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Working Paper

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ZEI Working Paper, No. B 13-2002

Provided in Cooperation with:

ZEI - Center for European Integration Studies, University of Bonn

Suggested Citation: von Hagen, Jürgen; Zhou, Jizhong (2002) : De facto and official exchange rate regimes in transition economies, ZEI Working Paper, No. B 13-2002, Rheinische Friedrich-Wilhelms-Universität Bonn, Zentrum für Europäische Integrationsforschung (ZEI), Bonn

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**De Facto and Official
Exchange Rate Regimes in
Transition Economies**

Working Paper

**B 13
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De Facto and Official Exchange Rate Regimes in Transition Economies^{*}

by

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Preliminary version, May 2002

Abstract

This paper provides an empirical investigation on the discrepancies between official exchange rate regimes and de facto exchange rate policies in transition economies. Since official and de facto regime choices are not independent of each other, we adopt a bivariate probit model to describe the joint determination of the two regime choices. After finding the important determinants of both regime choices, we use a univariate probit model to describe the determination of regime discrepancies. We find that errors in the selection of official regimes as well as the macroeconomic developments calling for conflicting adjustments in exchange rate regimes are important determinants of regime discrepancies.

Keywords: Exchange rate regimes, official regimes, de facto regimes, transition economies.

JEL Codes: E42, F31, F33.

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1. Introduction

The choice of the appropriate exchange rate regime for open economies is a venerable topic in international macro economics and finance. Early literature, based on the seminal works on optimal currency areas (OCA) by Mundell, Kenen, and McKinnon, stressed the usefulness of monetary policy to cope with aggregate demand shocks. Following Poole's (1970) analysis of monetary policy instruments, subsequent authors emphasized the type and source of the dominant shocks to which an economy is exposed. The literature building on Barro and Gordon's (1983) work on monetary policy credibility developed the idea that exchange rate pegs could help import credibility of low inflation policies from a foreign central bank (e.g. Giavazzi and Giovannini (1989) and von Hagen (1991)). Most recent literature warns against the instabilities arising from combining exchange rate pegs with high capital mobility (e.g. Eichengreen (1994), Obstfeld and Rogoff (1995), and Fischer (2001)). Following the collapse of the Bretton Woods System in the early 1970s, a strand of empirical literature has explained exchange rate regime choices and found some empirical support of these arguments.¹

Exchange rate regimes can be classified on two different grounds. One is the "official" regime, i.e., the regime that national authorities annually declare to the IMF. The other is the "de facto" regime. The de facto regime is the regime actually practiced by the authorities. Until recently, the fact that the official and the de facto regimes are often different has largely been ignored in the literature. However, as Calvo and Reinhart (2000) and Levy-Yeyati and Sturzenegger (2000) have recently pointed out, discrepancies between the official and the de facto regimes are not uncommon in practice. De facto regimes may be characterized by more or less exchange rate volatility than expected on the basis of official regimes, and these discrepancies may last for substantial periods of time. As shown by Gosh et al. (1997), frequent adjustments of the central parity can make an officially pegged exchange rate quite flexible. Calvo and Reinhart (2000) show that many countries that officially adopt floating exchange rates use frequent foreign exchange market interventions to maintain a high degree of exchange rate stability, a phenomenon they call "fear of floating".

Why countries choose to practice an exchange rate regime different from their official one remains a puzzle in the literature. Calvo and Reinhart (2000) argue that low credibility of the monetary authority is the main reason for fear of floating. By providing the economy with a transparent and easily verifiable nominal anchor for inflation expectations, stable exchange rates can help weak central banks to improve the

credibility of their commitment to price stability. Lahiri and Végh (2000) suggest that regime discrepancies result from a trade-off between the cost of foreign exchange market intervention and real output losses due to exchange rate volatility. Their analysis predicts that central banks allow the exchange rate to adjust to small shocks but intervene in the presence of large shocks to avoid excessive exchange rate volatility. Hausmann et al. (2000) explain regime discrepancies by the desire to avoid large exchange rate volatility, which increases with a country's borrowing in foreign currency. At a closer look, however, these arguments contribute more to explaining the desirable degree of exchange rate flexibility and, therefore, the choice of exchange rate regimes than to explaining discrepancies between official and de facto regimes. Apart from Holden et al. (1979) and Poirson (2001), existing empirical studies of exchange rate regime choice have focused on official rather than de facto regimes.²

The present paper takes a positive approach to explaining exchange rate regime discrepancies. It presents an empirical analysis of official and de facto exchange rate regime choices for a sample of 25 transition countries during the 1990s. This is an interesting sample, because, notwithstanding their economic heterogeneity, these countries share a common history of emerging from socialist regimes largely isolated from the world economy at the end of the 1980s, they all faced large macro economic imbalances and stabilization problems initially, they all became gradually integrated into international trade and financial markets during the period we consider. Yet, there is quite a variety of exchange rate regimes, both official and de facto, among these countries. In an earlier paper (von Hagen and Zhou (2002)) we have shown that the official regime choices of these countries can be explained empirically on the basis of standard arguments from international macro economics. Here, we extend Levy-Yeyati and Sturzenegger's (2000) analysis to our sample. We show, first, that, similar to their findings in a sample of industrialized and developing countries, regime discrepancies are in fact quite common among the countries we consider. We then develop a bivariate discrete-choice model explaining the joint determination of the official and the de facto regimes. Our results indicate that the official regimes respond more significantly to macro economic fundamentals such as openness and the commodity structure of international trade, while the de facto regimes respond more strongly to variables describing issues of macro economic stabilization such as inflation and budget deficits. Finally, we develop a discrete choice model of regime discrepancies.

The rest of the paper is organized as follows. Section 2 provides a brief review over the issues pertaining to de facto exchange rate regimes as well as to discrepancies between de facto and official regimes. Section 3 presents a bivariate discrete choice model for the joint regime determinations. Section 4 derives a univariate probit model from the bivariate one and analyzes empirically the deviations between the official and the de facto exchange rate regimes. Conclusions are collected in section 5.

2. Official and De Facto Exchange Rate Regimes

2.1 Identification of the discrepancies between official and de facto regimes

Two recent papers identify the differences between the officially claimed exchange rate regimes and the actually observed exchange rate policies. Calvo and Reinhart (2000) analyze the behavior of exchange rates, reserves, monetary aggregates, interest rates, and commodity prices for 154 exchange rate arrangements from 39 countries to assess whether official labels on exchange rate regimes provide an adequate representation of actual exchange rate policies.³ Their main finding is that countries claiming to run free or managed floats often intervene heavily in their foreign exchange markets to reduce exchange rate volatility. As a result, their exchange rate volatility is similar to that observed for countries that maintain official exchange rate pegs, and the volatility of international reserves is larger than under true floating regimes.

