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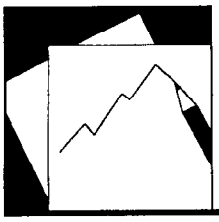

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A Model of Exchange Rate Regime Choice in the Transitional Economies of Central and Eastern Europe

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A Model of Exchange Rate Regime Choice in the Transitional Economies of Central and Eastern Europe

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Abstract

The paper develops a model of exchange rate regime choice centered on the trade-off between internal price stability and external competitiveness and allowing for institutional costs of altering exchange rate arrangements. The main implication of the model is a nonlinear relationship between the rate of inflation and the choice of regime for the next period. The model also suggests that a major inflationary shock—like the one to which all Central and Eastern European economies were subject when they allowed prices to be determined by the market—should give rise to a tightening of the exchange rate regime, followed by a gradual introduction of more flexibility as inflation subsides. A series of regressions on a sample of 13 Central and Eastern European economies yield results consistent with the hypothesis.

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I. INTRODUCTION

The choice of exchange rate regimes by Central and Eastern European (CEE) transitional economies exhibits a surprising degree of heterogeneity both across countries and over time.[2] The regimes adopted range from currency boards to an almost pure float, with fixed but adjustable rates, crawling pegs, bands, and crawling bands in between. Over the course of transition, some countries have moved toward more flexibility in their exchange rate arrangements (e.g., Poland and the Czech Republic), while others have moved in the opposite direction (e.g., Bulgaria and Bosnia).

This diversity seems surprising given the commonality of the communist legacy and the shared vision of the future—all countries in the region proclaim that they are building market economies and democratic political regimes with strong ties with (or preferably, membership in) the European Union as their goal. True, these countries are distinct in many aspects, but they hardly differ more from each other than Western European countries, which have maintained broadly similar arrangements for most of this century.

The traditional economic literature developed from Mundell's (1961) and McKinnon's (1963) seminal work on optimal currency areas does not help explain the diversity of the choices. All small and open economies, located in the same geographic region, similarly endowed with natural resources, the CEE countries should all have opted for the same regime. More sophisticated versions of the optimal currency area literature focus on the statistical distributions of various shocks (e.g., Turnovsky (1976)). The applicability of this approach to explaining the regime choice is limited since, by the very nature of transition, the countries of the region are not in steady-state positions, and the distributions of shocks cannot be considered stationary. Hence, the past offers little guidance with regard to future disturbances, so there is no relevant history that would allow one to apply this criterion.

The "new" theory of optimal currency areas, whose main advances are summarized by Tavlas (1993), offers more insights into the choices made by transitional economies. It allows for rational expectations and brings political economy into the picture. As one implication, it emphasizes the use of a fixed exchange rate as a nominal anchor in fighting inflation. This issue is very relevant for transitional economies, since price liberalization at the beginning of transition resulted in a powerful outburst of inflation and in some economies it started a wage-price inflationary spiral. Moreover, since not all regulated prices were liberalized at the same time, increases in controlled prices provided further inflationary shocks. An introduction of indirect taxes had a similar effect. In addition, the rapid economic transformation of these countries required continual relative price adjustment, which was inflationary in the presence of downward price rigidity. Finally, lax fiscal policies, in particular the support of loss-making state-owned enterprises, in some cases resulted in budget deficits financed by money creation. As a result, all

[2] Table A in the Appendix summarizes the evolution of exchange rate regimes in CEE countries.

the transitional economies confronted the issue of curbing runaway inflation, even though the extent of the problem was clearly different in different countries.

Fighting inflation requires a nominal anchor, and the choice is generally between money supply and the exchange rate. Calvo and Vegh (1999) offer an excellent survey of the issues surrounding this choice. An important advantage of the exchange rate is that it provides a highly visible, easily verifiable target, while monitoring the behavior of money supply is quite complicated. Such a visible anchor helps coordinate the expectations of price- and wage-setters around a low-inflation equilibrium. It also serves to reinforce the government's commitment to the stabilization effort, as monetary and fiscal policies inconsistent with maintaining the exchange rate target would result in a collapse of the regime on which the government has staked its credibility and consequently damage its electoral prospects. A fixed exchange rate regime facilitates the rebuilding of real money balances by economic actors, which will be demanded if the inflation rate is expected to go down. On the contrary, a reduction in the rate of growth of money supply under a money-based stabilization will leave businesses and households starving for liquidity, which will drive interest rates up and plunge the economy into a recession. Providing just enough cash at the beginning of the program (a one-time jump in the level of money supply, followed by a reduction in its rate of growth) is problematic for two reasons. First of all, the credibility of a money-based stabilization program that starts with an expansion of domestic credit will be very much in question. In addition, the unpredictability of money demand in transitional economies makes the calculation of the right amount of adjustment a highly precarious exercise, while the unstable money multiplier and underdeveloped indirect instruments of monetary policy make it difficult to meet a given target for broad monetary aggregates.

The superiority of the exchange rate anchor is by no means uncontested. Calvo and Vegh (1999) note that the choice between the two nominal anchors involves a trade-off of "recession now" (money-based stabilization) versus "recession later" (exchange-rate-based stabilization); the authors discuss both empirical evidence to this effect and conceptual reasons why this may be so. Tornell and Velasco (1995, 1998) cast doubt on the assumption that fixed exchange rate regimes impose more fiscal discipline on the government. They note that fiscal laxity will undermine a peg only after some time, forcing a discrete devaluation in the future, while under a float budget deficits financed by money creation will lead to an immediate depreciation. If the value of the domestic currency, and the overall price level, which is linked to it, affect private citizens' welfare[3] and hence their level of support for the government, the latter will face the consequences of fiscal profligacy later under a fixed exchange rate regime and may well opt for higher spending under a peg than under a float if its time horizon is sufficiently short.

In spite of these reservations, the belief in the efficacy of the exchange rate as a nominal anchor seems to have dominated the thinking of economic policymakers and external advisors at

[3] In the model of Tornell and Velasco, real money balances enter in the utility function of the representative consumer.

the outset of transition. Statements to this effect permeate such edited volumes as Williamson (1991), Barth and Wong (1994), and Sweeney et al. (1999), as well as numerous other books and articles. Floating was grudgingly recommended to countries that lacked sufficient foreign exchange reserves, where the alternative was seen to be infeasible.

On the other hand, it is well known that enlisting the support of an exchange rate anchor to fight inflation is not without problems. Most notably, the inflation rate does not drop immediately to trading-partner levels, for a variety of reasons, including imperfect credibility and explicit or implicit backward wage indexation. The result is a real appreciation of the domestic currency, which undermines the competitiveness of the country's exports and encourages imports, thus causing the trade balance and the current account balance to deteriorate and raising the question of sustainability of this type of stabilization in the long run. Indeed, the countries of the region that have chosen to peg have typically seen a deterioration in the trade and current account balances. It may be argued that restructuring and productivity growth should lead to an appreciation of the *equilibrium* real exchange rate, and that the current account deficits are comfortably financed with capital inflows. At the same time, the accounts of policy discussions in CEE countries indicate that real appreciation, loss of competitiveness, and current account deficits have been perceived as a problem, particularly in the wake of the Mexican and the Asian financial crises. Hence, having reduced inflation to moderate levels, a number of countries in the region (e.g., the Czech Republic, Hungary, and Poland) have introduced more flexible arrangements.

This paper offers a simple model of exchange rate regime determination where the trade-off between the use of the exchange rate as an anti-inflation tool and as a competitiveness tool takes center stage. While the discussions of the optimal choice of exchange rate regime abound, relatively few formal models of this choice have been developed in the literature. My model is related to those where price stability (facilitated by a fixed exchange rate) is traded off against a stimulus to the real economy that may be produced by depreciation of domestic currency.[4,5] Those models (e.g., Devarajan and Rodrik (1992); Edwards (1996)) approach the choice of exchange rate regime from the perspective of long-term optimality. The policymakers choose a

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[4] These models take root in the closed-economy literature looking at optimal conduct of monetary policy in the face of a trade-off between inflation and unemployment (e.g., Barro and Gordon (1983)). Similar trade-offs are also relevant for second-generation models of currency crises (e.g., Obstfeld (1996); Masson and Agénor (1999)). Of course, in currency crisis models the question that the authorities face is whether to devalue a fixed exchange rate rather than what exchange rate regime to choose. In addition, expectations and reaction functions of market participants play a key role in those models.

[5] There exist models that focus on different issues, such as the price-setting behavior of monopolistic producers (Devereux and Engel, 1998) or the fragility of the financial system (Chang and Velasco, 1998).

regime that will minimize the expected value of their loss function, while the economy is subject to shocks with a known probability distribution.[6] There are no linkages between periods.

A key feature of my model is a link between past inflation and the present, which comes in the form of backward wage indexation. In addition, I take a shorter-run approach in view of the fluidity of the choice of exchange rate regimes and the shortness of policymakers' horizons[7] in the economies in transition, especially in the earlier years. The regime is chosen for one period only, when past inflation is known, so the choice is optimal ex post.

My model predicts a nonlinear relationship between the inflation rate and the degree of exchange rate flexibility. The optimal degree of flexibility first increases with the rate of inflation, reflecting the concern for maintaining external competitiveness. At very high rates, however, inflation is seen as the most important problem, and the use of a fixed exchange rate as a nominal anchor is called for. A set of regressions confirms that this relationship indeed exists and is fairly robust in the data. In the recent literature a similar nonlinear relationship between inflation and exchange rate flexibility has been found for Latin America (Collins (1996); Frieden and others. (1999)). While the justification for expecting high-inflation countries to opt for a fixed exchange rate regime is the same nominal anchor argument that I use, these papers do not convert the logic into a formal model.

My model is an attempt to capture in a parsimonious form the essential features of the actual choice of exchange rate arrangements made by policymakers in the countries of Central and Eastern Europe. While the optimal regime is derived from a minimization of an explicit loss function, no direct link is made between this loss function and the welfare of the citizens of those countries. This is a positive description of the choices made rather than a normative model of what the optimal exchange rate regime should be.

While the trade-off between inflation and real appreciation is relevant for the countries in the Commonwealth of Independent States (CIS) as well, I do not see my model as adequately describing their choice of exchange rate regime. The main reason is that the model assumes consistency between the exchange rate regime on the one hand and monetary and fiscal policies on the other, and such consistency is generally lacking in the CIS countries. Moreover, an important premise of my theory—that a fixed exchange rate is used as an instrument of choice in inflation stabilization programs—is not borne out by evidence in that region. In addition to the CIS governments' inability to commit credibly to tight monetary and fiscal policies that would make a peg sustainable, important reasons for this difference between the CIS and CEE countries

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[6] Uncertainty in these models comes from terms of trade shocks.

[7] The shortness of policymaker horizons is posited because of the difficulty of political and economic forecasting far into the future during transition and because of the fairly short average tenure of governments in the countries of Central and Eastern Europe (see, e.g., EBRD (1999, Chart 5.6)).

may be the lack of a natural anchor currency for former, given their geographic location and trade patterns, and inadequate foreign currency reserves.

