-385.

Arellano, M. (1989): A Note on the Anderson-Hsiao Estimator for Panel Data, in: Economics Letters, Vol. 31, pp. 337-341.

[30] Belke and Gros (2002) report that the correlation between the volatilities of the bilateral dollar/euro exchange rate and the respective interest rate differential is essentially zero (around 0.1).

Babetski, J., Boone, L., Maurel, M. (2002): Exchange Rate Regimes and Supply Shocks Asymmetry: The Case of the Accession Countries, CEPR Discussion Paper no. 3408, London.

Begg, D., Eichengreen, B., Halpern, L., v. Hagen, J., Wyplosz, C. (2001): Sustainable Regimes of Capital Movements in Accession Countries, Centre for Economic Policy Research: Final Report, London.

Belke, A., Fehn, R. (2002): Institutions and Structural Unemployment: Do Capital-Market Imperfections Matter?, in: ifo Studien - Zeitschrift für empirische Wirtschaftsforschung, Vol. 48., pp. 405-451.

Belke, A., Goecke, M. (2001): Exchange Rate Uncertainty and Employment: An Algorithm Describing Play, in: Applied Stochastic Models in Business and Industry, Vol. 17, pp.181-204.

Belke, A., Gros, D. (1999): Estimating the Costs and Benefits of EMU: The Impact of External Shocks on Labor Markets, in: Weltwirtschaftliches Archiv, Vol. 135, pp. 1-48.

Belke, A., Gros, D. (2001): Real Impacts of Intra-European Exchange Rate Variability: A Case for EMU?, in: Open Economies Review, Vol. 12/3, pp. 231-264.

Belke, A., Gros, D. (2002): Monetary Integration in the Southern Cone, in: North American Journal of Economics and Finance, Vol. 13, pp. 323-349.

Belke, A., Gros, D. (2002a): Designing EU-US Monetary Relations: The Impact of Exchange Rate Variability on Labor Markets on both Sides of the Atlantic, in: The World Economy, Vol. 25, No. 6. pp. 789-813.

Belke, A. Hebler, M. (2001): Social Policy and Eastern Enlargement of the EU: Labor Market Impacts for the Accession Countries, in: Journal for Institutional Innovation, Development and Transition, Vol. 5, pp. 48-61.

Belke, A. Hebler, M. (2002): The New Social Dimension of the EU: Labor Market Impacts for the Accession Countries, in: Constitutional Political Economy, Vol. 13, Issue 4.

Belke, A,. Hebler, M. (2002a): EU-Osterweiterung, Euro und Arbeitsmärkte, Reihe Wirtschaft und Soziales, Oldenbourg Verlag.

Belke, A., Kaas, L. (2002): The Impact of Exchange Rate Volatility on Labor Markets: Europe versus United States, Paper presented at the 2002 Meeting of the European Economic Association, Venice.

Boeri, T., Terrell, K. (2002): Institutional Determinants of Labor Reallocation in Transition, in: Journal of Economic Perspectives, Vol. 16, No. 1.

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, Organized by Banco Central de Chile, Österreichische Nationalbank, and the University of Vienna, April 14-16, Vienna.

Bratkowski, A., Rostowski, J. (2001): The EU Attitude towards Euroization: Misunderstandings, Real Concerns and Ill-Designed Admission Criteria, CASE Institute Warsaw and Central European University, Warsaw.

Calvo, G.A., Reinhart, C.M. (2000): Fixing for Your Life, NBER Working Paper no. 8006, Cambridge/MA.

Chen, Y.-F., Zoega, G. (2001): Exchange-Rate Volatility as Employment Protection, Birkbeck Economics Discussion Papers 7/01, July, Birkbeck College, University of London.

Csajbók et al. (2002), Adopting the Euro in Hungary: Expected Costs, Benefits and Timing, National Bank of Hungary Occasional Paper No. 24.