Levy-Yeyati and Sturzenegger (2000), hereafter referred to as LYS, use cluster analysis to classify de facto regimes. The basic idea is that fixed (flexible) regimes should exhibit low (high) volatility in exchange rate movements but high (low) volatility in international reserves. For intermediate regimes both volatility measures should lie somewhere in the middle. Using cluster analysis means that all volatilities are compared to sample averages. This avoids the use of arbitrary standards of comparison, but the resulting classifications are sample-dependent. As the LYS data has only 106 observations from 20 transition economies, we follow their guidelines to construct a larger data set for 25 transition economies. We obtain 149 country-year observations with data on all the three volatility measures: volatility of exchange rates, volatility of exchange rate changes, and volatility of international reserves. We apply the same cluster analysis as used by LYS to classify them into four regimes: fixed, intermediate, flexible, or inconclusive.^{4,5} The additional 54 country-year observations without data on international reserve volatility are assigned to the regime with the shortest distance between the data point and the cluster centroid based on the remaining two volatility

measures. For a description of the data and the classification procedures see Appendix I; the results of our de facto classification are listed in Appendix II, Table A-2.

The classification based on our sample shows that there are clear differences in the distribution of volatility measures among de facto regimes. As shown in Table 1, the median value of the exchange rate volatility ($\sigma(e)$, measured by the average absolute monthly percentage change of the exchange rate) is below 1 percent for fixed regimes, almost 3 percent for intermediate regimes, and above 8 percent for flexible regimes. However, the volatility of reserves ($\sigma(r)$, measured by the average absolute monthly percentage change of international reserves), declines as exchange rate flexibility increases, with 9.9, 6.1, and 4.7 percent for fixed, intermediate, and flexible regimes respectively. Inconclusive regimes are characterized by low volatilities in both exchange rate movements and reserve changes, while intermediate regimes always lie between fixed and flexible regimes from every perspective. These findings, similar to those reported by LYS, are consistent with our expectations on the behavior of exchange rates and reserves under different exchange rate regimes.

Table 1: Exchange Rate and Reserve Volatility in Transition Economies (in %)

	$\sigma(e)$		$\sigma(\Delta e)$		$\sigma(r)$	
	Mean	Median	Mean	Median	Mean	Median
Fixed	1.92	0.97	2.37	0.99	10.62	9.86
Intermediate	4.84	2.89	5.98	3.46	10.02	6.10
Flexible	17.64	8.14	28.28	13.78	6.29	4.66
Inconclusive	0.63	0.58	0.78	0.80	2.99	3.28

Note: $\sigma(e)$ is the measure for the volatility of exchange rates; $\sigma(\Delta e)$ is the measure for the volatility of exchange rate changes; $\sigma(r)$ is the measure for the volatility of reserves. See Appendix I for detailed definitions. A total of 149 country-year observations are classified into 13 inconclusive, 90 fixed, 27 intermediate, and 19 flexible regimes.

The de facto exchange rate regimes thus classified are then contrasted to the official regimes to identify regime discrepancies. Here the official regimes refer to the IMF classification, with dollarization, currency boards, and conventional fixed pegs defined as fixed-rate regimes, horizontal bands, crawling pegs, and crawling bands as intermediate regimes, and managed and independent floats as flexible regimes (see Appendix II, Table A-1). Table 2 summarizes the main results with both LYS and our classification of de facto regimes. LYS find that almost half of the 2188 country-year

observations exhibit regime discrepancies. Discrepancies between official and de facto regimes are pervasive. They include 20.4 percent cases of “fear of floating” and 28.5 percent cases in which the de-facto regime is more flexible than the official one. We call this second discrepancy “fear of pegging”.⁶ Among the 106 observations from transition economies, LYS find that only 47 percent of the regime choices are consistent, one third is of the fear of floating type, and 19.8 percent represent fear of pegging. These estimates thus suggest that regime discrepancies are even more prevalent among transition economies than among other countries.

Table 2: Discrepancies Between Official and De Facto Exchange Rate Regimes

	LYS: Full Sample		LYS: Transition countries		Current sample	
	#	%	#	%	#	%
Fear of floating ¹	447	20.4	35	33.0	102	51.8
Consistent ²	1118	51.1	50	47.2	75	38.1
Fear of pegging ³	623	28.5	21	19.8	20	10.1
Total	2188	100.0	106	100.0	197	100.0

[1] De facto exchange rate regimes are less flexible than official regimes.

[2] De facto and official exchange rate regimes are of the same degree of flexibility.

[3] De facto exchange rate regimes are more flexible than official regimes.

Compared to LYS, our sample contains more transition countries and more recent years. While the standard of comparison LYS use to measure the consistency of exchange rate regime choices is based on the average volatilities from all countries and years in their sample, we use average volatilities only from the transition countries for this purpose. We find an even smaller share of consistent choices in our sample. About half of the countries in our group are characterized by “fear of floating”, while 10 percent exhibit “fear of pegging”. Thus, our data confirm that regime discrepancies are a common phenomenon. Like LYS, we find that transition economies are more prone to fear of floating than to fear of pegging.

To explore the differences between official and de facto regimes, Table 3 reports the average frequency and the average absolute size of regime changes for all transition economies and for two sub-groups. The latter are based on an index equal to zero for fixed-rate regimes, one for intermediate regimes, and two for flexible-rate regimes. The

table shows that the average transition country changed its official regime less than half as frequently than its de-facto regime. The average size of adjustment, however, is larger in the case of the official regimes. Countries not aspiring EU membership in the near future changed their official and de facto exchange rate regimes more frequently and in bigger steps than the EU candidates.

Table 3: Average Frequency and Size of Regime Changes

	Official Regimes		De Facto Regimes	
	Frequency	Size	Frequency	Size
All Countries	1.40	1.55	3.08	1.28
EU Candidates ^a	1.10	1.20	2.60	1.11
Non-Accession	1.60	1.78	3.40	1.39

Note: ^a Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic, Slovenia.

Table 4 considers persistence for official and de facto regimes over time. To derive a measure of persistence, assume that regime choices over time follow a Markov process, $r_t = Pr_{t-1} + u_t$, where r_t is a three-dimensional vector describing the distribution of regime choices in period t , and P is a 3x3 matrix reporting the transition probabilities. The diagonal elements of this matrix indicate the probability of staying in a given regime for two consecutive periods. The table reports the empirical estimates of these elements. Since we find that the transition matrix is non-stationary for the official regimes, we report the estimates for 1991--1995 and 1996--1999 separately.⁷ Table 4 indicates that official regimes are considerably more persistent than de facto regimes. Only de-facto fixed regimes exhibit a degree of persistence comparable to official regimes.

Table 4: Persistence of Exchange Rate Regimes: 1991—1999

	Fixed	Intermediate	Flexible
<i>Official Regimes</i>			
Sub-period: 1991-1995	0,60	1,00	0,88
Sub-period: 1996-1999	0,87	0,71	0,91
<i>De Facto Regimes</i>			
	0,74	0,22	0,42

Note: Persistence of a regime is measured by the probability of staying in the named regime for two consecutive years.

Similarly, we can compute the persistence of regime discrepancies based on the corresponding transition matrix. Table 5 reports the results. Fear of floating is much more persistent in our sample than both consistent combinations of official and de facto regimes and fear of pegging.⁸

Table 5: Persistence of Regime Discrepancies: 1991–1999

Fear of Pegging	Consistent	Fear of Floating
0,15	0,65	0,82

Note: Persistence of a regime discrepancy is measured by the probability of staying in the named type of regime discrepancy (including no discrepancy) for two consecutive years.