The paper is organized as follows. The next section introduces the model, derives the optimal choice of exchange rate regime, and discusses some comparative statics results. Then I study the dynamic implications of the model for the evolution of inflation and exchange rate regimes in the region. I discuss the limitations of the model in Section III. Empirical results along with a number of robustness checks are presented in Section IV. The last section concludes.

II. The Model

The discussion in the introductory section singles out the nominal anchor property of a fixed (or, more generally, pre-announced) exchange rate, inflation inertia, and concern about real appreciation as issues relevant for the choice of exchange rate regime in transitional economies. A parsimonious model of an open economy that highlights these features has been developed by Edwards (1993), and I take it as a foundation for my political economy model.

The structure of the economy is described by equations (1)–(6) below.

(1) $\pi_t = \alpha\pi_{Tt} + (1-\alpha)\pi_{Nt}$

(2) $\pi_{Tt} = d_t$

(3) $d_t = \phi\pi_{t-1}, \qquad 0 \le \phi \le 1$

(4) $N^D(\frac{P_N}{P_T}, Z_t) = N^S(\frac{W}{P_N})$

(4') $\eta(\pi_{Nt} - \pi_{Tt}) + \delta\, z_t = \varepsilon(w_t - \pi_{Nt}), \qquad \eta < 0,\ \delta > 0,\ \varepsilon < 0$

(5) $w_t = \gamma\pi_{t-1} + (1-\gamma)\pi_t^e, \qquad 0 \le \gamma \le 1$

(6) $\pi_t^e = \pi_t$

The economy produces two types of goods—a tradable and a nontradable commodity. Equation (1) defines overall inflation as a weighted sum of the rates of tradable and nontradable price increases. Equation (2) states that purchasing power parity holds for tradable goods. Hence, an increase in the price of tradables equals the rate of devaluation. Equation (3) defines the exchange rate regime of the country as a passive crawling peg. Parameter ϕ determines the extent to which devaluation compensates for past inflation, with ϕ=0 corresponding to a fixed exchange rate regime and ϕ=1 corresponding to real exchange rate targeting. Equation (4) states that the demand for nontradables, expressed as a function of their relative price and aggregate domestic demand Z_t, must equal the supply of nontradables, which depends upon the real product wage in that sector. Equation (4′) is obtained by differentiating Equation (4) with respect to time. Here η is the demand elasticity of nontradables with respect to their relative price; δ is the demand elasticity of nontradables with respect to aggregate demand pressures; and ε is the supply elasticity of nontradables with respect to the real product wage. Equation (5) says that the

growth rate of the nominal wage is a weighted average of past and expected future inflation, and the parameter γ captures the degree to which wage formation is backward-looking. Finally, Equation (6) reflects the assumption that inflationary expectations are formed rationally.

Equations (1) through (6) can be manipulated to obtain the following autoregressive process for inflation:

(7) $\pi_t = a\pi_{t-1} + bz_t$,

where $a = \dfrac{(\eta+\varepsilon\alpha)\phi + \varepsilon(1-\alpha)\gamma}{(\eta+\varepsilon\alpha) + \varepsilon(1-\alpha)\gamma}$ and $b = -\dfrac{\delta(1-\alpha)}{(\eta+\varepsilon\alpha) + \varepsilon(1-\alpha)\gamma}$,

$0 \le a \le 1, \qquad b > 0.$

I will not focus on aggregate demand shocks, so I set z_t=0, and (7) becomes

(7') $\pi_t = a\pi_{t-1}$.

We will also have:

(8) $\pi_{Tt} = d_t = \phi\pi_{t-1}$, and

(9) $w_t = \gamma\pi_{t-1} + (1-\gamma)a\pi_{t-1}$,

so the rate of real appreciation is

(10) $s_t = w_t - \pi_{Tt} = \gamma(1-\phi) \times \dfrac{\eta+\varepsilon}{(\eta+\varepsilon\alpha) + \varepsilon(1-\alpha)\gamma}\pi_{t-1}$.

Note that real appreciation is identified with an increase in the product wage in the tradable sector and reflects a loss of competitiveness in the international market.[8]

If ϕ=1, then a=1 and s_t=0. The inflation process has a unit root (there is no nominal anchor), and there is no real appreciation. Of course, in reality a break on inflation may be provided by policies other than a fixed exchange rate. These policies would be reflected in the z_t term.

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[8] I am following Edwards in identifying the real exchange rate with the product wage in the tradable sector (or, equivalently, with the wage in dollars). Nothing of substance would change if I defined it as the ratio of nontradable to tradable prices. With this definition, the rate of real appreciation would equal

$\tilde{s}_t = \pi_{Nt} - \pi_{Tt} = \gamma(1-\phi) \times \dfrac{\varepsilon}{(\eta+\varepsilon\alpha) + \varepsilon(1-\alpha)\gamma}\pi_{t-1}$, which is nearly identical to Equation (10).

Having ϕ=0 (credibly fixed exchange rate) is not enough to halt inflation in its tracks unless γ=0. If the wage formation process is backward-looking, inflation will not drop to zero immediately, and there will be some real appreciation.

Equations (7') and (10) describe the dynamics of inflation and real appreciation for given parameter values and the initial inflation rate. In keeping with my focus on the choice of exchange rate regime, I now make ϕ (the degree to which the exchange rate accommodates past inflation) a decision variable. I assume that the authorities minimize the following loss function:

$$(11)\quad L = \pi_t^2 + k\left(s_t - s^*\right)^2 + m\left(\phi_t - \phi_{t-1}\right)^2, \qquad k > 0, \quad m > 0.$$

This reflects an aversion to inflation, an unwillingness to have a real appreciation (and hence lose competitiveness in the tradables sector), and the cost of changing exchange rate arrangements. As is typical in the political economy literature, the loss function is assumed to be a convex function of its arguments, so that, e.g., a given increase of inflation is perceived to be more onerous if it starts from a higher base. The preferred level of inflation is zero, while the preferred rate of real appreciation is negative (s*<0)[9]. This assumption can be seen as a shortcut combining two common suppositions (e.g., Devarajan and Rodrik (1992)), namely, that real depreciation has an expansionary effect and that the government's real output target is greater than the natural rate. Changing the regime is presumed to be costly because of the status quo bias that has been well documented in the political economy literature in various incarnations (e.g., Alesina and Drazen (1991), Fernández and Rodrik (1991)). Changing an important rule by which the economy functions (and even an anticipation of such a change) introduces uncertainty and disruption in economic life, so this decision is not taken lightly. Moreover, in view of the argument that the choice of exchange rate regime has distributional consequences, an attempt to change the regime would generate resistance on the part of negatively affected groups; therefore, it is unlikely to be undertaken even by a benevolent government unless the net welfare benefit of such a change is high (Rodrik (1994)). These institutional costs are incurred regardless of the direction of the change, which explains the square term. The assumption that the cost of the exchange rate regime adjustment depends upon the magnitude of adjustment reflects the fact that marginal changes of the regime (changing the rate of the crawl or playing with the width of the band) are likely to introduce less disruption and generate less resistance than a radical switch in the regime.

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[9] One might argue that as the countries of Central and Eastern Europe are catching up in terms of income with the western world, their currencies should experience equilibrium real appreciation, and s*>0 might be a reasonable target. It should be noted, however, that the loss function is attached to a model of the economy which does not incorporate such equilibrium real appreciation. One could allow for such appreciation by assuming z_t to be positive in Equation (4). In that case inflation and real appreciation would be greater than the magnitudes given by Equations (7') and (10), respectively. Hence, s given by (10) can be seen as real appreciation on top of the equilibrium one.

The authorities choose the regime ϕ_t to minimize L taking ϕ_{t-1} and π_{t-1} as given. L is a quadratic function of ϕ_t with a positive coefficient on the square term, so it is convex in ϕ_t and the point where the derivative of L with respect to ϕ_t equals zero is the global minimum. Of course, we should also take into account that ϕ_t is only allowed to vary between zero and one. The first order condition yields the following expression:

$$(12)\quad \phi_t = \frac{\phi_{t-1} + \kappa\pi_{t-1} - (\zeta - \theta)\pi_{t-1}^2}{1 + (\xi + \theta)\pi_{t-1}^2} \quad ,$$

where

$$\kappa = -s^* \frac{k\gamma}{m} \times \frac{\eta + \varepsilon}{(\eta + \varepsilon\alpha) + \varepsilon(1-\alpha)\gamma},$$

$$\zeta = \frac{1}{m} \times \frac{(\eta + \varepsilon\alpha) \times \varepsilon(1-\alpha)\gamma}{[(\eta + \varepsilon\alpha) + \varepsilon(1-\alpha)\gamma]^2},$$

$$\xi = \frac{1}{m} \times \left[\frac{\eta + \varepsilon\alpha}{(\eta + \varepsilon\alpha) + \varepsilon(1-\alpha)\gamma}\right]^2, \text{ and}$$

$$\theta = \frac{k\gamma^2}{m} \times \left[\frac{\eta + \varepsilon}{(\eta + \varepsilon\alpha) + \varepsilon(1-\alpha)\gamma}\right]^2 .$$

$\kappa > 0,\ \zeta > 0,\ \xi > 0,\ \theta > 0.$

This is a nonlinear function of π_{t-1}. If π_{t-1}=0, then ϕ_t=ϕ_{t-1}—there is no reason to change the regime in this framework. It is obvious that when π_{t-1} is small, ϕ_t is an increasing function of π_{t-1}, while for large π_{t-1}, ϕ_t tends to a limit that is less than one and could be negative. Of course, ϕ_t<0 is not feasible; thus, for any inflation rate above a certain limit, fixing the exchange rate may be the optimal response. A bit of analysis[10] shows that the expression in (12) first increases and then decreases with π_{t-1}, so the model validates the logic of my informal argument.

Naturally, holding everything else constant, putting a greater weight in the loss function on real appreciation (increasing k) favors a more accommodative stance (higher ϕ_t), putting a

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$$\frac{d\phi_t}{d\pi_{t-1}} = \frac{\kappa - 2[(\zeta - \theta) + (\xi + \theta)\phi_{t-1}]\pi_{t-1} - \kappa(\xi + \theta)\pi_{t-1}^2}{\left[1 + (\xi + \theta)\pi_{t-1}^2\right]^2}$$

This expression is positive when π_{t-1} is small, negative when π_{t-1} is large, and it has one positive root.

greater weight on inflation (reducing both k and m) favors smaller ϕ_t, and increasing the cost of adjustment m makes the regime more sticky.

A greater degree of backward indexation of wages γ increases κ, ζ, and θ and decreases ξ. The effect on the exchange rate regime is ambiguous and depends on parameter values and initial conditions. There is no effect at zero inflation. At small rates, a higher degree of indexation will be accommodated by choosing a more flexible regime. At high rates of inflation, depending in particular on the weight assigned to external competitiveness in the loss function and on the regime in place at the moment, greater backward indexation may be offset with more aggressive pegging, may be accommodated through more flexibility, or may have no effect on the choice of regime if the choice is already at one of the extremes.