Deutsche Bundesbank (1996): Finanzmarktvolatilität und ihre Auswirkungen auf die Geldpolitik, Monatsberichte der Deutschen Bundesbank, April, pp. 53-70.

Dixit, A. (1989): Entry and Exit Decisions under Uncertainty, in: Journal of Political Economy, Vol. 97, pp. 620-638.

Greene, W.H. (2000): Econometric Analysis, 4th ed., New Jersey.

Gros, D. (2001): Who Needs an External Anchor?, CEPS Working Document, Brussels.

Gros, D., Thygesen, N. (1992): European Monetary Integration, New York, Harlow.

Habib, M. (2001): The Case for Euroisation in Central and Eastern European Countries – Evidence from Bulgaria, the Czech Republic, Hungary, and Poland, University College London, mimeo.

Hobza, A. (2002): CEE Candidate Countries on the Way to the Eurozone, Background Study for WRR, 10 June 2002, Centre for European Policy Studies, Brussels.

Krugman, P., Obstfeld, M. (2002): International Economics - Theory and Policy, 6th ed., Addison-Wesley, Reading/MA et al.

Lafrance, R., Tessier, D. (2000): Exchange Rate Variability and Investment in Canada, Bank of Canada Conference on Revisiting the Case for Flexible Exchange Rates.

Levin, A., Lin, C.-F. (1992): Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties. University of California, San Diego, Department of Economics Discussion Paper 92-23, May.

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

Nauschnigg, F. (2002): The Euro and the Use of Foreign Currencies in Central and Eastern Europe, Paper presented at the Conference on Unilateral or Multilateral Forms of Monetary Union, Fordham University April 4-6.

Neumeyer, P. (1998), Currencies and the Allocation of Risk: The Welfare Effects of a Monetary Union, American Economic Review, Vol. 88, pp. 246-259.

Nickell, S. (1997): Unemployment and Labor Market Rigidities: Europe versus North America, in: Journal of Economic Perspectives, Vol. 11, pp. 55-74.

Nuti, M. (2002): Costs and Benefits of Unilateral Euroization in Central Eastern Europe, in: Economics of Transition, Vol. 10, pp. 419-444.

Obstfeld, M., Rogoff, K. (2000): The Six Major Puzzles in International Macroeconomics: Is There A Common Cause?, in: NBER Macroeconomics Annual, pp. 339-390.

Oesterreichische Nationalbank (2002): Focus on Transition, 1/2002, Vienna.

Oesterreichische Nationalbank (2002a): Internal Data Bank, Vienna.

Peeters, M. (1997): Does Demand and Price Uncertainty Affect Belgian and Spanish Corporate Investment?, Dutch National bank – Staff Reports 13, Amsterdam.

Pissarides, C. (2000): Equilibrium Unemployment Theory, 2nd ed., Cambridge/MA.

Reinhart, C.M., Reinhart, V.R. (2001): What Hurts Most? G-3 Exchange Rate or Interest Rate Volatility?, NBER Working Paper no. 8535, Cambridge/MA.

Riboud, M., Sánchez-Páramo, C., Silva-Jáuregui, C. (2002): Does Eurosclerosis Matter? Institutional Reform and Labor 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.

Stix, H. (2002): Survey Results About Foreign Currency Holdings in Five Central and Eastern European Countries, CESifo Forum Vol. 3 no. 3, pp. 33-38.

The Vienna Institute for International Economic Studies (2002): Countries in Transition 2002, WIIW Handbook of Statistics, Vienna.

Annex

1. Program to calculate bilateral CEEC exchange rate variability series'

```
SMPL 1990.1 2002.12

FOR %EX ‘all exchange rates of interest’

  GENR VOL%EX = NA

  FOR !1=0 to 144 STEP 12

  SMPL 1990.1+!1 1990.12+!1

  GENR VOL%EX=SQR(@VAR(D(log(%EX))*100))

  NEXT

NEXT

SMPL 1990.1 2002.12
```

2. Data annex

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

EMP: Employment, total, average, growth rate in %

GDP: Gross domestic product, real growth rate, %

TRADE WEIGHTS: average trade weight of CEEC X with country Y (Sum of countries Y = “world” = 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, U.S., Turkey) over the period 1990-2001 and calculated as 100*(exports to country y plus imports from country Y)/(total exports to the “world” plus total imports from the “world”); Euroland

substitutes the eurozone countries from 1999 on. The source for exports and imports is UNO (UN SITC 3, dimension 1000 US$).

