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CAPITAL CONTROLS AND EXCHANGE RATE REGIMES: AN EMPIRICAL INVESTIGATION

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Abstract

It is often argued that deregulation of international transactions and its effects on the "globalization" of financial markets is behind the decline in the attractiveness of fixed exchange rate regimes. We argue that, instead, much of the recently observed decrease in the level of capital controls should be seen as endogenous to the exchange rate regime decision. We find that the durability of a peg (measured on the basis of the growth of international reserves), the political benefits of a commitment to a peg, domestic and foreign inflation (aversion), as well as business cycle volatility and synchronization are the main determinants of capital controls. The empirical analysis is based on data for 53 non-OECD countries covering the period 1980-94.

Keywords: Monetary policy, exchange rates, capital controls

JEL Classification: E42, E52, F32, F41

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1. Introduction

Why do so many countries still use capital controls? And what triggered the recent move to deregulation? The prevalence of capital controls poses a puzzle, because most economists argue that regulatory restrictions on current account or capital account transactions impose a welfare loss. Edwards (1999) argues, for instance, that they introduce major distortions and breed corruption. Furthermore, Klein and Olivei (1999) and Edwards (2001) report that, after controlling for other variables (including aggregate investment), countries with a more open capital account have outperformed countries that have restricted capital mobility in terms of economic growth. Likewise, Tamirisa (1999) reports that capital controls have a significant negative impact on trade. Adding to the puzzle is the fact that various authors conclude that capital controls may not be very effective. In his extensive survey, Dooley (1996) finds no clear evidence that controls work in the longer run. It generally does not take the private sector in countries with impediments to capital mobility a long time to get around the restrictions, e.g. by overinvoicing of imports and underinvoicing of exports. Dooley reports, however, that capital controls may prolong the life of a fixed exchange rate regime.

So far, the literature on capital controls has put forward two reasons for the introduction of capital restrictions (see e.g. Milesi-Ferretti 1998). First, capital controls might be (mis-) used for fiscal purposes, aiming, for instance, at the retention of domestic savings for redistribution. Secondly, capital controls might help to impose limitations on volatile short-term capital flows that are often thought to be responsible for currency crises and financial sector breakdowns of the Asian type (Edwards 2000a). In fact, deregulation of cross-border financial transactions in many developing countries and emerging markets has been cited as one of the reasons for the "vanishing middle ground", the impossibility of sustaining semi-flexible adjustable pegs when capital mobility is allowed to increase (Edwards 2000b, Calvo 1999, Eichengreen et al. 1998). For instance, Mussa et al. (2000, p. 13) write that "...countries that are tightening their links with modern, global financial markets are increasingly vulnerable to shifts in market sentiments, making the defense of pegged rates substantially more difficult." Consequently, the number developing countries among IMF members with floating exchange rate regimes has increased from about 10% in the mid 1970s to more than 50% in the late 1990s (Mussa et al. 2000). But are deregulation and exchange rate regime choice really independent? Could it not be the

decline in the attractiveness of pegging regimes that is behind the decline in regulation rather than the other way around? This paper extends this second line of thought by endogenizing the capital control decision.

Based on an extension of the exchange rate regime choice model in Berger, Jensen and Schjelderup (2000), we argue that a government will not unconditionally impose capital restrictions to defend a pegged (but adjustable) currency under pressure.[1] The reason for this is that introducing capital controls has both costs and benefits. On the *benefit side*, capital controls might help to secure the advantages of a fixed exchange rate regime. The benefits of introducing capital controls are the higher, the less developed the stabilization culture of the country and the more the country's business cycle is synchronized with the cycle in the target area of the peg. There might also be political benefits when governments value the exchange rate commitment as such. On the *cost side* of capital controls are the above-mentioned allocative inefficiencies. In addition, however, there is a credibility loss stemming from the fact that the introduction of capital controls signals (or confirms) that a fixed exchange rate is under siege. Faced with the alternatives of immediately letting the currency float or prolonging the life of a fixed but adjustable exchange rate regime by introducing capital controls, the government will actually impose capital controls only when the expected *net benefits* are positive. This line of reasoning implies a close link between the exchange rate regime and capital controls: a country will be more ready to abandon (or not to introduce) capital controls and thus move from an adjustable peg to a full float if the overall attractiveness of fixed exchange rates is in decline.

In what follows, we will develop this argument formally and test the predictions of the model, using data for 53 non-OECD countries covering the period 1980-94. We find that much of the observed liberalization of capital flows is due to a decrease in the attractiveness of fixed exchange rates. A history of public commitments to fixed exchange rates makes the introduction of capital controls more likely. Other political economic considerations seem to be less important.

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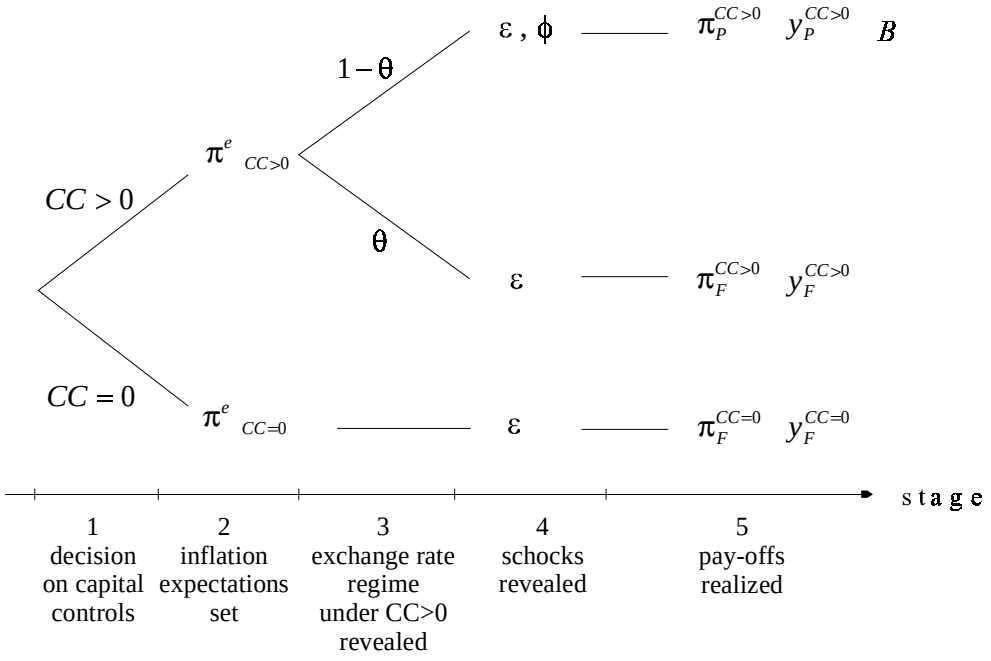
[1] Berger, Sturm and de Haan (2000) test the Berger, Jensen, and Schjelderup (2000) exchange rate regime choice model for a sample of 65 countries and annual observations from 1980-94. They find that the model provides a good description of actual regime choices. Edwards (1996) models the decision between (adjustable) pegs and floating rates. He assumes that a terms-of-trade shock is present both under fixed and floating rates, but abstracts from domestic shocks. In contrast to the present paper, Edwards treats capital controls as an exogenous variable in his empirical model of a country's ability to maintain a peg and thus neglects the simultaneity of the exchange rate regime and capital control decision.

The remainder of the paper is organized as follows. Section 2 presents a simple model to analyze the joint choice of an exchange rate system and capital controls. Section 3 explains the main empirical model and data employed, while Section 4 contains a number of robustness checks. The final section offers some concluding comments.

2. A theoretical model

Consider the following simple model of the decision process. The starting point is an exchange rate regime characterized by either officially fixed (pegged) exchange rates or some sort of "dirty" float, i.e. a regime of officially or unofficially managed exchange rates. According to the consensus view, surveyed by Dooley (1996), under such an exchange rate regime the main effect of the introduction of capital controls is an extension of the expected lifetime of such a regime that has come under pressure on the forex market.

Figure 1: Structure of the Model



A government contemplating introducing capital controls during or after the occurrence of exchange rate pressure will weigh the expected benefits and costs of such a measure. Figure 1 summarizes the structure of this decision process. At *stage*

1, capital controls are set. If the government abstains from capital controls ($CC = 0$), the exchange rate will be forced into floating right away.[2] Under a floating regime, monetary policy decisions are taken by the domestic central bank. If, however, capital controls were introduced ($CC > 0$), the government will only be forced into a floating regime (i.e. to adjust) with probability θ, where $0 < \theta < 1$. With probability $1 - \theta$ the pegging regime will prevail and monetary policy will be set abroad, that is by the central bank governing the currency targeted by the peg. To simplify, we assume that θ is exogenous. Behind this assumption could be a credible contingent rule that would let the government go off the peg in case of a large asymmetric shock either at home or abroad. In this case, θ would reflect the ex ante probability that such a shock occurs.[3] Alternatively, if forex market speculation was not connected to fundamentals, θ could simply express the ex ante beliefs of the government that the currency attack which led to the introduction of capital controls will eventually lead to a depletion of currency reserves.

