



KATHOLIEKE UNIVERSITEIT
LEUVEN

Faculty of Economics and
Applied Economics

Department of Economics

Choice of Exchange Rate Regime in Central and Eastern
European Countries: an Empirical Analysis

by

Agnieszka MARKIEWICZ

International Economics

Center for Economic Studies
Discussions Paper Series (DPS) 05.01
<http://www.econ.kuleuven.be/ces/discussionpapers/default.htm>

January 2005



**DISCUSSION
PAPER**

Choice of Exchange Rate Regime in Central and Eastern European Countries: An Empirical Analysis

Agnieszka Markiewicz*

January 2005

Abstract

This paper identifies the sources of divergences between current exchange rate policies in Central and Eastern European countries (CEECs). We use an ordered logit model for the official (*de jure*) and the actual (*de facto*) exchange rate classifications. We find that the differences of the exchange rate strategies among CEECs cannot be explained by these classifications. Financial and trade openness are the major determinants of divergences among exchange rate strategies in CEECs. More financially and trade integrated countries switch to more rigid regimes.

*Center for Economic Studies, Department of Economics, Naamsestraat 69, 3000 Leuven, Belgium, Agnieszka.Markiewicz@econ.kuleuven.ac.be. I thank Paul De Grauwe, Kristien De Smedts, Geert Dhaene and Hans Dewachter for useful comments.

1 Introduction

The recent enlargement of the European Union (EU), and the ensuing possibility of extension of the euro area brought the issue of the appropriateness of the exchange rate regime for the Central and Eastern European countries (CEECs) to center stage. The CEECs are small and open economies and their trade is concentrated with European Union members. In the view of the Optimum Currency Areas (OCA) theory (Mundell 1961, McKinnon 1963), these countries should peg their currencies to the euro. However, only Lithuania, Estonia and Bulgaria opted for a tight peg vis-à-vis the euro. Latvia pegged its currency to the Special Drawing Rights (SDR), while Hungary opted for an intermediate regime and Poland, the Czech Republic, Slovenia, Slovakia and Romania use floating regimes. Moreover, recently, in 1997, 1998 and 2000, the Czech Republic, Slovakia and Poland, respectively, switched to more flexible regimes. One of the reasons of these "controversial" exchange rate regime choices might be the inadequate evaluation of the effective exchange rate policies in these countries.

Alternatively, CEECs' exchange rate regime choices might have been influenced by other criteria than the traditional macroeconomic characteristics. In particular, during the last ten years, these countries experienced major evolutions in economic as well as political terms. The first phase of the transition process towards the market economy included the liberalization of prices and trade. In the second half of the 1990s, the CEECs made large progress in disinflation, robust economic growth returned and free movement of capital has been authorized. As a result, these countries started to attract foreign capital and some of them (Czech Republic in 1997 and Slovakia in 1998) experienced speculative attacks against their currencies. In addition, these economic developments have been accompanied by political turmoil and important social pressures. The modern literature on the choice of the exchange rate regime provides the additional criteria which might explain more adequately the exchange rate strategies in CEECs.

A major element of the Mundell-Fleming framework is the assumption of perfect capital mobility. From this model it follows that monetary policies in financially open economies cannot be aimed both at maintaining stable exchange rates and smoothing cyclical output. Increasing financial globalization and more frequent currency crises, resulted in the review of the dilemma between independent monetary policy and fixed exchange rates (Obstfeld and Rogoff 1995, Eichengreen 1994). Another strand of modern literature has emphasized the role of political conditions in the selection of exchange rate strategies (Edwards 1996, Torrell and Velasco 1995, Cukierman et al. 1992). Finally, the issue of exchange rate regime choice has been analysed with a view to its economic consequences and policy require-

ments to maintain a particular regime (Edison and Melvin, 1990; Gosh et al., 1997). These new approaches have been used in the literature to determine the choice of the exchange rate regime. Some authors applied them to large samples of countries (Levy-Yeyati and Sturzenegger 2002, Edwards 1996, Poirson 2001). Others limited their analysis to emerging economies (Collins 1996, and Calvo and Mishkin 2003). However, few economists empirically analysed the exchange rate regime choice problem in CEECs. Corker et al. (2000), Backé (1999) and Nerlich (2002) examine the exchange rate regime selection in some of the transition economies using a descriptive study. Bénassy-Quéré and Lahrière-Révil (1998) and Boone and Maurel (1999) approach the question of regime selection in CEECs empirically, but only via OCA theory characteristics. Finally, this problem has been examined by Von Hagen and Zhou (2002). They develop an empirical model of the choice of the exchange rate regime for a group of 25 transition economies in the 1990s. Their model tests for the relevance of OCA variables, financial development measures and crises variables to the selection of the exchange rate regime. Moreover, the authors assess the discrepancies between the *de jure* and *de facto* regimes in transition economies. However, they do not account for political conditions, which seem to be an important factor in the CEECs' selection of an exchange rate system.

In order to investigate the main determinants of exchange rate regimes in CEECs, and the sources of differences between adopted strategies, we test for two issues. First, we employ modern and traditional approaches mentioned above, and compare their capacity to explain the choice of regimes among CEECs. Second, we consider the choice of exchange rate regime according to the official (*de jure*) and *de facto* classifications. The discrepancies between them can indeed be the reason for misleading differences between exchange rate regimes in CEECs. We use both of these classifications, in a way that, to our knowledge, has not been developed in the existing empirical literature. We include the category of hard peg in order to test explicitly for the "corner solutions" hypothesis. We embody our hypotheses in an ordered logit model for an unbalanced panel of ten countries.

The sample includes eight new members of EU i.e. the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia. In addition, we supplement this group by Bulgaria and Romania, in order to diversify our sample. In fact, these two economies made less progress in transition to the market economy and stabilization of their economies than the eight new EU members. Our study is based on the period between 1993 and 2002. The reason for choosing 1993 as a start date is due to the unavailability of the data. In contrast with other work, our empirical study takes into consideration the most recent evolutions of exchange rate strategies in CEEC, stimulated by the perspective of joining the euro area.