UNEMP: Unemployment rate in %, end of period

WAGE: Average gross monthly wages, real growth rate, %

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

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

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

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

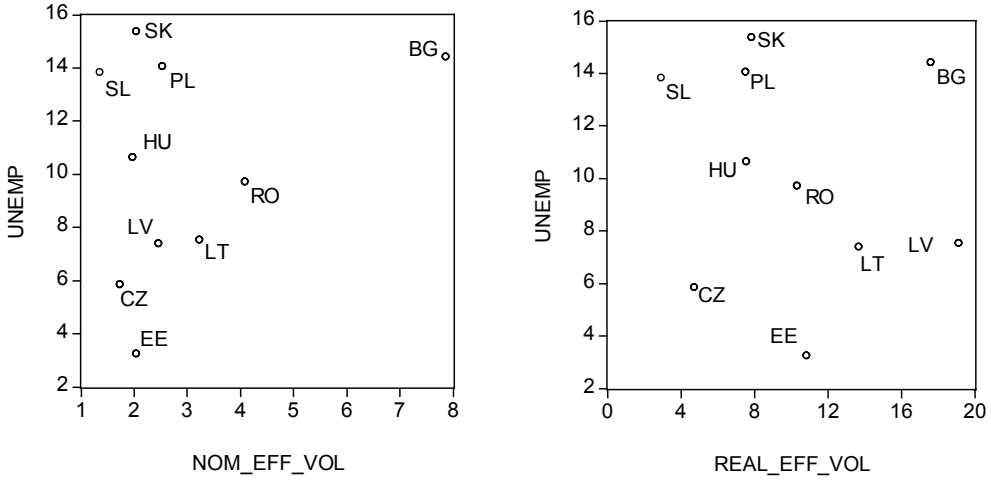
Exchange rate volatility vis-à-vis eurozone members is calculated as the volatility vis-à-vis the euro from 1999:01 on (except Greece: from 2001 on).

Exchange rate volatility “vis-à-vis the euro” is calculated as the volatility vis-à-vis the DM from 1990:01 until 1998:12 on and vis-à-vis the euro from 1999:01 on (except Greece: from 2001 on).

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).

Figures and Tables

Figure 1: *Employment performance and exchange rate volatility*
(10 Central and Eastern European countries, average 1992 – 2001)
a) Effective nominal exchange rate volatility
b) Effective real exchange rate volatility



c) Nominal exchange rate volatility vis-à-vis the DM/Euro
d) Real exchange rate volatility vis-à-vis the DM/Euro

