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AN EMPIRICAL INVESTIGATION INTO EXCHANGE RATE REGIME CHOICE AND EXCHANGE RATE VOLATILITY

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Abstract

We test a simple model of exchange rate regime choice with data for 65 non-OECD countries covering the period 1980-94. We find that the variance of output at home and in potential target countries as well as the correlation between home and foreign real activity are powerful and robust predictors of exchange rate regime choice. Surprisingly, a more volatile foreign economy can be an argument in favor of a fixed exchange rate regime once similarities in the business cycle are taken into account. Comparable results hold for a variant of the model that focuses on nominal rather than real determinants. We also look at the impact of "mistakes" in exchange rate regime choice on actual (nominal) exchange rate volatility. Countries that deviate from the model's predicted regime by choosing fixed instead of floating exchange rates generally suffer higher exchange rate volatility than other countries having a fixed exchange rate regime. We also investigate the role of such mistakes in within–sample episodes of current-account crises.

Keywords: Exchange rate regime, credibility versus flexibility, central bank independence

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1. Introduction

Few questions in international economics have aroused more debate than the choice of the proper exchange rate regime. Why have some developing countries adopted a (more or less) fixed exchange rate regime, while others have opted for more flexible systems? And why do countries change from one system to another? To be more specific: why did eighty-six developing countries (out of 100 for which this information is available) have a fixed exchange rate system in 1976, whereas in 1996 only forty-five (out of 123) had pegged their currencies (IMF 1997, p. 79)? The debate was fueled by the Asian crisis which is often interpreted as evidence against pegging.[1] However, this conclusion may be premature. The proper question to ask is not whether pegging as such is a wrong policy but whether the countries that pegged their currencies made the right choice.

In their recent survey on exchange rate systems Edwards and Savastano (1999) refer to various studies that explain the downward trend in the number of pegging countries, arguing that a flexible exchange rate system has advantages from a political-economy point of view. The switch to more flexible systems lowers the political costs of exchange rate changes.[2] Although we take political-economy considerations into account in our empirical analysis, the present paper focuses on the possibly diminishing economic advantages of a peg. Our simple theoretical model integrates the advantages of flexible and fixed exchange rates. It fits in with the modern literature on exchange rate regimes that emphasizes tradeoffs between credibility and flexibility.[3] In this literature it is stressed that a flexible regime allows a country to have an independent monetary policy, providing the flexibility to accommodate domestic and foreign shocks. A fixed exchange rate regime reduces the degree of flexibility but imparts a higher degree of credibility (Giavazzi and Pagano, 1988). In contrast to most previous studies, our model suggests that a more volatile foreign economy can be an argument *in favor* of a fixed exchange rate regime once similarities in the business cycles in both countries are taken into account.[4] The intuition behind this result is straightforward. Under fixed exchange rates, the pegging country not only loses the ability to stabilize domestic shocks, but it will also

[1] Williamson (1998) dissents from the "newly emerging consensus on the gains that developing countries will reap from moving toward 'more flexible' exchange rate regimes" (Edwards and Savastano (1999), p. 19).

[2] See, for instance, Aghevli et al. (1991), Collins (1996), Edwards (1996), Blomberg and Hess (1997) and Klein and Marion (1997). There is another line of research analyzing the economic consequences of the regime choice. A good example of this literature is Ghosh et al. (1997). Edwards and Savastano (1999) provide a survey.

[3] See, for instance, Frankel (1995) and Edwards (1996). Our analysis differs as we pay specific attention to the volatility of output in both the home country and the foreign country as well as to the correlation between the home country's and the foreign country's output shocks. A very different argument has been put forward by Tornell and Velasco (1995) who argue that an exchange rate regime can be thought of as a mechanism to allocate intertemporally the burden of the inflation tax.

[4] Collins (1996) summarizes previous literature on the choice of the exchange rate regime as follows: "countries which experience large foreign shocks should choose flexible exchange rates" (p. 118).

import monetary policy of the country to which it pegs. For a sufficiently large and positive correlation of shocks, a higher level of foreign output variance will support the choice of a fixed exchange rate regime because now foreign monetary policy is, in principle, targeting the same real shocks that haunt the home economy. Another implication of the model is that a low level of central bank independence in the pegging country also increases the advantages of pegging. Our empirical results based on panel data for 65 non-OECD countries covering the period 1980-94 support our theoretical model quite well. The variance of output growth at home and in potential target countries as well as the correlation between home and foreign real activity, and the level of central bank independence in the pegging country are powerful and robust predictors of exchange rate regime choice.

The remainder of the paper is organized as follows. Section 2 presents a simple model to analyze the choice of an exchange rate system. Section 3 contains the results of the empirical counterpart of our theoretical model. The model of exchange rate regime choice developed in Section 2 and empirically put to the test in Section 3 is based on long-term determinants. An interesting question is whether countries that chose to peg their exchange rate even though the estimated model predicts a floating exchange rate regime suffered from higher actual exchange rate volatility than others. This issue is analyzed in Section 4. We find that mistakes in institutional choice indeed matter for the actual behavior of exchange rates. The final section offers some concluding comments.

2.“To Peg or Not to Peg?” – A Simple Theoretical Model

Berger et al. (1998) present a simple model that sheds some light on the determinants of a government’s decision to peg or not to peg. The model abstracts from political-economic arguments and assumes that governments choose between exchange rate regimes in order to maximize a social welfare function.[5] Consider a small open economy in which log of output is given by a conventional Lucas supply curve

$$(1) \qquad y = \alpha(\pi - \pi^e) + \varepsilon,$$

with $\alpha > 0$ being a parameter and π and π^e denoting actual and expected inflation. The last term is the home country’s output shock with $E(\varepsilon) = 0$ and variance σ_ε^2. Inflation is interpreted as the monetary authority’s policy instrument. Expectations are formed at the beginning of the

[5] We will, however, address some political economic aspects in the empirical part of the paper. In what follows, we present an abbreviated and slightly altered version of their model.

period, that is, before the output shock is realized, while policy is determined after the shock. The model's demand side is given by a stochastic purchasing power parity condition of the form

(2) $\pi = e + \pi_F$,

where *e* is the change in the nominal exchange rate and π_F is the foreign rate of inflation controlled by the foreign country's central bank. If the foreign central bank follows a standard monetary policy program, foreign inflation will consist of a constant inflationary bias and a stochastic component due to stabilization policy. More formally, we can write: $\pi_F = \pi^* - \beta\theta$, where $\pi^* > 0$ is the inflationary bias and $\beta > 0$ is a constant. The random variable θ represents the foreign country's output shock with $E(\theta) = 0$ and variance σ_θ^2.[6] To simplify, we set $\beta = 1$. Substituting for π_F, (2) thus becomes

(2') $\pi = e + \pi^* - \theta$.

Note that *e* will perfectly compensate both changes in π^* and θ when unconstrained, leaving the home country's monetary authority free to set inflation. Fixing the nominal exchange rate, i.e. setting *e* = 0, however, will render national monetary policy endogenous.

Under *floating exchange rates*, monetary authority is delegated to the home country's central bank that acts to minimize expected deviations of output and inflation from their target levels set to $y^* > 0$ and $\pi^* = 0$, respectively,

(3) $EL_{CB} = E\left\{\lambda\left(y - y^*\right)^2 + \pi^2\right\}$,

where λ is the weight that the central bank puts on the real target. Taking into account (1) and assuming rational expectations, equilibrium inflation and output are

(4) $\pi = \lambda\alpha y^* - \frac{\lambda\alpha}{1 + \lambda\alpha^2}\varepsilon$ and

(5) $y = \frac{1}{1 + \lambda\alpha^2}\varepsilon$.

[6] Note that a more conservative and/or independent foreign central bank implies a lower π^* and a lower β. See Eijffinger and Hoeberichts (1998) for a discussion of the tradeoff between independence and conservativeness.

If the government evaluated the central bank's policy with a loss function similar to (3) but for a higher weight on the real target, $\overline{\lambda} > \lambda$, expected government welfare under a floating regime would be

$$(6) \qquad EL_{FL} = \overline{\lambda} y^{*2} + \left(\lambda \alpha y^{*}\right)^2 + \frac{\overline{\lambda}}{\left(1+\lambda\alpha^2\right)^2}\sigma_\varepsilon^2 + \frac{\lambda^2\alpha^2}{\left(1+\lambda\alpha^2\right)^2}\sigma_\varepsilon^2,$$

where the first term measures the loss from the equilibrium output being too low, the second term marks the loss from the inflationary bias, and the third and fourth terms denote losses from output and inflation volatility due to ε.

