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EXCHANGE RATE INTERVENTIONS AND INSURANCE: IS "FEAR OF FLOATING" A CAUSE FOR CONCERN?

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Resumen

Una de las características empíricas centrales de los regímenes cambiarios de las economías emergentes es el llamado "miedo a flotar". Sin embargo, mientras algunos ven el miedo a flotar como la respuesta monetaria óptima ex post a los shocks externos, pues protege los balances contables y evita brotes inflacionarios, otros argumentan que, desde una perspectiva ex ante, tal política conduce a un subaseguramiento del sector privado contra paradas repentinas de capitales externos. Un compromiso de la autoridad a dejar flotar el tipo de cambio durante las crisis aumentaría el incentivo a que los privados conservaran la liquidez internacional. Este artículo desarrolla un modelo de régimen cambiario óptimo cuando hay preocupaciones tanto ex ante como ex post. Dado que el miedo a flotar solo reduce el seguro durante potenciales paradas repentinas, revisamos los datos sobre regímenes cambiarios en busca de evidencia que pruebe que la flexibilidad cambiaria es condicional al estado de la economía. Encontramos políticas no condicionales con flexibilidad baja y uniforme en la mayoría de los mercados emergentes, lo que combinado con ausencia de seguros sustitutos apoya el argumento de que para tales economías sería deseable tener más flexibilidad cambiaria durante las paradas repentinas. Sin embargo, las flotaciones más recientes con grados intermedios de credibilidad muestran poca condicionalidad al estado a causa de una flexibilidad uniforme y alta. Los sistemas de flotación cambiaria más establecidos y con alta credibilidad exhiben regímenes condicionales al estado, que conservan la capacidad de aplicar intervenciones discrecionales, pero flotan durante las crisis potenciales. La flexibilidad cambiaria se asocia con una mayor acumulación de activos en dólares y una menor incidencia de las paradas repentinas. En su conjunto, la evidencia sugiere que las economías emergentes se benefician de la flexibilidad cambiaria y que la credibilidad de la política monetaria es un elemento esencial para el éxito de su aplicación.

Abstract

"Fear of floating" is one of the central empirical characteristics of exchange rate regimes in emerging markets. However, while some view "fear of floating" in terms of the optimal ex post monetary response to external shocks, protecting balance sheets and avoiding inflation, others have argued that from an ex ante perspective such a policy leads to private sector under-insurance against sudden stops. A commitment to floating during potential crises would increase the incentives of the private sector to conserve international liquidity. This paper develops a model of the optimal exchange rate regime when both ex ante and ex post concerns are present. Since it is only "fear of floating" during potential sudden stops which undermines insurance, we reexamine the data on exchange rate regimes for evidence that exchange rate flexibility is state-contingent. We find most emerging markets exhibit non-contingent policies with a uniformly low level of flexibility, which together with an absence of substitute insurance policies supports the claim that greater exchange rate flexibility during sudden stops would be desirable for such countries. However, more recent floats with intermediate levels of credibility exhibit little state contingency because of a uniformly high degree of flexibility. More established floats with high credibility exhibit state-contingent regimes, retaining a capacity for discretionary intervention, but floating during potential crises. Exchange rate flexibility is associated with increased private sector hoarding of dollar assets and reduced incidence of sudden stops. Together the evidence suggests that the insurance benefits to floating for emerging markets can be substantial and that the credibility of the monetary policy framework is central to successful implementation of this policy.

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1. Introduction

"Fear of floating" has recently come to be seen as one of the central *de facto* characteristics of exchange rate regimes in emerging markets since it was first identified by Calvo and Reinhart (2002). However the interpretation of this phenomenon is still open to question. Is it the case that the optimal monetary regime for emerging markets with open capital markets entails limited exchange rate flexibility? In the formulation of Shambaugh (2004), is the famous open economy trilemma really a dilemma for emerging markets, a choice between open capital markets or monetary freedom with no separate choice of exchange rate policy? Or is the trilemma alive and well? Does the pervasive "fear of floating" indicate instead that many emerging markets inadvisably choose to limit exchange rate flexibility when a genuine floating regime would be preferable?

Although the literature on this topic could be classified along many dimensions this paper focuses on the extent to which "fear of floating" is the optimal policy for emerging markets. The literature can be divided into those that focus on deriving "fear of floating" as the optimal *ex post* monetary policy, taking into account the particular economic environment and shocks faced by emerging markets, and those that focus on the *ex ante* effects of monetary policy, where anticipations of exchange rate policy can drive inefficient private sector decisions. The main factors that have been claimed to support "fear of floating" *ex post* are the pass through of (excessive) exchange rate volatility into domestic inflation, the costs to inflation credibility this might entail, and the contractionary effects of a devaluation on an economy with a high level of dollarized liabilities. Contrasting this, Caballero and Krishnamurthy (2004) have argued that although limited exchange rate flexibility is often the optimal discretionary policy *ex-post*, it distorts the incentives of the private sector to insure itself *ex-ante* against sudden stops in capital inflows. If the private sector anticipates that the exchange rate will be defended during a crisis, its own incentives to hoard international liquidity are weakened, and such anticipations can be the *ex ante* cause of the excessive dollarization which supposedly validates "fear of floating" *ex post*. "Fear of floating" is not optimal, but without a commitment to floating during crises, it is the equilibrium policy. Countries can improve their insurance against sudden stops by giving the private sector the right incentives, either through a commitment to a floating exchange rate, or various substitute policies that will be discussed more fully later.