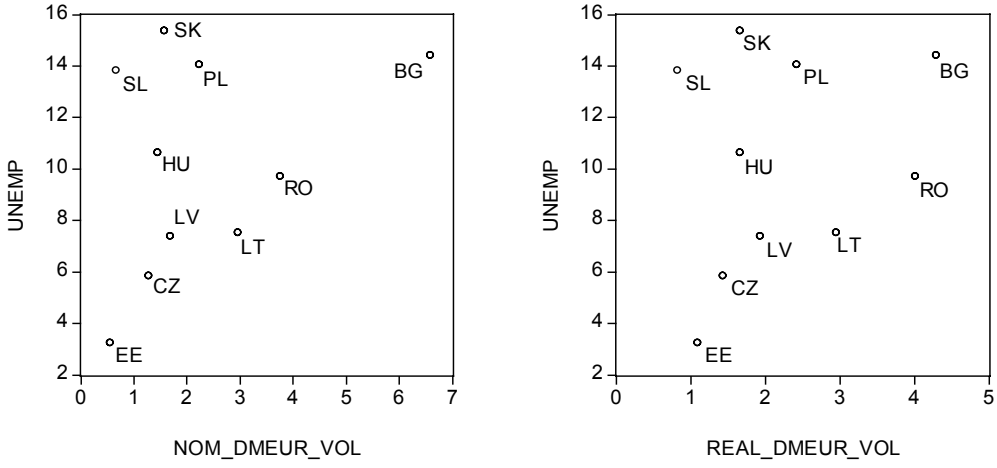


Table 1: *Labour market flexibility in the CEECs: How large are the costs of job creation and the fallback wage?*

	Employment protection legislation***				Unemployment insurance		Taxes	
	Regular empl.	Temporary empl.	Collective dismissals	EPL Strictness ****	Benefit replace-ment 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**	Coordinat ion-unions	Coordinatio n-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% of salaried workers are covered by collective agreements,
2: between 26 and 69% are covered, 3: 70% or more are covered
Source: Hobza (2002) and Riboud et al. (2002).

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 nominalexchange rate			0.12***	0.07	0.16**	/	/	/	/	/
Effective volatility of real exchange rate	0.08***	0.06**	/	/	/	0.20***	/	/	/	/
Volatility of national currency vis-à-vis euro (DM) (nominal exchange rate)							0.08**	0.01	/	/
Volatility of national currency vis-à-vis euro (DM) (real exchange rate)							/	/	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:										
R^2	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 $\left(y_{i,t-1} - y_{i,t-2}\right)$ 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***	0.04***		0.14***	/	/	/	/
Effective volatility of real exchange rate	0.08***	0.03**	/	/	0.10***		/	/	/	/
Volatility of national currency vis-à-vis euro (DM) (nominal exchange rate)							/	/	0.07	-0.02
Volatility of national currency vis-à-vis euro (DM) (real exchange rate)							0.10***	-0.03	/	/
AR-error assumed										
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:										
R^2	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 $\left(y_{i,t-1} - y_{i,t-2}\right)$ 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)		-0.28***		-0.30***		-0.36***		-0.3***
Real GDP growth rate	-0.31***	-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 $\left(y_{i,t-1} - y_{i,t-2}\right)$ is instrumented by the change of the unemployment rate lagged two periods. X denotes volatility for which country-specific coefficient is estimated.

Table 5: *Impact of exchange rate variability on the change in the unemployment rate - FGLS estimates for Viségrad countries (fixed effects)*

Regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Instrument for the change in unemployment rate (-1)	/	-0.08	/	-0.03	/	/		-0.11		-0.11
Real GDP growth rate	-0.47***	-0.34***	-0.38***	-0.26***	-0.45***	-0.33***	-0.36***	-0.31***	-0.36***	-0.32***
Measures of exchange rate volatility										
Effective volatility of nominal exchange rate	/	/	0.46**	0.44**	/	0.49**	/	/		
Effective volatility of real exchange rate	0.09*	0.09**	/	/	0.06	/	/	/		
Volatility of national currency vis-à-vis euro (DM) (nominal exchange rate)	/	/	/	/	/	/	/	/		0.51**
Volatility of national currency vis-à-vis euro (DM) (real exchange rate)	/	/	/	/			0.51**	0.51**	0.52**	
Common AR-error assumed					X	X				
Fixed effects:										
_CZ	0.85	1.21	0.64	0.56	1.33	0.58	0.67	0.68	0.76	0.79
_HU	0.43	0.54	-0.09	-0.44	0.66	-0.29	-0.02	-0.48	0.07	-0.34
_PL	1.99	2.33	1.00	0.87	2.17	0.69	0.75	0.66	0.95	0.82
_SK	1.78	2.29	1.22	1.25	1.97	1.01	1.30	1.35	1.34	1.43
Weighted statistics:										
R^2	0.65	0.64	0.72	0.65	0.58	0.63	0.71	0.65	0.71	0.66
F-statistics	13.11	8.54	17.09	8.99	6.89	8.27	16.57	9.17	16.52	9.51
Durbin-Watson	1.96	2.11	2.03	1.82	2.07	2.07	1.92	1.87	1.95	1.85
Total panel observations	41	36	40	36	37	36	40	36	40	36
Sample	1991-2001	1993-2001	1991-2001	1993-2001	1991-2001	1991-2001	1991-2001	1993-2001	1991-2001	1993-2001