3. A Model of Exchange Rate Regime Choices

3.1. Determinants of Exchange Rate Regimes

The optimal choice of exchange rate regimes is a topic with a long tradition in international macro economics. Here, we briefly summarize the main arguments from the literature. Building on Mundell (1961), McKinnon (1963) argues that small and open economies are more likely to adopt fixed exchange rates than large and relatively closed economies. Countries are also more likely to adopt flexible exchange rates, if their trade is geographically diversified. Kenen (1969) suggests that countries with concentrated production structures are more likely to adopt flexible exchange rates. In the empirical analysis below, we represent these considerations by empirical measures of the degree of openness of the economy (OPENNESS), geographical concentration of foreign trade (GEOCON), and commodity concentration of foreign trade (COMCON).⁹ We also consider the degree of openness to the European Union (OPENTOEU), the leading export market for many transition countries. We also use real GDP, expressed in logs, to measure the size of the economy.¹⁰

The development of a country's financial sector is another, important factor (McKinnon (1993) and Hausmann et al. (1999)). Countries with relatively undeveloped financial sectors often opt for fixed exchange rates, because they lack the market instruments to conduct domestic open market operations and because they wish to shield their fledgling banking industries against large exchange rate movements. We use

the ratio of broad money to GDP (MONEY) to approximate empirically the degree of financial sector development.

Henderson (1979), McKinnon (1981), and Boyer (1978) argue that fixed exchange rates yield better output stability in the presence of domestic nominal shocks, while flexible rates perform better in the presence of real shocks. Models in the tradition of the monetary approach to exchange rate determination, in contrast, focus on the transmission of inflation between countries and the use of exchange rate policies to achieve low inflation rates. Following Barro and Gordon (1983), numerous authors have argued that countries whose monetary authorities suffer from low credibility of low-inflation policies can import central bank credibility by adopting a fixed exchange rate with a more stable currency (e.g., Fratianni and von Hagen (1992), Giavazzi and Giovannini (1989), and Melitz (1988)). This view was particularly important in the early years of the transition from a socialist to a market economy, when price liberalization and the destruction of monetary overhangs inherited from past led to high inflation. We use variables to proxy such considerations of stabilizing inflation in the empirical analysis. The first is the annual rate of consumer price inflation (INFLATION).¹¹ The second is the cumulative inflation differential of a country relative to a weighted average of its five main trading partners (CUMINF). The third is an index of exchange rate pass-through to domestic prices (PASSTHRU). For each year, this index measures the correlation between monthly changes in consumer prices and monthly changes in the nominal effective exchange rate lagged by one quarter. Hausmann et al. (2000) propose this index as a measure of how much domestic price stability is affected by exchange rate movements. Furthermore, we include the real GDP growth rate (GDPGROWTH). Poor growth performance increases the incentive to ease monetary policy and let go off an exchange rate constraint imposed to combat inflation.

In recent years, the general trend towards capital mobility has shifted attention to the implications of capital movements for the choice of exchange rate regimes. Fixed exchange rate regimes, when combined with a high degree of capital mobility, are exposed to speculative attacks resulting from fundamental policy inconsistencies (Krugman (1979)) or self-fulfilling expectations (Obstfeld (1996)). The lesson is that countries should avoid unstable combinations of capital mobility and exchange rate fixity. Important factors that reduce the risk of speculative attacks are the availability of foreign currency reserves to defend a fixed exchange rate, and the consistency of macro economic policies. Sustainability of public finances is a key factor in this regard. We

select two variables to account for the risk of currency crisis in the empirical analysis. The first is the ratio of non-gold international reserves to broad money (RESERVE), a measure of the availability of international liquidity.¹² The other is the ratio of the government fiscal budget balance to GDP (FISCAL), a proxy for the soundness of fiscal fundamentals, which plays a crucial role in both first and second generation currency crisis models.

Besides these variables, we also include a dummy variable for the membership of the Commonwealth of Independent States (CIS), CISDUMMY. The CIS countries started their transition process later than most Central and Eastern European Countries (CEECs), their pace of reform is also slower than the CEECs.

3.2 A Bivariate Probit Model

Our model consists of two equations for regime determinations, one for official regimes and another for de facto ones. We consider a general bivariate ordered choice model, where both regimes have three choices: fixed, intermediate, or flexible regimes. Let Y and Q be the indicators for official and de facto regimes, respectively. Each variable takes the value of 0 for fixed regimes, 1 for intermediate regimes, and 2 for flexible regimes. The classification of the official exchange rate regimes is based on the IMF's revised classification of 1999.¹³ The classification of the de facto regimes is based on our cluster analysis. Let Y^* and Q^* be two latent variables describing the optimal degree of exchange rate regime flexibility for the official and the de facto regime, respectively. Each latent variable is assumed to be a linear function of some exogenous variables X and subject to a random disturbance. The two disturbances are assumed to follow a standard bivariate normal distribution with covariance parameter $\tilde{\rho}$. They are assumed to be independently and identically distributed (i.i.d.). To be specific,

$$Y_{it}^* = X_{1it}\beta_1 + u_{1it}, \quad Y_{it}=0 \text{ if } Y_{it}^* \leq 0, \quad Y_{it}=1 \text{ if } 0 < Y_{it}^* \leq c_1, \quad Y_{it}=2 \text{ if } Y_{it}^* > c_1 \quad (1a)$$

$$Q_{it}^* = X_{2it}\beta_2 + u_{2it}, \quad Q_{it}=0 \text{ if } Q_{it}^* \leq 0, \quad Q_{it}=1 \text{ if } 0 < Q_{it}^* \leq c_2, \quad Q_{it}=2 \text{ if } Q_{it}^* > c_2 \quad (1b)$$

$$E[u_{1it}] = E[u_{2it}] = 0, \quad \text{Var}[u_{1it}] = \text{Var}[u_{2it}] = 1, \quad \text{Cov}[u_{1it}, u_{2it}] = \tilde{\rho}. \quad (1c)$$

For each equation there are two thresholds separating the three regimes. The lower thresholds are normalized to zero and the upper thresholds, c_1 and c_2 , are strictly positive. Altogether there are nine possible combinations between official and de facto

exchange rate regimes. The parameters β_1 and β_2 and the thresholds can be estimated using a maximum likelihood (ML) estimator.

3.3 Empirical Results

To account for potential simultaneities, we instrumentalize all right-hand-side variables (except the CIS dummy) by lagged values. We start with a broad specification of the model including all explanatory variables mentioned above in both equations. We drop geographical trade concentration, inflation, and the cumulative inflation differential from the set of regressors, as they turn out to be non-significant. Table 6 presents two estimates of a broad and a narrow specification that drops the remaining regressors of very low significance. The likelihood-ratio test for jointly excluding the variables dropped in specification (2) of the table is 5.94 with a marginal probability of 0.65.

A positive coefficient means that an increase in the corresponding variable raises the probability of adopting a flexible regime. However, interpreting the estimated coefficients is difficult, because the effect of a change in an explanatory variable on the likelihood of choosing a particular regime depends on the value of the coefficient and on the realization of the explanatory variable itself. To facilitate the interpretation, Table 6 also reports the marginal effects of a change in each explanatory variable on the probability of choosing a fixed and an intermediate official exchange rate regime. These marginal effects are measured by the first-order partial derivatives of the probabilities with respect to the variable in question and evaluated at the sample mean of each variables.¹⁴ Since the marginal effects for all three regimes must sum to zero, the marginal effect of each variable on the probability to adopt a flexible rate can be obtained as minus the sum of the two marginal effects reported in Table 6.