For $\gamma<1$, κ is a decreasing function of α. Hence, for low inflation (such that the quadratic terms in (12′) can be ignored), less flexibility in the exchange rate is preferred by more open economies (recall that α is the share of tradables in the consumer basket) for any given π_{t-1}. θ declines with α. How that affects the choice of regime depends on parameter values and initial conditions.[11] ξ is an increasing function of α, so the term that contains ξ contributes to making the regime less flexible for more open economies. ζ is a complicated function of α. One can show (see Klyuev (2000)) that $\frac{\partial \zeta}{\partial \alpha} < 0$ whenever $|\eta + \varepsilon\alpha| > |\varepsilon\gamma(1-\alpha)|$. The last inequality will hold except in quite closed economies with a high degree of wage indexation (low α, high γ). Therefore, the term $\zeta\pi^2_{t-1}$ in the numerator somewhat mitigates the tendency of more open economies to have more sticky exchange rates, but it acquires significance only when the inflation rate is quite high. All in all, one can expect trade openness to be associated with less exchange rate flexibility at low rates of inflation, while at higher rates the result may be reversed.

III. Dynamic Implications

In the model developed above the policymakers look only one period ahead—an assumption that could be justified by uncertainty about more remote horizons, be it uncertainty about economic developments, geopolitical developments, or simply about the chances of being reelected. It might be interesting, however, to see what kind of dynamics the model implies for inflation and exchange rate regimes over several periods if the system suffers no major disturbances. Specifically, the following experiment is performed. I fix the structure of the economy as described by Equations (1) through (6), choose a starting point (initial exchange rate regime and initial inflation), and let a sequence of governments that minimize one-period loss function (11) determine the time path of the economy, assuming there are no shocks along the way. Each government will choose the regime ϕ as in (12), given the regime and the inflation

[11] If $\phi_{t-1} + \kappa\pi_{t-1} - \zeta\pi^2_{t-1} > 1 + \xi\pi^2_{t-1}$, then higher θ will lead to less exchange rate flexibility.

rate it has inherited from the previous government, and will leave this regime and inflation determined by (7′) as a legacy to its successor.

Equations (7′) and (12) determine the time path of inflation and exchange rate rule from any point on, provided the loss function does not change and the system is not subject to any shocks. A phase diagram can be used to analyze the behavior of the system.

Inflation is stationary in two cases—when it equals zero or when the exchange rate regime parameter ϕ equals one. If ϕ_t is less than one, inflation decreases in period t.

Equation (12) can be manipulated to obtain a change in the degree of exchange rate flexibility between two periods:

$$\phi_t - \phi_{t-1} = \frac{\kappa + (\theta - \zeta)\pi_{t-1} - (\theta + \xi)p^2\pi_{t-1}\phi_{t-1}}{1 + (\theta + \xi)\pi_{t-1}^2}\pi_{t-1} .$$

The degree of flexibility does not change in two cases—when inflation is zero or along a downward sloping line

$$\phi = \frac{\kappa}{(\theta + \xi)\pi} + \frac{\theta - \zeta}{\theta + \xi}$$

Above this line, flexibility decreases over time. Below, flexibility increases (provided inflation is still above zero). The phase diagram is shown in Figure 1. If the parameter ϕ is forced to lie between zero and one, the system will end up in one of a continuum of steady states. The economy may converge to zero inflation, and then it will keep the regime at which inflation first hit zero. Alternatively, it may converge to the fully flexible regime ($\phi = 1$) and an inflation rate between zero and $\kappa/(\xi+\zeta)$.[12]

Figure 2 displays the results of simulating the dynamic path of a fictional economy described by my model. The starting point was chosen to represent a typical situation of a Central European economy at the beginning of transition—that of high inflation and a flexible exchange rate regime. The two panels present cases corresponding to two possible steady states—that of a flexible exchange rate regime at low inflation (Panel a) and that of zero inflation at an intermediate regime (Panel b). Irrespective of the eventual steady state, a notable feature of

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[12] When inflation is above zero but below $\kappa/(\xi+\zeta)$, the desired degree of exchange rate flexibility ϕ is greater than 1, so it is the constraint $0 \le \phi \le 1$ that makes this whole segment a locus of possible steady states. If this constraint is removed, possible steady states are the whole horizontal axes (zero inflation) plus the point ($\phi=1$, $\pi=\kappa/(\xi+\zeta)$). The path toward the latter steady state may look like a spiral.

transitional dynamics is a dramatic initial decrease in the degree of exchange rate flexibility, followed by a gradual increase in flexibility, while inflation decreases monotonically. This kind of dynamics fits very well the stylized description of the evolution of exchange rate regimes and inflation in a large number of Central and Eastern European countries (Koch (1997), Masson (1999)), as well as the path suggested by prominent western advisors (e.g., Sachs (1996)).

For completeness, one would like to see how the model would perform if policymakers were not assumed to be myopic. Given the nonlinearity of the solution to the one-period problem, it is impossible to obtain an analytical solution to a multi-period (even a two-period) problem. Still, a few observations may be made.[13]

Obviously, lower inflation outcome in the first period will decrease the loss function in subsequent periods. On that count, one would expect a more aggressive pegging in the first period in a multi-period setting than in a one-period setting.[14] The convexity of the regime adjustment cost would suggest that altering the regime in small steps is preferable to changing it once and for all.[15] Depending on the initial conditions, these two factors may reinforce or countervail one another—the result depending on the parameters of the model (such as the weights in the one-period loss function and the rate of time discounting) in the latter case. It is quite clear that inflation will be on a downward path. Depending on the parameters of the model, moving first toward a peg and then reverting to more exchange rate flexibility may still be the optimal path, particularly if the economy starts from a situation in which inflation is high.

IV. Discussion and Limitations of the Model

Certainly a simple model cannot capture all the complexity surrounding the issue of exchange rate policy. In this section I will try to address the most obvious questions that arise vis-à-vis the model.

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[13] As the following two footnotes attest, I am not very comfortable with this exercise, because certain assumptions—which have been made for tractability and which are innocuous in a one-period situation—may become problematic in a multi-period setting.

[14] To some extent this result is an artifact of the way the loss function is constructed. In the model, what is perceived as bad by policymakers is the rate of real appreciation rather than the level of the real exchange rate. Arguably, it is the latter that leads, for example, to current account problems and should be more of a concern. In a one-period setting there is a one-to-one correspondence between the rate and the level, but the correspondence breaks down in a multi-period setting.

[15] This result may not be very appealing intuitively.

Credibility

The model does not distinguish between credible and incredible policy announcements. The exchange rate rule is assumed to be known to the public and followed by the government. In reality, of course, public pronouncements are not always reliable, and rules are not always obeyed. The same rule (e.g., a fixed exchange rate) may be viewed with different degrees of credibility in different countries. It may also become more credible over time, as the government demonstrates in practice its readiness to stand by the rule, or less credible, as real appreciation mounts. The institutional setting and the balance of political forces may make a given regime more or less stable. The rule itself may be made more or less difficult to change (see the discussion of currency boards below), so the cost of changing a regime should not be perceived as a universal constant—it may well be country-specific, situation-specific, or regime-specific. In addition, a credible disinflation program may affect the wage-formation process, making it less backward-looking (which would correspond to reducing γ in the model). The sustainability and the credibility of an exchange rate rule depend on concurrent monetary and fiscal policies, availability of foreign financing, and a host of other factors.

While recognizing the importance of the issue of credibility, I circumvented it in my model so that I could focus in a tractable way on the central point of my argument—a conflict between the internal and external balance, or the trade-off between inflation and real appreciation. The model does not emphasize the enhanced credibility of a fixed exchange rate compared with alternative regimes. Instead, this nominal anchor helps fight inflation in a purely mechanical way—by tying down the price of tradables and (through the equilibrium in the nontradable market) not letting the price of nontradables and the wage rate get too far out of hand. The regime is assumed to be perfectly credible, and aggregate demand management policies are assumed to be consistent with a given exchange rate target. I do not believe that that should bias my results in any particular way. Of course, we know that currency pegs are not 100 percent credible, and that nominally flexible regimes may not be so flexible in practice. This tells us that each category is in fact a collection of regimes differing at least in the degree of credibility, and that some regimes may be mislabeled. This makes empirical results less precise, but it should not impart a bias unless the mislabeling is systematically related to my explanatory variable—the rate of inflation.

Choice of policy rule

An important question is how one can quantify exchange rate policy to move from description to a tractable model while still reflecting the multitude of possible arrangements. The prevalent answer is to reduce the diversity to just two regimes. Most commonly, the countries are assumed to face a choice between a flexible regime and a fixed regime with (Edwards, 1996) or without (Devereux and Engel, 1998) the possibility of devaluation or abandoning the peg. Occasionally, some version of managed float is pitted against a peg, immutable or not (Collins, 1996). This dichotomy serves poorly my objective of accounting for the tremendous diversity of exchange rate arrangements in Central and Eastern Europe and tracing the evolution of exchange rate regimes within individual countries, which I read as a history of mostly marginal adjustments with occasional sharp breaks. Conceptually, I much prefer a continuous measure of

exchange rate regime, even though for an empirical implementation I will have to go to a cruder scale.[16]

The question still remains, of course, whether this particular continuous variable is an adequate representation of exchange rate regime. The policy variable ϕ was defined as a fraction of the previous period's inflation that the monetary authority was willing to accommodate through devaluation. Certainly, no country formulates its foreign exchange policy by announcing its ϕ. The actual choices may include using foreign currency as legal tender; introducing a currency board; announcing a peg to a foreign currency or a basket of currencies in a less rigid way; announcing a crawling peg with a particular rate of crawl; specifying a fluctuation band; combining the latter two arrangements in a crawling band; a managed float without specifying (or committing to) an exchange rate target; and an independent float.[17] One would hardly dispute associating ϕ=0 with a peg or a currency board. A value of ϕ between zero and one can be thought of as describing a crawling peg. Of course, in the actual crawling pegs the rate of crawl is specified directly rather than as a fraction of past inflation, but the correspondence is fairly close. One just has to be careful not to interpret a reduction in the rate of crawl as inflation declines as a change in regime. What crawling pegs attempt to achieve is to provide a nominal anchor (pre-announced path of the exchange rate) to focus inflationary expectations while accommodating inflation inertia. What differentiates crawling pegs is how aggressive they are in their anti-inflationary stance, which means how small the rate of crawl is relative to inflation registered in the past.

The correspondence between the model and reality is much looser when one brings wide currency bands or floating regimes into the picture. In the model, the path of the exchange rate is always pre-announced. In the discussion, I have associated higher values of ϕ with greater degree of flexibility. The logic for this assignment is that in the real world (at least in transitional economies during the initial stabilization), a lower degree of exchange rate flexibility is typically associated with a tougher stance on inflation, at the risk of allowing real appreciation. In the model, this stance is conveyed by a lower ϕ.

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[16] For most authors the problem is just the opposite—the available characterization of exchange rate regimes is too detailed for them, and they have to decide how to aggregate across categories in order to create a dichotomous measure for testing their theories.