The second Section describes the evolution of exchange rate strategies in CEECs and the discrepancies of *de facto* and *de jure* classifications in these countries. Section 3 reviews the theoretical hypotheses of different approaches to the exchange rate regime choice. In Section 4, we develop the baseline econometric model of exchange rate regime choice. The results of our estimations are presented in Section 5, and finally Section 6 concludes.

2 Regimes in Central and Eastern European countries

2.1 Evolution of exchange rate regimes in CEEC

The CEECs adopted rather diverse exchange rate regimes and monetary strategies since the early 1990s. Their monetary and exchange rate strategies can be divided into three phases following the challenges they were confronted with.

During the first phase, between 1990 and 1994, the monetary authorities focused on stabilizing the economy. Most CEECs entered the transition process with a monetary overhang and experienced high inflation rates. In order to combat inflation, several countries opted for the external anchor in the form of pegged exchange rates. Few countries (Bulgaria and Romania) initially adopted flexible exchange rate regimes, despite being confronted with high inflation rates. This might be due to the relatively low level of reserves that these countries held in the beginning of 1990s.¹ This lack of international reserves made it difficult to back a peg.

Until the mid-1990s, most CEECs made strong progress in disinflation. The need to stabilize the economy by an external anchor became less necessary and several countries gradually opted for a more flexible exchange rate regime. The general progress in stabilization of the economy, including the return of economic growth, substantial disinflation accompanied by early liberalization of capital accounts, attracted large capital inflows. In some countries, i.e. those characterized by fixed exchange rates (the Czech Republic, Hungary and Poland), these capital inflows required large-scale and costly interventions. As a consequence, some countries switched towards more flexible regimes. Not all the CEECs, however, followed more flexible exchange rate strategies. Some countries (the Baltic countries) maintained the fixed exchange rate regimes they had initially chosen. Finally, Bulgaria was the main exception, as it switched in the opposite direction, abandoning a relatively flexible regime and adopting a currency board arrangement.

Several recent changes in exchange rate policies are due to the prospects of joining the European Monetary Union (EMU). Accordingly, a number of CEECs have already adjusted their regimes in line with the institutional requirements of future participation in

¹During 1992 and 1993, Bulgaria and Romania held, on average, only one fifth of the reserves that Poland or Hungary possessed during the same period.

the monetary union. Lithuania recently changed the benchmark of its peg from the US dollar to the European currency. Hungary introduced a regime which shadows the Exchange Rate Mechanism (ERM) II, i.e. with a central parity vis-à-vis the euro and +/- 15% fluctuation band. Latvia, pegging to the SDR, has to adapt its regime to the conditions necessary to join the ERM II system. However, Poland, Czech Republic, Slovakia and Romania still use a floating regime. Moreover, the Czech Republic, Poland and Slovakia, recently switched to more flexible regimes.

2.2 Classification of exchange rate regimes in CEEC

In order to study the choice of the exchange rate regime, it is necessary to employ the proper classification of exchange rate systems. Recently, numerous empirical studies have provided evidence that the evaluation of adjustments in central parities and foreign exchange market interventions can generate exchange rate regimes considerably different from the official arrangements.² First, a country might experience very small exchange rate movements, even though the monetary authorities have no official commitment to maintaining the parity. This behavior is often referred to as the "fear of floating" phenomenon. Second, a country can manifest a "fear of pegging" behavior. This is the case when a country, claiming to have a pegged exchange rate, in fact carries out frequent changes in parity.

The approach taken here is, first, to report results according to the official classification, which uses the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*. In addition, we supplement these results by the *de facto* classification, based on the measure created by Reinhart and Rogoff (2002). Both classifications have their shortcomings. The *de jure* classification reveals the formal commitment of a central bank but it does not capture the policies inconsistent with this commitment. Although the *de facto* classification has the advantage of being based on observed behavior, it fails to reflect the commitment of the monetary authorities. In empirical work, the exchange rate regimes (both *de facto* and *de jure*) have been, as a rule, classified into three categories: peg, intermediate and float regime. We propose here a new categorization inspired by the "bipolar view" literature. The proponents of this approach emphasize an increasing role of the hard pegs as a sustainable solution in emerging economies. Thus, we distinguish in our study the soft pegs from hard pegs. The *de jure* exchange rate regimes are classified into four principal categories: hard peg, soft peg, intermediate and float regime. The hard pegs include currency boards. The soft pegs contain single currency pegs, SDR pegs and other narrow bands not being constrained by the strong commitment of the central bank. The intermediate category

²For a detailed discussion on the discrepancy between *de facto* and *de jure* exchange rate regime classifications, see Calvo and Reinhart (2000), Gosh et al. (1997) and Levy-Yeyati and Sturzenegger (1999).

contains tightly managed and broad band exchange rate systems. Finally, the float category includes managed floats and free floats. The *de facto* regimes are also classified into four groups. We regroup the Reinhart and Rogoff categories into four groups.

In Table 1 we show the discrepancies of the *de jure* and the *de facto* regimes in CEECs. Table 1 reports the percentage of adopted regimes, on average in CEEC. The period under study is divided into three stages: the stabilization phase (1993-1994), the transition phase (1995-1999) and the preparation phase (2000-2002). This division enables us to observe the evolution of the exchange rate regimes in these countries.

Table 1: Discrepancies between de jure and de facto exchange rate regimes in CEECs

		<i>de jure</i>			
		hard peg	soft peg	intermediate	float
<i>Stabilization phase</i>	1993-1994	17%	27%	40%	17%
<i>Transition phase</i>	1995-1999	28%	28%	20%	25%
<i>Preparation phase</i>	2000-2002	30%	30%	10%	30%
	1993-2002	25%	28%	23%	24%
		<i>de facto</i>			
		hard peg	soft peg	intermediate	float
<i>Stabilization phase</i>	1993-1994	15%	25%	50%	10%
<i>Transition phase</i>	1995-1999	28%	24%	22%	28%
<i>Preparation phase</i>	2000-2002	30%	30%	10%	30%
	1993-2002	24%	26%	27%	23%

First of all, we note that there are no substantial differences between the evolution of the *de jure* and the *de facto* regimes. During the stabilization phase, the hard and the soft pegs represented almost the same share of the *de jure* and the *de facto* exchange rate regimes. The floating regimes were more frequent in the *de jure* case indicating the "fear of floating" behavior. As can be seen in Table 1, 17 percent of CEECs were officially floating, while only 10 percent were carrying out purely flexible strategies in practice. Some of the official floaters were intervening on the exchange rate markets and thus using the intermediate regimes. Hence, the latter were more frequent in reality than officially, which is confirmed by the 10 percent difference between the *de facto* and the *de jure* intermediate regimes.