Under *fixed exchange rates* (2') reduces to

$$(7) \qquad \pi = \pi^{*} - \theta,$$

with $\pi^{e} = \pi^{*}$. Since (7) effectively determines actual inflation in the pegging country, monetary policy is now "imported" or set abroad. As a consequence, equilibrium output under rational expectations becomes a function of both the pegging country's output shock and the foreign output shock:

$$(8) \qquad y = \varepsilon - \alpha\theta.$$

From (7) and (8) expected government welfare under pegging becomes

$$(9) \qquad EL_{FIX} = \overline{\lambda} y^{*2} + \pi^{*2} + \overline{\lambda}\left(\sigma_\varepsilon^2 + \alpha^2\sigma_\theta^2 - 2\alpha\rho_{\varepsilon,\theta}\sigma_\varepsilon\sigma_\theta\right) + \sigma_\theta^2,$$

where $\rho_{\varepsilon,\theta}$ is the coefficient of correlation between ε and θ. The terms in (9) mark the losses arising from low output, imported average inflation, output volatility and inflation volatility, respectively.

Fixing the exchange rate is advantageous from the government's perspective if the expected welfare loss under the pegging regime is smaller than under the floating regime, that is if $EL_{Fl} > EL_{Fix}$. Using (6) and (9) and re-arranging yields the following inequality condition for the pegging regime to be favored over the floating regime:

$$(10) \qquad \tilde{\pi}^2 - \pi^{*2} > a\sigma_\varepsilon^2 + b\sigma_\theta^2 - c\rho_{\varepsilon,\theta}\sigma_\varepsilon\sigma_\theta,$$

with $\tilde{\pi} = \lambda\alpha y^{*} > 0$, $a = \lambda\alpha^2\,\frac{\overline{\lambda}\left(2+\lambda\alpha^2\right)-\lambda}{\left(1+\lambda\alpha^2\right)^2} > 0$, $b = 1 + \overline{\lambda}\alpha^2 > 0$, and $c = 2\overline{\lambda}\alpha > 0$.

A number of hypotheses on possible determinants of exchange rate choice can be drawn from this simple model.

(i) Credibility: A benevolent government should be more inclined to choose a pegging regime if ceteris paribus the pegging country's inflationary bias is high relative to the inflationary bias of the foreign country [LHS of (10)]. This is the possible *credibility gain* stemming from pegging to a stable foreign currency. Note that the home country's inflationary bias would be lower if monetary policy were delegated to an independent and conservative central banker. Therefore the credibility gain is a decreasing function of the independence and conservatism of the pegging country's central bank.[7]

(ii) Volatility: Whether pegging will be less or more attractive if ceteris paribus the variances of the home country's or the foreign country's output shock are increasing [first and second expression on the RHS of (10)] depends on the correlation of both shocks and the model's parameters. If $\rho_{\varepsilon,\theta} < 0$, higher volatility at home or abroad will work against a fixed exchange rate regime. The intuition is that under fixed exchange rates the pegging country not only loses the ability to stabilize domestic shocks. In addition, it will also import a monetary policy that reinforces rather than compensates such shocks (see eq. (8)). For a sufficiently large and positive $\rho_{\varepsilon,\theta}$, however, a higher σ_ε or σ_θ will support the choice of a fixed exchange rate regime because now foreign monetary policy is, in principle, targeting the same real shocks that haunt the home economy.[8] This is a possible *stabilization gain* (*flexibility*) associated with a fixed exchange rate regime identified by Berger et al. (1998).

(iii) Correlation: Imported stabilization is also behind the conjecture that fixed exchange rates are more advantageous if ceteris paribus the correlation between the home country's and the foreign country's output shocks is 'large' in the sense that $\rho_{\varepsilon,\theta}$ is positive and high or $\rho_{\varepsilon,\theta}$ is negative and small in absolute terms (last term RHS of (10)).

In Section 3 we will develop and test an empirical model incorporating these (as well as other) determinants of exchange rate regime choice.

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[7] A decrease in λ will lower the attractiveness of a pegging regime if $\partial a / \partial \lambda < 2\lambda(\alpha y^*)^2$, which will always be fulfilled as long as the initial degree of conservatism and independence of the central bank is sufficiently low. In this case the LHS of the inequality will always decrease by more than the RHS as λ is lowered. The reason is that, similar to Rogoff's (1985) argument relating to a conservative and independent central bank , the welfare gains from a lower inflationary bias outweigh the losses from higher output volatility. This net-gain under the floating regime hurts the case for fixed exchange rates.

[8] That *both* variances might work in that direction is because both increase the covariance of ε and θ. The necessary conditions are $\rho_{\varepsilon,\theta} > \sigma_\varepsilon / \sigma_\theta \cdot 2a/b$ for σ_ε and $\rho_{\varepsilon,\theta} > \sigma_\theta / \sigma_\varepsilon \cdot 2b/c$ for σ_θ.

3. The Empirical Model of Exchange Rate Regime Choice

There are, in principle, two concepts to classify exchange rate regimes. A country's *institutional* or legal exchange rate framework is captured by the data collected by the IMF. The IMF regularly compiles data about exchange rate regimes based on the information provided by its members and the IMF's own evaluation. Alternatively, a country's exchange rate regime could be evaluated by looking at *actual* or de-facto exchange rate behavior. The latter variant has the advantage of being independent of government self-declarations. But it produces rather noisy data that makes it hard to pinpoint institutional decisions based on longer-run fundamentals as described in the previous section's model. Consequently, in what follows we will focus on the institutional measure of exchange rate regime choice captured in the IMF data (see also Collins, 1996 and Edwards, 1996). We will, however, relate institutional and actual behavior of exchange rates when we look at the impact of "mistakes" in institutional choice on exchange rate volatility in Section 4.

Figure 1: Number of countries with a fixed exchange rate regime

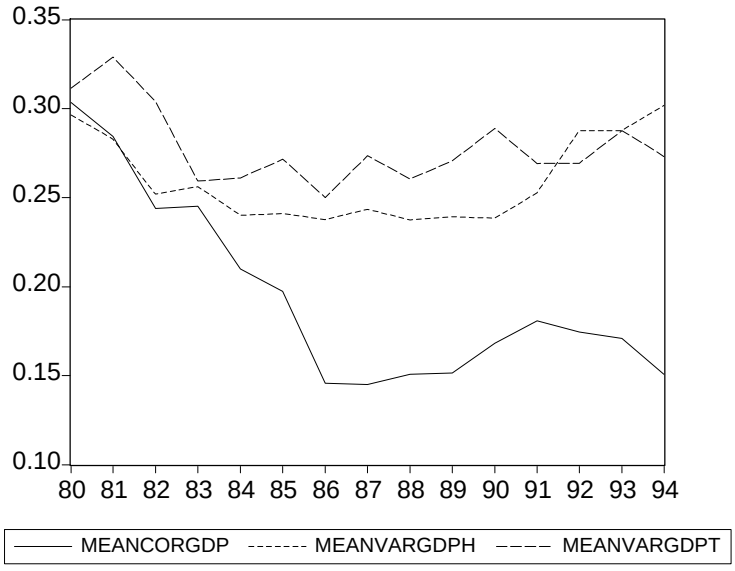
Notes: See the Appendix for the source. Displayed are the number of countries from our sample of 65 with a fixed exchange rate regime (PEGIMF = 1) from 1980 to 1994.

The variable of interest in the present section is PEGIMF. The variable is set to one if a country has fixed its exchange rate against either a single currency such as the US-dollar or a fixed-weight basket of currencies such as the IMF's special drawing rights (SDR). Alternatively, if a country's currency is floating or semi-floating according to its IFS/IMF classification, PEGIMF takes on a value of zero. For instance, Argentina's new currency board arrangement is defined as a fixed exchange rate regime while its pre-1992 exchange

rate regime was a float. While the index reduces the originally eight categories of exchange rate regimes in the IMF data to just two, it still has considerable variance.[9]

For the 65 non-OECD countries in our sample between 1980 and 1994 we have about 900 observations on PEGIMF of which 53 percent (47 percent) fall into the fixed (floating) exchange rate category. Figure 1 reveals that there is a more or less complete reversal of the ratio of fixed regimes to floating regimes. Between the early 1980s and the mid 1990s this ratio changed from about 2:1 to 1:2 as the overall number of countries with a fixed exchange rate fell. Despite the overall trend visible in Figure 1, a number of countries have gone back and forth between both regimes. The question is whether this variance can be explained by the model discussed above.

Figure 2: Some determinants of exchange rate regime choice



Notes: See text and the Appendix for a description of the data. Displayed are the cross-country sample means of the respective variables from 1980 to 1994.