The purpose of this paper is to explore the tension between these approaches and its implications for exchange rate policy in emerging markets. We attempt to shed light on the question of whether "fear of floating" is simply the optimal policy choice in a difficult environment or a suboptimal equilibrium with too little exchange rate flexibility during external crises. We take the view that these explanations are not necessarily mutually exclusive, allowing "fear of floating" to have different aspects under different circumstances. In the face of less severe external shocks, when the supply of international liquidity is not exhausted, countries will optimally stress the *ex-post* considerations preferring to avoid the inflationary effects of exchange rate instability. This does not preclude that during severe crises, when international liquidity shortages are binding, the exchange rate be allowed to float, the commitment to which *ex ante* provides maximal insurance against such events. In this view, while floating exchange rates can have important incentive effects, it is not necessary that the exchange rate float freely under all circumstances for these effects to obtain. This leads naturally to the concept of *state-contingency*. It is impossible to evaluate the consequences of "fear of floating" without understanding the circumstances under which such exchange rate rigidity occurred. Perhaps the significant *unconditional* "fear of floating" which the literature has identified masks *conditional* flexibility during external crises.

With this in mind, we develop a simple model that captures a trade off between *ex ante* and *ex post* considerations. The are two states of nature, a "good" state, during which international liquidity is sufficient, and a "bad", or crisis, state during which constraints on the supply of international liquidity are binding. The optimal policy with commitment is indeed state-contingent along the lines described above, intervening to stabilize the exchange rate, and prevent inflation pass-through,[1] when there is no crisis, but allowing the exchange rate to float if a potential crisis occurs, for its effect on expectations. However we also consider two second best policy regimes. We contrast the discretionary policy, which is determined *ex post* with no commitment. As in Caballero and Krishnamurthy (2004) such a policy will exhibit inefficient "fear of floating" during crises and forego the insurance benefits of the floating exchange rate, but it does not compromise the benefits of exchange rate stability during normal times. Finally we also consider the non-contingent policy with commitment. This regime is viewed as a proxy for the process of building

commitment to floating, during which it might be necessary to avoid intervention altogether. Although this brings the benefits of improved *ex ante* insurance against external shocks, there are short term costs in the form of the greater inflation pass-through that floating entails.

To empirically identify state-contingency the paper develops an indicator of *potential* sudden stops as a proxy for the bad state of nature described above. The indicator is derived from the spread on a broad index of high yield debt. A rise in high-yield spreads is treated as a (common) exogenous negative shock to external financing conditions for emerging markets and as such a potential sudden stop. By comparing the behavior of the exchange rate regime in periods with and without external pressure we classify the state-contingent exchange rate regime. It is important to emphasize that we evaluate state contingency with respect to *potential* sudden stops. This allows us to address the question of whether the exchange rate regime has an effect on the likelihood of *actual* sudden stops, which are treated as endogenous, and hence evaluate the insurance provided by floating exchange rates.

Classifying exchange rate regimes according to their behavior during potential sudden stops, we find that for many countries there is little difference between the degree of exchange rate flexibility during potential crises and other times, and exchange rate flexibility is uniformly low. These emerging markets are viewed as operating under a discretionary exchange regime. There is another group of emerging markets that does not exhibit state contingency because the6ir exchange rates flexibility is uniformly high. These countries cannot be described as exhibiting "fear of floating" and we interpret these countries as non-contingent regimes committed to floating. Finally a few countries do exhibit fully state-contingent exchange rate flexibility.

Having characterized the exchange rate behavior in the face of potential crises, the paper proceeds to investigate the extent to which the choice of regime can be given a normative interpretation. In particular, is it possible to conclude from widespread "fear of floating" during potential crises that a commitment to floating would be beneficial? In order to answer this question it is important to consider insurance substitutes. In particular, as discussed in Caballero and Krishnamurthy (2004), sterilization of capital inflows and direct financial regulation can substitute for the incentives provided by a commitment to floating. We

[1] As discussed above this is one *ex post* channel through which "fear of floating" can be justified, but not the

examine the data, but find little evidence of such substitute policies. The model suggests that "fear of floating" should therefore be associated with under-insurance against liquidity crises. We test this hypothesis by examining two outcomes, the likelihood of suffering a sudden stop and the link between the exchange rate regime and the self-insurance of the private sector. In both cases we find evidence that "fear of floating" matters. Less flexibility during potential crises is associated with a greater probability of an actual sudden stop[2] and more flexible regimes lead to greater hoarding of foreign exchange reserves by the private sector. Finally we investigate the determinants of exchange rate regime choices. A key ingredient in the analysis is the credibility of monetary policymaking. The model suggests that state contingent regimes require most credibility, non-contingent floating an intermediate level of credibility and discretionary policy the lowest level of credibility. The data give some support to this hypothesis showing an association between floating exchange rates and the overall credibility of the monetary policy framework, as measured by the commitment to inflation targeting.