The economic outcomes resulting from the three different scenarios sketched in Figure 1 depend on the expectations of the private sector, the structure of the economy, and the domestic and (conditional on the exchange rate regime) foreign shocks. Inflation expectations (π^e) are set at *stage 2* after the decision about capital controls has been taken, but before the actual exchange rate regime is revealed in the capital-controls-scenario (with $CC > 0$) at *stage 3*. Behind this is the stylized fact that expectations are often embedded in medium-term nominal contracts that do not allow quick reversal. For the same reason we assume that monetary policy is decided after expectations are set. Then, at *stage 4*, domestic (ε) and foreign (ϕ) shocks are realized and monetary policy at home and abroad is set. Finally, at *stage 5*, output (y) and inflation (π) are realized. The indices P and F denote a pegging or floating regime, respectively. The government will weigh the various outcomes according to their welfare functions. Capital controls will be introduced, if the expected losses from their introduction are smaller than the expected losses from resorting to freely floating exchange rates. But before we can describe the government's decision

[2] This is, of course, a gross simplification. A more general setting would allow the pegging regime to exist further with some probability even without capital controls in place ($CC = 0$). As long as the probability of an adjustment or regime switch to floating was *lower* in this scenario than when capital controls are introduced ($CC > 0$), the main thrust of our results will be unchanged.

[3] This interpretation abstracts from multiple equilibria. See Obstfeld (1996) and Flood and Marion (1999) for a discussion of the conditions under which this assumption might be met.

process in detail, we will have to compute the equilibrium outcomes under all scenarios.

Consider a simple structural model of a small open economy where the (log of) output is given by a conventional Lucas supply curve

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

with $\alpha > 0$ being a parameter.[4] The last term is the home country's output shock with known $E(\varepsilon) = 0$ and variance σ_ε^2. Inflation is interpreted as the monetary authority's policy instrument under floating exchange rates. Expectations are formed before the output shock is realized, while monetary policy is determined after the shock. The model's demand side is given by a stochastic purchasing power parity condition of the form

(2) $\pi = e + \pi^* - \phi$,

where *e* is the change in the nominal exchange rate and the last two terms stand for foreign inflation, that is, inflation in the country the government pegs its currency against. The term $\pi^* > 0$ is average foreign inflation (the foreign inflationary bias) and ϕ can be interpreted as the foreign central bank's reaction to the foreign output shock with $E(\phi) = 0$ and variance σ_ϕ^2. Note that *e* will perfectly compensate both changes in π^* and ϕ 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 to foreign monetary policy.

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

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

where λ is the weight that the central bank puts on the real target. The inverse $1/\lambda$ might be interpreted as the country's effective degree of monetary policy

conservatism or stabilization culture (see Berger, Sturm and de Haan 2000). Derivation of the central bank's reaction function, taking into account (1), is standard. Assuming rational expectations, we find that equilibrium inflation and output are

$$(4) \qquad \pi_F^{CC=0} = \tilde{\pi} - \frac{\lambda\alpha}{1+\lambda\alpha^2}\varepsilon \quad \text{and}$$

$$(5) \qquad y_F^{CC=0} = \frac{1}{1+\lambda\alpha^2}\varepsilon,$$

where $\tilde{\pi} = \lambda\alpha y^*$ is the inflationary bias under floating exchange rates.[5]

What is, however, the outcome after the introduction of *capital controls*? The idea behind the introduction of capital controls is the stabilization of a fixed exchange rate regime, and with probability $1-\theta$ capital controls will indeed ensure that the fixed exchange rate regime prevails. With probability θ, however, the government will be forced into a floating regime, that is an exchange rate adjustment. In the latter case, monetary policy will be set by the central bank; in the former case, monetary policy will be imported from abroad. If expectations could be set after the actual exchange rate regime had been observed, the economic outcome, for instance, under capital controls and floating rates would be similar to the results computed above in (4) and (5). However, since expectations have to be set *before* the actual exchange rate regime can be observed, expectations will take into account both possible outcomes under capital controls. We show in Appendix 1 how expectations are set as a probability-weighted average of expected inflation under the two possible regimes. Given expectations, we can compute the equilibrium values for output and inflation.

If the actual exchange rate regime after the introduction of capital controls was *floating* rates (i.e. after an adjustment), equilibrium inflation would be

$$(6) \qquad \pi_F^{CC>0} = \frac{1}{1+(1-\theta)\lambda\alpha^2}\tilde{\pi} + \frac{(1-\theta)\lambda\alpha^2}{1+(1-\theta)\lambda\alpha^2}\pi^* - \frac{\lambda\alpha}{1+\lambda\alpha^2}\varepsilon,$$

where the first two fractions sum up to unity. In other words, average actual inflation will be a weighted average of the inflation biases prevailing under a pure and a pegging regime without capital controls. A plausible assumption for many less

[4] Berger, Jensen and Schjelderup (2000) use a similar set-up.
[5] Note that $\pi^e\big|_{CC=0} = E\pi_F^{CC=0} = \lambda\alpha y^*$.

developed economies is that the latter is larger than the former, i.e. that $\pi^* < \tilde{\pi}$. If so, average inflation is lower in this scenario than under floating exchange rates without capital controls. Note, however, that the central bank's equilibrium reaction to domestic shocks is the same as under floating rates in the absence of capital controls (see (4)). Accordingly, we find output to be

$$(7) \qquad y_F^{CC>0} = \frac{(1-\theta)\alpha}{1+(1-\theta)\lambda\alpha^2}\left(\tilde{\pi}-\pi^*\right)+\frac{1}{1+\lambda\alpha^2}\varepsilon$$

and thus a positive function of the difference between the inflationary bias at home and abroad. In other words, there is an output gain associated with floating exchange rates under capital controls. Behind this result is the fact that inflation expectations, having been set before the actual exchange rate regime under capital controls was revealed, are lower than equilibrium inflation in case the regime turns out to be one of floating rates.

Equilibrium inflation under capital controls with prevailing *fixed* exchange rates can be observed directly from (2) as

$$(8) \qquad \pi_P^{CC>0} = \pi^* - \phi \ .$$

Using (1) and inflation expectations as described in Appendix 1, output is easily computed as

$$(9) \qquad y_P^{CC>0} = -\frac{\theta\alpha}{1+(1-\theta)\lambda\alpha^2}\left(\tilde{\pi}-\pi^*\right)-\alpha\phi+\varepsilon\,,$$

where the first term is the output loss stemming from the fixed exchange rate regime prevailing under capital controls. The reason for the output loss is similar to the one given for the output gain in (7), except that now, with the actual exchange rate regime being a peg, equilibrium inflation is lower than expected. But note that, since inflation expectations are set rationally ex ante (and thus are correct on average), the expected overall output gain from introducing capital controls is zero, i.e. $Ey^{CC>0} = 0$. This does not imply, however, that the expected change in government welfare is zero too. In fact, expected welfare from output is decreasing relative to the case without capital controls, because of the added uncertainty regarding the actual output level.

We now have the necessary ingredients to discuss the *government's decision rule* for the introduction of capital controls in more detail. In the given framework, a

natural assumption is that the government bases its decision on an expected loss function that is similar to the one introduced for the central bank, but for the weight the government attaches to the variance of output, i.e. $\bar{\lambda} \neq \lambda$:

$$(10) \qquad EL_{Gov} = E[\bar{\lambda}\left(y - y^{*}\right)^{2} + \pi^{2}] .$$

While a plausible conjecture would be to view the government as somewhat less conservative then the central bank ($\bar{\lambda} > \lambda$), we assume that the government cannot actually vary or fine-tune the central bank's preferences before setting capital controls, as in Rogoff (1985). Establishing the independence and conservativeness of a central bank is a time-dependent process that can be viewed as exogenous for the policy problem at hand.