During the transition phase, several countries switched to more flexible regimes. The share of the floaters, between 1995 and 1999, represented 25 percent of the *de jure* arrangements and 28 of the *de facto* regimes. This change of the exchange rate strategies was consistent with the progressive opening of CEECs' capital accounts and increasing risk of speculative attacks. The number of intermediate regimes declined during this period. The number of soft pegs, however, remained stable.

During the last, preparatory phase, the *de facto* and the *de jure* regimes clearly converged. While during the previous phases we observe the differences between the *de jure* and the *de facto* regimes, their shares equalized during the preparation phase. Between 2000 and 2002, we observe a further decline in intermediate regimes. The countries which moved to more flexible regimes at the end of the transition phase (Poland, the Czech Republic) kept the flexibility of their exchange rates. The number of countries using pegs in practice increased, in anticipation of joining the euro area.³

Turning to the overall observations, it seems that there are few discrepancies between the *de jure* and the *de facto* exchange rate regimes in CEECs. First of all, we account for the hard pegs, which reflect the official commitment of the central bank as well as the effective strategies of monetary authorities. Therefore, this exchange rate regime is appropriately categorized in both classifications. Second, the discrepancies were present at the beginning of the period under consideration, when CEECs manifested "fear of floating" behavior. During the years following the stabilization phase, the *de jure* and the *de facto* exchange rate regimes converged progressively. Finally, the preparation phase clearly shows that the monetary authorities carry out the policies consistent with their official announcements. The "fear of floating" phenomenon disappeared. This phenomenon is due to the lack of credibility of central banks. Therefore, the perfect convergence of the *de jure* and the *de facto* exchange rate regimes reflects an important progress in building the credible monetary authorities in CEECs.

3 Theoretical Determinants of Exchange Rate Regimes

Our analysis of the determinants of exchange rate regimes in CEECs is centered around four main approaches. The traditional approach is embodied in the theory of Optimum Currency Areas (OCA). The modern discussions on the choice of exchange rate regime include the impossible trinity view, the political economy view and the currency crises approach. These traditional and modern models imply a set of potential determinants of exchange rate regimes. We include nine of them as explanatory variables in the specification.

3.1 OCA Theory

The early literature, based on the theory of Optimum Currency Area (OCA) by Mundell (1961), stressed the geographical and trade characteristics. This approach weighs the trade and welfare gains from a stable exchange rate against the benefits of exchange rate flexibility as a shock absorber in the presence of nominal rigidities. Since stable exchange rates increase

³It is important to note that moving to rigid regimes in CEECs does not reflect the corner solutions hypothesis. In fact, the tight exchange rate policies are not embodied by any commitment of the central bank (condition claimed by the proponents of the bipolar view).

trade gains, pegs are more suitable for countries characterized by high trade openness. A rigid regime is also preferred in small economies, as small countries tend to trade more internationally. Finally, the geographical concentration of a country's trade favors pegging the currency to its main trading partner.

In order to test the relevance of the traditional OCA hypothesis in CEECs, we use measures of the country's size (GDP as real GDP), and openness (OPENNESS as the GDP share of exports plus imports).⁴

3.2 Impossible Trinity

A key ingredient of the Mundell-Fleming framework is the assumption of perfect capital mobility. This implies international arbitrage across countries in the form of uncovered interest parity. From this model it follows that it is impossible to simultaneously achieve the three goals: exchange rate stabilization, capital market integration and independent monetary policy. This is usually referred to as "impossible trinity". The currency crises in Mexico, Asia, Brazil and Russia, and increasing capital mobility brought the "impossible trinity" hypothesis to the forefront and resulted in the "bipolar view" of exchange rate regimes. According to this approach, high capital mobility made intermediate regimes less viable in financially open economies^{5, 6}. Since monetary policy in financially open economies cannot be aimed simultaneously at maintaining a stable exchange rate and at smoothing cyclical output fluctuations, these countries should move to the corner solutions, i.e. pure float or hard peg.

In addition, the rapid process of financial deepening and innovation reduced the effectiveness of capital controls. Consequently, the traditional trinity dilemma has been reduced to the monetary policy-exchange rate stability trade-off. Moreover, countries with relatively undeveloped financial sectors lack market instruments to conduct domestic open market operations. Thus, low financial development should increase the probability of adopting pegs.

We assess the empirical relevance of the impossible trinity approach employing as the explanatory variables a capital control index (RESTR) and the ratio of broad money to GDP (MONEY, a measure of financial development), both lagged one period.

3.3 Currency crisis

The early literature of balance-of-payments crises (Krugman 1979) stressed that crises were caused by weak "economic fundamentals", such as excessive expansionary fiscal and mone-

⁴We use lagged values of these variables in order to minimize potential endogeneity problems.

⁵Intermediate regimes are all regimes except for the pure floats and the hard pegs.

⁶See e.g. Fischer (2001).

tary policies. It shows that, under a fixed exchange rate, domestic credit expansion in excess of money demand growth leads to a gradual but persistent loss of international reserves and, ultimately, to a speculative attack on the currency. The process ends with an attack because economic agents understand that the fixed exchange rate regime will collapse, as it is inconsistent with current economic conditions. The empirical implication of this model is that expansionary monetary policy combined with a fixed exchange rate leads to external imbalances. As a consequence, a country experiencing a high rate of inflation might be reluctant to fix its exchange rate. Following this argument, we introduce the inflation rate differential (INFL) into our specification. We use as a benchmark inflation rate the German inflation rate. We suppose that the German inflation rate is a good approximation of the European one, since in the 90's, European countries followed the monetary policy of the Bundesbank.