The outline of the paper is as follows. Section 2 describes the theoretical framework we use to approach the data. Section 3 describes the data and methodology and provides an outline of the empirical facts. Section 4 provides a more formal analysis of the time series measures of exchange rate flexibility. Section 5 examines the consequences of the choice of exchange rate regime. Section 6 analyzes the determinants of exchange rate flexibility and Section 7 concludes.

2. Fear of Floating: Theoretical Discussion

2.1 Existing Literature

As stated above, various models have been proposed in the literature to explain "fear of floating". Calvo and Reinhart (2002) suggest that "fear of floating" can be explained by a monetary policy dilemma trading off seigniorage benefits of inflation against cost of deviating from an inflation target in an environment with risk

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only one. We focus on one channel to keep the modeling streamlined.

[2] It is important to emphasize that this result is not by construction. Exchange rate regimes are characterized in relation to *potential* crises, while the measure of sudden stops is an *actual* outcome.

premium shocks and a high pass through of the exchange rate into the national price level. In their model fear of floating is increasing in the size of the risk premium shocks and the extent to which inflation targeting is valued over seigniorage. Other authors, such as Aghion et al (2003) emphasize the balance sheet channel. Typically it is taken as given that there are substantial dollar liabilities which risk bankruptcies in the event of a devaluation. However, Céspedes et al (2004) present a model in which the balance sheet effects of dollarized liabilities do not necessarily overturn the standard Mundell-Fleming analysis that floating rates are better in the presence of external real shocks since there are also effects on the asset side. Lahiri and Vegh (2001) rationalize "fear of floating" as the optimal policy in an environment with an output cost of nominal exchange rate fluctuations, an output cost of higher interest rates to defend the currency, and a fixed cost of intervention. The fixed cost generates a non-linearity in which "fear of floating" only arises for large shocks. Despite deriving "fear of floating from different imperfections, for our purpose the important feature these models have in common is that "fear of floating" emerges as a characteristic of the *optimal*, *ex-post* monetary policy.

A different view is offered by Caballero and Krishnamurthy (2004). Fear of floating arises in their model out of a time-consistency problem. Although it is optimal to tighten monetary policy *ex-post*, taking as given that the country is suffering an international liquidity crisis, such a policy increases the extent to which firms fail to conserve international liquidity *ex-ante*. The central monetary policy issue for a country facing such sudden stops is to make sure that the private sector takes enough precaution to insure itself against such crises. A floating exchange rate is the optimal policy from an *ex-ante* perspective as it raises the return to holding international liquidity, leads to greater hoarding of dollar liquidity, and helps to ameliorate the under-insurance of the private sector. The difficulty in implementing this policy is that once a crisis occurs, the floating exchange rate is no longer optimal, since an exchange rate depreciation leads to inflation, and so the time-consistent equilibrium entails "fear of floating". In developing our theoretical model, the central insight we take from this analysis is the existence of a commitment problem with respect to floating.

The framework that we outline below combines elements from both approaches to exchange rate flexibility and we assume that "fear of floating" can have a different aspect under different circumstances. In particular we assume that there are two states of the world. In the "good" state, there is no shortage of international

liquidity, and hence no issues of insurance, and the government optimally focuses on the *ex post* issues. In particular, since foreign exchange markets exhibit "excess" volatility[3] there will be incentives to limit exchange rate volatility and prevent its pass-through into domestic inflation. In the "bad" state, a shortage of international liquidity is binding. The focus of policy should be on the prevention of, or insurance against, such crises. In this case "fear of floating" is not the optimal response taking into account the *ex-ante* effects on the incentives of the private sector to insure itself. We will examine the choice of exchange rate flexibility under three different assumptions about the government, and its ability to commit.

The *discretionary regime* is the optimal policy assuming the government cannot commit to floating during sudden stops and so the policy is determined *ex-post.* Such a policy will be optimal in the "good" state, but will contribute to under-insurance during sudden stops in the "bad" state. The *state-contingent regime* assumes that the government can commit to floating during sudden stops but is also free to intervene in the good state without compromising that commitment. Finally we consider the *non-contingent regime* in which the government can commit to its exchange rate regime, but the private sector does not observe the state of the world. As a result the government must choose the same exchange rate flexibility at all times, since intervention during normal times can compromise the commitment to floating during crises.

The restriction on feasible policies in the non-contingent regime might appear *ad hoc* as it is not derived endogenously within the model but simply imposed as an assumption. In defense we consider this regime for several reasons. First we think of it as a useful approximation to the feasible floating policy for a country that needs to build credibility for its commitment to floating. A similar situation has been modeled formally in the context of building a reputation for inflation credibility by Barro (1986). In that model the private sector is uncertain about the preferences of the policymaker and the policymaker takes into account the fact that the private sector learns about these preferences through his actions. The equilibrium exhibits periods in which policymakers that are tough on inflation drive inflation to a very low level to demonstrate this fact until a reputation is established. We conjecture that a policy of non-contingent floating can operate in a similar manner when a reputation for floating during crises has not been established. Furthermore this policy

[3] The forward discount bias is often attributed to noise traders. See Frankel and Froot (1989).

regime appears to describe the behavior of some countries in our empirical investigation so we are compelled to consider it as a theoretical possibility.