[17] This categorization corresponds to current IMF classification of exchange rate regimes. Independent float is different from pure float (which is not practiced anywhere in Central and Eastern Europe) in that it allows for foreign exchange interventions by monetary authorities as long as these interventions are directed at smoothing fluctuations in the exchange rate rather than establishing a target for it. Obviously, exchange rate regime classification does not constitute a complete characterization of monetary policy framework.

Aggregate demand management

In the original Edwards (1993) model, inflation could be brought down without using the exchange rate as a nominal anchor. Instead, the authorities could suppress aggregate demand, which would be reflected in a negative z_t term in equation (7). My neglect of this term amounts to assuming that countries that pre-announce the path of the exchange rate conduct policies consistent with maintaining this path. In addition, given my interpretation of ϕ as a degree of exchange rate flexibility, I am presuming that countries that opt for a flexible regime do not try to bring inflation down through other means.

Certainly neither of the assumptions is true in every case, but individual deviations would be captured in the error term, and I do not expect the deviations to have a systematic pattern. First of all, for reasons noted in the introduction, money-based stabilization programs have rarely been attempted in Central and Eastern Europe. Slovenia may be a major exception, but even in that country the exchange rate was not allowed to float freely. Secondly, it has been noted that among the transitional economies of Central and Eastern Europe, those with more sound fiscal policies tended to adopt a pegged exchange rate (Begg, 1998). Regardless of whether the reason for that correlation is that less disciplined countries realized that exchange rate pegs would not be sustainable and did not even try to launch such an infeasible regime, or whether the story of a fixed exchange rate tying government's hands has some validity, this fact allows me to use the exchange rate regime as a sufficient statistic for government policy and reduces the decision making of the government to a uni-dimensional problem. On the other hand, it is extremely important to ascertain which story is the right one before attempting to formulate the government's problem, since if the decision concerning the choice of exchange rate regime is driven by the state of public finances, rather than the other way around, this would impose a constraint on the government that is not recognized in my model. Romania may be a case in point. It is a high-inflation country that should have embarked on an exchange-rate based stabilization program according to my model, but it has continually been unable to muster the necessary macroeconomic discipline, which in particular has been reflected in a sorrowful state of public finances. One may easily question institutional capacity in other Southern European countries. Still, on the whole, in Central and Eastern Europe macroeconomic policies appear to be relatively consistent and governance is adequate compared to countries further east, where the application of my model would seem to be unwarranted.

Currency boards

One would be right to argue that a currency board is a type of exchange rate regime quite different from a simple peg. The principal difference is the degree of institutional commitment to maintaining the peg and the consequent difficulty of changing the regime, which is much greater under a currency board. This translates into an empirical fact that currency boards are much more stable than other regimes. In particular, no country in Central and Eastern Europe has ever

evoked this arrangement.[18] My model would handle an introduction of a currency board, which follows an episode of high inflation, as decreasing the rate of crawl ϕ to zero and a rise in the cost of changing the exchange rate regime m. A sharp increase in m is a natural way in my model to capture what is special about a currency board—the institutional difficulty of changing this arrangement, which will generate, albeit somewhat tautologically, the persistence of such a regime (both in real life and in my model). What the model does not explain is why some countries choose ordinary pegs in the face of high inflation while others go all the way to currency boards.

V. Empirical Analysis

The purpose of this section is to demonstrate the validity of my model by comparing its predictions with the actual behavior of exchange rate regimes. I use panel data for the years 1990–98 for 13 Central and Eastern European transitional economies: Albania, Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia, Poland, Romania, Slovakia, and Slovenia. This exhausts the list of countries in the region for which adequate data are available. The year 1990 is taken to be the starting year of the economic transformation in the region. Before that the developments were mostly on the political front and centered on demonopolizing political power and gaining de facto independence from the Soviet Union. The foreign exchange regimes were largely unreformed, and currencies were not convertible. Of course, not all of the countries existed in 1990, so for them the series start with independence.

The most serious conceptual difficulty to overcome when testing my model against the data is finding an appropriate proxy for the dependent variable. The first conceptual peril, as discussed above, is to associate the policy parameter ϕ in my model with the degree of exchange rate flexibility. Once this leap of faith is made, the remaining steps are classifying the existing regimes into a number of categories and arranging the categories in the order of increasing flexibility.

I mostly rely on the IMF's publications to classify exchange rate regimes. The monthly issues of *International Financial Statistics* feature a table of exchange rate arrangements. Until 1999, this classification contained three categories relevant for Central and Eastern European economies: pegged to a currency or a basket of currencies; managed float; independent float. I use the IMF classification as of December 31 of a given year and assign the value of 0, 1, or 2, respectively, to the dependent variable for the three regimes. The variable increases with the degree of flexibility, and I run both OLS and ordered logit regressions.

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[18] Currency boards have been established in Estonia (1992), Lithuania (1994), Bulgaria (1997), and Bosnia (1998). Lithuania pegs its currency to the US dollar, while the three other countries peg to the deutsche mark. Bosnia is not included in the regression analysis below for lack of adequate statistical information.

This classification is quite coarse, and I have constructed an alternative coding for the dependent variable based on my reading of the IMF's reports on *Exchange Arrangements and Exchange Restrictions*, as well as on the Economist Intelligence Unit's *Country Profiles* and *Country Reports*. The coding, in the order of increasing flexibility, is: 0 – currency board; 1 - peg; 2 – crawling peg; 3 – band; 4 – crawling band; 5 – managed float; 6 – independent float. This classification is essentially the format currently used in the *International Financial Statistics*. While this classification scheme is much richer than the first one, its disadvantage is that the coding has been done by the author and hence may reflect some subjective bias. In any case, the two variables are highly correlated, and the empirical results turn out to be quite similar.

In recent years it has become increasingly popular to characterize the de facto exchange rate regime on the basis of observing actual movements in the exchange rate and other macroeconomic variables (e.g., Poirson, 2001). While I certainly agree with the tenor of this approach, the practical implementation is greatly complicated, as one needs to account not only for variation in the exchange rate but also for the developments in the external and internal environment that may exert pressure on the exchange rate and for the multitude of ways of defending exchange rate parity (reserve intervention in the spot market; forward sales; interest rate defense; capital controls). I do not think that attempts to combine all these factors into one measure have been successful.

My main explanatory variables are the lagged value of the dependent variables, the rate of inflation, and inflation squared. The model suggests a nonlinear relationship between these and the dependent variable. Estimating a nonlinear equation presents high demands on the data and is hardly justified since the exact functional form depends on the specification of the loss function and is unlikely to be robust. The main message that I take from the model is that the desired degree of exchange rate flexibility first increases and then decreases with inflation, and that the exchange rate regimes are "sticky" and are not readily changed. The spirit of the model will be retained by simply putting a linear combination of the three explanatory variables on the right hand side.

Of course, the parameters of the economy and the weights in the loss function may change from country to country. Smaller foreign reserves would make a country more wary about real appreciation, so k in the loss function increases, or s^* becomes more negative, or both, and the country will prefer a more flexible regime for any given rate of inflation. Similarly, higher unemployment may increase the target for output growth and make a country more averse to real appreciation, which would translate into a more flexible arrangement. More engagement in international trade corresponds to a greater α in the model. As the analysis indicates, at low levels of inflation a country heavily involved in trade will favor a fixed exchange rate regime, but it may prefer more flexibility when the inflation rate is high and when a fixed exchange rate would lead to a loss of competitiveness. To test this hypothesis, total trade (exports plus imports) as a share of GDP is included in the regression as a separate variable and interacted with inflation.

Tables 1 and 2 give summary statistics for the sample that I use in my baseline regression. The data for all non-categorical variables come from the *International Financial Statistics* of the IMF. As we can see, all three exchange rate regimes distinguished by the IMF are almost equally represented in the sample, with independent floating occurring somewhat less frequently than the two other options. The countries in the region trade a great deal with the outside world. There is considerable variation within the sample in the level of international reserves, which ranges from very low to quite high magnitudes, no matter which variable (M1, M2, imports, GDP) is used as a scale. The unemployment rate also varies considerably.

Given the prominent role that inflation plays in the model, I give more detailed information on that variable in Table 3. The mean inflation rate in the sample is 68.1 percent per year, which is quite high. At the same time, the median inflation in the sample is much lower, 22.5 percent. The mean is drawn to the right by relatively rare occurrences of very high inflation.

Table 4 shows an association between foreign exchange regime and the rate of inflation in a previous year. A simple picture does not emerge from this table. All three regimes may have originated from low, moderate, or high inflation. Apparently, the countries in the intermediate category had the lowest inflation in the past. Mean and median inflation were lower in the countries that later chose a fixed regime than in those that chose an independent float. At the same time, the highest yearly inflation in the sample (as well as the second highest) gave rise to a peg. One can also note that variation in inflation rates is very large among the countries that subsequently adopted a currency peg, while it is quite small among the countries that chose a managed float.

This way of looking of the data, however, disregards the issue of institutional rigidity, as it does not take into account the persistence of exchange rate regimes. Table 5 shows the transition matrix, each cell giving the number of cases corresponding to certain past and present regimes. The persistence of regimes is immediately obvious. What is also interesting is the circumstances under which a given regime did or did not change.

The intermediate regime—managed floating—looks very stable. Only two transitions out of this regime are reflected in the table, of which only one is real—the Romanian switch from a managed to an independent float in 1992. The transition from a managed float to a fixed regime reflects a reclassification by the IMF in 1997 of the Latvian informal peg to the SDR. There was no actual change in the regime. On the other hand, the apparent stability may be misleading, as it results in part from the coarseness of classification. Managed floating in the original IMF classification (as opposed to the one used since 1999) is a very broad concept that includes quite different arrangements (including crawling pegs, horizontal bands, crawling bands, and the current, narrow definition of managed floating), and marginal changes in these arrangements as well as switching between the arrangements would not be captured as a regime change under this classification. It is noteworthy that the range of variation in inflation in the countries that kept managed floating is much narrower than in any other situation. As I have already noted, the only country on a managed float with very high inflation, Romania in 1992, was forced to abandon the regime.

Countries with both high and low inflation have managed to keep a fixed exchange rate regime. There is little surprise about low inflation. The countries with high inflation in that cell are mostly those that had fixed their exchange rates at the outset of a stabilization program in the early years of transition and managed to stay with their regime for more than a year. The exchange rate was typically devalued before fixing, which on the one hand built in a temporary cushion against real appreciation (which explains why, contrary to my theory, these high and moderate inflation countries did not abandon their pegs), but on the other hand contributed to subsequent inflation. The most striking example is Poland, which pegged its zloty to the U.S. dollar on January 1, 1990 and managed to keep the peg until May 1991, despite inflation of 555 percent in 1990.

On the other hand, real appreciation did take its toll, and Poland was forced to devalue in May 1991, and then switched its currency regime to a crawling peg in October 1991. This is characteristic of the four other instances of switching from a peg to a managed float regime[19]—the switch happened in the face of balance of payment difficulties of varying degrees. At the same time, real appreciation has not always eventually led to abandoning a fixed exchange rate regime. Most notably, currency board countries have kept their arrangements in spite of growing real appreciation and huge current account deficits.

The two switches from a fixed regime to independent floating occurred in Albania in 1992 and in Bulgaria in 1991.