According to Krugman's currency crisis model, the collapse of pegged exchange rate is accompanied by a steady erosion of international reserves. In fact, the attack on a currency immediately depletes reserves and forces the authorities to abandon the parity. Thus, the level of international reserves has often been used as a leading currency crisis indicator. A country willing to peg has to hold a high amount of international reserves to improve the credibility of its exchange rate arrangement. We examine the importance of the level of international reserves (RESERVES as the ratio of international reserves to broad money) in the selection of exchange rate regime.

While this traditional approach stresses the role played by declining international reserves in triggering the collapse of a fixed exchange rate regime, some recent models suggest that the decision to abandon the parity or to choose a flexible regime may stem from the authorities concern about the evolution of other key economic variables. For instance, Ozkan and Sutherland (1995) present a model in which the authorities' objective function depends positively on certain benefits derived from keeping a fixed nominal exchange rate and negatively on the deviations of output from a certain level. Under a fixed exchange rate, increases in foreign interest rates lead to higher domestic interest rates and lower levels of output, making it more costly for the authorities to maintain the parity. These hypotheses are consistent with the European experience in 1992-1993, when speculative attacks coincided with a deepening recession that worsened the high level of unemployment. More generally, this approach suggests that a variety of factors, which may affect the authorities' objective function, could be used as indicators of a currency crisis. For instance, an increase in the domestic interest rate, needed to maintain a fixed exchange rate, may result in higher financing costs for the government. To the extent that the authorities are concerned about the fiscal consequences of their exchange rate policy, the decision to adopt a peg may depend on the

public deficit. It might be an important argument particularly in CEECs, since these countries wish to join EMU and, therefore, have to respect the convergence criteria.⁷ However, the link between the exchange rate regime and the public deficit is not clear. A flexible exchange rate may reduce the risk of speculative attacks and of interest rates increases, necessary to defend the peg. Nevertheless, as a flexible regime increases the uncertainty, the risk premium raises the interest rates and thus the level of the public deficit. We investigate the relevance of the public deficit to the choice of the exchange rate regime by using as a regressor the level of government's deficit as a percentage of GDP (DEFICIT). The values of the three crises variables will be lagged one period.

3.4 Political economy

Numerous authors emphasized the credibility gains of adopting a peg arrangement.⁸ It has been argued that governments with a low institutional credibility, willing to convince the public of their commitment to price stability, may adopt a peg as a "policy crutch" to tame inflationary expectations. Accordingly, weak governments that are more vulnerable to expansionary pressures may choose to use a peg as an instrument to eliminate (or considerably reduce) these pressures. In addition, some authors argued that a fixed exchange rate disciplines the government because any fiscal excess might result in a currency crisis.⁹

Collins (1996) and Edwards (1996) built their empirical models around a framework in which the political cost associated with a devaluation under fixed exchange rates plays a major role. While Collins did not directly use political economy variables in her analysis, Edwards introduces variables that measure the degree of political stability and the strength of the government. He finds that weaker governments and unstable political environments reduce the likelihood that a peg will be adopted. His results reflect the "sustainability hypothesis", contradicting "policy crutch" approach.

In order to investigate which political economy approach is appropriate to the selection of the exchange rate regime in CEECs, we follow Edwards (1996) and we employ two indices. The strength of the government is measured as the fraction of seats in the lower chamber of the parliament held by the government's party or coalition (GOVERN). The second index (POLSTAB) focuses on instances where there has been a transfer of power from a party or group in office, to a party or group formally in the opposition. This index measures the stability of the political system since its value increases with the number of years that the party or a coalition is in office.¹⁰

⁷The public finance convergence criteria impose a constraint of 3 % on public deficit and of 60% on public debt, both in terms of GDP.

⁸See the precursors Barro and Gordon (1983), Giavazzi and Pagano (1998) and Drazen (2000).

⁹See Aghevli et al. (1991).

¹⁰The details on the construction of this measure are included in Appendix 1.

4 Baseline model of Regime Choice

In this section we present the econometric model which is applied to test the hypotheses presented in the previous section, in a unified framework. We describe the choices of exchange rate regimes using a discrete variable, $y_{i,t}$. Following our classification from Section 2.2, this variable can take one of the four values:

$$\begin{aligned} y_{i,t} &= 0 \text{ if a flexible regime is chosen by the country } i \text{ in year } t, \\ y_{i,t} &= 1 \text{ if the country } i \text{ chooses the intermediate regime in year } t, \\ y_{i,t} &= 2 \text{ if a soft peg is chosen by country } i \text{ in year } t, \\ y_{i,t} &= 3 \text{ if a currency board arrangement is adopted by country } i \text{ in year } t \end{aligned}$$

with the probabilities p_i , where $i = 0, 1, 2, 3$ and $\sum_{i=0}^3 p_i = 1$. This choice is based on the continuous latent variable $y_{i,t}^*$ (attractiveness of the fixed exchange rate regime), which is a linear function of all the economic variables discussed above:

$$y_{i,t}^* = Z_{i,t} + u_{i,t}, \text{ for } i = 1, 2, \dots, N, t = 1, 2, \dots, T_i,$$

where $Z_{i,t}$ is a vector of explanatory variables, N is the number of countries and T_i denotes the number of observations for country i . The likelihood of belonging to these categories is defined in terms of probabilities of the values of an underlying latent variable $y_{i,t}^*$. We assume that the country chooses a flexible exchange rate regime when the latent variable is below a certain threshold level c_1 :

$$y_{i,t} = 0 \text{ if } y_{i,t}^* < c_1.$$

When the latent variable is between the two thresholds c_1 and c_2 the country adopts the intermediate regime:

$$y_{i,t} = 1 \text{ if } c_1 < y_{i,t}^* < c_2.$$

If the latent variable takes values between c_2 and c_3 the country chooses the "traditional peg":

$$y_{i,t} = 2 \text{ if } c_2 < y_{i,t}^* < c_3.$$

Finally, if the latent variable exceeds c_3 the country adopts the currency board arrangement:

$$y_{i,t} = 3 \text{ if } y_{i,t}^* > c_3.$$

These three thresholds ($c_1 < c_2 < c_3$) are estimated in our analysis along with the coefficients of the explanatory variables of the vector $Z_{i,t}$. The probabilities of $y_{i,t}$ being classified as flexible, intermediate, pegged or hard peg are given by:

$$\begin{aligned}\Pr(y_{i,t} = 0) &= \Pr(Z_{i,t} + u_{i,t} < c_1) \\ &= \Pr(u_{i,t} < c_1 - Z_{i,t}) = F(c_1 - Z_{i,t}),\end{aligned}$$

$$\begin{aligned}\Pr(y_{i,t} = 1) &= \Pr(c_1 < Z_{i,t} + u_{i,t} < c_2) \\ &= \Pr(c_1 - Z_{i,t} < u_{i,t} < c_2 - Z_{i,t}) = F(c_2 - Z_{i,t}) - F(c_1 - Z_{i,t}),\end{aligned}$$

$$\begin{aligned}\Pr(y_{i,t} = 2) &= \Pr(c_2 < Z_{i,t} + u_{i,t} < c_3) \\ &= \Pr(c_2 - Z_{i,t} < u_{i,t} < c_3 - Z_{i,t}) = F(c_3 - Z_{i,t}) - F(c_2 - Z_{i,t}),\end{aligned}$$

$$\begin{aligned}\Pr(y_{i,t} = 3) &= \Pr(Z_{i,t} + u_{i,t} > c_3) \\ &= \Pr(u_{i,t} > c_3 - Z_{i,t}) = 1 - F(c_3 - Z_{i,t}),\end{aligned}$$

where $F(x) = \Pr(u_{i,t} < x)$ is the cumulative probability distribution of the error term. We can assume here that the error term follows the logistic or normal distribution. Because the information criteria (Akaike, Schwarz and Hannan-Quinn) do not indicate clearly the superior model (probit or logit) for our data set, we assume the error term $u_{i,t}$, to be i.i.d with a logistic distribution function with a mean of 0 and variance of $\frac{\pi^2}{3}$. Because the probit estimations provide the similar results, our arbitrary choice of logistic distribution does not have any negative consequences on the quality of this study. Since the values of the exchange rate regime variable can be logically ordered, this gives rise to an ordered logit. Accordingly, the probabilities of $y_{i,t}$ taking values 0, 1, 2 or 3 are given by:

$$\Pr(y_{i,t} = 0) = \Lambda(c_1 - Z_{i,t}) = \frac{1}{1 + \exp(Z_{i,t} - c_1)},$$

$$\Pr(y_{i,t} = 1) = \Lambda(c_2 - Z_{i,t}) - \Lambda(c_1 - Z_{i,t}) = \frac{1}{1 + \exp(Z_{i,t} - c_2)} - \frac{1}{1 + \exp(Z_{i,t} - c_1)},$$

$$\Pr(y_{i,t} = 2) = \Lambda(c_3 - Z_{i,t}) - \Lambda(c_2 - Z_{i,t}) = \frac{1}{1 + \exp(Z_{i,t} - c_3)} - \frac{1}{1 + \exp(Z_{i,t} - c_2)},$$

$$\Pr(y_{i,t} = 3) = 1 - \Lambda(c_3 - Z_{i,t}) = 1 - \frac{1}{1 + \exp(Z_{i,t} - c_3)},$$

where $\Lambda(\cdot)$ represents the logistic distribution function. The estimates of the coefficients of the vector $Z_{i,t}$ and the thresholds c_1 , c_2 and c_3 are obtained by maximizing the likelihood function using the Quadratic Hill Climbing algorithm.

The econometric literature on panel data models suggests to employ the specific fixed effects model, if one focuses on a particular set of countries. This is clearly the case of our study. However, the maximum likelihood estimator (MLE) is inconsistent in the case of a country-specific fixed effects models. As N tends to infinity, for a fixed T , the number of fixed effects μ_i , for $i = 1, \dots, N$, increases with the sample size N , and we have an *incidental-parameter* problem. This means that fixed effects cannot be consistently estimated for a fixed T . MLE is consistent when T tends to infinity. However, T is usually small for panel data ($T=10$ in our case). For the linear panel data regression model, when T is fixed, only parameters of explanatory variables β can be estimated consistently, by removing the fixed effects from the estimated model by the Within transformation. This is possible for the linear case because the MLE of β and μ_i are asymptotically independent, but this is no longer the case for a qualitative limited dependent variable model with fixed T (Chamberlain 1980). Therefore, we pool all country-year observations to run an ordered logit estimation. We should test here for the poolability of our data, which means to compare the panel data model to the cross-section model. The standard procedure in this case would be to use the likelihood ratio test for two models: the large one with estimated specific country effects and the nested one without these effects. However, since the ML is an inconsistent estimator of the first one, the likelihood ratio test fails *ex ante*. Therefore, we will proceed to a pooled data ordered logit estimation.

5 The econometric results and their implications

In this section we empirically assess the importance of the hypotheses of the four approaches to the exchange rate regime choice in CEECs. We estimate the specification, for *de jure* and *de facto* classifications.

5.1 *De jure* exchange rate regimes

The results of *de jure* classification estimations are reported in Table 2. A positive sign of a coefficient means that an increase of the associated variable raises the probability of adopting a hard peg. In order to facilitate the interpretation of the results, we also report the discrete changes in probabilities of choosing a hard peg ($y=3$), a soft peg ($y=2$), an intermediate regime ($y=1$) and a float ($y=0$), for significant coefficients. These changes are the differences in the predicted probabilities as one explanatory variable changes by one unit, and all the other regressors are held at their means.