From the ex ante perspective of *stage 1* (see Figure 1), the government will move to introduce capital controls ($CC > 0$) if the expected losses outweigh the expected losses under a fully floating exchange rate regime. The expected loss under a regime with capital controls is the probability-weighted average of the two possible expected outcomes under this regime: with probability $1-\theta$ the fixed exchange rate regime will prevail with expected losses $EL\left(\pi_P^{CC>0}, y_P^{CC>0}\right)$ and with probability θ the fixed exchange rate regime will make way for floating rates despite capital controls leading to expected losses $EL\left(\pi_F^{CC>0}, y_F^{CC>0}\right)$. If, however, the expected losses under capital controls are larger than the expected loss under floating exchange rates without capital controls, $EL\left(\pi_F^{CC=0}, y_F^{CC=0}\right)$, the government will refrain from introducing such controls ($CC = 0$). Formally, we can state this rule as follows:

$$(11)\ CC \begin{cases} > 0 & \text{if } (1-\theta)\left[EL\left(\pi_P^{CC>0}, y_P^{CC>0}\right) - B\right] + \theta EL\left(\pi_F^{CC>0}, y_F^{CC>0}\right) < EL\left(\pi_F^{CC=0}, y_F^{CC=0}\right) \\ = 0 & \text{otherwise} \end{cases}.$$

Note that the decision rule allows for an additional political net-benefit B associated with the introduction of capital controls. The net-benefit is positive ($B > 0$) if the deciding authority values the allocative inefficiencies caused by imposing capital controls higher than its political-economic advantages. For instance, we can imagine a government that has officially fixed its exchange rate to, say, the US-dollar, to value the upholding of its commitment in the eye of the public. To a lesser degree this should also be true if the government has been following a policy of a "dirty float". Most governments will interpret the deviation from a pre-announced or

practiced policy of fixing the national currency to a foreign currency as a sign of weakness (see also Edwards 1996). Avoiding this will be a benefit of introducing capital controls, lowering the expected losses in the scenario in which capital controls successfully stabilize the fixed exchange rate regime (see first expression in the upper line of (11)).

After substituting for the equilibrium values of output and inflation as stated in (4) to (9), taking expectations, and some rearranging, we can rewrite the government's decision rule (11) as

$$(11') \quad CC \begin{cases} > 0 & \text{if } B + c\pi^*\tilde{\pi} - a\pi^{*2} + b\tilde{\pi}^2 > d\,\sigma_\varepsilon^2 + g\,\sigma_\phi^2 - k\,\rho_{\varepsilon,\phi}\sigma_\varepsilon\sigma_\phi \\ = 0 & \text{otherwise} \end{cases},$$

where he have made use of the fact that $Ey^{CC>0} = 0$. The coefficients are, respectively, defined as

$$a = [\theta(1 + \bar{\lambda}\alpha^2) + (1-\theta)(1+\lambda\alpha)^2]/\Delta \qquad b = (1+\lambda\alpha)^2 - [\theta\alpha^2(\bar{\lambda} + \lambda\alpha^2)]/\Delta$$

$$c = 2\theta\alpha^2(\bar{\lambda} - \lambda)/\Delta \qquad d = \lambda\alpha^2(\bar{\lambda}(2 + \lambda\alpha^2) - \lambda)/(1+\lambda\alpha)^2$$

$$g = 1 + \alpha^2 \qquad k = 2\alpha\bar{\lambda},$$

with $\Delta = [1 + (1-\theta)\lambda\alpha^2]^2$. All coefficients but *b* and *c* are unambiguously positive. In the case of *b* and *c* this is true as long as the government has a high (but not too high) preference for output relative to the central bank.[6] Also note that $c > b$.

Inequality (11') has a straightforward interpretation. The left-hand side of the upper line in (11') summarizes the expected benefits from introducing capital controls. In addition to *B*, the government will consider the gain from low inflation due to imported monetary policy under a prevailing system of fixed exchange rates. The overall benefits are likely to be positive. The right-hand side of the upper line in (11') reports the expected losses stemming from domestic and foreign output shocks under capital controls. Net-losses are most likely positive, even though a positive correlation between both shocks tends to lower the expected costs from forgoing the

[6] The coefficient *b* is positive if $\bar{\lambda} < [(1 + (1-\theta)\lambda\alpha^2)^2 - \theta]/\alpha^2\theta(1-\theta)$, *c* is positive if $\bar{\lambda} > \lambda$. The latter condition relates to the mentioned exchange rate regime uncertainty under the capital control scenario. It ensures that, from the perspective of the government, the expected welfare loss from output compared to the case without controls dominates the differential decrease in expected losses from inflation. This decrease occurs because average inflation with capital controls is lower than without.

chance to stabilize economic shocks via flexible exchange rates and domestic stabilization policy.

From (11') we can deduce a number of testable hypotheses about the determinants of the decision to introduce capital controls.

Political benefits (*B*): for constant inefficiency losses of imposing capital controls, an increase in the political benefits associated with keeping up a fixed exchange rate system increases the probability that capital controls are introduced.

Durability of peg (θ): an increase in the probability that fixed exchange rates will give way to floating rates even after the introduction of capital controls tends to hurt the case for the introduction of capital controls in the first place.[7] Equivalently, an increase in the probability of the peg prevailing (a decrease in θ) will foster the case for capital controls.

Domestic inflation ($\tilde{\pi}$): the larger the domestic inflationary bias, the more attractive the introduction of capital controls for the government. The reason for this is that capital controls increase the chances that the imported low-inflation regime (i.e. the fixed exchange rate) prevails.[8]

Foreign inflation (π^*): an increase in imported inflation under fixed exchange rates tends to increase the probability of capital controls being introduced at low levels of π^*. This is because increases in imported inflation from modest levels decrease the ex ante variance of outcomes under a capital control regime. At higher levels of imported inflation relative to domestic inflation, however, the effect is dominated by the disadvantage of importing too high an inflationary bias from abroad.

Business cycle synchronicity: a higher correlation between the domestic country's and the foreign country's output shocks ($\rho_{\varepsilon,\phi}$) clearly has a positive effect on the probability of capital controls being introduced – the cost of such a measure (and thus the right-hand side of (1') above) is strictly decreasing in $\rho_{\varepsilon,\phi}$. The reason for this is simply that, with a higher covariance between both economies, imported stabilization policy under a pegging regime prevailing with the help of capital controls is more in line with domestic needs.

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[7] This is always true if the domestic inflationary bias ($\tilde{\pi}$) is sufficiently high relative to foreign inflation (π^*) and the domestic central bank is not too liberal as compared to the government.

[8] Domestic inflation could increase either because of an increase in y^* or (under some conditions) in λ.

Volatility: the model offers somewhat less guidance as to the effects of higher volatility of the business cycle at home or abroad on the capital control decision. Rule (11') shows that the effect of a change in volatilities depends on the correlation of both shocks, the relative size of the standard deviation of shocks at home and abroad, and the model's parameters.[9] Clearly, for $\rho_{\varepsilon,\phi} < 0$, any increase in volatility in either area would further destabilize the domestic economy under prevailing fixed exchange rates. This would make the introduction of capital controls less attractive. For a sufficiently large and positive $\rho_{\varepsilon,\phi}$, however, the effects of changes in volatility might diverge. Moreover, higher volatility is no longer unambiguously associated with more capital controls. Take the example in which $\rho_{\varepsilon,\phi} > 0$ and sufficiently large and the initial level of foreign volatility is relatively low compared to home volatility. In this case, an increase in *foreign* volatility will make imported stabilization policy more active and better suited to the needs of the domestic economy. Consequently, holding up a regime of fixed exchange rates by introducing capital controls might become more attractive.[10] This could be an argument in favor of capital controls. At the same time, in the described example, a further increase in *domestic* volatility would have the opposite effect. Since it would further widen the gap between desired and actual stabilization policy under fixed exchange rates, the domestic government would now be less inclined to restrict capital movements to uphold an adjustable pegging regime. Ultimately, the exact relation between volatility and capital controls seems to be an empirical question.

3. The empirical model and the data

How should capital controls be measured? Previous studies of the determinants of capital controls typically constructed dummy variables based on the information provided in the IMF's *Exchange Rate and Monetary Arrangements*. For example, Alesina, Grilli and Milesi-Ferretti (1994) use dummy variables to measure capital controls in 20 OECD countries. They find that capital export controls are more likely in countries with high inflation rates and significant government changes. Grilli and

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[9] The necessary conditions for an increase in σ_ε (in σ_ϕ) to help the case for capital controls is $\rho_{\varepsilon,\phi} > 2d\sigma_\varepsilon/(k\sigma_\phi)$ (is $\rho_{\varepsilon,\phi} > 2g\sigma_\phi/(k\sigma_\varepsilon)$).