A few exceptions notwithstanding, the countries that have kept an independent float are mostly moderate and high inflation countries.

The countries that have made a switch from an independent float to a fixed exchange rate are high inflation countries. In fact, these countries—Lithuania in 1994 and Bulgaria in 1997—went all the way to introducing currency boards.

As is indicated by the table, four countries initially on an independent float decided to tackle their inflation problem through less resolute means: by introducing a managed float. It should be noted that both Croatia in 1994 and Macedonia in 1995 strove to maintain the value of their currencies constant against the deutsche mark, and the Latvian transition in 1995 again represents a reclassification of the actually fixed exchange rate regime, so this cell may be overblown at the expense of the one right above it.

After this cursory look at the data, my next step is to proceed to formal analysis. Given the nature of the dependent variable, I use the ordered logit model. I mostly rely on the IMF classification of the exchange rate regime (as opposed to my classification) to make sure the results are free from subjectivity bias. A number of robustness checks are discussed.

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[19] Romania in 1991, Hungary in 1995, the Czech Republic in 1997, the Slovak Republic in 1998.

The ordered logit regression results are summarized in Table 6. My baseline regression (Column 1) includes inflation, inflation squared, and dummies for lagged regime. There is a considerable degree of stickiness in exchange rate regime choice, as indicated by a large and highly statistically significant coefficient on the lagged dependent variable.

The idea of a nonlinear relationship between the inflation rate and the degree of exchange rate flexibility is confirmed by the regression—both coefficients have predicted signs and are highly statistically significant. The pseudo *R*-squared of 56 percent is fairly decent for such a parsimonious specification.[20]

The partial relationship between inflation and the degree of exchange rate flexibility, as given by the baseline regression, peaks at the inflation rate of 300 percent per year. When inflation is lower, the relationship is positive: the probability of choosing a fixed regime diminishes and the probability of choosing an independent float rises if the rate of inflation increases ceteris paribus. In this range, external competitiveness is the dominant concern. Above 300 percent per year, more inflation is more likely to be followed by a tightening of the exchange regime—internal stability comes to center stage, and the exchange rate is used as a nominal anchor.

Table 7 shows how the regime would be chosen if inflation and previous regime were its only determinants. As we can see, at low inflation the regime is likely to remain unchanged,[21] while at very high inflation a peg becomes the preferred alternative. While these outcomes comply with my theory, the cutoff points are higher than what I had expected. At the same time, this table traces quite well the experiences of high inflation countries,[22] as demonstrated by Table 8. The table accurately predicts Romania's drift from a peg to a managed float and to an independent float, Lithuania staying with its independent float, Poland staying with a peg, and Bulgaria switching to a fixed regime after its hyperinflation. In the cases of Albania in 1991 and Bulgaria in 1993, the model predicts a move from a fixed regime to managed floating, while the countries actually moved all the way to independent floating; these are the only discrepancies between predicted and actual outcomes.

When added to the baseline, the other control variables enter the regression with expected signs. The coefficient on the ratio of international reserves to M2 is negative and statistically significant. Economies with higher unemployment choose to have more flexible regimes, but the

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[20] Adding the two inflation terms to a regression of regime on the two previous regime dummies increases the pseudo *R*-squared by 17 percentage points and log likelihood by 16 units..

[21] The right-hand side of the regression equation at zero inflation is just below the high cutoff point (and well within estimation errors) when the previous regime is an independent float, so 16.1 in the bottom right cell of the table is statistically indistinguishable from zero.

[22] Arbitrarily defined here as countries having inflation over 200 percent per annum.

quantitative effect is quite small and statistically significant only at the 20 percent level. Openness to trade does not seem to be a major factor affecting the choice of exchange rate regime. The coefficient on trade is negative, and the coefficient on the interaction term between trade and inflation is positive, which is consistent with the model, but neither coefficient is statistically significant. Throughout these exercises, the coefficients on previous regime dummies, inflation, and inflation squared change fairly little and retain high statistical significance.[23]

I report a large number of robustness tests in Klyuev (2000). Here I will address what I perceive is the most important problem with the regressions: the potential endogeneity of my explanatory variables. In particular, inflation can certainly be affected by the choice of the exchange rate regime; this is both common wisdom and an empirical regularity, as well as an important premise of my model.[24] In the model, the exchange regime is determined on the basis of what inflation was in the past, and in the data the realization of inflation (calculated on the basis of average prices in a given year and in the preceding year) antedates the realization of the regime (taken at the beginning of the next year). This timing may solve the problem of causality (unless one is willing to argue that the anticipation of what the exchange regime will be in the future is a major determinant of what inflation is now), but the estimates of regression coefficients may still be biased, since both the regressors and the dependent variable are quite persistent. The argument runs like this: a shock affecting the choice of regime in a given period will affect inflation in that period (by virtue of the influence of the regime on inflation) and the regime in the next period (since regimes are persistent). Hence, a correlation between current inflation and future regime may occur not only because current inflation affects the choice of regime for the future (the relationship I am interested in), but also because they are both affected by the past choice of regime.

This argument does not necessarily imply a bias in my results, since I explicitly control for the persistence of the regime in my regression by including a lagged value of the dependent variable. As long as the functional form is correct and the disturbances themselves are not serially correlated, the regressors (lagged regime and inflation) will not be correlated with the disturbances, so the timing resolves the problem of simultaneity. Still, it would be comforting to find an appropriate instrument for inflation that would be highly correlated with the inflation rate and arguably uncorrelated with the future choice of the regime.

I noted in the introduction that all transitional economies in the Central and Eastern Europe experienced major inflationary shocks when they liberalized their price systems. I use a change in the index of liberalization of internal markets developed by de Melo and others (1996). The index reflects the authors' judgment, informed by country reports and expert opinions, on

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[23] Change is more pronounced when trade is included in the regression because of the interaction term.

[24] See, for example, Fischer and others (1996) or Ghosh and others (1997).

the extent of liberalization of domestic prices and abolition of state trading monopolies. It ranges from zero to one, with a 0.1 gradation, and increases with liberalization. The index is available for all the countries in my sample for the years 1989–94. Since 1994, a similar index has been produced by the European Bank for Reconstruction and Development (EBRD) and published in its *Transition Reports*. The correspondence is quite close between the two indices in the only year when they overlap. Since liberalization occurred fairly early in the transition, the EBRD index of price liberalization has been virtually unchanged since 1994, so I use only the de Melo and others index and I restrict my attention to the years 1990–94. As Column 1 of Table 9 indicates, the baseline regression in this subsample looks similar to the one for the entire sample (Cf. Table 6, Column 1).

My measure of liberalization as a process (as opposed to the level of liberalization as a state) is simply the difference in the liberalization index between two consecutive years. A sharper change in this index would have a more dramatic impact on prices, so this change should be correlated with inflation. Indeed, the correlation coefficient is 0.52. To be sure, price liberalization is not the only reason for inflation, but it is an important one. On the other hand, the decision to liberalize prices is presumably independent of the exchange rate regime. Hence, this variable is a promising instrument. As my regressions include both inflation and its square, I need two instruments. I obtain a second instrument simply by squaring the change in the liberalization index.

Instrument variable estimation results are presented in the second column of Table 9. Compared with the simple regression, I lose a slight amount of explanatory power. All the coefficients still have the expected signs and remain statistically significant. The absolute values of the coefficients on the two inflation terms approximately treble. I take it as a confirmation of my story—when only the exogenous components of inflation are considered, the reaction to inflation looks even sharper.

Table 10 contains the results of fixed effects estimation. One might posit that each country has inherent characteristics that barely move over time and determine its choice of regime, and all the action I get in my regression comes from the lagged regime term, which captures these characteristics. If this were true, all my explanatory variables would have been rendered insignificant by an inclusion of country fixed effects. In fact, the nonlinear relationship between inflation and the choice of regime is still there when country fixed effects are included[25] (Table 10, Column 2). I get the same story from intra-country temporal variation that I get from the full panel.

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[25] Direct comparison of coefficient values in two logit regressions may be misleading, since the coefficients cannot be interpreted as marginal effects. Comparing the ratios of coefficients is more meaningful. One can see, for example, that the rate of inflation at which its partial relationship with regime reaches its top varies very little across the four specifications in Table 10.

Controlling for year fixed effects (Table 10, Column 3) does not change the picture. This means that the assumption that disturbances are uncorrelated across countries in a given year is not crucial. Adding both country and year fixed effects (Table 10, Column 4) still does not disturb the main message of the model.

Finally, I re-estimate the relationships above using my own codification of the degree of exchange rate flexibility rather than relying on the IMF's classification.[26] This scheme has seven gradations, which are, in the order of increasing flexibility, a currency board, a conventional peg, a crawling peg, a horizontal band, a crawling band, a managed float, and an independent float. I have assigned regimes to individual observations on the basis of the IMF's reports on *Exchange Arrangements and Exchange Restrictions* as well as *Country Reports* and *Country Profiles* by the Economist Intelligence Unit. The Pearson correlation coefficient between this and the IMF's measures of exchange rate flexibility is 0.81, and the Spearman rank correlation coefficient is 0.85.

Not surprisingly, the results are quite close to those obtained using the IMF's classification. I report these regressions in Table 11. The story on the importance of previous regime and inflation for the choice of the regime holds in this specification. The availability of foreign exchange reserves and the rate of unemployment influence the choice in the predicted way, but the former is only marginally significant and the latter is statistically insignificant. The level of trade openness does not seem to affect the choice of the regime.

The main message that I take from this regression exercise is that the nominal anchor versus the competitiveness trade-off can be traced quite well in the choice of exchange rate regimes in transitional economies. In addition, exchange rate regimes are shown to be sticky. This fact is obvious, but it is usually implicitly attributed to the stickiness of the variables underlying the choice, and the inclusion of a lagged dependent variable on the right-hand-side (motivated by institutional costs of adjustment) is rare in the literature.[27]

Other controls, such as foreign exchange reserves and the rate of unemployment, behave mostly in the predicted way. Countries with less international reserves are less likely to peg as it is more difficult for them to peg. Countries with high unemployment want more room for expansionary policies and are less willing to sacrifice flexibility for low inflation. Openness to trade does not seem to affect the choice once lagged regime and inflation are controlled for.

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[26] As I have already noted, this classification is quite close to the one currently used by the IMF. I am not claiming credit for developing this classification, but I had to do the coding according to this classification myself.

[27] I know of only one paper—Bernhard and Leblang (1999)—where this is done.

VI. Conclusion

In this paper I have developed a model of exchange rate regime determination which emphasizes the trade-off between the use of the exchange rate to promote external competitiveness and its use to promote domestic price stability. This trade-off is relevant for transitional economies, which have been subject to numerous inflationary shocks. The main implication of the model is that the relationship between the rate of inflation and the degree of exchange rate flexibility is expected to be nonlinear: a rise in inflation from a low level would call for more flexible arrangements, while an increase in already high inflation would call for fixing the exchange rate.