Table 2: Determinants of *de jure* exchange rate regimes

variable	coeff	z-statistic	changes in probabilities			
			$y=3$	$y=2$	$y=1$	$y=0$
OPENNESS	0.036	3.08**	0.007	-0.001	-0.005	-0.001
GDP	-0.010	-1.24				
RESTR	-0.529	-2.18**	-0.041	-0.065	0.040	0.066
MONEY	-0.095	-4.64***	-0.009	-0.012	0.011	0.010
DEFICIT	-0.186	-0.67				
INFL	0.010	1.95*	0.001	0.001	-0.001	-0.001
RESERVES	0.009	1.15				
POLSTAB	-0.367	-3.43***	-0.030	-0.046	0.033	0.043
GOVERN	0.086	3.51***	0.009	-0.002	-0.005	-0.001
Log likelihood	-80.80					
$LR \chi^2(9 \text{ df})^a$	87.72					
Predictive power ^b (%)	71 %					

Notes: * z statistics significant at 10%; ** at 5%; *** at 1%

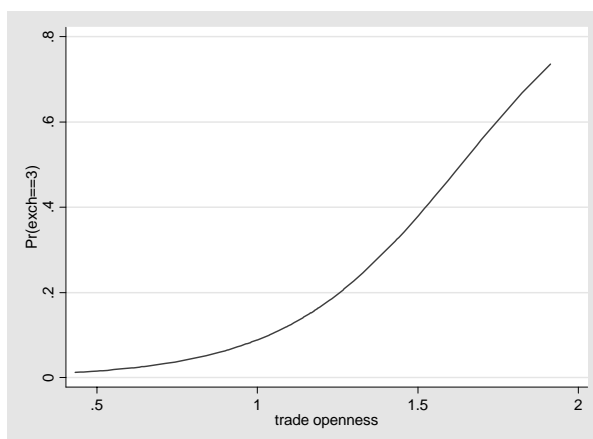
a: The χ^2 value is defined as $2(L_1 - L_0)$, where the L_0 is the value of the log-likelihood function with only the constant term, and L_1 is the value of the log-likelihood function when all the explanatory variables are included.

b: Since for ordered logit models the R^2 is meaningless, we report here an appropriate measure of goodness of fit, i.e. predictive power of the specification. This measure computes the share of regimes correctly predicted by the model.

First of all, we note that the model correctly predicts 71 percent of the *de jure* exchange rate regimes in CEEC. The results suggest that six out of nine explanatory variables play a role in choosing the exchange rate regime in CEECs. The size of the economy (GDP) does not play the role in the selection of the *de jure* exchange rate regime. The coefficient of the degree of trade openness (OPENNESS) is significant and has the expected sign.

More open CEECs tend to adopt more rigid exchange rate regimes. A one percentage point increase in the openness ratio increases the probability of choosing a currency board by 0.007, holding all the other explanatory variables at their means. Figure 1 shows the effect of the trade openness on the probability of adopting a currency board. All the other explanatory variables are held constant at their means.

Figure 1: **Openness and the choice of exchange rate regime in CEECs**



The figure presents the relationship between predicted probability of adopting a currency board and the trade openness. The later is defined here as a share of the sum of imports and exports in terms of GDP. All the other explanatory variables are held constant at their means.

Figure 1 shows that the relationship between the probability that a hard peg is chosen and the degree of openness is not linear. However, we see clearly that the increase in degree of trade openness increases the probability of choosing a hard peg.

Turning to the "impossible trinity hypothesis", coefficients of two financial variables are significant. The development of the financial sector (MONEY) favors the choice of more flexible exchange rate systems. This is as expected. However, the countries that are more integrated to capital markets (RESTR, decrease of restrictions) are more prone to adopt a peg. According to the "bipolar view", financially open countries should choose a hard peg or a pure float. The results show that as CEECs open their capital account they move towards the rigid corner. Only one crises indicator seems to play a significant role in the choice of exchange rate regime. The larger the inflation differential (INFL) with Germany, the larger the likelihood of adopting a fix regime. For each additional percentage point of inflation differential the probability of adopting a soft peg increases by 0.01, holding all the other explanatory variables constant at their means. In fact, CEECs used the fixed exchange rate as an external anchor to bring down the inflation expectations. Finally,

both coefficients of political stability variables are significant. However, their signs are opposite. The first one (POLSTAB) suggests that, the more politically unstable the country is, the more likely it is to select the rigid regime. This result supports the "policy crutch" hypothesis. Controversially, stronger governments have a greater tendency toward selecting a pegged system. This result is a puzzle, and we check for the correlation between these two variables. Although the correlation is low (0.1566), we perform the likelihood ratio test. Its value is 18.55, which indicates that these two variables are jointly significant at the 1% level. In addition, we run separate regressions with each of them. The results confirm statistical significance and the signs of their coefficients. The opposite signs of coefficients of political variables remain a puzzle.

5.2 *De facto* exchange rate regimes

Table 4 reports the results of the specification of the *de facto* exchange rate regime. First of all, we note that there are few differences between the results of the *de facto* and the *de jure* regime specification. This is not surprising given the fact that the discrepancies of the two classifications are not substantial.¹¹ Since many *de facto* measures of exchange rate regimes have been developed and they seem to differ one from the other¹², in addition to the Reinhart and Rogoff regimes measures, we employ as well the *de facto* classification created by Levy-Yeyati and Sturzeneger (LYS). The results of the estimations carried out with LYS exchange rate regimes are very similar. We report here only the results of the specification of the *de facto* Reinhart and Rogoff measure. Eight out of nine variables are individually significant, at least at the 10 percent significance level. The *de jure* specification exhibits a lower level of predictive accuracy (65 percent against 71 percent of the *de facto* exchange rate arrangements) of all exchange rate regimes in CEECs.

As can be seen in Table 4, the coefficients of both OCA indicators are significant. Similarly to the *de jure* specification results, the sign of the coefficient of openness ratio (OPENNESS) confirms the OCA hypothesis. In contrast with the *de jure* specification, the size of the economy (GDP) influences the choice of exchange rate regime. Smaller pegs favor rigid exchange rate regimes. For each additional billion of US dollars of the country's real GDP, the probability of choosing the pure float increases by 0.0001, holding all the other explanatory variables constant at their means. Turning to financial variables, both coefficients indicate the significant impact of financial globalization on the choice of the *de facto* exchange rate regime. More financially open countries are more likely to adopt the rigid regimes. As in the case of the *de jure* regime, an increasing inflation differential increases

¹¹See Section 2.2.