[10] See Berger, Jensen and Schjelderup (2000) for a discussion of the (perhaps equivalently surprising) relation between volatility and exchange rate regime choice.

Milesi-Ferretti (1995) and Milesi-Ferretti (1998) extend this analysis to more than 150 developed and less-developed countries.[11]

We use this latter data set – which was kindly made available by Milesi-Ferretti – in our analysis as it provides information for a large group of countries over quite a long period. This is not to say, however, that these data are without drawbacks. One problem is that dummy variables do not reflect different degrees of intensity of capital controls over time. Moreover, they fail to distinguish between the types of flow that are being restricted, and they ignore the fact that legal restrictions may be circumvented.[12] However, there is one important advantage of using indicators based on legal restrictions: they are a good expression of governments' policy intentions. As we are interested in testing whether capital restrictions are linked with other aspects of government policy, notably the choice of the exchange rate regime, we use the Alesina-Grilli-Milesi-Ferretti data on capital controls.

Figure 2 illustrates the occurrence of capital controls in our sample of 82 less developed countries between 1980 and 1994.[13] A striking feature is that only two types of capital controls, restrictions on current account transactions and multiple exchange rates (for some or all capital transactions and/or currencies), seem to show sufficient variance to validate an empirical investigation (compare Table 1 below).[14] *Current account* restrictions in particular have been less frequent since the mid 1980s. The percentage of countries with that type of capital control in place increased from about 50% in 1980 to more than 80% in the late 1980s, only to decrease rapidly to about one third of the sample in 1994. *Multiple exchange rate* regulations have declined to even smaller percentages, albeit from a much lower level in the early 1980s. In contrast, the enforced *surrender of export earnings* in hard currencies and

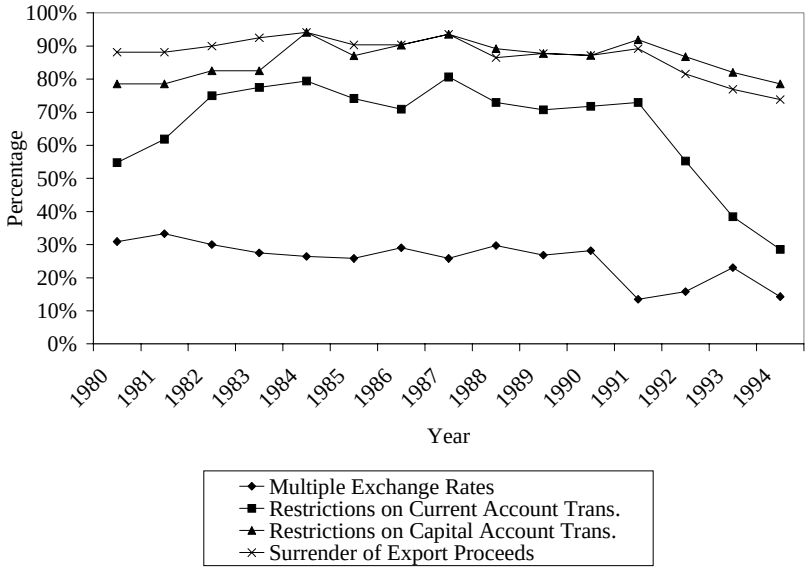
[11] These authors find that capital controls are more likely to be in place in countries where monetary policy is under the control of government. Also they are more likely to be imposed in poorer countries, and in countries with a larger government. Finally, controls are less likely to be imposed in economies that are open, that have a flexible exchange rate system and no current account difficulties.

[12] Alternatives are based on either interest differentials or more detailed indices. For instance, Lemmen and Eijffinger (1996) have measured differentials between domestic onshore and offshore nominal interest rates in European Union countries as indicators for capital controls. Resulting negative (positive) deviations are associated with capital export (import) restrictions. They conclude that inflation, government instability and gross fixed capital formation can provide a reasonable explanation of capital controls in the EU. Data on interest differentials are, however, not available for most countries in our sample. Recently, Tamirisa (1999) used an index based on 142 individual types of national exchange and capital controls. Unfortunately, this index is available only for 1996. Likewise, Quinn's (1997) indicator, which ranges from 0 to 4 and which has been used by Edwards (2001), is only available for a limited period.

[13] The sample available in the empirical model is smaller. See below.

the occurrence of restrictions for *capital transactions* (for resident-owned funds) seem to be a very widespread and more or less permanent (or time-invariant) feature in the sample. More than 80% of the sample countries still have such capital controls in place. Moreover, there is hardly any change in the distribution among countries. Consequently, in what follows, we will focus our empirical investigation on current account restrictions and, as a robustness check, on multiple exchange rates.

Figure 2: Percentage of Countries in Sample Using Controls



Before we move on to discuss data on the determinants of these capital control measures, we need to specify the sample selection. In line with the model described in Section 2, the sample should be restricted to observations with *de facto fixed exchange rate regimes*. To fulfill this requirement, we follow Kraay (2000), who uses monthly data on nominal exchange rate movements to select years and countries with de facto pegging regimes (see Appendix 2 for details). An exchange rate regime is defined as de facto fixed if the average over the previous twelve months of the absolute value of percentage changes in the nominal exchange rate does not exceed 2.5%, or about one half of one standard deviation from the mean for the entire sample. Hence, we only consider those observations on capital controls for which the exchange rate has been relatively stable either in the current or the previous year. Note that the observed stability of the exchange rate need not imply absence of a

[14] See Milesi-Ferretti (1998) for further details on these restrictions.

(non-successful) speculative attack. This procedure reduces our sample from 741 observations for 58 countries for which we have both data on capital controls and explanatory variables to a sample of 564 observations from 53 countries.[15] Table 1 shows summary statistics and short descriptions of the variables used in the empirical analysis (see Appendix 2 for details).

[Table 1 about here]

Another issue of importance is the identification of *target areas*. To construct the exchange rates just discussed as well as measures for foreign inflation and foreign business cycle volatility, we have to identify to which currency (or basket of currencies) a given country in a particular year is effectively or potentially pegging its currency. Here we rely mainly on the data provided in the IMF's annual reports. The IMF reports whether countries peg to the US dollar, the French franc, the SDR (i.e. IMF Special Drawing Rights), or any other currency or composite. For those countries pegging to an unknown basket of currencies we opt to construct a composite exchange rate based on trade shares (see Appendix 2). A detailed list of the target areas for each country can be found in Berger, Sturm and de Haan (2000, Table A1).

[Table 2 about here]

Table 2 presents the results of our main empirical model. Reported are the estimated coefficients of a random effects probit model for the aforementioned panel of 53 countries between 1980 and 1994. The Log-Likelihood statistics given on the bottom indicate that random effects are indeed the proper set-up for the data at hand. The left-hand side of the estimated model consists of CURAC, the bivariate dummy-variable specifying occurrence of restrictions on current account transaction in a given country and year. The models predict about 2/3 of the observations on CURAC correctly and thus provide a reasonably good description of the data. Column (1) reports the estimated coefficients and their t-statistics for our base model, while columns (2) to (9) provide further results including additional variables as a

[15] The reason for including both the current and the previous year is that all observations on capital controls and their determinants are made on an annual basis and thus are less precise than the monthly data on nominal exchange rates. Note that most of our results do not depend on the sample selection.

robustness test. This additional result, as well as an application of the empirical model to the occurrence of multiple exchange rates, will be discussed in more detail in Section 4. In what follows, we focus on the base model and CURAC.

The base model is founded on the theoretical considerations discussed in Section 2. We have pre-selected our sample to include only observations on fixed exchange rates (see above) and any such exchange rate regime might come under a speculative attack. To control for variance in the intensity of such attacks, we introduce SPECATTD, a dummy variable that is 1 in the case of a speculative attack of certain size on a country's (de facto) fixed exchange rate in a given year and 0 otherwise. An attack is defined as an observed sharp loss in non-gold reserves measured in US dollars in at least one month exceeding 40% – or about two standard observations of the average monthly non-gold reserve change in our sample.[16] As a rule, it should be expected that the occurrence of *pressure on the forex markets* would increase the probability of capital controls being introduced. Indeed, there is a positive and significant influence of SPECATTD in column (1) of Table 2.

The anticipated *durability of a peg* is captured by GRRES51. This variable measures the average growth of international reserves in the five years preceding the current year. (Appendix 2 offers a more detailed account of the construction of all variables used in the empirical exercise.) Arguably, a history of strongly increasing reserves decreases the probability that an existing peg will give way to floating exchange rates even after the introduction of capital controls. Consequently, as discussed in the previous section, we might expect such an increase to lower the likelihood of restrictions on current account transactions to be introduced. Column (1) shows that the coefficient for GRRES51 in the base model is estimated to be significantly negative, which is in line with this expectation.