I have tested this hypothesis on a sample of 13 transitional economies for the years 1990-98. Ordered logit regressions confirm the main implication: the terms on inflation and its square have predicted signs and are highly statistically significant. The model has also passed a number of robustness checks, such as instrumental variable estimation, inclusion of country and year dummies, addition of other explanatory variables, exclusion of certain groups of countries, and estimation using alternative coding for the dependent variable. After controlling for inflation, exchange rate regimes have been found to be highly persistent. The propensity to fix the exchange rate is weakened by low levels of international reserves with respect to broad money and by high unemployment.

Table 1a. Exchange Rate Regime—IMF Classification

Regime	Frequency	Percent
0	30	34.88
1	33	38.37
2	23	26.74
Total	86	100.00

Note: 0–fixed; 1–managed floating; 2–independently floating

Table 1b. Exchange Rate Regime—Author's Classification

Flex	Frequency	Percent
0	13	15.12
1	16	18.60
2	8	9.30
3	3	3.49
4	4	4.65
5	20	23.26
6	22	25.58
Total	86	100.00

Note: 0–currency board; 1–peg; 2–crawling peg; 3–band; 4–crawling band; 5–managed float; 6–independent float

Table 2. Continuous Variables—Summary Statistics

Variable	Obs	Mean	Std. Dev.	Minimum	Maximum
Inflation	86	68.1	143.8	0.5	1082.6
Trade ratio	60	0.924	0.349	0.327	1.679
Unemployment	57	9.26	3.56	3.0	16.5
Res_m2	81	0.348	0.189	0.035	1.235
Res_m1	81	0.816	0.435	0.076	2.444
Res_imp	82	3.52	1.55	0.69	8.53
Res_gdp	68	0.121	0.061	0.014	0.272

Inflation–year-on-year percentage increase in the CPI
Trade_ratio–(exports+imports/GDP)
Unemployment–year average unemployment rate, percent
Res_m2–international reserves/M2, end of year
Res_m1–international reserves/M1, end of year
Res_imp–end of year international reserves in months of imports
Res_gdp–end of year international reserves/GDP

Table 3. Characteristics of Inflation in the Sample

Mean	68.13
Standard deviation	143.81
Variance	20681
Skewness	4.89
Kurtosis	31.68
Percentiles	
1%	0.5
5%	4.1
10%	5.1
25%	9.7
50%	22.5
75%	62.0
90%	154.8
95%	255.2
99%	1082.6

Four smallest observations

0.5	1.1	2.7	4.0

Four largest observations

338.5	410.2	555.4	1082.6

Table 4. Characteristics of Inflation by Subsequently Adopted Exchange Rate Regime

Inflation	Fixed	Managed Float	Independent Float
Minimum	4.2	0.5	7.8
First quartile	8.8	8.4	33.2
Median	19.8	15.9	85.0
Third quartile	29.0	26.8	154.8
Maximum	1082.6	230.6	410.2
Mean	75.0	27.8	117.1
Standard deviation	214.7	42.9	107.1

Table 5a. Transition Matrix for Exchange Rate Regimes – IMF Classification

		Previous Regime											
		Fixed				Managed Float				Independent Float			
New Regime	Fixed	27				1				2			
		4.2	18.9	40.2	555.3	8.5	8.5	8.5	8.5	72.2	577.4	577.4	1082.3
	MF	5				24				4			
		6.7	28.3	70.1	231.0	0.5	12.2	14.9	45.3	16.4	42.0	51.9	107.3
	IF	2				1				20			
		226	282.2	282.2	338.5	211.2	211.2	211.2	211.2	7.8	77.4	95.9	410.2

Note: The top number in each cell is the number of country-years in which this situation occurred. The numbers at the bottom of each cell are, left to right, the minimum, median, mean, and maximum inflation observed in each situation.

Table 5b. Transition Matrix for Exchange Rate Regimes—Author's Classification

		Previous Regime						
		0	1	2	3	4	5	6
New Regime	0	11	0	0	0	0	1	1
	1	0	15	0	0	0	1	0
	2	0	2	6	0	0	0	0
	3	0	2	0	1	0	0	0
	4	0	0	1	0	3	0	0
	5	0	0	0	2	0	15	3
	6	0	2	0	0	0	0	20

Note: 0–currency board; 1–peg; 2–crawling peg; 3–band; 4–crawling band; 5–managed float; 6–independent float

Table 6. Ordered Logit Estimation

Regressor	1	2	3	4
Reg_pr=1 dummy	4.19	4.83	3.90	4.42
	(5.10)	(4.92)	(3.81)	(3.98)
Reg_pr=2 dummy	6.67	7.37	6.36	7.94
	(6.21)	(5.91)	(4.43)	(4.53)
Inflation	0.0440	0.0329	0.0499	0.0506
	(3.97)	(2.88)	(3.52)	(1.72)
Inflation Squared	-0.0000733	-0.0000545	-0.0000830	-0.0000954
	(-3.37)	(-2.46)	(-3.03)	(-2.61)
Foreign Reserves	-	-3.81	-	-
		(-2.12)		
Unemployment	-	-	0.173	-
			(1.32)	
Trade Ratio	-	-	-	-0.842
				(-0.49)
Trade*Inflation	-	-	-	0.00923
				(0.37)
Number of Observ	86	81	57	60
Pseudo *R*-squared	0.56	0.59	0.60	0.67

Note: Dependent variable – degree of exchange rate flexibility according to the IMF.
z-statistics in parentheses.

Table 7. Ordered Logit Estimation – Predicted Distribution

		Previous Regime		
		Fixed	Managed Float	Independent Float
New Regime	Fixed	$\pi<69.2; \pi>531.6$	$\pi>633.0$	>680.5
	MF	$69.2<\pi<531.6$	$\pi<83.7; 517.1<\pi<633.0$	$\pi<16.1; 584.7<\pi<680.5$
	IF	--	$83.7<\pi<517.1$	$16.1<\pi<584.7$

Note: Regime—degree of exchange rate flexibility according to the IMF.

Table 8. Outcomes for High Inflation Countries

			Regime		
Country	Year	Inflation	Previous	Predicted	Actual
Romania	1992	211	1	2	2
Albania	1992	226	0	1	2
Romania	1991	231	0	1	1
Romania	1993	255	2	2	2
Bulgaria	1991	339	0	1	2
Lithuania	1993	410	2	2	2
Poland	1990	555	0	0	0
Bulgaria	1997	1083	2	0	0

Note: Regime—degree of exchange rate flexibility according to the IMF.

Table 9. Instrumental Variable Estimation

Regressor	1 Ordered Logit	2 IV
Previous Regime = MF	3.84	3.74
	(2.66)	(2.83)
Previous Regime = IF	5.05	6.19
	(3.41)	(4.05)
Inflation	0.0474	0.1444
	(3.20)	(2.03)
Inflation Squared	-0.0000786	-0.0002507
	(-2.79)	(-1.91)
Number of Observations	34	34
Pseudo *R*-squared	0.55	0.47

Note: Dependent variable—degree of exchange rate flexibility according to the IMF Instruments—change in price liberalization index, square of change in price liberalization index sample—1990–94 z-statistics in parentheses.

Table 10. Fixed Effect Estimation

Regressor	1 Baseline	2 Country FE	3 Year FE	4 Country and Year FE
Previous regime = MF	4.19	6.27	4.39	6.24
	(5.10)	(3.24)	(4.95)	(2.90)
Previous regime = IF	6.67	9.30	7.55	10.06
	(6.21)	(3.93)	(6.02)	(3.67)
Inflation	0.0440	0.0736	0.0425	0.0784
	(3.97)	(3.65)	(2.91)	(3.09)
Inflation squared	-0.0000733	-0.000119	-0.0000713	-0.0001285
	(-3.37)	(-3.44)	(-2.51)	(-2.79)
number of observations	86	86	86	86
Pseudo R-squared	0.56	0.71	0.59	0.73

Note: Dependent variable – degree of exchange rate flexibility according to the IMF. z-statistics in parentheses.

Table 11. Ordered Logit Estimation

Regressor	1	2	3	4
Prev. Regime=peg	4.97	4.08	5.77	4.28
	(3.77)	(3.00)	(2.91)	(3.09)
Prev. Regime=CP	6.38	5.49	7.68	5.37
	(4.37)	(3.35)	(3.20)	(3.34)
Prev. Regime=HB	9.13	8.24	10.79	8.10
	(4.97)	(4.31)	(4.61)	(3.98)
Prev. Regime=DB	7.97	7.53	9.65	7.29
	(4.80)	(4.47)	(3.65)	(4.07)
Prev. Regime=MF	9.62	9.76	11.05	8.04
	(6.06)	(5.90)	(5.07)	(4.62)
Prev. Regime=IF	13.3	13.55	15.36	12.15
	(7.31)	(6.82)	(5.09)	(5.57)
Inflation	0.0238	0.0145	0.0243	0.0224
	(2.10)	(2.15)	(1.57)	(1.63)
Inflation Squared	-0.0000413	-0.0000253	-0.0000507	-0.0000376
	(-1.87)	(-2.53)	(-2.35)	(-1.44)
Foreign Reserves	-	-2.87	-	-
		(-1.58)		
Trade Ratio	-	-	0.112	-
			(0.06)	
Trade*Inflation	-	-	0.0123	-
			(0.70)	
Unemployment	-	-	-	0.0908
				(0.86)
Number of Observ	86	81	60	57
Pseudo *R*-squared	0.49	0.53	0.53	0.45

Note: Dependent variable – author's classification of exchange rate regimes. Regressors include dummies for categories: peg; CP – crawling peg; HB – horizontal band; CB – crawling band; MF – managed float; IF – independent float. Omitted category – currency board. *z*-statistics in parentheses.

Figure 1. Phase Diagram.