Figure 2 displays the time paths of the sample mean of three of the explanatory variables suggested in Section 3. VARGDPH measures the variance of shocks to real GDP growth in a country in the ten years preceding a particular observation. The series captures the role of σ_ε^2 in equation (10). VARGDPT (i.e. σ_θ^2) captures the same information for the possible target area a country might decide to fix its currency against. CORGDP (i.e. $\rho_{\varepsilon,\theta}$) measures the correlation between shocks to real GDP growth in the home country and the

[9] We have also experimented with a somewhat broader definition of our dummy variable but this did not change

target area.[10] We give a more detailed description of the construction of these series in the Appendix. What we can learn from a casual inspection of Figure 2 is that the dynamics of these sample means have some but not a clear-cut relation to the dynamics in the number of countries choosing a fixed exchange rate (see Figure 1). For instance, the average correlation of real GDP shocks seems to be declining broadly in line with the drop in the number of pegging regimes only until the mid-1980s. To uncover the actual relationship between the institutional exchange rate regime choice both across time and across countries we need to estimate a more fully fledged econometric model.

Before we can proceed to describing the model, however, another data related issue needs to be addressed. In order to construct the variables VARGDPT and CORGDP we have to define a possible target area for the home country to peg its exchange rate to. Allocating a target area is quite straightforward if a country continuously fixed its currency via-à-vis a single other currency such as the US-dollar or a weighted average of currencies such as the SDR. In the latter case shocks are computed from the weighted average of the target area's real GDP where the weights are the ones used in the currency basket. Countries that predominantly but not always pegged to a certain currency or group of basket of currencies are treated similarly. In those cases in which countries pegged to varying areas or did not peg at all during the sample period, we have chosen as possible target areas either the SDR countries or the US depending on regional proximity and economic considerations.[11] For those countries pegging to an unknown basket of currencies, we opt to construct a composite exchange rate based on the relative shares of the three to six countries with whom they trade the most. Table A1 in the Appendix identifies all computed or historically given target areas for every country in the sample.

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most of our main results.

[10] Note that equation (10) suggests that we use the covariance rather than the coefficient of correlation. Results hardly change when we do. However, to minimize interaction between our right-hand side variables, we only present results for $\rho_{\varepsilon,\theta}$.

[11] See Table A1 in the Appendix for details. We also experimented with alternative specifications. We found the results robust with regard to such variations.

Table 1: Estimation results (dependent variable is PEGIMF; probit model with GDP shocks)

	(1)	(2)	(3)	(4)	(5a)	(5b)	(6)	(7)
Constant	-0.704**	15.583**	38.526**	20.126**	22.500**	44.830**	12.811+	34.741**
	-3.308	2.726	6.217	3.274	4.055	5.193	1.921	3.670
VARGDPH	0.746*	0.922**	0.751*	0.803*	0.291	0.638	0.580	0.556
	2.520	2.763	1.993	2.308	0.856	1.355	1.435	0.665
VARGDPT	1.150**	1.340**	2.349**	2.032**	1.886**	1.791**	2.895**	2.307**
	4.862	4.499	8.261	4.900	5.926	6.192	5.684	4.670
CORGDP	0.252	1.162**	1.183**	0.961**	0.982**	-0.147	1.184**	0.324
	1.198	4.025	4.131	2.747	2.593	-0.490	3.339	0.810
TORAVG	0.882*	2.605**	0.976	2.761**	0.018	2.382**	2.494*	3.659**
	2.113	4.065	1.154	4.366	0.025	2.599	2.099	2.880
INSTAVG		-0.160	-0.433**	-0.058	-0.295**	-0.360**	-0.205	-0.702**
		-1.507	-3.960	-0.600	-2.990	-2.915	-1.507	-3.727
LPOPAVG		-6.304**	-13.713**	-8.062**	-8.188**	-16.544**	-5.217*	-12.180**
		-3.099	-6.236	-3.619	-4.138	-5.283	-2.241	-3.668
BRIT		0.493+	1.586**	0.683*	0.607+	0.252	0.293	1.259**
		1.845	3.632	2.131	1.800	0.582	0.990	2.823
SAFRICA		0.845**	0.448+	1.963**	0.294	1.608*	0.990+	1.041+
		3.017	1.561	4.695	0.729	2.467	1.869	1.876
OPEN51			-2.638**					-2.030**
			-6.735					-3.154
GROWTH51				0.889				-1.108
				0.386				-0.245
DEBTGDP1						-0.321**		-2.776**
						-5.690		-7.615
RESMON51							-0.138	-0.359+
							-0.887	-1.952
# obs	887	877	851	859	712	712	762	582
# countries	65	65	63	63	55	55	59	50
Rho	0.765**	0.731**	0.759**	0.777**	0.756**	0.757**	0.743**	0.791**
	25.683	20.421	20.248	21.344	16.670	15.435	15.842	20.560
% correct	0.657	0.686	0.696	0.659	0.691	0.692	0.688	0.773

** Significant at a 1 percent level. * Significant at a 5 percent level + Significant at a 10 percent level
Notes: Rho is the correlation between the individual effects residual and the remainder stochastic disturbance (Rho = s(u)^2 / [s(u)^2 + s(v)^2]). In case it is insignificant the data may is not consistent with the random effects model, i.e. there may be no discernible evidence of random effects in our data.

Table 1 presents the results of random effects probit model with PEGIMF as the endogenous variable. In column (1) we regress PEGIMF on a constant, VARGDPH, VARGDPT, CORGDP, and TORAVG.[12] The model is based on 887 observations from 65

[12] Note that we do not include a variable that measures the inflationary bias of the target countries. The reason is that we did not want to mix legal and non-legal measures of central bank independence (see below). Also, the majority of possible target areas consists of industrial countries, namely the US, UK, Germany, and France. Their respective central banks have – relative to most countries in our sample – a comparably high degree of independence that hardly varies over time. Therefore indices of central bank independence in non-OECD countries may well be interpreted as measures of the size of the *relative* credibility gain associated with a pegging regime.

countries. TORAVG is the 1980-94 average of the *turnover rate* of central bank governors.[13] The long-term average of the turnover rate measures the degree of dependence of the home country's central bank from the government. Inferring from Section 2 we would expect TORAVG to have a positive impact on the probability of a country to chose a fixed exchange rate regime because a currency peg might serve as a substitute for an independent and conservative central bank.[14] CORGDP should have a positive effect on PEGIMF too, since more *synchronized business cycles* between the possible target area and the home country will bring imported monetary policy more in line with the needs of the pegging country. For VARGDPH and VARGDPT, the *variance of shocks* to GDP growth at home and abroad, our priors are less clear. However, Figure 2 suggests that on average CORGDP has been positive. This at least points towards a positive impact of both variables on the likelihood that a fixed exchange rate regime is chosen.

We find the results to be in line with these predictions. The model correctly predicts more than 65 percent of observations on exchange rate regimes. TORAVG has a positive and significant impact (at the 5 percent level marked by "*") on PEGIMF. The same holds for VARGDPH. The effect of VARGDPT on the probability that a peg is chosen is positive as well. Its impact is stronger than that of VARGDPH and significant even at the 1 percent level (marked by "**"). While the correlation between real shocks in the home country and its (possible) target area has the expected sign, it is only marginally significant in column (1). Things change, however, once we introduce standard controls for some *idiosyncratic country characteristics*. After controlling for political instability, population size, colonial heritage, and regional effects in the model presented in column (2), CORGDP shows a strong positive and significant (at the 1 percent level) influence of the probability that a country chooses a fixed exchange rate regime.[15]

As to the controls, INSTAVG, a time-invariant measure capturing a number of dimensions of political instability, and LPOPAVG, the average population (in logs), exhibit a significant negative influence on PEGIMF. It would seem that, quite intuitively, larger and politically less stable nations tend towards more flexible exchange rate arrangements. BRIT, a dummy variable that is 1 when a country was formerly a British colony, and SAFRICA, a

[13] The turnover rate (TOR) of central bank governors is widely used as a measure for central bank (in)dependence in non-OECD countries (see Cukierman, 1992, Cukierman et al., 1992 and De Haan and Kooi, 2000). We employ an entirely new data set for the TOR. See the Appendix for further details.

[14] Literally this is only correct if a central bank that becomes more *independent* from the government is also more *conservative* than the government. See Eijffinger and Hoeberichts (1998) and Berger, De Haan and Eijffinger (2000) for a discussion of the relation of central bank conservatism and independence.

dummy marking Sub-Saharan African countries, both have a positive impact of the probability of a peg and are at least significant at the 10 percent level (marked by "+").[16] A more detailed discussion of these control variables can be found in the Appendix. Adding this set of four control variables does improve the percentage of correctly predicted observations of PEGIMF, and marginally reduces the significance of including a country specific disturbance term.