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

Table 6: *Impact of exchange rate variability on the change in the unemployment rate - SUR estimates for Viségrad countries (fixed effects)*

Regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Instrument for the change in unemployment rate (-1)	/	-0.27***	/	-0.28***				-0.30***		-0.30***
Real GDP growth rate	-0.46***	-0.36***	-0.38***	-0.31***	-0.33***	-0.11*	-0.34***	-0.27***	-0.35***	-0.27***
Measures of exchange rate volatility:										
Effective volatility of nominal exchange rate	/	/	0.48***	0.29**		0.56***			/	/
Effective volatility of real exchange rate	0.11***	0.08**	/	/	0.06				/	/
Volatility of national currency vis-à-vis euro (DM) (nominal exchange rate)	/	/							0.59***	0.57***
Volatility of national currency vis-à-vis euro (DM) (real exchange rate)	/	/					0.60***	0.57***	/	/
AR-error assumed										
Fixed effects:										
_CZ	0.72	1.86	0.60	2.13	1.11	-0.03	0.51	1.80	0.64	1.80
_HU	0.27	3.05	-0.14	3.04	0.34	-1.15	-0.22	2.71	-0.07	2.71
_PL	1.79	4.99	0.95	4.74	1.61	-0.58	0.42	4.02	0.72	4.02
_SK	1.58	5.21	1.19	5.27	1.44	-0.13	1.10	5.04	1.19	5.04
Unweighted statistics:										
R^2	0.66	0.60	0.72	0.71	0.48	0.46	0.70	0.71	0.70	0.71
Durbin-Watson	1.94	1.99	2.09	2.22	1.90	2.22	1.88	2.15	1.96	2.15
Total panel observations	41	39	40	38	37	36	40	38	40	38
Sample	1991-2001	1992-2001	1991-2001	1992-2001	1991-2001	1991-2001	1991-2001	1992-2001	1991-2001	1992-2001

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

Table 7: *Indicators of strictness of labor market regulations*

Country	Czech Republic	Estonia	Hungary	Poland	Slovak Republic	Slovenia
Realisation of indicator	2.1	2.6	1.7	2.0	2.4	3.5

For explanations see Table 1, 4th column.

Table 8 : *Robustness tests based on strictness of employment protection legislation - FGLS estimates for 6 CEECs (common coefficients)*

Regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Common constant	0.93***	0.84***	0.80**	0.84***			0.99***	0.54	1.16***	0.77**
Instrument for the change in unemployment rate (-1)	/	0.05	/	0.05				-0.08***		-0.08***
Real GDP growth rate	-0.36***	-0.33***	-0.31***	-0.33***			-0.31***	-0.16***	-0.33***	-0.17***
Interaction terms:										
Effective volatility of nominal exchange rate*Strictness			0.13**	0.04**						
Effective volatility of real exchange rate*Strictness	0.04**	0.04**								
Volatility of national currency vis-à-vis euro (DM) (nominal exchange rate) *Strictness									0.09*	0.26***
Volatility of national currency vis-à-vis euro (DM) (real exchange rate) *Strictness							0.11**	0.29***		
Weighted statistics:										
R^2	0.53	0.47	0.61	0.55			0.59	0.55	0.62	0.51
F-statistics	31.56	14.00	42.57	18.87			39.77	18.98	45.15	16.36
Durbin-Watson	1.78	1.76	1.66	1.59			1.72	1.77	1.75	1.72
Total panel observations	59	51	58	51			58	51	59	51
Sample	1991-2001	1993-2001	1991-2001	1993-2001			1991-2001	1993-2001	1991-2001	1993-2001