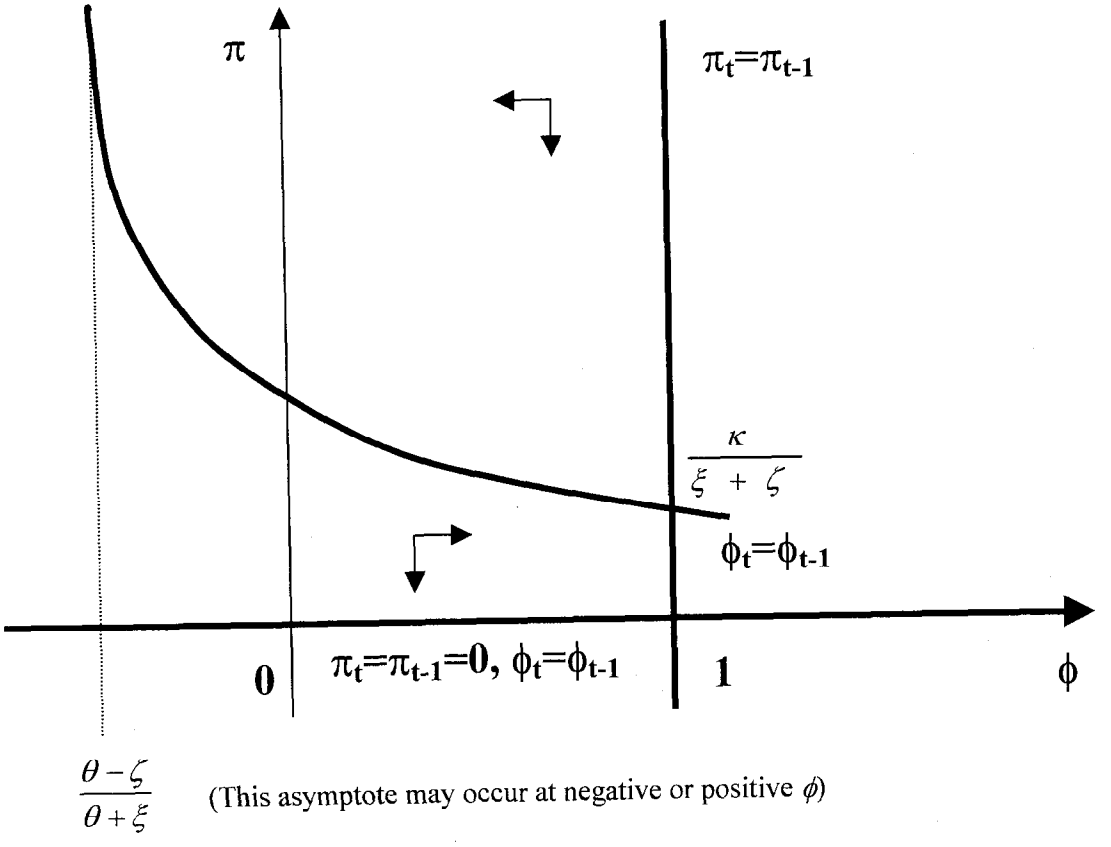

Figure 2a. Simulated Time Path. Moderate Inflation Steady State

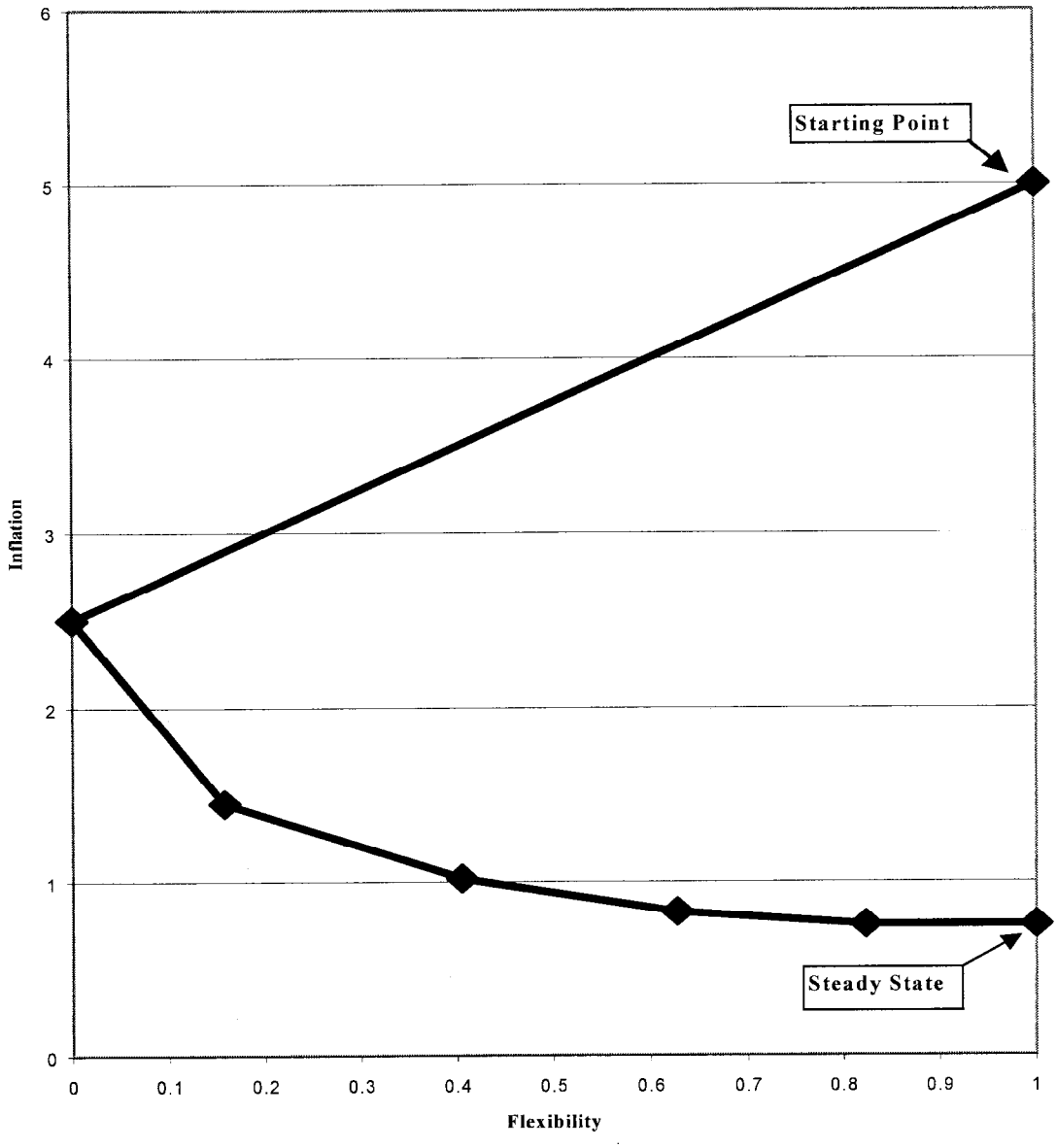

Figure 2b. Simulated Time Path. Zero Inflation Steady State

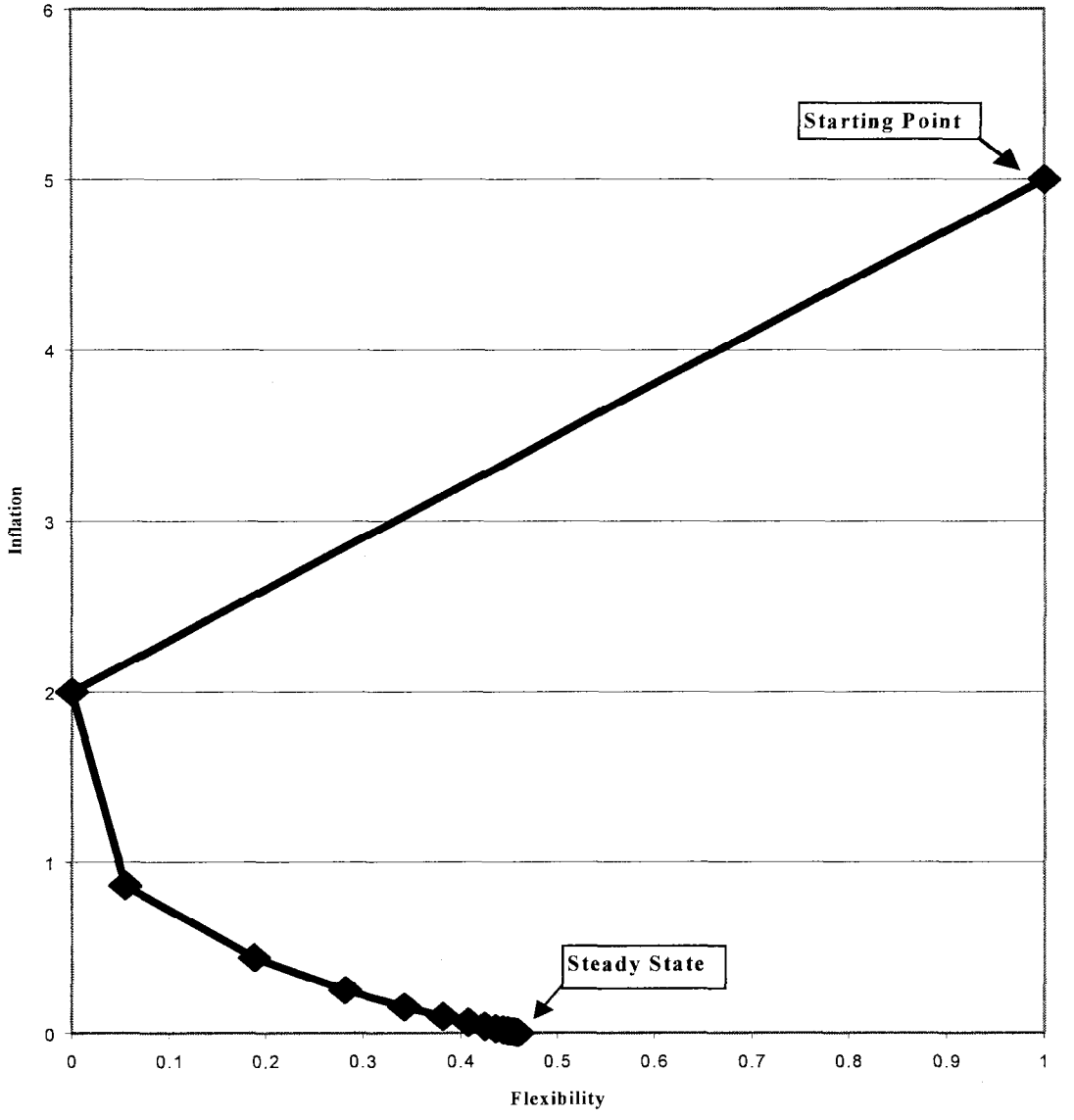

Table A. Inflation Rates and Exchange Arrangements

Country	Year	Inflation	Regime	Flex	Brief History
Albania	1992	226.0	2	6	The exchange rate for the lek is determined on the basis of supply and demand for foreign exchange.
Albania	1993	85.0	2	6	
Albania	1994	22.6	2	6	
Albania	1995	7.8	2	6	
Albania	1996	12.7	2	6	
Albania	1997	33.2	2	6	
Albania	1998	20.6	2	6	
Bulgaria	1991	338.5	2	6	The lev became internally convertible in 1991. A currency board was introduced in July 1997, pegging the lev to the DM.
Bulgaria	1992	82.0	2	6	
Bulgaria	1993	72.8	2	6	
Bulgaria	1994	96.2	2	6	
Bulgaria	1995	62.0	2	6	
Bulgaria	1996	123.0	2	6	
Bulgaria	1997	1082.6	0	0	
Bulgaria	1998	22.3	0	0	
Croatia	1993	1438.6	2	6	The exchange rate of the kuna is determined in the interbank foreign exchange market. The National Bank of Croatia may set intervention exchange rates to level undue fluctuations in the exchange rate.
Croatia	1994	107.3	1	5	
Croatia	1995	4.0	1	5	
Croatia	1996	4.3	1	5	
Croatia	1997	4.1	1	5	
Croatia	1998	6.4	1	5	
Czech Rep.	1993	20.8	0	1	The koruna was pegged to a USD/DM combination in a narrow band in 1993. The band was broadened to 7.5% in 1996. The koruna was devalued and floated in 1997.
Czech Rep.	1994	10.1	0	1	
Czech Rep.	1995	9.1	0	1	
Czech Rep.	1996	8.8	0	3	
Czech Rep.	1997	8.4	1	5	
Czech Rep.	1998	10.7	1	5	
Estonia	1992	1069.3	0	0	The kroon has been pegged to the DM in a currency board system since 1992.
Estonia	1993	89.8	0	0	
Estonia	1994	47.7	0	0	
Estonia	1995	28.8	0	0	
Estonia	1996	23.1	0	0	
Estonia	1997	10.6	0	0	
Estonia	1998	10.7	0	0	