In columns (3) to (7) we extend the results of column (2) by introducing a number of additional variables that, while not suggested by the simple theoretical model in Section 2, are sometimes thought to influence exchange rate regime choice. One way to interpret this exercise is as a robustness check: are the results of the basic model robust with regard to the introduction of alternative explanatory variables? A quick glance at Table 1 shows that the answer to this question is "yes". For instance, adding *openness* (OPEN51) as suggested for instance by Collins (1996) – defined as the lagged backward-looking moving five-year average of the sum of exports and imports over GDP – does not alter the results of the basic model by much (column (3)). The only change worth mentioning is that TORAVG turns insignificant on conventional levels. It does, however, keep its positive sign and still has a t-Statistic of about 1.2.

Openness itself has a negative influence on the probability of a country choosing a fixed exchange rate regime in the model (significant at the 1 percent level).[17] Collins (1996) argues that less open countries will have thinner markets for foreign exchange and that policy makers in these countries will find it more difficult to manage a flexible exchange rate system.

Another variable that might have an influence on exchange rate regime choice is *real growth*. Indeed it could be argued that a pegging regime is less attractive in extended periods of low or negative growth when loose monetary policy might promise some short-term relief (see also Collins, 1996). Column (4) follows up on that notion by adding the variable GROWTH51, the lagged backward-looking five-year moving average of real GDP growth of the home country. However, this variable has no significant explanatory power and leaves the results for the basic model more or less unchanged.

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[15] A previous study that also found some support for the view that domestic and foreign shocks influence a country's choice of exchange rate regime is Melvin (1985). However, this study does not take both variance and correlation into account.

[16] We experimented with a complete set of colonial and regional dummies, but found that only the ones used in column (2) showed a consistent and statistically strong influence on PEGIMF. SAFRICA essentially captures the CFA French franc zone. Additional results are available on request.

Additional results concerning *total external debt* are displayed in column (5b). DEBTGDP1, one-year lagged external debt denominated in foreign currency in percent of GDP, has a highly significant negative influence on a country's propensity to peg. In other words, highly indebted countries seem to prefer floating over fixed exchange rates. If some of the external funds are channeled into the private sector, either directly or, for instance, via state guarantees for bank-lending to firms, this result can be seen as supporting the banking-view of currency crises put forward, for instance, by Mishkin (1999). The argument is that a peg makes it more likely that foreign investors indulge in "excessive lending", which, in turn, will fuel a boom-and-bust cycle, eventually leading to a severe currency crisis. Since countries with high amounts of foreign denominated debt suffer more from a sudden devaluation of their currency, they should indeed be less inclined to opt for a fixed exchange rate regime.

Note, however, that this result comes amidst serious collinearity between the external debt variable and the correlation measure CORGDP. With the introduction of external debt the impact of CORGDP seems to disappear. A comparison of columns (5a) and (5b) shows that this is due to the interaction of both variables rather than to the fact that using DEBTGDP1 reduces the available sample size. In fact, CORGDP exhibits a strong negative influence on DEBTGDP1 and that relation remains significant even when other possible determinants of external debt are taken into account.[18] Therefore, perhaps an explanation of what is going on in column (5b) is that the average decline in business cycle synchronicity, which helped to explain the decline in the overall number of fixed exchange rate regimes, also inspired an inflow of external funds. This conjecture is supported by the fact that average growth rates (and real interest rates) in many of the so-called emerging market economies were relatively high compared to the OECD countries during the sample period.

Another extension of the basic model worth exploring involves hard *currency reserves*. Column (6) presents the estimated coefficients with RESMON51, the lagged backward-looking five-year moving average of international reserves in percent of base money. As with openness and real growth, the basic model is robust with regard to the additional variable. Somewhat surprisingly, however, reserves do not have a significantly positive influence on the pegging decision. This is also true for a number of alternative data specifications – for instance, using a reserves-to-GDP ratio does not provide significant

[17] Collins (1996) also found a negative effect of openness in her probit model. We get similar results for openness if we include it as a time-invariant long-run average rather than as a backward-looking moving average. Alternative results available on request.

results either. One explanation is that the legal or institutional exchange rate indicator PEGIMF mirrors long-term or medium-term decisions on the exchange rate regime well captured by our theoretically derived base model, while international reserves are a short-term determinant of such decisions.

Finally, we have added dummy variables indicating whether some kind of capital control restriction was in place.[19] Generally, the dummies had not a significant coefficient (not shown).[20]

While the various extensions of the base model raise its overall predictive power – the comprehensive model presented in column (7) correctly predicts more than 77 percent of the observed exchange rate regime choices in our sample –, the additional controls all but void the quantitative impact of the base model. For instance, the quite strong positive impact that foreign volatility and the central bank turnover rate have on the probability of a fixed exchange rate occurring are increasing when we move from column (1) to (7). Evaluated at sample means, the estimated elasticities for VARGDPH, VARGDPT, and TOR are, respectively, 0.14, 0.24, and 0.18 in column (1) and 0.06, 0.34, and 0.46 in column (7). The influence of business cycle synchronicity is quite stable across models: a one percent increase in CORGDP increases the probability that a fixed exchange rate regime is chosen by about 0.035 percent both in columns (1) and (7). The figure is only seemingly small. To put it into perspective, remember that, on average, countries in our sample were confronted with a decline in CORGDP by about 50 percent between 1980 and 1994 (see Figure 2).

Before we turn to the analysis of actual exchange rate behavior, however, we briefly discuss another robustness check of our main findings. Table 2 presents results from models mirroring those in Table 1 except for the fact that the variance and correlation variables are inflation-based and not real GDP-based. Behind this exercise lies the question of whether the standard model of monetary policy, which is at the core of the theoretical model in Section 2, is indeed a good approximation of reality. The model predicts a linear relation between real and nominal shocks both in the target area and in the home country.[21] But what if there were,

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[18] For instance, if we use an OLS model similar in structure to column (2) to explain DEBTGDP we find the coefficient for CORGDP to be a negative and significant at the 1 percent level.

[19] We have employed four dummies, indicating multiple exchange rates, restrictions on current account transactions, restrictions on capital account transactions and surrender of export proceeds, respectively. The data were kindly provided by Gian Maria Milessi-Ferretti.

[20] These findings contrast somewhat with those of Edwards (1996) who found that restrictions on capital account transactions entered significantly.

[21] More specifically, from the model in Section 2 it follows that $\sigma_\theta^2 = \sigma_{\pi_F}^2$, $\sigma_\varepsilon^2 = \left(\frac{1+\lambda\alpha^2}{\lambda\alpha}\right)^2 \sigma_\pi^2$, and $\rho_{\varepsilon,\theta} = \rho_{\pi,\pi_F}$.

for instance, non-additive control errors involved in monetary policy that would distort these relations? In this case a prudent test of the hypotheses developed in Section 2 should indeed rely on inflation-based rather than on output-based variables.

Table 2: Estimation results (dependent variable is PEGIMF; probit model with inflation shocks)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	0.143	18.645**	58.561**	8.432+	25.174**	5.569	32.905**
	0.730	4.435	8.478	1.646	3.760	1.029	3.567
VARDCPIH	-1.613	-2.518	-10.460	-6.305+	-0.807	8.242	-0.201
	-0.418	-0.757	-1.462	-1.720	-0.185	1.381	-0.013
VARDCPIT	1.014**	1.051**	0.552**	0.894**	1.180**	0.941**	1.281**
	8.190	6.690	3.948	6.167	8.407	6.605	3.997
CORDCPI	0.924**	1.147**	1.208**	1.056**	1.045**	1.493**	1.259**
	8.751	9.329	9.707	7.548	6.154	7.086	3.359
TORAVG	-0.828*	2.397**	3.072**	2.316**	-0.199	3.618**	0.956
	-2.324	3.151	5.390	3.359	-0.231	5.355	0.920
INSTAVG		-0.578**	-0.459**	-0.646**	-0.183	-0.427**	-0.428*
		-6.444	-4.867	-6.369	-1.626	-4.007	-1.990
LPOPAVG		-7.198**	-21.232**	-3.370+	-9.268**	-2.666	-11.592**
		-4.827	-8.650	-1.893	-3.885	-1.378	-3.565
BRIT		0.252	1.136**	1.174**	0.635	0.567*	1.539*
		0.913	4.165	4.037	1.591	2.197	2.252
SAFRICA		0.639*	2.947**	0.431	1.663**	0.729+	2.331**
		2.001	6.642	1.308	3.933	1.651	2.969
OPEN51			-3.000**				-1.625
			-6.572				-1.207
GROWTH51				-0.513			4.974
				-0.193			0.656
DEBTGDP1					-0.368**		-3.389**
					-6.306		-4.762
RESMON51						-0.380**	-0.208
						-5.004	-0.945
# obs	850	850	827	834	692	741	597
# countries	65	65	63	63	55	59	50
Rho	0.791**	0.805**	0.831**	0.855**	0.720**	0.799**	0.853**
	33.677	25.423	28.608	37.488	15.308	21.199	19.586
% correct	0.560	0.665	0.690	0.616	0.697	0.665	0.705

** Significant at a 1 percent level. * Significant at a 5 percent level + Significant at a 10 percent level
Notes: Rho is the correlation between the individual effects residual and the remainder stochastic disturbance (Rho = s(u)^2 / [s(u)^2 + s(v)^2]). In case it is insignificant the data may is not consistent with the random effects model, i.e. there may be no discernible evidence of random effects in our data.