Consider the determination of official regimes, first. The upper half of Table 6 suggests that the macroeconomic fundamentals considered by optimum currency area theory provide some guidance of the choice of exchange rate regimes. Openness to foreign trade increases the likelihood of adopting a fixed exchange rate regime. Specifically, countries whose openness is 10 percent larger than the sample mean are three percent more likely to adopt an official peg than the “average country.” We do not find a significant impact of geographical concentration of trade as suggested by theory; however, openness to the EU reinforces the effect of openness on the choice of official regimes, and this variable may pick up some of the effect of trade concentration as well, as the EU is the main trading partner for many of the countries in our group. An increase

in openness to the EU by ten percent above the sample mean raises the likelihood of a fixed-rate regime, after accounting for its non-linear effect, by a net of 14.8 percent. As suggested by theory, a high degree of commodity concentration in foreign trade increases the likelihood of adopting a flexible-rate regime. The table shows that an increase in the commodity concentration of trade by 10 percent above the sample mean leads to a decrease in the probability of a fixed rate regime by 14 percent and in the probability of an intermediate regime by 11.2 percent, respectively. Contrary to conventional wisdom, large countries in our sample are more likely to adopt a fixed rate, while the CIS countries have a significant tendency to prefer flexible rates. The latter result may be due to the fact that their main trade partner from the past, Russia, suffered from severe monetary instability during the sample period, which made a peg to the ruble unattractive.

As expected, financial sector development, measured by the ratio of broad money to GDP, increases the likelihood of choosing a flexible exchange rate. The availability of foreign exchange reserves clearly favors the adoption of a fixed rate or an intermediate regime. Finally, the fiscal balance appears with a positive and significant parameter. This implies that a growing deficit ($FISCAL < 0$) is associated with a growing likelihood of choosing a fixed-rate regime. An increase in the fiscal deficit relative to GDP by one percent above the mean raises the likelihood of a fixed-rate regime by 2.55 percent and the likelihood of an intermediate regime by 2.03 percent. This may reflect efforts to use the exchange rate constraint as a way to impose discipline on fiscal authorities that might otherwise pressure the central bank into monetizing deficits and creating inflation (Tornell and Velasco (2000)). We do not find a significant impact of inflation or cumulative inflation differentials on the choice of the exchange rate regime, suggesting that pegging the exchange rate to stabilize inflation did not play a large role among our group of countries in the 1990s. These results are consistent with our analysis in von Hagen and Zhou (2002). The model's predictive performance is quite satisfactory.

Turning to the model for the de-facto exchange rate regimes, we note, first, that the traditional fundamentals, geographical concentration, openness, commodity trade concentration, and financial sector development contribute little to the observed choices. Only openness to the EU remains significant as before, suggesting that countries trading a lot with the EU have a stronger tendency to adopt a de-facto peg. Increasing trade openness to the EU by one percent above the sample mean raises the

likelihood of a de-facto fixed rate by 1.6 percent. The reduced specification of the model suggests that large countries in our sample have a stronger tendency to adopt a de-facto float, a result that is in line with conventional international macroeconomic predictions. A high degree of exchange rate pass-through raises the likelihood of a de-facto peg, which is consistent with our priors. In contrast to its effect on official regimes, a growing fiscal deficit raises the likelihood of adopting a more flexible de-facto regime. An increase in the budget deficit relative to GDP by one percent increases the likelihood of adopting a de-facto float by 1.41 percent.

Neither inflation nor cumulative inflation differentials have a significant impact on the choice of the exchange rate regimes. Thus, combating inflation seems to have played a much smaller role in the determination of these choices than conventional wisdom suggests. Table 6 also reports the correlation between the error terms of the two equations as $\rho = 0.37$ and statistically significant. This indicates that the two choices are positively correlated and confirms that they should be analyzed jointly. Overall, the predictive performance of the model seems quite satisfactory, as it “predicts” about two thirds of the in-sample regime choices correctly for each regime separately, and about half of joint choices of official and de-facto regimes.

4. A Model of Regime Discrepancies

4.1 A Univariate Probit Model for Regime Discrepancies

Although the bivariate probit model can explain the determination of both official and de facto exchange rate regimes and, therefore, is able to predict regime discrepancies implicitly, it does not allow us to investigate the quantitative influence of the explanatory variables on the likelihood of regime discrepancies in a straightforward way. For this purpose, we now derive a univariate probit model for regime discrepancies.

The difference between the indices for official and de facto exchange rate regimes yields a direct measurement of regime discrepancies, $Z_{it} = Q_{it} - Y_{it}$. By definition, Z_{it} is an integer between -2 and +2, with $Z_{it} = -2$ indicating the strongest deviation towards de facto pegging and $Z_{it} = 2$ the strongest deviation towards de facto floating. We adopt an ordered choice probit model to explain the regime discrepancies measured by this index. Let Z_{it}^* be a country's latent variable indicating the desired degree of regime discrepancy. When Z_{it}^* is very large, the country will prefer a de facto regime far more flexible than the official regime; while Z_{it}^* is very small, a de facto regime much more rigid than the official regime will be adopted. For intermediate variables of Z_{it}^* , the de

facto regime will be consistent with or deviate only slightly from the official one. This leads us to five ordered choices of regime discrepancy:

$$\begin{aligned}
Z_{it} &= -2 \text{ if } Z_{it}^* \leq 0, & Z_{it} &= -1 \text{ if } 0 < Z_{it}^* \leq d_1, & \text{"fear of floating"} \\
Z_{it} &= 0 \text{ if } d_1 < Z_{it}^* \leq d_2, & & & \text{consistent} \\
Z_{it} &= 1 \text{ if } d_2 < Z_{it}^* \leq d_3, & Z_{it} &= 2 \text{ if } Z_{it}^* > d_3, & \text{"fear of pegging"}
\end{aligned} \tag{2}$$

Here $d_1 < d_2 < d_3$ are positive thresholds, and the lowest threshold is normalized to zero. In the actual estimations presented below we combine the cases with $Z_{it}=1$ and with $Z_{it}=2$ into one broader category, since the number of observations with $Z_{it}=2$ is very small. Thus, we need to estimate only the thresholds d_1 and d_2 .

Given the model in (1a)-(1c), the latent variable for regime discrepancies is:

$$Z_{it}^* = Q_{it}^* - Y_{it}^* = X_{2it}\beta_2 - X_{1it}\beta_1 + u_{2it} - u_{1it} = X_{it}\beta + u_{it}, \tag{3}$$

where X contains all explanatory variables, \hat{a} is the coefficient vector, and the composite error term, $u=u_2-u_1$, is i.i.d. normal.¹⁵ Based on the indication rule, it is straightforward to formulate the likelihood function and estimate the parameters.