A second right-hand-side variable suggested by Section 2 is *political benefits* associated with prolonging the existence of a fixed exchange rate regime. The higher these benefits stemming from, for instance, the upholding of a public commitment of a government to peg to a basket of foreign currencies, the larger the likelihood that a country introduces capital controls. A plausible assumption is that these benefits will be larger, the longer such a commitment is in place. PEGIMF51 measures the average number of years a country has publicly declared (to the IMF) its exchange rate to be

[16] Note that GRRES51, which is based on a similar aggregate, excludes the current period.

fixed against the US dollar or any other currency or composite in the previous five years.[17] The data is taken from the IMF's annual reports. And indeed, judging from column (1), countries with an "older" public commitment to fixed exchange rates are significantly more likely to introduce controls on current account transactions than others.

In addition to the political benefits stemming from upholding an official commitment to fixed exchange rates, however, there might also be political costs. For instance, the number and/or influence of private interests lobbying for an unlimited flow of funds across borders will be larger in more open economies. To control for this influence, we include OPEN51, the average degree of openness of a country in the five years preceding the current year. Openness might also be an (albeit very crude) indicator of the allocative inefficiencies caused by capital controls. The variable should have a negative sign. This is indeed the empirical finding reported in column (1) of Table 2. OPEN51 exhibits a significant and negative influence on the probability of CURAC taking on the value 1. That is, more open economies tend to be less likely to introduce restrictions on current account transactions. Incidentally, measures of openness have repeatedly been reported to decrease the probability for introduction of fixed exchange rates (Collins 1996, Berger, Sturm and de Haan 2000).[18]

Domestic inflation is another variable in the base model. As discussed, a higher rate of domestic inflation should make the introduction of capital controls more likely. Such controls might help to extend the life of a fixed exchange rate regime and the nominal anchor it provides for domestic inflation. As observed inflation data is heavily distorted by periods of hyperinflation in the sample, we follow Collins (1996) and opt for an indirect measure of inflation aversion. DUMMIH75 is a binary variable that takes the value 1 if a country in a given year shows CPI-inflation in the upper 17.5% of all sample observations and 0 otherwise. The exact threshold is somewhat arbitrary, but we get broadly comparable results with alternative cut-off points. From column (1) in Table 2 we see that, in line with theory, countries with relatively high

[17] The current year is excluded to avoid a possible simultaneity problem.

[18] An alternative explanation for the influence of openness stemming from this line of thought is that more open economies have deeper and more resilient forex markets that lower the expected volatility (and thus the expected costs) of freely floating exchange rates. By extension, it might be conjectured that a higher degree of openness makes it less likely that controls on current account transactions are

inflation were significantly more likely to introduce controls on current account transactions than others.

Foreign inflation, that is CPI-inflation in the (mostly industrialized) countries at which a government might target its exchange rate, is less contaminated by extreme observations.[19] Accordingly, we use DCPI51, the average rate of inflation in the previous five years, as the fourth variable in the base model. Foreign inflation has a significant and positive impact on the probability that current account transactions are restricted by regulatory controls. This is in line with theory which suggests such a positive effect for sufficiently low levels of foreign inflation.

CORGDP, VARGDPH and VARGDPT are the empirical equivalent of the volatility-related arguments in the theoretical model. CORGDP represents *business cycle synchronicity*. It is defined as the correlation between the Hodrick-Prescott-filtered growth rates of real GDP in the domestic country and the target area. Section 2 suggests an unambiguously positive influence of synchronicity on the probability of capital controls being introduced. This is borne out by column (1) in Table 2, which shows a significant positive coefficient for CORGDP. *Volatility* of real GDP at home and abroad in the target area is measured by the variance of the Hodrick-Prescott-filtered growth rates of real GDP (VARGDPH). Here theory offers less guidance as to what exactly to expect from the empirical exercise – except that both variables should influence the capital control decision. From Table 2 we learn that the likelihood of current account controls being introduced is significantly decreasing in domestic business cycle volatility, but significantly increasing in foreign business cycle volatility (VARGDPT). Section 2 already discussed a possible explanation for such a finding based on our theoretical model.[20]

[Table 3 about here]

introduced to save a regime with fixed exchange rates. See Grilli and Milesi-Ferretti (1995) and Milesi-Ferretti (1998) on the empirical influence of openness on capital controls.

[19] See the note on the selection of target areas in the main text above.

[20] An interesting observation pointing in that direction is that the sample mean of VARGDPH *conditional* on CORGDP being positive and large (0.3 or higher) is smaller than the conditional sample mean of VARGDPT. This seems to support the idea that an increase in the latter will bring imported stabilization policy under a pegging regime more in line with domestic needs. As discussed in the previous section, this might help the case for capital controls.

What are the quantitative effects associated with the estimated base model? The upper panel in Table 3 reports the marginal effects of a change in the right-hand-side variables on the probability of CURAC being 1 in the base model evaluated at sample means (first column). T-statistics and means are shown in columns two and three. To put the estimated marginal effects into perspective, the last column shows the implied impact of a one-standard-deviation increase in each right-hand-side variable on CURAC, assuming that the marginal impact is constant. "Impact" is expressed in units of CURAC standard deviation. Overall, the quantitative impact of the base model seems all but negligible. For about half of the right-hand-side variables the impact of a one-standard-deviation increase is between 0.4 and 0.5, with openness and foreign output variance standing out as having an especially strong impact on CURAC. The smallest impact is noted for home inflation and the occurrence of speculative attacks (about 0.2).

4. Robustness checks

A number of other variables might have an influence on the probability of capital controls being introduced. As well as the evaluation of additional arguments, the inclusion of further variables into the base model can also help to check the robustness of the results reported above. Regarding robustness, the main message stemming from columns (2) to (9) in Table 2 is quite reassuring. With the possible exception of domestic inflation (DUMIH75) and the measure of speculative pressure (SPECATTD), the theoretically deduced determinants remain mostly significant across models.

A first additional argument to be introduced into the base model is the situation at the *world capital market*. Bartolini and Drazen (1997) have suggested that developing countries use policies of capital mobility as a signal of their policy intentions towards foreign investments. However, in times of rising interest rates, for instance, in the U.S. capital market, the reflux of funds from developing countries will reduce their willingness to produce such signals and liberalize current or capital account transactions. And indeed, USR, the nominal three-month treasury bill rate, exhibits a significantly positive effect on the probability that current account transactions are restricted (see column (2) in Table 2). This supports more casual evidence presented by Bartolini and Drazen (1997, Figure 1). Note that, even though

there is some collinearity between USR and DCPIT51 that reduces the impact of the latter variable, the results for the base model hardly change.[21]

Some impact on CURAC could also be expected of *population size* (LPOPAVG) and lagged real *per capita income* (LYPC1). In particular, the latter variable might be of some importance because, as argued by Mussa et al. (2000), the integration into world capital markets is a positive function of the economic development of a country. Higher income countries might be more likely to see their currency peg under pressure on the forex market simply because they are more involved in the international capital market and thus more vulnerable to changes in cross-country capital flows. This, in turn, could make it more attractive for them to resort to capital controls. However, while both variables seem to interact with openness and some other country-specific variables, neither of them is significant itself (see columns (3) and (4) in Table 2).

Columns (5) to (7) report the results for a number of *political economic* variables being added to the base model. EIEC is an indicator of the intensity of political *competition* (provided by Beck et al. 1999) and CRGOV51 measures the average number of government crises in the previous five years (provided by Sierman 1998). An increase in either variable should indicate a shortening of the time horizon of government. Following arguments by Edwards (1994), one might speculate that a more shortsighted government is less prone to introduce capital controls to uphold a longer-term commitment to limit inflation via an exchange rate peg. However, while it seems that both variables have the expected negative effect (see columns (5) and (6)), they only border significance. Similarly, the *ideological color* of government does not seem to play a significant role. LEFT, a dummy-variable signaling a left-wing government, has a positive but not a significant influence on the probability of CURAC taking the value 1. There is, however, some evidence that the introduction of restrictions on current account transactions is significantly positive related to *political unrest.* While there is no significant relation between STRIKE51, the average number of strikes in the previous five years, and CURAC, the average number of anti-government demonstrations in the previous five years, DEMON51, has a significantly positive influence (see column (7) in Table 2). A possible explanation is that governments want to limit capital flight channeled through current account

[21] Results for the real treasury rate are similar.

transactions. All in all, however, the link between political economic factors and capital controls seems to be rather weak.