2.2 A Model

The model will draw heavily on the framework of Caballero and Krishnamurthy (2004), postulating an over-investment problem in the "bad" state, which is the mirror image of the failure to optimally hoard sufficient international liquidity as insurance against sudden stops. Crucially the extent of over-investment depends on anticipations of exchange rate policy. The framework is extended by postulating a desire to limit exchange rate flexibility in the "good" state, when there are no insurance issues, but the pass-through of exchange rate volatility into the price level is still a cause for concern. There is a tension between these goals, and the optimal policy will resolve this, under different constraints on commitment to which the policy maker is subject. We present the model in reduced form without explicitly considering the micro-foundations of the mechanisms through which exchange rate policy acts, to simplify the exposition.

Consider a three period economy. At time 0 firms makes investment decisions. At time 1 a crisis may or may not occur which requires firms to make some reinvestment to maintain the productivity of their asset. At time 2 the economy consumes its output, which depends on both the investment at time 0 and the reinvestment at time 1. If a crisis occurs in period 1 the government faces *ex-post* incentives to tighten monetary policy, as in the literature in which fear of floating is optimal, to protect itself against inflation, since the insurance aspects of exchange rate policy are already sunk, but *ex ante* insurance concerns are foremost. If no crisis occurs, excess exchange rate volatility is still undesirable through its effect on prices and "fear of floating" is optimal.

The insurance aspect of monetary policy is that from the point of view of time 0 the investment decisions of firms depend on expectations of the exchange rate during the crisis. In particular, the country is assumed to hold a fixed amount of international collateral that it can choose to use to finance investment at time 0 or hoard as insurance against a crisis at time 1. The exchange rate determines the price at which international

collateral can be traded in the domestic market at time 1, and so provides incentives for its accumulation or usage. There is a pecuniary externality that leads to an undervaluing (relative to the price which maximizes time 2 output) of international collateral, and hence firms over-invest at time 0 and conserve too little international collateral for the possible crisis at time 1. Monetary policy affects the exchange rate and hence has the power to correct this mis-pricing, but to do so the government has to commit to allow the exchange rate to depreciate during the crisis. This raises the return to holding international liquidity, lowers the return to investing and moves the investment decisions of firms closer to the output maximizing level. The time inconsistency problem arises since once the crisis occurs the investment decision is predetermined and the exchange rate depreciation just raises inflation which is costly to the government, so *ex-post* the government prefers to limit exchange rate flexibility.

The objective function of the government is given by $W(Y,|\pi|)$ where $|\pi|$ is the expected absolute inflation rate which prevails in period 1, Y is the expected output of the economy in period 2, $W_Y > 0$ and $W_{|\pi|} \leq 0$.[4] The output that is produced in period 2 depends on whether or not there was a crisis. The states of the world in which no crisis occurs and a crisis occurs will be denoted *B* and *G* with probabilities of these states of nature are *p* and *1-p* respectively. If no crisis has occurred the economy produces $Y^G(K)$, and if a crisis occurs $Y^B(K)$, where K is the investment level of the private sector in period 0. During the crisis there is a production shock which requires further investment, and although the productivity of the capital stock is restored the country ends up investing more to produce each unit of output, so $Y^G(K) > Y^B(K)$.

The inflation rate depends on the monetary policy of the government via the exchange rate. We formalize monetary policy as a choice over the flexibility of the exchange rate, F which in general can differ across the *G*-state and *B*-state, F^G and F^B. If the exchange rate is flexible during the potential crisis the exchange rate depreciates and inflation increases. If the government chooses an inflexible exchange rate then depreciation and inflation is limited. Likewise if no crisis occurs we assume that excess exchange rate

[4] This objective implies that the government is equally averse to inflation and deflation. Holding output *Y* constant, the optimal inflation rate is zero.

volatility would be passed into the price level if a flexible exchange rate is adopted.[5] We define the exchange rate e as the domestic price of one of international liquidity (dollars) so that larger values represent depreciations.

$$\pi = \pi(e); \pi_e > 0 \text{ and } e = e(F), |\, e^G \,|_F > 0, e_F^B > 0$$

In reduced form, $|\, \pi \,|_F > 0$.

The investment decision, $K(e^B)$, depends on the (rationally expected) exchange rate which prevails in period 1, e^B , but only in the event that the crisis occurs. If the crisis does not occur then firms do not require any further foreign capital and so the exchange rate in the good state does not affect the objective function of the firm. Investment is not under the direct control of the government, although it determines welfare through output, Y , and for this reason the government must pursue its monetary policies taking into account the incentive effect that the exchange rate has on decentralized private sector investment decisions.