However, direct ML estimation of (3) is inefficient, since it does not fully exploit the information contained in the observation of the official regime, Y_{it} , about the error term. For example, if an official fixed-rate regime has been declared, $Y_{it} = 0$, the de facto regime can not be more rigid than the official one and $Z_{it}^* < d_1$ ($Z_{it} < 0$) is excluded from the set of possible regime discrepancies. Similarly, $Z_{it}^* > d_2$ ($Z_{it} > 0$) is impossible, if the official regime is already the most flexible one, $Y_{it} = 2$. Thus, the conditional expectation of $E(Z_{it}^*|X_{it}, Y_{it})$ is different from the conditional expectation of $E(Z_{it}^*|X_{it})$, which would otherwise be the basis for estimating the parameters \hat{a} in equation (3). This is in turn due to the fact that the conditional expectation of $E(u_{it}|X_{it}, Y_{it}) = E(u_{it}|Y_{it}) = (p-1)E(u_{1it}|Y_{it}) \neq 0$. For the last inequality, it can be shown (Maddala (1983)) that

$$E(u_{1it}|Y_{it}=0)=E(u_{1it}|u_{1it}-X_{1it}\hat{a}_1) = -\phi(-X_{1it}\hat{a}_1) / \Phi(-X_{1it}\hat{a}_1), \tag{4a}$$

$$E(u_{1it}|Y_{it}=1)=[\phi(-X_{1it}\hat{a}_1)-\phi(c_1-X_{1it}\hat{a}_1)] / [\Phi(c_1-X_{1it}\hat{a}_1)-\Phi(-X_{1it}\hat{a}_1)], \tag{4b}$$

$$E(u_{1it}|Y_{it}=2)=E(u_{1it}>c_1-X_{1it}\hat{a}_1)=\phi(c_1-X_{1it}\hat{a}_1) / [1-\Phi(c_1-X_{1it}\hat{a}_1)]. \tag{4c}$$

Generally, the conditional expectations, $E(u_{1it}|Y_{it})$, will not be zero. They can be obtained from an estimate of the parameters $\hat{\alpha}_1$ and the likelihood function. Given (4a)–(4c), we rewrite the model in equation (3) as follows

$$\begin{aligned} Z_{it}^* &= X_{it}\hat{\alpha} + (\tilde{n}-1)E(u_{1it}|Y_{it}) + \hat{a}_{it}, & \text{or equivalently,} \\ Z_{it}^{**} &= Z_{it}^*/\hat{\sigma} = X_{it}(\hat{\alpha}/\hat{\sigma}) + \hat{\alpha}\hat{\sigma}_{j=0,1,2}D_{jit}E(u_{1it}|Y_{it}=j) + \hat{a}_{it}/\hat{\sigma}. \end{aligned} \quad (5)$$

Here \hat{a}_{it} is a disturbance with conditional mean $E(\hat{a}_{it}|Y_{it}, X_{it})=0$ and a standard deviation of $\hat{\sigma}$. D_j is a dummy for official regime j , which takes a value of unity when official regime j is adopted, and zero if not. The coefficient for D_j is $\hat{\alpha}=(\tilde{n}-1)/\hat{\sigma}$. Note that the other coefficients are estimable only to an unknown proportionality.

To interpret equation (5), note that the conditional expectation $E(u_{1it}|Y_{it})$ is a measure of the inappropriateness of the observed official exchange rate regime given the realization of $X_{1it}\hat{\alpha}_1$. To see this, assume that we observe $X_{1it}\hat{\alpha}_1 > c_1$. From equation (1a), we should expect a floating-rate regime. Suppose that we observe an intermediate regime, i.e., $Y_{it} = 1$, instead. From (4b), we can infer that the random term u_{1it} must be sufficiently negative to induce this choice. If the observed official regime were a fixed-rate one, $Y_{it} = 0$, u_{1it} must be even more negative than that. Thus, $E(u_{1it}|Y_{it})$ is a measure of the discrepancy between the predicted official regime given the explanatory variables contained in X_1 and the observed official regime. In equation (5), $\hat{\alpha} < 0$ indicates that the discrepancy between the actual and the official regime responds negatively to discrepancy between the observed and the predicted official regime. Thus, if the observed official regime is more flexible than the predicted one, $E(u_{1it}|Y_{it}) > 0$, we should expect $Z_{it}^* < 0$, i.e., the actual regime is more rigid than the observed official one. In other words, “fear of floating” prevails, when a country officially adopts a flexible exchange rate, although the explanatory variables contained in X_1 indicate that a peg is the appropriate regime. Thus, deviations of the de-facto from the official regime partially correct the discrepancies between the observed and the predicted official regime. Such a pattern would emerge if changes in the official regime are more costly from the point of view of the policy maker than changes in the de-facto regime, and the latter is used to react to temporary fluctuations in economic conditions or gradual changes in the fundamentals determining the choice of the official regime. Such a pattern is consistent with the findings reported in section 2, i.e., that official regimes change less frequently and in larger steps and are more persistent than de facto regimes.

4.2 Empirical Results

Table 7 reports our estimates of the ordered choice model for regime discrepancies. Recall that a positive coefficient for a variable means that higher values of this variable raise the probability of observing a case where the de facto regime is more flexible relative to the official arrangement. As before, we report the marginal effects of a change in each variable on the likelihood of observing cases of strong “fear of floating” ($Z=-2$), intermediate “fear of floating” ($Z=-1$), and consistent regimes ($Z=0$). These marginal effects are again calculated at the sample means of all explanatory variables. As before, all right-hand-side variables except the CIS dummy are instrumentalized using past values.

A first, important result from Table 7 is that the conditional expectation $E(u_{1it}|Y_{it})$ appears with a strongly significant, negative coefficient. As discussed above, this indicates that countries use their de-facto regimes to compensate, in part at least, differences between the observed and the predicted official regime. The marginal effects show that this influence on the de-facto regime choice is quite strong.

We find that openness pushes the regime discrepancy into the positive direction, although the coefficient is only marginally significant. In contrast, the influence of trade exposure to the EU is stronger and significant. Here, the marginal effects are particularly telling. They indicate that increasing trade exposure with the EU pushes the “average” country in the direction of a consistent regime. That is, countries with little trade with the EU are more likely to exhibit “fear of floating.” Similar results hold for the effects of economic size, measured in terms of GDP, and the availability of foreign exchange reserves. The latter indicates that transition countries tend to adopt fixed exchange rates and make their de facto regimes consistent with that if reserves are sufficiently available. In contrast, rising commodity concentration of trade and a rising degree of exchange-rate pass-through both increase the likelihood of finding cases of “fear of floating.”

The strongest impact on the likelihood of regime discrepancies comes from fiscal deficits. Here we see that rising deficits ($FISCAL < 0$) strongly reduce the likelihood of “fear of floating” and raise the likelihood of “fear of pegging” instead. This confirms our earlier finding that countries move to a tighter official and a weaker de-facto exchange rate constraint in the presence of large fiscal deficits. Finally, we now also find a significant impact of the cumulative inflation differential. Specifically, large and rising

cumulative inflation differentials induce countries to choose a more flexible exchange rate policy than the one officially announced.