A last variable to be added to the base model is DEBTGDP1, the lagged ratio of external foreign currency debt to GDP. A higher debt level seems to be significantly positive related to the probability of current account controls being introduced. But note that this comes amidst serious collinearity between the left-hand-side variables. As already discussed in Berger, Sturm and de Haan (2000), DEBTGDP51 is highly negatively correlated with CORGDP51 – foreign funds seem to be flowing more rapidly into developing countries when the business cycles at home and abroad diverge. And indeed, when one instruments DEBTGDP51 by its own lagged value and CORGDP51, the debt variable loses its significance, while the performance of the base model is strengthened (see DBYC2 in column (9)). Note, however, that the use of debt severely limits the number of available observations compared to the previous models.

What is the *quantitative impact* of the additional variables just reviewed? Returning to Table 3 (lower panel) above, we find that, as a rule, the marginal effects of the extension variables remain relatively small. With the possible exception of real per capita income and the ideology variable (neither of which is significant), all estimated marginal coefficients and "impact" indicators remain small compared to those of the base model (compare Table 3, upper panel).

[Table 4 about here]

Table 4 presents the results of an application of the empirical models discussed in Sections 3 and 4 to MULTEX, a 0,1-variable indicating the presence of multiple exchange rate regulation. Judged by the results for the base regression and its robustness across columns, the models' performance is somewhat weaker with MULTEX than with CURAC. This does not come as a surprise given the lack of variance in the left-hand-side variable as already discussed (see Figure 2 in Section 3 and Table 1). Still, with the exception of the measures for foreign and domestic inflation, the right-hand-side variables of the base model in column (1) act in

remarkably similar ways in Tables 4 and 2.[22] With regard to the additional variables introduced in columns (2) to (9), it is perhaps interesting that the occurrence of MULTEX is significantly influenced by population size (negative), income level (positive) and the presence of a "left-wing" ideology in government (positive). Neither of these factors played a significant role in explaining current account controls. Overall, however, Table 4 seems to support the findings reported on CURAC above.

5. Conclusion

In the wake of the financial crises of the late 1990s, the question of the proper exchange rate regime choice for developing countries and emerging markets has caught the interest of economists and policy makers alike. A common notion is, in the light of the increased capital mobility and widespread deregulation of capital controls during the last decade, that the intermediate solution of the adjustable peg is no longer a feasible option for countries involved in the world capital market. Indeed, fewer and fewer governments publicly commit to an intermediate monetary regime and more and more countries declare their monetary regime to be one of floating exchange rates. While some of this recent development amounts to window dressing, i.e. a mere redefinition of adjustable pegs as floats as, for instance, Mussa et al. (2000) report, there certainly is a major movement towards more flexible exchange rate arrangements. But is this really due to an exogenous change in determinants such as the observed decrease in capital controls?

The answer of the present paper is no. We argue that an important part of the observed shift away from capital controls is endogenous. We have developed a simple model that links the decision to liberalize cross-country transactions to exchange rate regime choice, determining both institutions simultaneously. Testing the model with data for 53 non-OECD countries covering the period 1980-94, we find that much of the observed decline in the use of restrictions on current account transactions is due to a decrease in the attractiveness of fixed exchange rates. A similar result is obtained for regulations on multiple exchange rates. (Other forms of capital controls, such as

[22] Inflation is rarely significant and, where it is (see DUMIH75 in columns (1) and (3) of Table 4), its sign is changed compared to Table 2. No other variable that is significant in the CURAC model changes its sign when significant in the MULTEX model.

the enforced surrender of export proceeds or explicit restrictions on capital transactions, show hardly any variance over time and across countries.)

What are the determinants of capital control decisions? We conclude on the basis of our theoretical and empirical analysis that the durability of a peg measured on the basis of the growth of international reserves, the political benefits of a commitment to a peg, domestic and foreign inflation (aversion), as well as business cycle volatility and synchronization are the main determinants of capital controls.

We conclude that much of the recently observed decrease in the level of capital controls in emerging markets and developing countries should not be viewed as an exogenous determinant of exchange rate regimes. Rather, the decline in capital controls should be seen as endogenous to the exchange rate regime decision.

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Appendix 1: Inflation Expectations under Capital Controls

In line with the assumption made about the exogenous nature of θ, the probability that the government will be forced into a floating regime, expectations are set as the probability-weighted average of expected inflation under the two possible regimes

(A1) $\quad \pi^e\big|_{CC>0} = (1-\theta)E\pi_P^{CC>0} + \theta E\pi_F^{CC>0}$.

Actual inflation under a pegging regime can be derived from (2), which reduces to

(A2) $\quad \pi_P^{CC>0} = \pi^* - \phi$,

(see (8) in the main text) with $E\pi_P^{CC>0} = \pi^*$ being the inflationary bias imported from abroad under a pegging regime. If, despite the introduction of capital controls, the actual exchange rate regime turns out to be a float, inflation will be determined by the domestic central bank. Minimizing its loss function (3) with regard to π under this scenario we find

(A3) $\quad \pi_F^{CC>0} = \dfrac{\lambda\alpha^2}{1+\lambda\alpha^2}\pi^e\big|_{CC>0} + \dfrac{\lambda\alpha}{1+\lambda\alpha^2}(y^* - \varepsilon)$,

with $E\pi_F^{CC>0} = (\lambda\alpha^2\pi^e\big|_{CC>0} + \lambda\alpha y^*)/(1+\lambda\alpha^2)$. Using (A2), (A3), and (A1) and solving for expectations we arrive at

(A1') $\quad \pi^e\big|_{CC>0} = \dfrac{(1-\theta)(1+\lambda\alpha^2)}{1+(1-\theta)\lambda\alpha^2}\pi^* + \dfrac{\theta}{1+(1-\theta)\lambda\alpha^2}\tilde{\pi}$,

where the sum of the two fractions is just unity. That is, expected inflation after the introduction of capital controls is a weighted average of the inflationary biases prevailing abroad and under a floating exchange rate regime at home.

Appendix 2: Data

Data Source

Unless mentioned otherwise all underlying data are from the International Financial Statistics of the IMF. Series 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.

Sample Selection and actual or potential pegged-to-currency (TARGET)

In the empirical analysis we concentrate on a large set of developing countries, covering the period 1980-1994. To construct many of our explanatory variables we have to identify which currency (basket) each country effectively pegs its currency to in each year. The IMF reports whether countries peg to the US dollar, the French franc, the SDR, or any other currency or composite. 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 which countries non-pegging countries would potentially peg to, we look at their history. If they have never pegged we choose to use the US dollar or the SDR as their potential target currency. A detailed list of the target areas for each country can be found in Berger, Sturm and de Haan (2000, Table A1).

When selecting our sample, we require the recent exchange rate to have been "relatively" fixed. Following Kraay (2000), we use monthly data to construct for each observation an average over the previous twelve months of the absolute value of percentage changes in the nominal exchange rate (in terms of the (potential) target currency (basket)). We then construct a dummy that equals one during all episodes for which this average does not exceed 2.5%, or about one half of one standard deviation from the mean for the entire sample. When converting this measure to annual frequency, we only select those observations in which the sum of the monthly dummy variable equals 12 in this year or in the previous year. Hence, we only consider those (annual) observations for which the exchange rate has been "relatively" stable either

this year or the previous year. This reduces our entire sample of 741 observations from 58 countries to a sample 564 observations from 53 countries.

The 53 countries in the sample are: Argentina, Bahamas, Bahrain, Bangladesh, Belize, Botswana, Burundi, Chile, Colombia, Costa Rica, Cyprus, Dominican Republic, Ecuador, Egypt, El Salvador, Ethiopia, Fiji, Ghana, Greece, Guatemala, Haiti, Honduras, India, Indonesia, Jamaica, Jordan, Kenya, Korea (South), Kuwait, Madagascar, Malawi, Malta, Mauritius, Mexico, Morocco, Nepal, Nigeria, Pakistan, Paraguay, Peru, Philippines, Saudi Arabia, South Africa, Sri Lanka, Swaziland, Tanzania, Thailand, Trinidad and Tobago, Tunisia, Uruguay, Vanuatu, Venezuela and Zimbabwe.

Capital control measures (CURAC, MULTX, CAPAC, EXPPR)

Gian Maria Milesi-Ferreti has kindly provided capital control measures. The dummies indicate restrictions on current account transactions, multiple exchange rates, restrictions on capital account transactions and surrender of export proceeds, respectively.