¹²Frankel (2003) shows that Calvo's and Reinhart's measure of *de facto* exchange rate regimes differs considerably from the LYS classification.

Table 3: Determinants of de facto exchange rate regimes

Variables	coeff	z-statistic	changes in probabilities			
			$y=3$	$y=2$	$y=1$	$y=0$
OPENNESS	0.066	6.69***	0.009	-0.007	-0.002	-0.0001
GDP	-0.015	-1.86*	-0.0007	-0.002	0.002	0.0001
RESTR	-0.643	-2.29**	-0.024	-0.104	0.117	0.011
MONEY	-0.080	-4.40***	-0.001	-0.010	0.013	0.001
DEFICIT	-0.287	-1.12				
RESERVES	0.024	2.26**	0.003	0.001	-0.002	-0.0001
INFL	0.007	3.52***	0.0003	0.0008	-0.001	-0.0008
POLSTAB	-0.188	-1.71*	-0.009	-0.025	0.031	0.002
GOVERN	0.108	3.18**	0.005	0.013	-0.017	-0.001
Log likelihood	-66.74					
LR $\chi^2(9)^a$	108.99					
Predictive power ^b (%)	65 %					

Notes: * z statistics significant at 10%; ** at 5%; *** at 1%

a: The χ^2 value is defined as $2(L_1 - L_0)$, where the L_0 is the value of the log-likelihood function with only the constant term, and L_1 is the value of the log-likelihood function when all the explanatory variables are included.

b: Since for ordered logit models the R^2 is meaningless, we report here an appropriate measure of goodness of fit, i.e. predictive power of the specification. This measure computes the share of regimes correctly predicted by the model.

the probability of adopting a peg. A one percentage point increase in this differential increases the probability of adopting a soft peg by 0.0008, all the other regressors being held constant at their means. Finally, the choice of the *de facto* exchange rate regimes in CEECs depends significantly on the political conditions of the country. On the one hand, stronger governments favor pegs. On the other hand, politically unstable countries are more likely to adopt the rigid regime. The specification of the *de facto* regimes confirms the political conditions puzzle in CEECs. Finally, in contrast with the *de jure* regimes, the *de facto* ones are determined by the level of available international reserves. An additional percentage point in the ratio of international reserves increases the probability of adopting a soft peg by 0.001, holding all the other explanatory variables constant at their means.

6 Conclusion

The objective of this study was to identify the sources of divergences between exchange rate strategies among CEECs. We investigated two potential reasons for these divergences. First, we built an extended specification of the exchange rate regime choice. We considered the relevance of variables suggested by traditional and modern theories. Second, we employed two distinct classifications of exchange rate regimes, i.e. *de jure* and *de facto*. In order to test the validity of our hypotheses we used an ordered logit framework.

The estimations of both the *de jure* and the *de facto* specifications provide very similar

results. This shows that the *de facto* exchange rate regimes in CEECs do not diverge considerably from what is announced. Thus, the difference of the exchange rate strategies among CEECs cannot be explained by the inappropriateness of the different classifications. Moreover, the convergence between the *de facto* and the *de jure* exchange rate regimes over time indicates the important gains in credibility of monetary authorities.

The results lend overall support to the following traditional and modern determinants of the exchange rate regime. Confirming the OCA theory, fixing is strongly associated with small and open economies. Strong governments are more capable to implement more rigid exchange rate regimes. A country experiencing a high inflation rate differential adopts a peg as an instrument of disinflation policy: it strongly favours the idea of using the exchange rate regime as an instrument of importing credibility. Finally, two financial variables play a significant role in the choice of the exchange rate regime in these countries. First, the development of the financial sector favours floats in CEECs. Second, financial openness favours pegs. Since the "impossible trinity" approach rules out a combination of intermediate exchange rates and open capital markets, more financially integrated countries switch to more rigid regimes (and ultimately hard pegs).

Financial and trade openness seem to be the major determinants of divergences among exchange rate strategies in CEECs. Bulgaria, Lithuania and Estonia, which exhibit very high levels of financial and trade openness, adopted currency boards arrangements. Countries like Poland or Romania, which preserve certain restrictions on their capital accounts and are less open to international trade, still use more flexible exchange rate regimes. This result suggests that complete financial and trade liberalisation vis-à-vis the EU, required from all the new members, will tend to move all CEECs towards a rigid exchange rate regime.¹³

¹³Romania's aim to gain EU membership in 2007 is strongly supported by the member states. Once this country becomes an effective member of the EU, it will also have to satisfy the *acquis communautaire*.

References

- [1] Backé P.(1999), "Exchange Rate Regimes in Central and Eastern Europe: A Brief Review of Recent Changes, Current Issues and Future Challenges." *Focus in Transition*, No. 2, pp. 47-67.
- [2] Cukierman A. and Edwards S., Tabellini G., (1992), Seignorage and Political Instability, *American Economic Review*, vol. 82, pp. 537-555.
- [3] Bayoumi T., Eichengreen B. (1993), "Shocking aspects of European Monetary Integration." in: Francisco Torres and Francesco Giavazzi, Eds, Growth and Adjustment in the European Monetary Union, pp. 193-230. Oxford: Cambridge University Press.
- [4] Bénassy-Quéré A., Lahrèche-Révil A. (1999), "L'euro comme monnaie de référence à l'Est et au Sud de l'Union Européenne." *Revue Economique*, Novembre, vol. 50, n°6.
- [5] Boone L., Maurel M. (1999), "An optimal Currency Area Perspective of the EU Enlargement to the CEECs'." *CEPR Discussion Paper*, No. 2119.
- [6] Corker R., Craig B., van Elkan R., Iakova D. (2000), "Exchange Rate Regimes in Selected Advanced Transition Economies-Coping with Transition, Capital Inflows, and EU Accession." *IMF Policy Discussion Papers* PDP/00/3.
- [7] Calvo G., Reinhart C. (2002), "Fear of Floating." *Quarterly Journal of Economics*, 117, pp. 379-408.
- [8] Chamberlain G. (1980), "Analysis of Covariance with Qualitative Data", *Review of Economic Studies*, Vol. 47, No. 1, pp. 225-238.
- [9] Collins S. (1996), "On Becoming More Flexible: Exchange Rate Regimes in Latin America and Caribbean." *Journal of Development Economics*, Vol. 51, pp.117-138.
- [10] Drazen A. (2000), *Political Economy in Macroeconomics*. Princeton University Press Princeton, New Jersey.
- [11] Edwards S. (1996), "The Determinants of Choice Between Fixed and Flexible Exchange Rate Regimes." *NBER Working Paper* 5756.
- [12] Eichengreen B. (1994), *International Monetary Agreement for the 21st Century*. The Brookings Institutions. Washington, DC.
- [13] Fischer S. (2001), "Exchange Rate Regimes: Is the Bipolar View Correct?" *Journal of Economic Perspectives*, Vol. 15 N°2, pp. 3-24.