5. Summary and Conclusions

Several recent studies have pointed out that official and de facto exchange rate regimes often differ in practice. While documenting these discrepancies, the existing studies do not attempt to provide an empirical answer to the obvious question, why countries choose different official and de facto regimes. This is the purpose of the current paper. We have presented an empirical study of the choices of official and de facto exchange rate regimes of 25 transition countries during the 1990s. We have shown, first, that regime discrepancies are frequent among these countries. Furthermore, official regimes are more persistent and change in less frequent but larger steps than de facto regimes. This is consistent with the notion that official regime changes carry a fixed cost that exceeds the cost of changing the de facto regime, and that countries use the latter as a policy instrument to adjust their exchange rate policy to macro economic developments earlier and faster than they respond with their official regime.

Our empirical analysis has presented a bivariate discrete-choice model for the official and the de-facto exchange rate regime. Official regime choices seem to be guided significantly by the conventional wisdom of international macro economics. Thus, we find that more open countries are more likely to adopt more rigid exchange rate regimes, countries with a high degree of commodity concentration in international trade are less likely to do so, and countries more strongly exposed to trade with the EU are also more likely to choose a peg as the official regime. In addition, we find that countries with more developed monetary systems are more likely to adopt an official floating-rate regime. Increasing availability of foreign exchange reserves and increasing fiscal deficits both raise the likelihood of adopting an exchange rate peg. The latter suggests that monetary authorities tried to impose some discipline on fiscal policies by subjecting themselves to the constraint of a fixed exchange rate.

The choice of de-facto regimes, in contrast, seems to be much less guided by macro economic fundamentals such as openness and the commodity structure of international trade. As before, we find that trade exposure to the EU increases the likelihood of choosing a peg. We also find that large countries are more likely to choose a de-facto float than small countries. There is a stark difference, however, in the impact of fiscal deficits between official and de-facto regime choices. Rising fiscal deficits

strongly push the choice of the de-facto regime towards a more flexible one. Combined with the earlier result for official regimes, this means that countries with large fiscal deficits are likely to exhibit strong “fear of pegging”, i.e., a more flexible de facto regime than the official one.

Next, we develop a discrete choice model of regime discrepancies to explain deviations between the official and the de-facto regimes more directly. A first result of interest here is that regime discrepancies respond to the inappropriateness of the observed official regime. Specifically, if a country’s official regime is too rigid as suggested by our discrete choice model, its de-facto regime is likely to be more flexible than its official one. Conversely, if a country’s official regime is too flexible, its de facto regime is likely to be more rigid than the official one. Thus, the widespread observation of “fear of floating,” where countries adopt de-facto pegs although they declare themselves officially to have floating exchange rates, reflects cases where the underlying fundamentals contained in our model favor a more rigid exchange rate regime than that actually adopted. Such a pattern could arise, if the underlying fundamentals gradually develop in a way favoring fixed exchange rates, or if countries preferring exchange rate pegs are reluctant to declare official pegs because of reputational constraints and the fear of being exposed to speculative attacks.

Table 6: Bivariate Ordered Probit Model for the Joint Determination of Official and De Facto Exchange Rate Regimes

Variables	(1)		(2)		Marginal Effects	
	Coeff.	t-ratio	Coeff.	t-Ratio	Fixed	Intermediate
<i>Official Regimes</i>						
OPENNESS	-1.49	-3.16	-1.41	-3.02	0.30	0.24
OPENTOEU	-7.95	-1.74	-8.24	-2.25	1.76	1.41
OPENTOEU ²	12.47	2.64	13.00	3.23	-2.78	-2.22
GDP	-0.38	-2.92	-0.39	-2.94	0.08	0.07
COMCON	5.95	2.39	6.54	3.08	-1.40	-1.12
MONEY	2.66	3.24	2.71	3.43	-0.58	-0.46
PASSTHRU	-0.95	-1.09				
RESERVE	-1.56	-3.98	-1.57	-4.07	0.34	0.27
FISCAL	11.30	2.61	11.91	2.89	-2.55	-2.03
GDPGROWTH	1.81	0.71				
CISDUMMY	2.40	3.52	2.33	3.61	-0.43	-0.27
Constant	0.16	0.08	-0.20	-0.16		
Upper Threshold	0.85	5.91	0.84	5.93		
<i>De Facto Regimes</i>						
OPENNESS	-0.56	-1.40				
OPENTOEU	-2.45	-0.86	-4.67	-2.01	1.63	-0.78
OPENTOEU ²	3.53	1.27	4.91	1.88	-1.72	0.82
GDP	0.12	1.28	0.23	3.01	-0.08	0.04
COMCON	-1.06	-0.74				
MONEY	0.82	1.02				
PASSTHRU	-1.39	-1.78	-1.31	-1.74	0.46	-0.22
RESERVE	-0.11	-0.63				
FISCAL	-4.47	-1.29	-7.69	-2.98	2.69	-1.28
GDPGROWTH	-0.33	-0.16				
CISDUMMY	0.74	1.30				
Constant	-0.21	-0.22	-0.38	-0.87		
Upper Threshold	0.76	6.06	0.74	6.07		
\hat{n}	0.37	2.59	0.37	2.64		
Observations	154		154			
Log-likelihood	-215.70		-218.67			
Correct pred.						
Official (%)	70.1		70.8			
De facto (%)	64.9		63.6			
Joint (%)	47.4		43.5			

Note: Statistics with *, **, or *** are significant at 10%, 5%, or 1% level, respectively.

Table 7: Determination of Regime Discrepancies

Variables	Coeff. t-Ratio		Coeff. t-ratio		Marginal effects for Z=		
					-2	-1	0
$E(u_{1it} Y_{it})$	-1.14	-7.13	-1.14	-7.18	0.33	0.11	-0.42
OPENNESS	0.58	1.56	0.55	1.52	-0.16	-0.05	0.20
OPENTOEU	2.67	0.95	2.66	0.95	-0.76	-0.26	0.98
OPENTOEU ²	-4.47	-1.61	-4.49	-1.61	1.29	0.43	-1.65
COMCON	-4.27	-2.98	-4.31	-3.01	1.24	0.42	-1.59
GDP	0.27	2.91	0.27	2.91	-0.08	-0.03	0.10
PASSTHRU	-0.98	-1.37	-0.99	-1.40	0.28	0.10	-0.37
MONEY	-0.87	-1.18	-0.90	-1.22	0.26	0.09	-0.33
RESERVE	0.92	4.68	0.93	4.75	-0.27	-0.09	0.34
FISCAL	-15.06	-4.36	-14.83	-4.45	4.46	1.44	-5.47
INFLATION	-0.33	-0.50					
CUMINF	0.20	1.90	0.17	1.90	-0.05	-0.02	0.06
GDPGROWTH	-0.79	-0.30					
CISDUMMY	-1.83	-3.34	-1.83	-3.35	0.55	0.05	-0.56
CONSTANT	1.88	1.81	1.85	1.78			
Threshold2	1.09	7.81	1.08	7.19			
Threshold3	3.38	10.76	3.36	10.86			
Observations	154		154				
Log-likelihood	-136.2		-136.3				
Correct pred. (%)	58.4		58.4				

Note: Statistics with *, **, or *** are significant at 10%, 5%, or 1% level, respectively.
The dependent variable is $Z=Q-Y$, where Q (Y) is the code for the de facto (official) exchange rate regimes. Each code takes the value of 0, 1, or 2 for fixed, intermediate, or flexible regimes, respectively.