Speculative attack dummy (SPECATTD)

We identify speculative attacks by using a dummy-indicator of speculative pressure: sharp reserve losses. Specifically, we consider all episodes in which the monthly decline in non-gold reserves measured in US dollars exceeds 40%, which is about two standard deviations above the mean change for the entire sample. Converting this to annual data, we consider each year in which a severe decline like this occurs at least once as a year in which there has been a speculative attack.

Inflation measures (DUMIH75, DCPIT51)

We use the percentage change in the consumer price index in both the home and target country as our measure for inflation. For both measures we take the lagged 5-year moving average. As the inflation rate in some of the developing (home) countries is sometimes rather extreme, we opted to construct a dummy variable for the home countries. (As most target countries are OECD countries, this problem does not prevail there.) The 17.5% of the observations showing the highest inflation rates will have the value one in the dummy variable DUMIH75.

Growth in international reserves (GRRES51)

We use the lagged 5-year moving average growth rate of international reserves denominated in SDR. The series is available on an annual basis only.

Official pegging strategy (PEGIMF51)

The IMF classifies each country into different categories concerning their exchange rate regime. 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 are considered to be non-pegging. To construct our explanatory variable PEGIMF51, we take the lagged 5-year moving average of this fixed exchange rate dummy.

Variance real GDP shocks home (VARGDPH) and target countries (VARGDPT) and the correlation between both real GDP shocks (CORGDP)

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 local currency and US dollar, respectively, 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.

Openness (OPEN51)

Openness is measured as the sum of total imports and exports as a percentage of GDP.

US interest rate (USR)

We use the US 3-month treasure bill rate as our world interest measure.

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.

Log of real GDP per capita (LYPC1)

Simply the log of real GDP per capita.

Political instability (CRGOV51, DEMON51, STRIKE51)

In order to capture political uncertainty or instability, we include three variables indicating socio-political unrest. Those variables are the number of strikes, government crises, and anti-government demonstrations, and are taken from Sierman (1998).

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 at 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 Sierman (1998) data, we opted to use the Sierman (1998) data in the final analysis. This does not influence our conclusions.

Political institutions (EIEC, LEFT)

We use two measures of political institutions. The first is an executive index of electoral competitiveness. It can take on values between 1 and 7. (1: no executive; 2: unelected executive; 3: elected, 1 candidate; 4: 1 party, multiple candidates; 5: multiple parties are legal, but only one party won seats; 6: multiple parties did win seats but largest party received more than 75% of the seats; 7: largest party got less than 75%).

The second is a dummy variable which equals 1 if the party of the chief executive is a left-wing party, and zero otherwise. Both measures are taken from the database of political institutions, version 2.0, constructed by Beck, Clarke, Groff, Keefer and Walsh (1999).

External debt as percentage of GDP (DEBTGDP1, DBTYC2)

Total external debt is taken from the World Bank Development Indicators and is defined as debt owed to non-residents 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.

Our second measure, DBTYC2, is the residual from a linear regression explaining DEBTGDP1 using a constant, lagged DEBTGDP1 and CORGDP as explanatory variables.

Tables A1 and A2 summarize the above. The first gives all underlying series needed to construct the variables shown in the latter. Table 1 shows summary statistic and short descriptions of all variables used in the empirical analysis.

Table A1: Original series used to construct the different variables

Series	Description	Unit	Frequency	Countries	Source
CURAC	Capital controls: multiple exchange rates	Dummy	Annual	Home	Gian Maria Milesi-Ferreti
MULTX	Capital controls: restrictions on current account trans.	Dummy	Annual	Home	Gian Maria Milesi-Ferreti
CAPAC	Capital controls: restrictions on capital account trans.	Dummy	Annual	Home	Gian Maria Milesi-Ferreti
EXPPR	Capital controls: surrender of export proceeds	Dummy	Annual	Home	Gian Maria Milesi-Ferreti
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
SDRDOL	Annual SDR exchange rate	SDR per US$	Annual	Home	IFS cd-rom
PEGIMF	Official pegging strategy	Dummy	Annual	Home	IMF
RES	Total reserves minus gold	US$	Monthly	Home	IFS cd-rom
INTRES	International reserves	SDR	Annual	Home	IFS cd-rom
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
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
USR	3-month treasury bill rate	Percentage	Annual	Home	Federal Reserve Board of Governors
POP	Population	Number	Annual	Home	IFS cd-rom
STRIKE	Strikes	Dummy	Annual	Home	Clemens Sierman
CRGOV	Crisis (government)	Dummy	Annual	Home	Clemens Sierman
DEMON	Anti-government demonstrations	Dummy	Annual	Home	Clemens Sierman
EIEC	Executive index of electoral competitiveness	Dummy	Annual	Home	Database of Political Institutions
LEFT	Dummy equals 1 if party of chief executive is left-wing	Dummy	Annual	Home	Database of Political Institutions

Table A2: Constructed variables used in the empirical analysis

Series	Description	Underlying series
SPECATTD	Dummy measuring speculative attacks	RES
DUMIH75	Dummy measuring upper 25%-tile of lagged 5-year moving average change in Consumer Price Index in home country	DCPI
DCPIT51	Lagged 5-year moving average change in Consumer Price Index in target country	DCPI
CORGDP	Correlation Real GDP shock	TARGET, GDP, AEXCH
VARGDPH	Variance real GDP shocks home	GDP
VARGDPT	Variance real GDP shocks target	TARGET, GDP, AEXCH
GRRES51	Lagged 5-year moving average growth rate in international reserves	INTRES, SDRDOL, AEXCH
PEGIMF51	Lagged 5-year moving average of fixed exchange rate dummy based on IMF reports	PEGIMF
OPEN51	Lagged 5-year moving average openness.	IMP, EXP, GDPNOM
LPOPAVG	Average log population	POP
LYPC1	Lagged log of real per capita income	GDP, POP, AEXCH
CRGOV51	Lagged 5-year moving average government crises	CRGOV
DEMON51	Lagged 5-year moving average Anti-government demonstrations	DEMON
STRIKE51	Lagged 5-year moving average strikes	STRIKE
DEBTGDP1	Lagged external debt as percentage of GDP	DEBT, AEXCH, GDPNOM
DBTYC2	Lagged External debt as percentage of GDP corrected for its lagged value and CORGDP	DEBT, AEXCH, GDPNOM, TARGET, GDP

Table 1: Summary statistics and

short description of variables used in the analysis

Series	Obs	Mean	Std. Error	Min	Max	Short description (see Appendix 2 for details)
CURAC	564	0.65	0.48	0.00	1.00	Indicator of current account transactions
MULTX	564	0.25	0.44	0.00	1.00	Indicator of multiple exchange rates
CAPAC	564	0.86	0.35	0.00	1.00	Indicator of capital account transactions
EXPPR	564	0.87	0.34	0.00	1.00	Indicator of export proceeds restrictions
SPECATTD	564	0.14	0.35	0.00	1.00	Dummy for speculative attack
DUMIH75	564	0.18	0.38	0.00	1.00	Dummy for high home CPI-inflation
DCPIT51	564	0.06	0.03	0.01	0.14	Foreign inflation rate
CORGDP	564	0.21	0.26	-0.76	0.91	Correlation btw. home and foreign output shock
VARGDPH	564	0.22	0.18	0.02	1.12	Variance of home output shock
VARGDPT	564	0.29	0.41	0.03	1.92	Variance of foreign output shock
GRRES51	564	0.07	0.18	-0.61	0.66	Growth of international reserves
PEGIMF51	564	0.61	0.44	0.00	1.00	Official pegging history according to IMF
OPEN51	564	0.69	0.43	0.14	2.20	Measure of Openness
USR	564	7.60	3.39	3.02	14.73	US interest rate
LPOPAVG	564	15.84	1.87	11.68	20.37	Average population size (in logs)
LYPC1	562	7.61	1.62	4.84	21.28	Real per capita GDP (in logs)
EIEC	564	5.07	2.26	2.00	7.00	Index of electoral competition
CRGOV51	559	0.09	0.17	0.00	1.00	Number of government crises
LEFT	538	0.25	0.43	0.00	1.00	Dummy for left-wing government
DEMON51	559	0.97	1.97	0.00	12.20	Number of anti-government demonstrations
STRIKE51	559	0.24	0.50	0.00	3.00	Number of strikes
DEBTGDP1	441	0.49	0.27	0.05	1.66	External debt in % GDP
DBTYC2	404	0.00	0.07	-0.22	0.31	DEBTGDP1 explained by lagged DEBTGDP1 and CORGDP