In the light of these considerations, it is re-assuring that the results listed in Table 2 are very much in line with those in Table 1. Again we find that a more volatile foreign economy (VARDCPIT – see the Appendix for details) as well as a higher synchronicity of business cycles (CORDCPI) has a significantly positive influence on the probability that a fixed exchange rate is chosen. However, the influence of a more volatile home economy (VARDCPIH) on the pegging decision is less clear in Table 2 than in Table 1. In most columns the variable is not significantly different from zero. A lower degree of central bank

independence (i.e. a high TORAVG) remains significantly positively related to PEGIMF except for column (1) where the controls for idiosyncratic country characteristics are excluded. As for the extensions, we find again that openness and external debt have a significantly negative effect on the likelihood of a fixed exchange rate regime being chosen. Interestingly, the interaction between CORDCPI and DEBTGDP1 does not lead to a insignificant coefficient for the correlation measure in Table 2. We also find that, in contrast to Table 1, in Table 2 international reserves (RESMON51) have a statistically significant negative impact on PEGIMF. The dummy variables for the existence of capital controls had (again) no significant effect (not shown). The quantitative impact of the base model presented in Table 2 are broadly comparable with the results in Table 1, too. A notable exception is the somewhat bigger role that CORCPI plays compared to CORGDP. Evaluated at sample means, a one percent increase in CORCPI increases the probability of choosing a fixed exchange rate regime by about 15 percent in column (1) and 18 percent in column (7) of Table 2. All in all, however, the main message of Table 2 is that the results concerning the basic model are very much comparable with the findings presented above.

A final issue is the possible endogeneity of our right-hand-side variables. It certainly helps that our empirical exercise is theory-based. For instance, foreign business cycle volatility, a variable suggested by the theoretical model in Section 2, is independent from the home country's chosen exchange rate regime. In addition, we do not include home inflation but rather its determinant, actual central bank independence as measured by the turnover rate.[22] In order to limit the remaining simultaneity issues, we introduce all right-hand-side variables either as backward-looking or time-invariant (see above). The notion that this procedure effectively minimizes possible repercussions between PEGIMF and its determinants is supported by the fact that our basic results do not change when we confine our sample to countries that actually changed their exchange rate regime at some point.[23]

4. Do (Wrong) Exchange Rate Regimes Matter?

The model of exchange rate regime choice developed in Section 2 and empirically put to test in Section 3 is based on long-term determinants. For instance, we estimate the impact of backward-looking averages of volatility or sample-averages of the turnover rate of central

[22] Gosh et al. (1997) in their comprehensive study on the effects of exchange rate regimes find the strongest relation with inflation. Real growth, which enters our model as an additional control variable, is only weakly connected with these institutional choices.

[23] Additional results are available on request from the authors.

bank governors on the probability that a fixed exchange rate regime is chosen. Moreover, the exchange rate regime measure used is a bivariate institutional index of exchange rate regimes rather than a variable based on actual exchange rate behavior. The question remains whether such institutional choices matter for observed exchange rate movements. A particularly interesting query is whether countries that chose to peg their exchange rate even though the estimated model suggested a floating exchange rate suffered from higher actual exchange rate volatility than others. After all, many observers of the recent Asian turmoil argue that fixed exchange rates contributed to the currency and financial crises of the 1990s.

To answer this question we conduct a second series of regressions. Using OLS random-effects techniques, we relate PEGSTD, the standard deviation of the percentage changes of the nominal exchange rate within a year, to the residuals of the basic exchange rate regime choice model described in columns (2) of Tables 1 and 2 above. The exchange rates are defined vis-à-vis the possible target areas identified in the previous section (see the Appendix). The left panel reports the results for the residuals stemming from the GDP-based model, the right panel reports those of the inflation-based model.

Take the case of countries with an institutionally fixed exchange rate (PEGIMF = 1) first. Here a high residual in the base model suggests that the country chose a pegging regime despite the fact that our model suggested a floating exchange rate in that particular year. Consequently, we should also expect a positive correlation between the standard deviation of actual exchange rate growth and the residuals stemming from the base model. The reason is that a country with a fixed exchange rate regime that is in line the with the suggestions of the base model is simply less likely to deviate from the fixed exchange rate. Consequently it is also less likely to produce a non-zero standard deviation of actual exchange rates than a country with high residuals. In other words, the residuals from the base model multiplied by PEGIMF should have a positive and significant impact on PEGSTD. It is less clear, however, what we should expect in the case of countries that chose a floating exchange rate (PEGIMF = 0). Since we cannot infer from the institutional choice of the exchange rate regime on possible realizations of PEGSTD as in the first case, we also lack a prior with regard to the possible impact of the residuals from the base model on actual exchange rate volatility.[24]

[24] Such a hypothesis would demand a more explicit model of actual exchange rate behavior.

Table 3: Impact of policy choice on actual volatility of exchange rate (dependent variable: PEGSTD; OLS random effects)

	GDP-based model						Inflation-based model					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.031**	0.031**	0.022**	0.042**	0.003	0.005	0.033**	0.033**	0.024**	0.044**	0.006**	0.008
	6.922	6.981	4.125	9.575	0.680	0.834	7.735	7.688	4.662	10.355	1.242	1.386
RES (2)												
PEGRES (2)	0.008*	0.008*	0.008*	0.007*	0.008*	0.007*	0.008**	0.009**	0.008**	0.007*	0.007*	0.007*
	2.289	2.095	2.236	2.108	2.387	2.284	2.777	2.712	2.631	2.442	2.482	2.533
NOPEGRES (2)	-0.002	-0.003	-0.002	-0.002	0.002	0.006	0.003	0.003	0.002	0.002	0.004	0.007*
	-0.372	-0.563	-0.423	-0.458	0.532	1.302	0.891	0.938	0.641	0.584	1.370	2.159
INST5		0.001				-0.003		-0.001				-0.004+
		0.516				-1.187		-0.341				-1.859
TOR5			0.032**			0.030**			0.031**			0.029**
			2.837			2.700			2.716			2.687
GROWTH				-0.354**		-0.296**				-0.351**		-0.296**
				-6.820		-5.326				-6.762		-5.356
DEBTGDP					0.044**	0.040**					0.043**	0.039**
					10.697	10.130					10.698	10.176
# obs.	877	867	877	872	759	744	877	867	877	872	759	744
Adj. R2	0.004	0.003	0.013	0.054	0.134	0.181	0.007	0.006	0.014	0.055	0.137	0.186
Hausman test	0.996	1.087	2.004	1.777	2.844	6.862	1.612	1.792	2.659	1.609	3.235	4.823
F-test	3.000**	2.886**	2.646**	2.627**	1.980**	1.556**	2.923**	2.883**	2.577**	2.572**	1.917**	1.508*

** Significant at a 1 percent level. * Significant at a 5 percent level + Significant at a 10 percent level

Notes: Hausman test compares fixed- and random-effects model. In case the Chi-square statistic is significantly different from zero, the fixed-effects model should be preferred. F-test compares random-effects model with a model only including a constant. In case the F-test statistic is significantly different from zero, the random-effects model should be preferred.

Columns (1) in Table 3 provide the results of a regression of PEGSTD on the residuals of the base model based on real GDP growth and inflation (see columns (2) of Tables 1 and 2) both for institutionally pegging and floating countries. The former are represented by PEGRES, the latter by NOPEGRES. We find that indeed the standard deviation of actual exchange rates significantly increases (at the 5 percent level) under a regime with institutionally fixed exchange rates when the residuals stemming from the base model are higher. Following the interpretation introduced above, this seems to suggest that *pegging regimes* that are in line with the fundamentals identified in the theoretical model in Section 2 have less variability of their currencies. There is no significant relation between the residuals of the base model and PEGSTD for floating exchange rate regimes in Table 3. This result (as well as all other findings presented in Table 3) are quite similar whether we use inflation-based or GDP-based residuals from the exchange rate regime choice model.