Appendix I:

Cluster Analysis for the Classification of De Facto Exchange Rate Regimes

AI.1. Volatility Measures

We choose three volatility measures as relevant for the regime classification: volatility of exchange rates, volatility of exchange rate changes, and volatility of reserves. Volatility of exchange rates, $\sigma(e)$, is defined as the average of the absolute monthly percentage changes in the reference exchange rate during a calendar year. The reference exchange rate is the nominal exchange rate of the home currency vis-à-vis the reference currency or currencies. If the home currency is officially pegged to a single foreign currency, such foreign currency is regarded as the reference currency. In case of composite currency peg, the changes in the reference exchange rate is the weighted average of the changes in each component exchange rates. In case of horizontal bands, crawling pegs, or crawling bands, the reference exchange rates are defined in a similar way. In other cases the reference exchange rates are simply the nominal exchange rates against US dollar. Volatility of exchange rate changes, $\sigma(\Delta e)$, is defined as the standard deviation of the monthly percentage changes in the reference exchange rates. Volatility of reserves, $\sigma(r)$, is defined as the average of the absolute monthly changes in the non-gold international reserves (in US dollar), divided by the monetary base in the previous month (also in US dollar).

Data on the monthly exchange rates of the currencies of the transition countries vis-à-vis US dollar are extracted from the UNECE database kindly provided by Charles Wyplosz. The monthly exchange rates among US dollar and other reference currencies, as well as data on non-gold international reserves and on monetary base, are extracted from the IMF's *International Financial Statistics*.

AI.2. Defining Features of Regime Groups

The defining features of each de facto regimes are summarized in the following table.

Regime Groups	$\sigma(e)$	$\sigma(\Delta e)$	$\sigma(r)$
Fixed Regimes	low	low	high
Intermediate Regimes	medium	medium	medium
Flexible Regimes	high	high	low
Inconclusive Regimes	low	low	low

AI.3. Procedures of the Cluster Analysis

The whole procedure consists of five main sections: normalization of data, elimination of outliers, nearest centroid sorting, further rounds of sorting, and classification of outliers.

(I) Normalization of Data

The data is normalized by subtracting from each volatility measure the mean of this variable and then dividing the result by the standard deviation of this variable. The mean and standard deviation of each volatility variable are computed using pooled observations from all countries and over all available time periods.

(II) Elimination of Outliers

Two observations with the highest $\sigma(e)$ as well as two with the lowest $\sigma(e)$ are first eliminated as outliers. Another 4 outliers are eliminated based on $\sigma(\Delta e)$ in the same way. Finally yet another 4 outliers are singled out based on $\sigma(r)$. All together 12 outliers are eliminated from the data set. The remaining data points are subject to cluster analysis.

(III) Nearest Centroid Sorting¹⁶

We adopt MacQueen's k-means method for data sorting. Here we set k equal to four. The algorithm for sorting m data units into k clusters is composed of the following steps:

1. Choose k data units in the data set randomly as clusters of one member each.
2. Assign each of the remaining m - k data units to the cluster with the nearest centroid. After each assignment, re-compute the centroid of the gaining cluster.
3. After all data units have been assigned in step (2), take the existing cluster centroids as fixed seed points and make one more pass through the data set assigning each data unit to the nearest seed point.
4. Label each cluster according to the features listed in the above table.

(IV) Further Rounds of Sorting

For the data units classified as "inconclusive" in the previous round, re-normalize these data units, and repeat the steps in section (III) until the number of inconclusive regimes is reduced to less than 10% of m.¹⁷

(V) Classification of Outliers

Combine the results from the previous two sections and compute the centroids for each cluster. Assign the outliers to the cluster with the nearest centroid.

AI.4. Classification of the Additional Data

The additional data have observations only on exchange rates, so the volatility of reserves is not available. Based on the volatility of exchange rates and the volatility of exchange rate changes, each observation is assigned to the cluster with the shortest distance between the data point and the two-dimensional cluster centroid. This completes the classification procedures.

Appendix II: Exchange Rate Regimes in Transition Economies

Table A-1: The IMF Classification of Official Exchange Rate Regimes

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Albania	3	3	8	8	8	8	8	8	8	8
Armenia	na	na	(3)	(8)	8	8	8	8	8	8
Azerbaijan	na	na	(3)	(3)	8	8	8	8	7	7
Belarus	na	na	(3)	(3)	(7)	7	4	7	7	7
Bulgaria	3	8	8	8	8	8	8	2	2	2
Croatia	na	na	3	8	4	4	4	4	4	7
Czech Rep.	3	3	3	3	3	3	4	7	7	7
Estonia	na	na	2	2	2	2	2	2	2	2
Georgia	na	na	(3)	(8)	7	7	7	3	8	8
Hungary	3	3	3	3	3	6	6	6	6	6
Kazakhstan	na	na	(3)	(8)	8	8	8	7	7	8
Kyrgyz Rep.	na	na	(3)	(8)	8	7	7	7	7	7
Latvia	na	na	(8)	(8)	3	3	3	3	3	3
Lithuania	na	na	(8)	(8)	2	2	2	2	2	2
Macedonia	na	na	8	8	3	3	3	3	3	3
Moldova	na	na	(3)	(8)	8	8	8	8	8	8
Poland	3	5	5	5	5	6	6	6	6	6
Romania	3	7	8	8	8	8	8	8	7	7
Russia	na	na	(3)	(8)	8	4	6	6	7	8
Slovak Rep.	na	na	na	3	3	3	4	4	7	7
Slovenia	na	(7)	7	7	7	7	7	7	7	7
Tajikistan	na	na	na	(3)	(3)	8	8	8	7	7
Turkmenistan	na	na	(3)	(3)	3	7	7	3	3	3
Ukraine	na	na	(3)	(8)	8	7	7	4	4	7
Uzbekistan	na	na	(3)	(3)	(8)	7	7	7	7	7

Note: End-year observations. Codes in parentheses refer to the periods when the newly-introduced national currencies have not yet assumed the status as the sole legal tender. The meanings of the codes are: na=not available, 1=currency union (no separate legal tender), 2=currency board arrangements, 3=conventionally fixed pegs (adjustable pegs, de facto pegs), 4=horizontal bands, 5=crawling pegs, 6=crawling bands, 7=managed floating without preannounced path for the exchange rate, 8=independent floating.