Monetary policy affects the investment decision of firms, and under the assumptions of Caballero and Krishnamurthy (2004) firms over-invest (relative to the maximizing time 2 output) unless the exchange rate is allowed to depreciate during crises. If the exchange rate is flexible in the crisis, investment decreases towards the output maximizing level. Y^B increases, since more international capital is available during the crisis for reinvestment, and due to an externality (see Caballero and Krishamurthy (2004) for details) firms do not take decisions which maximize output. At the same time Y^G declines since if there is no crisis it would have been optimal to invest all available international capital in the domestic economy. Nevertheless, the assumption that there is an over-investment problem implies by definition that the gain in state *B* outweighs the loss in state *G* so that expected output Y increases with exchange rate flexibility in the bad state, F^B .

[5] There is an asymmetry in the shocks in the two states of nature. In the *B*-state a shortage of international capital tends to depreciate the exchange rate if the government allows it to, so that π is positive and

$$K = K(e); K_e < 0,\ Y_K^G(K) > 0,\ Y_K^B(K) < 0 \text{ but } Y_K(K) < 0$$

In reduced form we can write $Y^G(F^B)$ and $Y^B(F^B)$ where F^B is exchange rate flexibility in the *B*-state with

$$Y_{F^B}^G < 0,\ Y_{F^B}^B > 0 \text{ and } Y_{F^B} > 0$$

Finally we can write the problem of the government as:

$$\max_{F^G, F^B} W(Y, |\pi|) = W\{(1-p)Y^G + pY^B, (1-p)|\pi^G| + p|\pi^B|)\}$$

The analysis above demonstrates that the government faces a tradeoff in choosing exchange rate flexibility since $Y_{F^B} > 0$ which is beneficial while $|\pi|_{F^B} > 0$ and $|\pi|_{F^G} > 0$ which is undesirable. We will characterize the solution to this problem under the following three assumptions: the time-consistent discretionary policy, the optimal non-contingent policy with commitment and the optimal state-contingent policy with commitment.

Case i) The Discretionary Policy, No Commitment

The time consistent policy is chosen in period 1 taking investment decisions and the occurrence, or not, of the crisis as given. The fact that policy is chosen *ex-post* implies that the government has the option of carrying out a state-contingent policy. We denote the exchange rate flexibility chosen in each state as F^B and F^G where the index denotes the fact that the policy is chosen *ex-post* in period 1.

If the crisis occurs then the government solves

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increasing in exchange rate flexibility *F*. In the *G*-state external shocks can lead to appreciation or depreciation. $|\pi|$ increases with *F* but the sign depends on the shock in the *G*-state.

$$\max_{F} W(Y,|\pi|)$$

Once the crisis has occurred monetary policy has no effect on aggregate output, which is predetermined by the aggregate capital stock and the remaining international liquidity, so $Y_F^B = 0$ and the first order condition which determines the optimal F^B is given in terms of the marginal costs and benefits of exchange rate flexibility as:

$$MC_D^B = pW_\pi(Y,|\pi|)\,|\pi^B|_{F^B}$$

$$MB_D^B = 0$$

$$\Rightarrow 0 = W_\pi(Y,|\pi|)\,|\pi^B|_{F^B}$$

The government tightens monetary policy until either $W_\pi(Y,|\pi|) = 0$, in which case there are no further benefits to lower inflation, or $|\pi^B|_{F^B} = 0$, in which case inflation cannot be lowered any further.

If the crisis does not occur then the government solves

$$\max_{F} W(Y,|\pi|)$$

The same reasoning implies that the optimal F^G satisfies

$$MC_D^G = pW_\pi(Y,|\pi|)\,|\pi^G|_{F^G}$$

$$MB_D^G = 0$$

$$\Rightarrow 0 = W_\pi(Y,|\pi|)\,|\pi^G|_{F^G}$$

We obtain identical first order conditions for the optimal flexibility *F* in both states, and under the simplifying assumption that the relationship between absolute inflation $|\pi|$ and flexibility is the same in both states, the discretionary policy exhibits no state-contingency even though this is an *a priori* possibility.

Case ii) The Non-Contingent Policy with Commitment

Under this assumption the government must commit to the same degree of exchange rate flexibility whether or not the crisis occurs. We denote the non-contingent optimal policy by F . The first order conditions in terms of the marginal costs and benefits of flexibility are:

$$MC_{NC} = (1-p)W_{\pi}(Y,|\pi|)\,|\pi^{G}|_{F} + pW_{\pi}(Y,|\pi|)\,|\pi^{B}|_{F} = W_{\pi}(Y,|\pi|)\,|\pi|_{F}$$

$$MB_{NC} = (1-p)W_{Y}(Y,|\pi|)Y_{F}^{G} + pW_{Y}(Y,|\pi|)Y_{F}^{B} = W_{Y}(Y,|\pi|)Y_{F}$$

$$\Rightarrow W_{Y}(Y,|\pi|)Y_{F} = W_{\pi}(Y,|\pi|)\,|\pi|_{F}$$

In contrast to case i) there are both costs and benefits to exchange rate flexibility since the decision is made *ex-ante* when the incentive effects of exchange rate policy on expectations and output can be taken into account. At the margin the optimal policy will trade off the insurance benefits of exchange rate flexibility *ex-ante* (which operate through output) against the inflation costs ex-post.