In order to test the robustness of the result concerning PEGRES, columns (2) to (6) report results for various extensions of the model. INST5 is the five-year backward-looking averages of our *political instability* measure and TOR5 is the five-year backward-looking sum of the central banker *turnover rate* already introduced (see the Appendix for details). However, only TOR5 is significantly related to PEGSTD. It would seem that an increase in the turnover rate but not in political instability is significantly positive correlated with an increase in exchange rate volatility. Interpreted literally, this result suggests that a more independent central bank (i.e. one with a lower turnover rate) might be instrumental in keeping exchange rate volatility down. There is, however, an issue of reversed causality here to which we will return. Note that neither the inclusion of INST5 nor that of TOR5 in the model alters results for PEGRES.

Interestingly, a high contemporaneous level of *external debt* over GDP (DEBTGDP) has a significantly positive impact on PEGSTD. This suggests that the arguments put forward by the banking-view of currency crises (see Section 3) not only influence the institutional exchange rate regime choice but also actual exchange rate behavior. We also find that higher contemporaneous *real growth* (GROWTH) has a highly significant negative influence on within-year exchange rate volatility. As one would expect, lower growth rates will lead to more volatile actual exchange rates. Again, the results concerning PEGRES do not change with the inclusion of these additional variables.

A natural question with regard to the results in Table 3 is to the possibility of reversed causality. Of course, we can imagine a strong devaluation of a pegged currency to have

contemporaneous repercussions on, for instance, political instability or growth. In order to follow up on this notion we repeated all regressions with the additional right-hand side variables lagged one period. Quite reassuringly, we find all results but the one for the central bank turnover rate more or less unchanged. While TOR51 (see the Appendix) still exhibits a positive influence on PEGSTD, its level of significance drops below conventional levels. One way to interpret this is indeed that causality runs from PEGSTD to TOR5: it is currency turmoil that increases the turnover rate of central bank governors and not vice versa.[25]

We conclude that there is a significant impact of "mistakes" in exchange rate regime choice on actual (nominal) exchange rate volatility no matter whether other possible determinants are controlled for. As a rule, countries that deviate from the model's predicted regime choice by choosing fixed instead of floating exchange rates generally suffer higher exchange rate volatility. How strong is the effect in economic terms? The coefficients reported in columns (6) of Table 3 already indicate that, compared, for instance, to the impact of GROWTH and DEBTGDP, the effect of a one percent increase in PEGRES is relatively small. Still, the influence is not negligible. Take the GDP-based model reported in the left panel of Table 3. The elasticity of PEGSTD with regard to PEGRES is about 0.04. Evaluated at sample means, a one standard deviation increase in PEGRES would have increased PEGSTD by 0.0073 or about 1/10 standard deviations.

Another way to evaluate the consequences of exchange rate regime choice is to ask what does the model of exchange rate regime choice have to say about recent examples of balance-of-payments crises? Table 4 reports some statistics on the behavior of actual exchange rates to that end. As before, the standard deviation of exchange rates is computed from the monthly growth rate of nominal exchange rates within a given year. We find that, based on our entire sample of 893 observations across countries and years, the standard deviation associated with fixed exchange rate regimes is only marginally lower than in the overall sample. One explanation commonly given is that fixed exchange rate regimes are just as prone to suffer sudden dramatic bursts of re-valuations than floating regimes (Caramazza and Azis, 1998). According to Table 4, however, this is only part of the story. Another part is institutional mistakes.

In line with the regression results in Section 4, the last column of Table 4 shows that those fixed exchange rate regimes in line with our base model during 1980-94 had less

[25] Other results point at a negative interaction of the level (or change) of *international reserves* with observed exchange rate volatility. The variable has at least a marginally significant influence on PEGRES. Not surprisingly, a higher level of reserves makes actual exchange rates less volatile under a pegging regime.

volatile actual exchange rates. So primarily countries that selected a fixed exchange rate regime which is *not* in line with fundamentals are haunted by sudden exchange rate volatility.[26]

Table 4: Standard deviation of nominal exchange rates

	All floating and fixed exchange rate regimes	Fixed exchange rate regimes	Fixed exchange rate regimes supported by model
	During entire period 1980-94		
Std.	0.031	0.030	0.027
Obs.	893	475	339
	During balance-of-payment crises		
Std.	0.116	0.124	0.057
Obs.	29	6	1
	During banking crises		
Std.	0.038	0.005	0.007
Obs.	17	3	2

Notes: Definition of balance-of-payments crises and banking crises from Kaminsky and Reinhart (1999, data appendix). Standard deviation as defined in the Appendix. Observations are countries * years. We get qualitative similar results if we use the standard deviation of nominal exchange rate levels from their trend instead.

This is also true during times of balance-of-payments crises. The middle panel of Table 4 reveals that of the 29 observations of exchange rate volatility within our sample that are identified by Kaminsky and Reinhart (1999) as falling into a balance-of-payments crises, only six occurred under a pegging regime. It is interesting to note that the standard deviation of exchange rates under fixed regimes is somewhat but not dramatically higher than under floating rates. Note, however, that the one fixed exchange rate regime that was in line with the model's recommendation suffered a significantly less volatile exchange rate. Again it would seem that it is wrongly fixed exchange rates rather than regimes of fixed exchange rates per se that are linked to bursts of actual forex market volatility.

During banking crises the behavior of exchange rates hardly differs between regimes supported or not supported by the model (lower panel in Table 4). This is line with Kaminsky and Reinhart's (1999) results that such crises predate rather than accompany balance-of-payments crises.

However, since the reversed causality issue is probably most virulent here, we do not report these additional results.

[26] Note that the second column excludes those floating regimes for which the model suggests a fixed exchange rate regime. Including those does increase the number of relevant observations to 483 and the average standard deviation to 0.029.

5. Concluding comments

Like most previous studies our theoretical model is based on two highly simplified cases: a fully flexible exchange rate versus an irrevocably (and credibly) fixed nominal exchange rate. Purely floating and fixed systems are, of course, only two possible options. Edwards and Sevastano (1999) distinguish nine existing different exchange rate regimes, varying from free float to full dollarization. Still, our theoretical model yields some very interesting insights that have not been (fully) taken into account in most of the previous literature. It suggests, for instance, that a more volatile foreign economy can be an argument in favor of a fixed exchange rate regime once similarities in the business cycles in both countries are taken into account. The model supports Frankel's (1999) view that there are no general rules as to the optimality of an exchange rate regime. Frankel argues that the decision to peg or not to peg varies over time with the circumstances. Our theoretical model derives recommendations on the choice of the exchange rate regime based on such characteristics in any given period. And our empirical results suggest that these characteristics indeed matter.

Again, some caveats are in order here as some of the problems that plague the literature on the consequences of exchange rate regimes may also have affected our results. As pointed out by Edwards and Sevastano (1999) most studies classify studies following the countries' official description of the exchange rate (typically the one they report to the IMF). However, differences between *de jure* and *de facto* regimes may be substantial. Furthermore, it is assumed that the regimes were sustainable in the period under consideration and that duration is assumed to be immaterial. We have taken the first issue into account by focusing also on actual exchange rate stability. Furthermore, our results show that de *jure choices* are not on paper only, as they matter for actual behavior. The second issue has only partly been taken into account in that we analyze whether a 'wrong' policy choice has affected actual exchange rate volatility. Our results suggest that mistakes in institutional choice indeed matter: the standard deviation of the nominal exchange rate of countries that should – according to our model – not have fixed their exchange rate is higher than that in countries that made a choice in accordance with our model. In future research we plan to further explore possible explanations of mistakes in institutional choice, especially focusing on political-economic factors forcing (democratic and non-democratic) countries to peg or float when our model yields different advice.

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Appendix

Data Source

In the empirical analysis we concentrate on a large set of developing countries, covering the 1980-1994 period. Unless mentioned otherwise all underlying data are from the International Financial Statistics of the IMF. Series names ending with 'AVG' mean that they are averages over the entire period. Those ending with '5' are five-year backward-looking moving averages. In order not to lose valuable observations, the underlying series for these variables start in 1975. If a series name (also) ends with a '1' it means that it is lagged one period. An additional 'D' in front of a name indicates that first-differences over time are taken.

Official pegging strategy (PEGIMF) and actual or potential pegged-to-currency (TARGET)

The IMF classifies each country into different categories concerning their exchange rate regime. To construct our dependent variable PEGIMF, we declare countries which peg to the US dollar, the French franc, the SDR, or any other currency or composite as 'pegging' countries. Countries with a (semi-) flexible exchange rate we consider to be non-pegging. For those countries pegging to an unknown basket of currencies we opt to construct a composite exchange rate based on the relative shares of the three to six countries with whom they trade the most. The trade data is taken from IMF's Trade Statistics. To determine to which countries non-pegging countries would potentially peg, we look at their history. If they have never pegged we choose to use the US dollar or the SDR as their potential target currencies. Table A1 shows all countries, the periods during which they pegged or had a floating currency, and their (potential) target countries.