- [14] Flood R. (1979), "Capital mobility and the Choice of Exchange Rate System." *International Economic Review*, 20 (June), pp. 405-512.
- [15] Giavazzi F., Pagano M. (1988), "The Advantage of Tying One's Hands." *European Economic Review*, Vol. 32. pp.1055-1075 .
- [16] Gosh A., Gulde A-M., Wolf H., Ostry J., (1997), "Does the Nominal Exchange Rate Regime matter ?" *NBER Working Paper* 5874.
- [17] International Monetary Fund (various issues): *Annual Report on Exchange Rate Arrangements and Exchange Restrictions*. Washington DC.
- [18] Krugman, Paul, (1979), "A Model of Balance-of-Payments Crises," *Journal of Money, Credit and Banking*, vol. 11(3), pp. 311-325.
- [19] Levy-Yeyati E., Sturzeneger F., (2001), "Exchange Rate Regimes and Economic Performance." *IMF Staff Papers*, Vol. 47, Special Issue.
- [20] Levy-Yeyati E., Sturzeneger F., (2003), "A de facto Classification of Exchange Rate Regimes: A Methodological Note."
- [21] Von Hagen J., Zhou J., (2002), "De Facto and Official Exchange Rate Regimes in Transition Economies", *ZEI Working Paper*, B 13.
- [22] McKinnon R., (1963), "Optimum Currency Areas." *American Economic Review*, vol. 53, pp. 207-222.
- [23] Melvin M., (1985), "The Choice of an Exchange Rate System and Macroeconomic Stability." *Journal of Money, Credit and Banking*, vol.17 n°4, pp. 467-478.
- [24] Mundell R., (1961), "A Theory of Optimal Currency Areas", *American Economic Review*, vol. 51, pp. 657-665.
- [25] Obsfeld M., Rogoff K., (1995), "The Mirage of Fixed Exchange Rates", *Journal of Economic Perspectives*, Vol. 9, No. 4, pp. 73-96.
- [26] Ozkan, F.G. and A. Sutherland. (1995), "Policy Measures to avoid a Currency Crisis", *The Economic Journal*, vol. 105, No. 429, pp. 510-519.
- [27] Porison H., (2001), "How Do Countries Choose their Exchange Rate Regime?", *IMF Working Paper* 01/46.
- [28] Reinhart C. Rogoff K., (2002), "The Modern History of Exchange Rate Arrangements: A Reinterpretation", *NBER Working Paper* 8963.

- [29] Rizzo J., (1998), "The Economic Determinants of the Choice of an Exchange Rate Regime: a Probit Analysis." *Economic Letters* 59, pp. 283-87.
- [30] Tornell A. and Velasco A. (1995), "Fiscal Discipline and the Choice of Exchange Rate Regime", *European Economic Review*, Vol. 39, Issues 3-4, pp. 759-770.

Appendix A

Frequencies of exchange rate regimes

Table 4: De jure dependent variable

Regime	Value	Count
Pure float	0	24
Intermediate	1	23
Soft peg	2	28
Hard peg	3	25
		100

The first column includes the values of dependent variable. The second column reports a count and a percentage (since the number of all the regimes is equal to 100) of the corresponding exchange rate regimes.

Table 5: De facto dependent variable

Regime	Value	Count
Pure float	0	23
Intermediate	1	27
Soft peg	2	26
Hard peg	3	24
		100

The first column includes the values of dependent variable. The second column reports a count and a percentage (since the number of all the regimes is equal to 100) of the corresponding exchange rate regimes.

Appendix B

Data Description

Table 6: Data description

Variable	Definition and Source
DEBT	Lagged value of the stock of public debt in terms of GDP. (Source: EBRD Transition Report).
DE JURE	Official exchange rate regimes. (Source: IMF Annual Report on Exchange Arrangements and Exchange Restrictions).
DE FACTO	Actual exchange rate regimes. (Source: Reinhart C. Rogoff K., 2002)
GDP	Real GDP in billions of US dollars.(Source: IFS, various issues).
GOVERN	Strength of Government measured as the fraction of seats in the lower chamber of the parliament on the number of seats held by the governmental party or coalition. (Source: Database of Political Institutions 2000, Thorsen et al. and calculations of the authors).
INFL	Inflation differential ($\pi - \pi^*$) where π is a domestic inflation rate and π^* is a German inflation rate. (Source: IFS).
MONEY	Financial development measured as a ratio of broad money to GDP. (Source: EBRD Transition Report).
OPENNESS	Degree of trade openness measured as the ratio of exports and imports to the GDP. (Source: IFS).
POLSTAB	Political stability: the value of the index increases with the number of years that the government stays in office (value of one for every year). If there is a transfer of power from a party or group in office, to a party or group formally in the opposition, the value falls to one again. (Source: www.electionworld.org, calculations of the authors).
RESERVES	International reserves measured as the ratio of international reserves (without gold) to broad money. (Source: EBRD Transition Report).
RESTR	Restrictions on capital movements. The values of the index are included between 0 and 6, where 0 indicates no restrictions and 6 stands for completely closed capital account. (Source: The index created and provided by Garibaldi P., Mora N.,Sahay R., Zettelmeyer J. (IMF), updated by the authors) ¹⁴ .

¹⁴We are very grateful to J. Zettelmeyer who provided us with this dataset.