Case iii) The State-Contingent Policy with Commitment

Under this assumption the degree of flexibility is unconstrained across states of nature and the government can choose separately F^{G} and F^{B} . The first order conditions for this problem are:

In the *B*-state

$$MB_{C}^{B} = pW_{Y}(Y,|\pi|)Y_{F^{B}}^{B}$$

$$MC_{C}^{B} = pW_{\pi}(Y,\pi)\,|\pi^{B}|_{F^{B}}$$

$$\Rightarrow W_{Y}(Y,|\pi|)Y_{F^{B}} = W_{\pi}(Y,|\pi|)\,|\pi|_{F^{B}}$$

In the *G*-state

$$MB_{C}^{G} = 0$$

$$MC_C^G = (1-p)W_\pi(Y,\pi) \mid \pi^G \mid_{F^G}$$

$$\Rightarrow 0 = W_\pi(Y,\mid \pi \mid) \mid \pi \mid_{F^B}$$

In particular, during a potential crisis, it is optimal to trade off the insurance benefits of exchange rate flexibility against the cost of inflation. During other times there are no benefits (at the margin) to exchange rate flexibility so the optimal policy only takes into account the costs of inflation. This implies that the fully optimal policy is indeed state contingent, with more flexibility during potential crises.

2.3 Comparing the policy regimes

The section above solved the model under several different assumptions about the policy options of the government. It remains to rank these choices. We can establish the following ranking: the State-Contingent Policy dominates the Non-Contingent Policy, which dominates the Discretionary Policy. The reason is simply that set of feasible policies expands with credibility. The Contingent Policy sets a separate and fully optimal exchange rate policy for each state of nature, taking into account the ex-ante insurance properties of exchange rate flexibility, and as such must *a fortiori* dominate any other policy option since every non-contingent policy is also a contingent policy, and it is always feasible, if superfluous to commit to the discretionary policy. Likewise the discretionary policy implies the same exchange rate flexibility in both states of nature, so it is a feasible non-contingent policy, and the same argument applies.

Figure 1 illustrates the intuition. For each state of nature the figure plots the marginal benefit and marginal cost of exchange rate flexibility as derived above, and the optimal degree of flexibility at the intersection of these schedules. For the non-contingent and discretionary regimes, losses in each state of nature relative to the fully optimal state-contingent policy with commitment are shaded. In particular the non-contingent policy involves losses in both states of nature as in the *G*-state, it entails too much flexibility and in the *B*-state, too little. The discretionary policy is actually identical to the state-contingent policy in the *G*-state, since it limits exchange rate flexibility, but in the *G*-state it leads to sub-optimal "fear of floating" since a flexible exchange rate would be preferable.

In the next section we turn to examine the data on exchange rate flexibility through the model developed above and categorize exchange rate regimes. We look for evidence of state-contingent flexibility which would mitigate the welfare implications of the "fear of floating" that the literature has previously discussed. At the same time we examine the outliers relative to the "fear of floating" category, countries which although not operating state-contingent regimes are distinguished by their uniformly *high* level of flexibility.

3. "Fear of Floating", Non-Contingent Floating and State-Contingent Flexibility

3.1 Methodology

The methodological approach that we adopt to characterizing exchange rate flexibility follows Calvo and Reinhart (2002). However, unlike their paper, which sought to characterize differences in unconditional exchange rate, flexibility across countries, in comparison with the benchmark floaters of Australia and the members of the G-3 our purpose is to extend this analysis to investigate whether exchange rate flexibility of emerging market floaters varies over states of nature.[6] We do not dispute that "fear of floating" characterizes the unconditional exchange rate regime across emerging markets, but we seek to determine whether this unconditional measure conceals flexibility with respect to shocks that are important from an insurance perspective.

The literature on the *de facto* classification of exchange rate regimes has burgeoned recently. Extending the analysis of Calvo and Reinhart (2002), Reinhart and Rogoff (2004) have developed a *de facto* classification of exchange rate regimes which shows substantial numbers of deviations from the declared *de jure* regimes. The fear of floating manifests itself in the misclassification of regimes that *de jure* float, but *de facto* are less flexible. At the same time, Levy-Yeyati and Sturzenegger (2004) developed a similar index, albeit based on a different classification methodology with the same finding of extensive misclassification. An alternative

[6] Of course, Germany has a fixed exchange rate as a member of the Euro and previously limited flexibility in the Exchange Rate Mechanism, but Calvo and Reinhart's point was that the currencies of the G-3 floated freely against each other.

classification scheme is constructed in Stambaugh (2004). We follow the approach of Calvo and Reinhart (2002) for two reasons. First, the methodologies in the other papers cited above are more suited to the broad classification question of distinguishing between fixed and flexible arrangements but our investigation is focused on the differences within the group of *de jure* flexible regimes. Second, we want our results to be comparable with those reported in Calvo and Reinhart's paper which started the "fear of floating" debate.[7]

To measure flexibility we compare movements in exchange rates with movements in monetary policy instruments that affect the exchange rate. Examining the exchange rate in isolation is not informative about exchange rate policy, as it does not take into account the shocks that monetary policy had to face. If the exchange rate is stable we do not know whether it was due to policy choices despite shocks or to a lack of shocks. To deal with this problem we define a flexible exchange rate as an exchange rate that is volatile relative to the instruments that could stabilize it. The implicit idea is that the policy maker faces a choice about where to allocate a given external shock. It can be allowed to affect the exchange rate if policy is inactive, or the exchange rate can be insulated if policy is active. Exchange rate flexibility is about the relative volatilities of the exchange rate and instruments and not about the absolute volatility of either in isolation.