Table 2: Explaining Current Account Controls (CURAC)

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
Variable	Param.	t-ratio	Param.	t-ratio	Param.	t-ratio	Param.	t-ratio	Param.	t-ratio	Param.	t-ratio	Param.	t-ratio	Param.	t-ratio	Param.	t-ratio
Constant	-0.05	-0.12	-0.33	-0.81	-3.46	-1.25	2.24	3.05	0.75	1.28	-0.35	-0.63	0.17	0.31	-0.35	-0.40	1.75	3.14
SPECATTD	0.83	2.85	0.89	2.91	0.42	1.13	0.33	1.19	0.76	2.32	0.52	0.79	1.01	2.72	0.73	1.14	0.79	1.47
GRRES51	-3.25	-6.70	-3.47	-7.29	-3.86	-6.18	-3.24	-5.17	-3.25	-6.06	-3.73	-6.16	-3.07	-5.14	-2.13	-3.02	-1.45	-1.36
PEGIMF51	1.38	4.89	1.33	4.54	1.50	3.72	0.94	3.07	1.30	4.30	1.68	4.18	1.50	4.02	2.31	4.23	2.37	4.60
OPEN51	-1.69	-2.76	-1.53	-2.60	-1.43	-1.81	-3.14	-4.26	-1.71	-2.65	-2.51	-4.05	-1.96	-2.67	-3.16	-3.71	-5.22	-4.76
DUMIH75	0.82	2.28	0.90	2.40	0.41	1.21	0.84	2.48	0.79	1.87	1.03	2.55	0.45	1.04	0.20	0.46	0.50	0.91
DCPIT51	10.88	2.79	2.96	0.65	11.83	2.21	18.03	3.22	8.99	1.77	13.19	2.83	12.11	2.84	11.45	1.92	12.88	1.85
CORGDP	1.43	3.12	1.41	3.13	1.18	2.08	1.21	1.83	1.31	2.60	2.30	4.97	1.31	2.11	1.54	1.44	3.47	3.64
VARGDPH	-2.29	-2.88	-2.13	-2.62	-2.86	-3.51	-3.52	-3.43	-2.47	-2.72	-2.46	-2.72	-2.43	-2.71	-1.33	-1.38	-4.03	-3.23
VARGDPT	1.72	3.42	1.75	3.53	1.91	3.52	1.91	2.79	1.70	2.95	2.30	4.43	1.64	2.50	2.11	2.77	3.82	3.65
USR			0.08	3.01														
LPOPAVG					0.26	1.76												
LYPC1							-0.18	-1.52										
EIEC									-0.07	-1.53								
CRGOV51									-1.46	-1.99								
LEFT											1.04	1.54						
DEMON51													0.22	2.98				
STRIKE51													0.20	0.85				
DEBTGDP1															1.93	2.65		
DBTYC2																	0.56	0.13
Rho	0.85	27.59	0.85	29.67	0.77	24.98	0.82	18.92	0.85	25.39	0.87	32.73	0.86	29.78	0.91	28.27	0.91	35.73
Log-L	-179.28		-176.89		-180.96		-176.10		-174.15		-164.79		-173.37		-129.08		-111.47	
LogLNoRE	-316.55		-316.29		-314.62		-310.45		-301.40		-288.70		-305.48		-238.48		-220.79	
# obs.	564		564		564		562		559		538		554		441		404	
# countries	53		53		53		53		53		53		53		45		44	
% correct	0.68		0.70		0.69		0.66		0.68		0.67		0.69		0.67		0.65	

Table 3: Marginal Effects

	Parameter	t-ratio	Mean	Impact[a]
		Base model		
SPECATTD	0.276	2.775	0.138	0.201
GRRES51	-1.077	-6.434	0.066	-0.404
PEGIMF51	0.457	4.545	0.615	0.419
OPEN51	-0.560	-2.814	0.694	-0.502
DUMIH75	0.270	2.387	0.176	0.214
DCPIT51	3.601	2.743	0.059	0.225
CORGDP	0.475	2.890	0.211	0.257
VARGDPH	-0.757	-2.632	0.220	-0.284
VARGDPT	0.568	3.571	0.293	0.485
		Extensions[b]		
USR	0.027	2.954	7.598	0.194
LPOPAVG	0.040	1.756	15.837	0.158
LYPC1	-0.066	-1.523	7.615	-0.223
EIEC	-0.021	-1.675	5.094	-0.101
CRGOV51	-0.459	-1.859	0.087	-0.159
LEFT	0.345	1.756	0.249	0.313
DEMON51	0.055	2.951	0.973	0.225
STRIKE51	0.050	0.824	0.244	0.052
DEBTGDP1	0.255	2.077	0.495	0.144
DBTYC2	0.046	0.134	0.000	0.007

[a] "Impact" is defined as the marginal effect of a variable estimated at sample means multiplied by the variable's standard deviation divided by the standard deviation of CURAC. See Table 1 for the standard deviations.

[b] The estimates for the "Extensions" refer to columns (2) and following in Table 2. The respective results for the other variables in the extended models are available on request.

Table 4: Explaining Multiple Exchange Rates (MULTX)

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
Variable	Param.	t-ratio	Param.	t-ratio	Param.	t-ratio	Param.	t-ratio	Param.	t-ratio	Param.	t-ratio	Param.	t-ratio	Param.	t-ratio	Param.	t-ratio
Constant	-0.45	-0.67	-0.80	-1.33	11.58	2.38	-4.38	-4.24	-1.52	-2.79	-2.95	-4.76	-1.88	-3.26	-0.83	-0.99	1.44	1.77
SPECATTD	-0.13	-0.26	0.17	0.52	0.40	1.33	-0.07	-0.18	0.07	0.27	0.54	1.33	0.36	1.00	0.09	0.10	0.65	0.77
GRRES51	-2.39	-3.79	-2.42	-4.20	-2.24	-3.90	-3.06	-4.30	-1.87	-3.23	-3.01	-3.38	-1.83	-2.85	-2.49	-2.16	-2.18	-1.63
PEGIMF51	1.64	2.85	2.81	4.74	2.35	4.83	2.71	4.35	2.48	3.97	1.94	3.38	2.51	4.52	1.77	2.75	3.46	4.45
OPEN51	-2.99	-3.35	-4.69	-6.18	-5.84	-3.51	-2.57	-3.55	-2.83	-3.79	-2.98	-2.89	-2.67	-4.03	-5.51	-4.21	-10.62	-4.83
DUMIH75	-0.56	-2.00	-0.21	-0.60	-0.79	-2.95	-0.01	-0.04	-0.11	-0.33	-0.15	-0.64	-0.44	-1.29	-0.28	-0.55	-0.06	-0.10
DCPIT51	-0.24	-0.04	-4.36	-0.58	-1.93	-0.36	-12.82	-1.34	-0.12	-0.02	-6.07	-1.07	1.96	0.25	7.05	0.70	-4.07	-0.39
CORGDP	3.57	6.31	3.64	6.45	1.59	3.66	2.71	4.38	1.57	4.37	2.96	3.20	1.83	4.57	4.02	5.52	4.26	3.04
VARGDPH	-7.19	-4.77	-5.36	-3.22	-3.67	-3.55	-5.71	-3.35	-1.49	-1.88	-3.89	-2.62	-1.94	-1.86	-6.26	-2.01	-2.87	-1.42
VARGDPT	1.10	2.24	1.61	3.72	0.75	1.74	0.51	1.06	0.80	1.99	1.29	2.31	0.74	1.71	0.08	0.11	1.32	1.31
USR			-0.02	-0.63														
LPOPAVG					-0.69	-2.61												
LYPC1							0.43	2.94										
EIEC									0.04	0.59								
CRGOV51									-1.20	-2.14								
LEFT											1.97	3.53						
DEMON51													0.21	0.97				
STRIKE51													0.35	1.02				
DEBTGDP1															1.54	1.67		
DBTYC2																	3.62	1.30
Rho	0.93	44.90	0.83	24.68	0.84	23.74	0.82	16.82	0.84	19.51	0.88	20.07	0.86	29.78	0.92	31.45	0.89	22.34
Log-L	-148.15		-161.73		-160.63		-151.13		-162.78		-150.73		-155.73		-119.88		-105.53	
LogLNoRE	-262.06		-262.02		-260.48		-246.33		-251.36		-246.58		-257.04		-204.09		-179.26	
# obs.	564		564		564		562		559		538		554		441		404	
# countries	53		53		53		53		53		53		53		45		44	
% correct	0.73		0.73		0.71		0.74		0.72		0.74		0.72		0.73		0.71	