Standard deviation of percentage change in exchange rate (PEGSTD)

To construct an actual measure of exchange rate volatility we look at the yearly standard deviation of the percentage change of the actual monthly exchange rate between the home and target country.

Variance real GDP/inflation shocks home (VARGDPH/VARDCPIH) and target countries (VARGDPT/VARDCPIT) and the correlation between both real GDP/inflation shocks (CORGDP/CORDCPI)

To construct an empirical measure for the variance of the home and foreign countries output shocks we have used the following procedure. For the home and foreign country we have calculated the real GDP growth rates in, respectively local currency and US-dollar over the period 1971-1994. In case the home country (potentially) pegs to a composite, the real GDP growth rate of the foreign country is computed by using a weighted average of the underlying countries. For the SDRs the weights are 0.4, 0.21, 0.17, 0.11 and 0.11 for, respectively the United States, Germany, Japan, France, and the United Kingdom. For other composites the weights are according to their trade shares. For each ten-year period in which there are more than three observations available we apply the Hodrick-Prescott technique to filter out the shocks in output growth (for both the home and foreign country). The variance of these output shocks for the sample 1980-1989 are then, for instance, taken as a measure for the variance of the output shock in the year 1990. We also calculated the correlation between the output shocks of the home and foreign country over all these ten-year periods. This is our measure for the correlation between both output shocks. A similar procedure is applied to construct an empirical measure for the variance of the home and foreign countries inflationary shocks and their correlation. Our measure of inflation is the percentage change in the consumer price index.

Central Bank Independence and the turnover rate (TORAVG, TOR5, TOR51)

As proxy for Central Bank Independence Campillo and Miron (1997) use Cukierman's (1992) legal index. However, Cukierman argues that legal independence measures may be a better proxy for actual independence in industrial countries than in developing countries. Cukierman (1992) and Cukierman et al. (1992) therefore developed a yardstick for central bank autonomy which is not based on regulation but on the actual average term of office of central bank governors in different countries. This indicator is based on the presumption that, at least above some threshold, a higher turnover rate (TOR) of central bank governors indicates a lower level of independence. Until recently, Cukierman's TOR was the only such measure available. However, using three sources of information, we have been able to construct a more extensive data set starting in 1975 including the annual changes of the governor. The data sources (in the order that we have used them in constructing our data set) are: information we received directly from various central banks, Pringle (1999) and the IMF's International Financial Statistics. As to the latter, generally, either the country's governor to the IMF or his alternate is the governor of the central bank. In each monthly issue of the IFS the names of the governor to the IMF and his alternate are shown, which makes it possible to infer whether the central bank has a new Chief Executive Officer. In the empirical analysis we take both the average and the five-years backward-looking moving sum of this turnover rate.

Political instability (INSTAVG, INST5)

In order to capture the multi-dimensional aspects of political uncertainty or instability, we construct an index that summarizes eight variables indicating socio-political unrest. Those variables are the number of assassinations, strikes, guerilla problems, government crises, purge, riots, revolutions, and anti-government demonstrations and are taken from Siermann (1998). Here we employ the method of principal components. Principal components analysis is a statistical technique that helps us to reduce the number of variables in an analysis by describing linear combinations of the variables that contain most of the information, i.e. linear combinations with the greatest variance.

In the initial analysis we also used data from the Barro-Lee data set (number of political assassinations, number of military coups and revolutions, a dummy for countries that have been involved in war any time between 1960 and 1990), Knack and Keefer (1995) (political instability, and an index of civil liberties), and Barro (1996) (political rights). As these variables are only available at a cross-section level averaging over a much longer period than used in this analysis and were not available for as many countries as the data of Siermann (1998), we opted to use the data of Siermann (1998) in the final analysis. Our conclusions are not influenced by this.

Average log population (LPOPAVG)

To have a measure for the size of a country we include the average logarithm of the population of the country.

Former British colonies (BRIT) and sub-Saharan African countries (SAFRICA)

To capture institutional differences we included dummies for former British colonies and sub-Saharan African countries. We also tried dummies for former Spanish and French colonies and Latin-American countries, but they were hardly ever significant and are therefore submitted from the final analysis.

Openness (OPENAVG, OPEN51)

Openness we measure in the usual way as the sum of total imports and exports as percentage of GDP.

Real GDP growth rate (GROWTH, GROWTH51)

Simply the growth rate of real GDP.

External debt as percentage of GDP (DEBTGDP1)

Total external debt is taken from the World Bank Development Indicators and is defined as debt owed to nonresidents repayable in foreign currency, goods, or services denominated in US dollars. Total external debt is the sum of public, publicly guaranteed, and private non-guaranteed long-term debt, use of IMF credit, and short-term debt. Short-term debt includes all debt having an original maturity of one year or less and interest in arrears on long-term debt. Before calculating its share in GDP, we transformed GDP into US dollars by using the annual exchange rate.

International reserves as percentage of the base money (RESMON51) and as percentage of GDP (RESGDP51)

First we transfer international reserves denominated in SDR's into local currency by using the annual exchange rate and the annual SDR/US dollar exchange rate. Then we scale it by using either the base money (M0) or nominal GDP.

Capital restrictions CAPRES1-4: dummies, indicating multiple exchange rates, restrictions on current account transactions, restrictions on capital account transactions and surrender of export proceeds, respectively.

Tables A2 and A3 summarize the above. The first gives all underlying series needed to construct the variables shown in the latter. Table A4 shows some summary statistic of all variables used in the empirical analysis.

Table A1: Summary of countries and their pegging decisions

Home country	Target countries	Pegging	Floating
Argentina	US	1992-1994	1980-1991
Bahamas	US	1980-1994	
Bahrain	SDR		1980-1994
Bangladesh	US, Japan, UK	1980-1981	
	US, Japan, Singapore	1982-1991	
	US, Japan, Hong Kong	1992-1994	
Belize	US	1983-1994	
Botswana	US	1980	
	SDR, South Africa	1981-1994	
Brazil	US		1980-1994
Burundi	US	1980-1983	
	SDR	1984-1992	
	Belgium, Germany, France	1993-1994	
Chile	US	1980-1982	1983-1994
Colombia	US		1980-1994
Costa Rica	US	1980-1982	1983-1994
Cyprus	UK, France, Italy, Germany, Greece, Japan	1980-1994	
Dominican Republic	US	1980-1985, 1991	1986-1990, 1992-1994
Ecuador	US	1980-1983, 1989	1984-1988, 1990-1994
Egypt	US	1980-1987	1988-1994
El Salvador	US	1980-1985, 1987-1990	1986, 1991-1994
Ethiopia	US	1980-1993	1994
Fiji	New Zealand, UK, Japan, Australia	1980-1994	
Ghana	US	1980-1985, 1987-1994	1986
Greece	SDR	1980-1994	
Guatemala	US	1980-1990	1991-1994
Haiti	US	1980-1991	1992-1994
Honduras	US	1980-1990	1991-1994
India	SDR		1980-1994
Indonesia	SDR		1980-1994
Iran	SDR	1981-1993	1980, 1994
Jamaica	US	1980-1984	1985-1994
Jordan	SDR	1980-1989	
	Iraq, US, India	1990-1991	
	Iraq, US, Germany	1992-1994	
Kenya	SDR	1980-1988	
	UK, Germany, Japan	1989-1992	
	UK, Germany, US	1993-1994	
Korea South	US	1980	1981-1994
Kuwait	Japan, UK, Netherlands	1980-1981	
	Japan, Italy, US	1982, 1984	
	Japan, Italy, Netherlands	1983	
	Japan, US, Netherlands	1985-1990, 1993	
	Japan, US, Germany	1991-1992	
	Japan, US, India	1994	
Madagascar	France	1980-1982	1987-1994
	France, US, Japan	1983-1984	
	France, US, Germany	1985-1986	1987-1992
	France, Germany, Japan		1993-1994
Maldives	Japan, Sri Lanka, Germany		1980
	Singapore, Japan, Sri Lanka		1981-1983
	Singapore, Japan, Thailand		1984-1985
	Singapore, Thailand, Germany	1986-1987	1988
	Singapore, Thailand, UK		1989
	Singapore, UK, Sri Lanka		1990-1994