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

Table 9: *Robustness tests based on strictness of employment protection legislation - SUR estimates (fixed effects) for 6 CEECs (common coefficients)*

Regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Common constant	0.76***	0.71***	0.59**	0.71	0.88***	1.60***	1.14***	1.87***		
Instrument for the change in unemployment rate (-1)		0.08		0.08		-0.10***		-0.10***		
Real GDP growth rate	-0.37***	-0.29***	-0.29***	-0.29***	-0.29***	-0.25***	-0.32***	-0.26***		
Volatility-strictness unteraction terms:										
Effective volatility of nominal exchange rate*Strictness	/	/	0.16***	0.04***						
Effective volatility of real exchange rate*Strictness	0.05***	0.04***								
Volatility of national currency vis-à-vis euro (DM) (nominal exchange rate) *Strictness							0.11**	0.14***		
Volatility of national currency vis-à-vis euro (DM) (real exchange rate) *Strictness					0.13***	0.17***				
Weighted statistics:										
R^2	0.49	0.32	0.55	0.39	0.52	0.47	0.55	0.47		
Durbin-Watson	1.75	1.60	1.60	1.61	1.59	1.70	1.66	1.65		
Total panel observations	59	51	58	51	58	55	59	55		
Sample	1991-2001	1993-2001	1991-2001	1993-2001	1991-2001	1992-2001	1991-2001	1992-2001		

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

Table 10 : *Robustness tests based on an indicator of labor costs - SUR estimates for 9 CEECs* (fixed effects)*

Regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Instrument for the change in unemployment rate (-1)		0.01		-0.01				-0.03		-0.02
Real GDP growth rate	-0.37***	-0.33***	-0.35***	-0.34***			-0.35***	-0.35***	-0.36	-0.35***
Measures of exchange rate volatility:										
Effective volatility of nominal exchange rate			0.10***	-0.01						
Effective volatility of real exchange rate	0.06***	0.02**								
Volatility of national currency vis-à-vis euro (DM) (nominal exchange rate)									0.07	-0.03***
Volatility of national currency vis-à-vis euro (DM) (real exchange rate)							0.12***	-0.06*		
Wage	(-1) .02**	0.04***	0.03*	0.04***			0.04***	0.04***	0.03	0.04***
Fixed effects:										
_BG	-0.03	0.19	-0.05	0.70			0.17	0.86	0.20	0.77
_CZ	0.80	1.05	1.08	1.22			1.01	1.32	1.20	1.25
_EE	1.24	1.45	1.17	1.85			1.14	1.93	1.40	1.86
_HU	0.59	0.18	0.72	0.42			0.73	0.53	0.85	0.45
_LV	1.25	1.67	1.83	2.14			1.95	2.25	2.05	2.16
_PL	1.90	1.70	1.87	1.97			1.78	2.14	2.03	2.03
_RO	0.13	-0.08	0.20	0.23			0.11	0.42	0.36	0.29
_SK	1.67	1.78	1.83	2.06			1.84	2.18	1.99	2.10
_SL	1.11	0.91	0.97	1.07			0.95	1.15	1.15	1.10
Unweighted statistics:										
R^2	0.55	0.37	0.56	0.37			0.60	0.38	0.58	0.38
Durbin-Watson	1.52	1.87	1.46	1.86			1.60	1.87	1.49	1.89
Total panel observations	84	72	83	72			83	72	84	72
Sample	1991-2001	1993-2001	1991-2001	1993-2001			1991-2001	1993-2001	1991-2002	1993-2001

The term $\left(y_{i,t-1} - y_{i,t-2}\right)$ is instrumented by the change of the unemployment rate lagged two periods. Numbers in brackets in front of coefficients indicate the lag of the implemented regressor. If not otherwise indicated the variable is inserted contemporaneously. *Lithuania excluded since no wage growth indicator is available.