Table A-2: De Facto Exchange Rate Regimes

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Albania	(1)	(3)	(3)	(1)	(1)	2	3	3	2	3
Armenia	na	na	(3)	3	3	1	1	1	1	1
Azerbaijan	na	na	na	(2)	(3)	1	1	1	0	1
Belarus	na	na	(3)	(3)	(3)	1	2	3	3	1
Bulgaria	na	(1)	(1)	(2)	1	1	3	2	1	1
Croatia	(1)	(3)	(3)	2	1	1	0	2	1	1
Czech Rep.	(2)	(1)	(1)	1	0	1	0	2	2	3
Estonia	na	na	1	1	0	0	0	1	1	1
Georgia	na	na	na	(2)	(3)	(1)	1	1	2	1
Hungary	2	1	1	1	1	1	1	1	1	1
Kazakhstan	na	na	na	na	2	1	1	1	1	1
Kyrgyz Rep.	na	na	na	(2)	(2)	1	2	1	3	1
Latvia	na	na	(2)	1	1	0	0	0	0	1
Lithuania	na	na	(3)	1	1	1	1	1	1	1
Macedonia	na	na	na	na	1	1	1	2	1	1
Moldova	na	na	3	1	1	1	1	1	1	1
Poland	1	3	3	3	1	1	1	1	2	2
Romania	(3)	3	1	1	2	2	2	1	2	2
Russia	na	na	(3)	(2)	(2)	2	1	1	3	2
Slovak Rep.	na	na	na	2	1	1	0	1	1	2
Slovenia	na	na	1	2	1	2	1	1	1	1
Tajikistan	na	na	(2)	(1)	(2)	(3)	(1)	(2)	(3)	(3)
Turkmenistan	na	na	na	na	(3)	(3)	(3)	(1)	(2)	(1)
Ukraine	na	na	na	3	3	1	1	0	3	2
Uzbekistan	na	na	na	na	(3)	(1)	(2)	(1)	(1)	(2)

Note: Codes without parentheses are de facto regimes classified by the cluster analysis methodology based on three volatility variables. Codes in parentheses are de facto regimes classified solely based on the behavior of the exchange rates without data on the reserves changes. The meanings of the codes are: na=not available, 0=inconclusive observations, 1=fixed regimes, 2=intermediate regimes, 3=flexible regimes.

Appendix III: Definitions of Variables and Data Sources

CISDUMMY: Dummy for the member countries of the Commonwealth of Independent States, including Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyz Republic, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan.

COMCON: Commodity concentration of foreign trade, measured by the Gini-Hirschman coefficient defined below. Commodities are first defined at the one-digit SITC level (0-9) to create ten broad groups and then reclassified into seven main commodity categories. Denoting exports of commodity i from country j by X_{ij} and country j 's total export by X_j , the Gini-Hirschman coefficient for country j , C_j , is defined as $C_j = \frac{1}{X_j^2} \sum_i X_{ij}^2$. Data on commodity trade are from International Trade Center.

FISCAL: General government budget balance, normalized by GDP. A positive (negative) entry denotes a surplus (deficit). Data source is IMF, *International Financial Statistics* (various issues), and EBRD, *Transition Report* (1999).

GDP: Gross domestic products in current prices, in billions of US dollars and then in logarithms. Data are from IMF, *World Economic Outlook Database*, September 2000.

INFLATION: Change in the consumer prices, annual average, transformed using the formula $x^* = x/(1+x)$. Data source is IMF, *International Financial Statistics* (various issues).

MONEY: Broad money, normalized by GDP. Broad money is the sum of "money" and "quasi-money". Data source is IMF, *International Financial Statistics* (various issues).

OPENNESS: Degree of openness to foreign economies, measured by the ratio of total trade volume to GDP. Total trade volume is the sum of goods export (f.o.b.) and goods import (c.i.f.). Trade data are from IMF, *Direction of Trade Statistics* (various issues). GDP data are from IMF, *World Economic Outlook Database*, September 2000.

OPENTOEU: Degree of openness to the EU, measured by the share of trade with the EU in total trade. Data source is IMF, *Direction of Trade Statistics* (various issues).

PASSTHRU: Pass-through effects from exchange rate depreciation to inflation, measured by the correlation coefficient between one-quarter lagged monthly depreciation rates and current monthly inflation rates. Data source is IMF, *International Financial Statistics* (various issues).

RESERVE: Ratio of non-gold international reserves to broad money. Data sources are IMF, *International Financial Statistics* (various issues), *Country Report* (various issues), and EBRD, *Transition Report* (1999).

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Endnotes

* We thank Charles Wyplosz for helping us with data.

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¹ See, among others, Heller (1978), Holden et al. (1979), Dreyer (1978), Melvin (1985), Savvides (1990), Edwards (1996), Bernhard and Leblang (1999), and Poirson (2001).

² Holden et al. (1979) and Poirson (2001) construct empirical indices of exchange rate variability and regress them on a set of explanatory variables.

³ The three transition economies included in the sample are Bulgaria, Estonia, and Lithuania.

⁴ The “inconclusive” regime refers to the cluster with low volatilities on both exchange rates and reserves. This could reflect a fixed policy regime in operation or just the absence of shocks to the foreign exchange market. For the subsequent comparisons with official regimes, these cases subsumed under fixed rate regimes, as both exhibit low volatility in the exchange rates.

⁵ We also classify de facto regimes based on just two measures: volatility of exchange rates and volatility of international reserves. The results fail to classify some observations with currency boards as either fixed or inconclusive regimes. The classification based on three volatility measures are free of this problem and will be used in the following analysis.

⁶ Levy-Yeyati and Sturzenegger (2000) use this term for countries that did not report a fixed rate as the official regime, although in practice their policy closely resembled a currency peg. Since this implies that the official label looks more flexible than the de facto regime, it is essentially the same as fear of floating. We reserve the term “fear of pegging” for cases where de facto regime is more flexible than the official one.

⁷ Based on a Chi-square test, the null hypothesis of stationarity is rejected at the 5% significance level for the official regime classification, but can not be rejected at 10% level for the de facto regime classification.

⁸ Note that the transition out of an existing regime discrepancy usually leads to consistency between official and de facto regimes. The probability of moving from a case of fear of floating to a case of fear of pegging is one percent, while the probability for a transition in the opposite direction is 20 percent.

⁹ See Appendix III for a detailed data description.

¹⁰ Except for OPENTOEU, these variables are all standard in the empirical literature. See, among others, Dreyer (1978), Melvin (1985), Savvides (1990), and Poirson (2001).

¹¹ In order to dampen the impact of some hyperinflationary episodes on the estimation, we follow Gosh et al. (1997) and transform the inflation rate (x) by $x/(1+x)$.

¹² Edwards (1996) and Poirson (2001) find strong evidence that reserve sufficiency increases the likelihood for fixed exchange rates being adopted. Meese and Rose (1998) also report some indirect evidence to this effect. Rizzo (1998) and Berger et al. (2000), however, provide some counter evidence.

¹³ Data on official exchange rate regimes are from the following sources: IMF, *International Financial Statistics* (various issues), *Exchange Arrangements and Exchange Restrictions Annual Report* (1998), and *Exchange Rate Arrangements and Currency Convertibility: Developments and Issues* (1999). For the years before 1998, we have updated the official classifications using the IMF criteria and national and IMF data sources. Currency boards and conventional fixed pegs are included in fixed rate regimes, horizontal bands, crawling pegs and crawling bands in intermediate regimes, and managed and free floats in flexible rate regimes.

¹⁴ The marginal effects of the CIS dummy are measured as changes in the relevant probability when the dummy switches from zero to unity.

¹⁵ From (1c) it can be shown that the unconditional variance of u is $2(1-\bar{\eta})$.

¹⁶ See Anderberg (1973, pp. 162).

¹⁷ The 10% threshold is an arbitrary criterion.

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ISSN 1436 - 6053

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