We follow Calvo and Reinhart (2002) in using changes in reserves and interest rates as measures of the monetary policy instruments available to the authorities, and hence as measures of the degree of intervention. However, using these variables is not without its problems and we will review here some of the issues.[8] We risk errors of omission and commission in using changes in reserves or interest rates as measures of intervention and furthermore these potential biases might be more or less relevant depending on whether the question is to determine the within-country state contingency of exchange rate flexibility or compare exchange rate regimes across countries. Nevertheless, despite the many qualifications or issues of

[7] Furthermore the question of the correct classification methodology is far from settled. Different methodologies appear to be suitable for different purposes and as Frankel (2003) notes the correlation among different *de facto* measures is actually quite low so we choose that which is most suitable for the questions we wish to address. For example the correlation between the Reinhart-Rogoff (2004) classification and the Levy-Yeyati-Sturzenegger is 0.41 which is not much larger than the 0.33 correlation of the Reinhart-Rogoff (2004) with the much maligned *de jure* classification.

[8] Calvo and Reinhart (2002) also discuss some of the same issues.

interpretation we use these measures, as they are the best data that we have available and have been used by the authors of previous studies with which we would like to be able to compare our results.

Reserves can change for reasons unrelated to intervention, in particular accrual of interest and management of foreign currency debt. However, as will become clearer below, since we focus on large movements in reserves it is unlikely that we will misclassify an accounting change of reserves as an intervention due to the magnitude of the changes on which we focus, thus we are unlikely to be biased towards measuring too much intervention. On the other hand there can be "hidden" movements of reserves for example related to credit lines or derivative transactions which are not reported on the balance sheet. It is possible that we miss some of these interventions, and as such we misclassify regimes as not intervening when in fact they are. This would not be a problem were it our intention to establish "fear of floating" as it would bias our results towards finding flexibility and make the hypothesis harder to establish. However, since a major goal is to investigate the circumstances in which the exchange rate regime becomes more flexible it is possible that our findings could be explained by a change in the method of intervention towards "hidden" transactions. This can be a problem both within a country in establishing state-contingency if the change in the means of intervention is correlated with the shocks we use to measure state-contingency and across countries if countries with apparently flexible regimes are more likely to use "hidden" transactions.

Regarding interest rates as measures of foreign exchange intervention we also face several issues. The first is the extent to which the interest rate is genuinely an instrument of exchange rate management. Calvo and Reinhart (2002) present much anecdotal evidence that interest rates in emerging markets are active instruments of exchange rate management, but Shambaugh (2004) presents more systematic evidence that interest rate policy is not uniform across emerging markets and countries with more flexible exchange rates have more autonomy in setting their interest rates. If interest rates are not just tools of exchange rate management we risk misclassifying episodes as interventions when they are not. With regard to the within-country results this would present a problem only to the extent that the shocks that we use to measure external crises had a direct effect on the domestic economy, separate from the exchange rate channel, and interest rate policy responded directly to these effects. This does not seem a very plausible assumption. With regard to cross-country comparisons the issues are more serious since the empirical measures of interest

rates that are available across countries are far from uniform, and policy interest rates, which are the most natural counterpart to the theoretical analysis, are not always available. In addition to the possibility that the extent to which interest rate policy is directed towards exchange rate management varies across countries it is possible that we introduce biases related to systematic differences in the interest rate series we use across countries. If the extent of misclassification varies systematically with exchange rate flexibility, for example if more flexible exchange rates give more monetary policy autonomy so that the interest rate can be directed to domestic macroeconomic objectives, then there would be a bias towards finding "fear of floating". This issue is actually relevant for the results in Calvo and Reinhart (2002) although they do not discuss it, but it makes it more difficult for us to establish circumstances in which exchange rates are flexible.

As in Calvo and Reinhart (2002) we first adopt a relatively atheoretical approach to exploring the data. To measure exchange rate volatility we compute the probability that the monthly percentage change in the nominal exchange rate is within a given band. To measure instrument volatility we examine the movement of foreign exchange reserves and interest rates. We will denote the absolute value of the percent change and the absolute value of the change in variable x by $\hat{x}$ and $|x|$, respectively and x^c a critical threshold. We are interested in the probability that the variables $\hat{x}$ or $|x|$ are less than x^c. We follow Calvo and Reinhart (2002) in considering percent changes for nominal exchange rates and international reserves (setting x^c equal to 2.5%), and absolute changes for nominal and real interest rates (setting x^c equal to 400 basis points). We use bands as measures of volatility as they are less dependent on outliers than variances and also are less likely to miss-identify changes in instruments as interventions because they focus in big policy changes, although we carry out a more formal analysis that uses variances in the next section.