Table A. Inflation Rates and Exchange Arrangements (Continued)

Country	Year	Inflation	Regime	Flex	Brief History
Hungary	1990	29.0	0	1	The central rate of the forint was formally pegged to a basket (whose composition varied) in 1989, but 5% fluctuations were allowed and frequent compensatory devaluations were taking place. A policy of preannounced monthly devaluations has been followed since May 1995.
Hungary	1991	34.2	0	1	
Hungary	1992	23.0	0	1	
Hungary	1993	22.5	0	1	
Hungary	1994	18.9	0	1	
Hungary	1995	28.3	1	2	
Hungary	1996	23.5	1	2	
Hungary	1997	18.3	1	2	
Hungary	1998	14.4	1	2	
Latvia	1992	243.3	2	5	Latvia gradually passed from the Russian ruble through the Latvian rublis to the Latvian lats, which became the sole legal tender in October 1993. Since February 1994, the lats has been pegged informally to the SDR.
Latvia	1993	108.8	2	5	
Latvia	1994	35.9	2	1	
Latvia	1995	25.0	1	1	
Latvia	1996	17.6	1	1	
Latvia	1997	8.5	0	1	
Latvia	1998	4.6	0	1	
Lithuania	1992	1020.5	2	5	Similar transition from the ruble through the talonas to the litas. In April 1994 a currency board was introduced, pegging the litas to the USD.
Lithuania	1993	410.2	2	5	
Lithuania	1994	72.2	0	0	
Lithuania	1995	39.7	0	0	
Lithuania	1996	24.6	0	0	
Lithuania	1997	8.9	0	0	
Lithuania	1998	5.1	0	0	
Macedonia	1993	362.4	2	6	The National Bank of Macedonia participates in the wholesale foreign exchange market to maintain the value of the denar against the DM at a level that would meet balance of payments objectives.
Macedonia	1994	130.9	2	6	
Macedonia	1995	17.6	1	5	
Macedonia	1996	3.8	1	5	
Macedonia	1997	3.6	1	5	
Macedonia	1998	1.1	1	5	
Poland	1990	555.4	0	1	The zloty was pegged to the USD in January 1990. In May 1991, the zloty was devalued and pegged to a basket. In October 1991, a preannounced crawling peg was introduced, with occasional step devaluations. The fluctuation margin was widened to 2% in March 1995, 7% in May 1995, and 10% in February 1998.
Poland	1991	76.7	1	2	
Poland	1992	45.3	1	2	
Poland	1993	36.9	1	2	
Poland	1994	33.3	1	2	
Poland	1995	26.8	1	4	
Poland	1996	20.2	1	4	
Poland	1997	15.9	1	4	
Poland	1998	11.7	1	4	

Table A. Inflation Rates and Exchange Arrangements (Concluded)

Country	Year	Inflation	Regime	Flex	Brief History
Romania	1990	4.2	0	6	The exchange rate for the leu was unified in November 1991. Still, the rationing of hard currency occurs and controls are applied to the markets for foreign exchange. Full internal convertibility of the leu was introduced on January 30, 1998.
Romania	1991	230.6	1	6	
Romania	1992	211.2	2	6	
Romania	1993	255.2	2	6	
Romania	1994	136.8	2	6	
Romania	1995	32.2	2	6	
Romania	1996	38.8	2	6	
Romania	1997	154.8	2	6	
Romania	1998	59.1	1	5	
Slovakia	1993	23.2	0	1	From July 1994 to October 1998 the koruna was pegged to a combination of the USD and the DM. The initial fluctuation band of 1.5% was widened to 3% in January 1996, 5% in July 1996, and 7% in January 1997. On Otober 2, 1998 the currency basket and the fluctuation band were abolished.
Slovakia	1994	13.4	0	1	
Slovakia	1995	9.9	0	1	
Slovakia	1996	5.8	0	3	
Slovakia	1997	6.1	0	3	
Slovakia	1998	6.7	1	5	
Slovenia	1993	31.9	1	5	The tolar has been floating since its introduction in October 1991. The central bank interferes in the foreign exchange market with the objective of stabilizing the real exchange rate.
Slovenia	1994	19.8	1	5	
Slovenia	1995	12.6	1	5	
Slovenia	1996	9.7	1	5	
Slovenia	1997	9.1	1	5	
Slovenia	1998	8.6	1	5	

Regime:
0 – fixed to a foreign currency or a basket;
1 – managed float;
2 – independent float.

Flex:
0 – currency board;
1 – peg;
2 – crawling peg;
3 – horizontal band;
4 – crawling band;
5 – managed float;
7 – independent float.

REFERENCES

Agénor, Pierre-Richard and Paul R. Masson, 1999, "Credibility, Reputation, and the Mexican Peso Crisis," *Journal of Money, Credit, and Banking*, Vol. 31, pp. 70–84.

Alesina, Alberto and Allan Drazen, 1991, "Why Are Stabilizations Delayed?" *American Economic Review*, Vol. 81, 1170–88.

Barro, Robert J. and David B. Gordon, 1983, "A Positive Theory of Monetary Policy in a Natural Rate Model," *Journal of Political Economy*, Vol. 91, pp. 589–610.

Barth, Richard C. and Chorng-Huey Wong, eds., 1994, *Approaches to Exchange Rate Policy Choices for Developing and Transitional Economies*, Washington: International Monetary Fund.

Begg, David, 1998. "Disinflation in Central and Eastern Europe: The Experience to Date," in Cottarelli, Carlo and Gyorgy Szapáry (eds.), *Moderate Inflation: The Experience of Transitional Economies*, Washington: International Monetary Fund.

Bernhard, William and David Leblang, 1999, "Democratic Institutions and Exchange-rate Commitments," *International Organization*, Vol. 53.

Calvo, Guillermo A. and Carlos A. Végh, 1999, *Inflation Stabilization and BOP Crises in Developing Countries*, NBER Working Paper 6925.

Chang, Roberto, and Andres Velasco, 1998, *Financial Fragility and the Exchange Rate Regime*, NBER Working Paper 6469.

Collins, Susan, 1996, "On Becoming Flexible: Exchange Rate Regimes in Latin America and the Caribbean," *Journal of Development Economics*, Vol. 41, pp. 117–138.

Devarajan, Shantayanan, and Dani Rodrik, 1992. "Do the Benefits of Fixed Exchange Rates Outweigh Their Costs? The CFA Zone in Africa," in Ian Goldin and L. Alan Winters (eds.), *Open Economies: Structural Adjustment and Agriculture*, Cambridge, UK: Cambridge University Press.

de Melo, Martha, Cevdet Denizer and Alan Gelb, 1996, *From Plan to Market: Patterns of Transition*, Policy Research Department Working Paper No. 1564, Washington: World Bank.

Devereux, Michael and Charles Engel, 1998 *Fixed vs. Floating Exchange Rates: How Price Setting Affects the Optimal Choice of Exchange-Rate Regime*, NBER Working Paper 6857.

European Bank for Reconstruction and Development, 1999, *Transition Report 1999: Ten Years of Transition* (London).

Edwards, Sebastian, 1993, "Exchange Rates as Nominal Anchors," *Weltwirschaftliches Archiv*, Vol. 129.

_____, 1996, *The Determinants of the Choice Between Fixed and Flexible Exchange-Rate Regimes*, NBER Working Paper 5756.

Fernández, Raquel and Dani Rodrik, 1991, "Resistance to Reform: Status Quo Bias in the Presence of Individual-Specific Uncertainty," *American Economic Review*, Vol. 81, pp. 1146–55.

Fischer, Stanley, Ratna Sahay, and Carlos Vegh, 1996, "Stabilization and Growth in Transition Economies," *Journal of Economic Perspectives*, Vol. 10, pp. 45–66.

Frieden, Jeffry, Piero Ghezzi, and Ernesto Stein, 1999, *The Political Economy of Exchange Rate Policy in Latin America*, Manuscript.

Ghosh, Atísh R., Anne-Marie Gulde, Jonathan D. Ostry, and Holger C. Wolf, 1997, *Does the Nominal Exchange Rate Regime Matter?* NBER Working Paper 5874.

Klyuev, Vladimir, 2000, *Essays on Monetary and Exchange Rate Policy in Transition Economies*, Doctoral Thesis, Harvard University.

Koch, Elmar B., 1997, *Exchange Rates and Monetary Policy in Central Europe – a Survey of Some Issues*, Working Paper 24, Austria: Austrian National Bank.

Masson, Paul R. 1999, *Monetary and Exchange Rate Policy of Transition Economies of Central and Eastern Europe after the Launch of EMU*, IMF Policy Discussion Paper PDP/99/5 (Washington: International Monetary Fund).

McKinnon, Ronald D.,1963, "Optimal Currency Areas," *American Economic Review*, Vol. 53, pp. 717–725.

Mundell, Robert A., 1961, "A Theory of Optimal Currency Areas," *American Economic Review*, Vol. 51, 657–665.

Poirson, Hélène, 2001, "How Do Countries Choose Their Exchange Rate Regime?" IMF Working Paper WP/01/ (Washington: International Monetary Fund).

Rodrik, Dani, 1994, "The Rush to Free Trade in the Developing World: Why So Late? Why Now? Will It Last?" in Stephan Haggard and Steven B. Webb (eds.), *Voting for Reform: Democracy, Political Liberalization, and Economic Adjustment*, New York, NY: Oxford University Press.

Sachs, Jeffrey D., 1996, "Economic Transition and the Exchange-Rate Regime," *American Economic Association Papers and Proceedings, American Economic Review*, Vol. .56, pp. 147–152.

Sweeney, Richard. J., Clas G. Wihlborg, and Thomas D. Willett, eds., 1999, *Exchange-Rate Policies for Emerging Market Economies*, Boulder, CO: Westview Press.

Tavlas, George, 1993, "The New Theory of Optimal Currency Areas," *World Economy*, Vol. 16, pp. 663–85.

Tornell, Aaron and Andrés Velasco, 1995, *Money-Based versus Exchange-Rate-Based Stabilization with Exogenous Fiscal Policy*, NBER Working Paper 5300.

_____, and Andrés Velasco, 1998, "Fiscal Discipline and the Choice of Nominal Anchor in Stabilization," *Journal of International Economics*, Vol. 46, pp. 1–30.

Turnovsky, Stephen J., 1976, "The Relative Stability of Alternative Exchange Rate Systems in the Presence of Random Disturbances," *Journal of Money, Credit and Banking, Vol.* 8, pp. 29–50.

Williamson, John, ed, 1991, *Currency Convertibility in Eastern Europe,* Washington: Institute for International Economics.