Malawi	SDR	1980-1984	
	South Africa, UK, Germany	1985-1990	
	South Africa, US, Japan	1991	
	South Africa, Germany, Japan	1992-1993	
	South Africa, Zimbabwe, Japan	1994	
Malaysia	Japan, US, Singapore	1980-1993	1994
Malta	UK, Germany, Italy	1980-1994	
Mauritius	SDR	1980-1983	
	UK, France, Germany	1984-1991	
	UK, France, South Africa	1992	
	UK, France, US	1993-1994	
Mexico	US	1983	1980-1982, 1984-1994
Morocco	France, Spain, Germany	1980	1981-1982, 1985, 1987-1988, 1990
	France, Spain, US	1993-1994	1983-1984, 1986, 1989
	France, Spain, Italy	1991-1992	
Mozambique	Thailand, Italy, US	1986-1987	
	US	1988-1989	
	US, Thailand, Italy	1991	
	US, Portugal, Spain		1992
	South Africa, Zimbabwe, Portugal		1993-1994
Nepal	US	1980-1983	
	Hong Kong, Japan, Germany	1984-1985	
	Japan, Germany, Singapore	1986-1990	
	Germany, Japan, India	1991-1993	
	Germany, India, Thailand	1994	
Nicaragua	US	1980-1993	1994
Nigeria	SDR		1980-1994
Pakistan	US	1980-1982	1983-1994
Paraguay	US	1980-1989	1990-1994
Peru	US	1986-1990	1980-1985, 1991-1994
Philippines	SDR		1980-1994
Saudi Arabia	SDR		1980-1994
Singapore	Malaysia, Japan, US	1980-1988	1989-1994
	Japan, Australia, Singapore	1991-1994	
South Africa	SDR		1980-1994
Sri Lanka	SDR		1980-1994
Swaziland	South Africa	1980-1994	
Syria	US	1980-1994	
Tanzania	UK, Germany, Japan	1980-1993	1994
Thailand	Japan, US, Singapore	1980-1981, 1985-1994	1982-1984
Trinidad and Tobago	US	1980-1993	1994
Tunisia	France, Italy, Germany	1980-1988	1989-1994
Turkey	SDR		1980-1994
Uganda	US	1988-1990	
	UK, Kenya, Germany	1991	
Uruguay	SDR		1980-1994
Vanuatu	France	1982	
	SDR	1983-1988	
	Japan, Italy, Spain	1989	
	Japan, Italy, Australia	1990-1994	
Venezuela	US	1980-1989	1990-1994
Zaire (Congo)	SDR	1980-1983	1984-1994
Zambia	SDR	1980-1983, 1990-1991	
	Japan, South Africa, Saudi Arabia	1984	
	Japan, UK, US	1985	
	US	1988-1989	

Zimbabwe	South Africa, UK, Germany	1981
	South Africa, UK, US	1982-1983
	UK, US, Germany	1984
	UK, Germany, Italy	1985
	South Africa, UK, Germany, US	1986-1994

Table A2: Original series used to construct the different variables

Abbreviation	Description	Unit	Frequency	Countries	Source
PEGIMF	Official pegging strategy	Dummy	Annual	Home	IMF
TARGET	Actual or potential pegged-to-currency	Dummy	Annual	Home	IMF Trade Statistics
EXCH	Monthly exchange rate	Local currency per US$	Monthly	Home & Target	IFS cd-rom
AEXCH	Annual exchange rate	Local currency per US$	Annual	Home & Target	IFS cd-rom
CAPRES1-4	Dummies indicating capital controls	Dummy	Annual	Home	Gian Maria Milesi-Ferretti
GDP	Real GDP	Local currency, constant prices	Annual	Home & Target	IFS cd-rom
GDPNOM	Nominal GDP	Local currency	Annual	Home	IFS cd-rom
DCPI	Changes in Consumer Prices	Percentage	Annual	Home & Target	IFS cd-rom
TOR	Central Bank Independence (Turnover Rate)	No of change in governors	Annual	Home	Own dataset
DEBT	External debt	US$	Annual	Home	World Bank
IMP	Nominal imports	Local currency	Annual	Home	IFS cd-rom
EXP	Nominal exports	Local currency	Annual	Home	IFS cd-rom
POP	Population	Number	Annual	Home	IFS cd-rom
BMON	Reserve/Base money (M0)	Local currency	Annual	Home	IFS cd-rom
RES	International Reserves	SDR	Annual	Home	IFS cd-rom
SDRDOL	Annual SDR Exchange Rate	SDR per US$	Annual	Home	IFS cd-rom
ASSAS	Assassinations	Dummy	Annual	Home	Clemens Siermann
STRIKE	Strikes	Dummy	Annual	Home	Clemens Siermann
GUERIL	Guerrilla	Dummy	Annual	Home	Clemens Siermann
CRGOV	Crisis (government)	Dummy	Annual	Home	Clemens Siermann
PURGE	Purge	Dummy	Annual	Home	Clemens Siermann
RIOTS	Riots	Dummy	Annual	Home	Clemens Siermann
REVOL	Revolutions	Dummy	Annual	Home	Clemens Siermann
DEMON	Anti-government demonstrations	Dummy	Annual	Home	Clemens Siermann
BRIT	Dummy for former British colonies	Dummy		Home	Barro (1996) & The Political Reference Almanac (http://www.polisci.com)
SAFRICA	Dummy for sub-Saharan African countries	Dummy		Home	Sala-i-Martin (1997) & The Political Reference Almanac (http://www.polisci.com)

Table A3: Constructed variables used in the empirical analysis

Abbreviation	Description	Underlying series
PEGSTD	Standard deviation of percentage change in exchange rate	EXCH, TARGET
VARGDPH	Variance real GDP shocks home	GDP
VARGDPT	Variance real GDP shocks target	TARGET, GDP, AEXCH
CORGDP	Correlation real GDP shocks	TARGET, GDP, AEXCH
VARDCPIH	Variance inflation shocks home	DCPI
VARDCPIT	Variance inflation shocks target	TARGET, DCPI
CORDCPI	Correlation inflation shocks	TARGET, DCPI
TORAVG	Average turnover rate	TOR
TOR5	5-years moving average turnover rate	TOR
INSTAVG	Average political instability measure	ASSAS, CRGOV, DEMON, GUERIL, PURGE, REVOL, RIOTS, STRIKE
INST5	5-years moving average political instability measure	ASSAS, CRGOV, DEMON, GUERIL, PURGE, REVOL, RIOTS, STRIKE
LPOPAVG	Average log population	POP
OPENAVG	Average openness	IMP, EXP, GDPNOM
OPEN51	Lagged 5-years moving average openness	IMP, EXP, GDPNOM
GROWTH51	Lagged 5-years moving average real GDP growth rate	GDP
GROWTH	Real GDP growth rate	GDP
DEBTGDP1	Lagged external debt as percentage of GDP	DEBT, AEXCH, GDPNOM
DEBTGDP	External debt as percentage of GDP	DEBT, AEXCH, GDPNOM
RESMON51	Lagged 5-years moving average of international reserves as percentage of base money	RES, SDRDOL, AEXCH, BMON
RESGDP51	Lagged 5-years moving average of international reserves as percentage of GDP	RES, SDRDOL, AEXCH, GDPNOM

Table A4: Summary statistics of variables used in the analysis

Series	Obs	Mean	Std Error	Minimum	Maximum
PEGSTD	887	0.031	0.075	0.000	1.181
VARGDPH	887	0.260	0.212	0.026	1.212
VARGDPT	887	0.280	0.393	0.032	1.947
CORGDP	887	0.194	0.281	-0.764	0.908
VARDCPIH	862	0.007	0.015	0.000	0.131
VARDCPIT	862	0.001	0.000	0.000	0.003
CORDCPI	859	0.295	0.461	-1.000	0.990
TORAVG	887	0.278	0.193	0.050	0.950
TOR5	879	0.286	0.270	0.000	1.600
INSTAVG	877	0.000	1.951	-2.101	6.996
INST5	869	0.000	1.697	-1.355	8.898
LPOPAVG	887	2.763	0.115	2.460	3.015
OPENAVG	857	0.635	0.380	0.145	2.034
OPEN51	855	0.634	0.396	0.122	2.201
GROWTH51	867	0.036	0.034	-0.087	0.148
GROWTH	882	0.033	0.050	-0.254	0.252
DEBTGDP1	716	0.644	0.742	0.015	9.605
DEBTGDP	763	0.653	0.753	0.015	9.605
RESMON51	770	0.773	1.134	0.011	12.310
RESGDP51	828	0.001	0.002	0.000	0.012
PEGIMF	887	0.534	0.499	0.000	1.000
BRIT	887	0.450	0.498	0.000	1.000
SAFRICA	887	0.258	0.438	0.000	1.000