To examine whether flexibility varies when the country faces a potential sudden stop, we use a measure of high yield spreads (defined as the difference between Moody's Seasoned AAA and BAA Corporate Bond Yields) to capture a source of exogenous financial pressure. Shocks are measured as the difference between the logarithm of the actual series and its trend as measured with the Hodrick-Prescott filter. In particular, we define a period of external pressure as an episode when either the shock is one standard deviation above its average, or the change in the actual series is one standard deviation above its average. These two dimensions imply that we are defining potential crises as periods when the level or the change in high yield spreads were

particularly high. As a consequence, the periods entering within this definition are 1990.10-1991.04, 1998.10-1999.03, 2001.01, 2001.12-2002.12, and 2003.06.

It is important to emphasize that this variable is intended as an exogenous source of *potential* financial pressure. Since we are interested in the preventive properties of exchange rate regimes it would not be correct to look at actual crises. Our goal is to examine exchange rate choices during episodes in which countries had a choice about whether to pursue a tight monetary policy or let the exchange rate depreciate. For this reason we will pay careful attention when interpreting the results to whether we have excluded all false positives related to actual crises, when even fixed exchange rates can pass through periods of turbulence. Furthermore, although we will pay more careful attention to this issue in discussing the results it is worth emphasizing that such "false positives" concerning exchange rate flexibility are more likely to occur in situations of low levels of reserves and financial crises that we already partially excluding with the sample selection (see below). The index of high yield spreads and the periods identified as potential sudden stops are illustrated in Figure 2.

Figure 3 shows the relationship between potential and actual sudden stops. The index of actual sudden stops in emerging markets is based on the definition of Calvo et al (2004) and will be discussed more fully in section 5. However as this figure makes clear while many actual sudden stops occurred during the period of turmoil in emerging markets in 1998-1999, fewer occurred in 2001-2002 when the index of potential crises indicates a high level of external pressure. This less than perfect correlation between actual and potential sudden stops is not a problem for the analysis that follows. First, to classify exchange rate regimes it is more important to identify a plausible exogenous shock than explain all sudden stops. Second, we will be interested in explaining when the common high yield spread shock becomes a country-specific sudden stop. The fact that there is some variation in the relationship between high yield spreads and sudden stops allows us to investigate which factors can account for this. In particular it will be argued in Section 5 that the increased adoption of flexible exchange rates has been associated with increased insurance against (potential) external crises.

3.2 Data

We use monthly data taken from the *International Financial Statistics* for all our analysis. The nominal exchange rate is the monthly end-of-period bilateral dollar exchange rate (Source: IFS line ae). Reserves are measured using gross foreign exchange reserves minus gold (Source: IFS line 1L.d). Regarding nominal interest rates we follow Calvo and Reinhart (2002) in trying to use policy interest rates whenever possible. As these vary by country, we use interbank rates (for Argentina, Australia, Brazil, India, Indonesia, Malaysia, Mexico, Pakistan, Singapore, South Africa, and Thailand. Source: IFS line 60B), deposit rates (for Chile. Source: IFS line 60L), discount rates (for Colombia and Peru. Source: IFS line 60) and T-bill rates (For Israel and Philippines. Source: IFS line 60C).

The sample was chosen to include emerging economies that are sufficiently developed so as to have access to capital flows, so that they face the open economy policy dilemmas described above. In particular we only incorporate countries that are included in Morgan Stanley Capital International (MSCI) index.[9] In contrast to Calvo and Reinhart (2002) we consider only the period starting in 1990 because only during this phase did voluntary capital flows to these economies become substantial. We exclude the transition economies because they experienced shocks and reforms of a very different nature during the 1990s and we limit our analyses to exchange rate regimes with some *de jure* exchange rate flexibility so that we include only regimes classified as managed floating or independent floating as reported to the IMF. Finally we exclude regimes with severe macroeconomic instability since the macroeconomic issues are very different for economies with high levels of inflation,[10] and for each episode we exclude the three months before and after any explicit change of exchange rate regime to avoid contaminating the results with transition effects.

[9] The EMBI which is the probably better known index for emerging markets has frequently changed the sample definitions, so we focused on the MSCI to define the sample used here.

3.3 The Stylized Facts

We first use the measure of exchange rate flexibility described above to discuss the unconditional "fear of floating" result that has been described in the literature. We compute the relative frequencies of large exchange rate movements and large policy changes and plot them in figure 4. In particular we plot on the horizontal axis the sample probability that the nominal exchange rate remains within the band, which is measure of exchange rate stability, and on the vertical axis the sample probability that the instruments remain within the band as a measure of instrument volatility. The volatility of policy instruments is a weighted average of the volatility of the nominal interest rate and the volatility of reserves, using as weights the variance of the volatility of each instrument.

To interpret the diagram, it is useful to consider the slope of the line connecting each point to the origin as a measure of exchange rate flexibility. The steeper the slope the more volatile the exchange rate relative to the policy instruments. Movements along a ray towards the origin represent more volatility in *both* the exchange rate and instruments, without changing the *relative* volatility of either, and hence can be interpreted as a measure of the shocks with which exchange policy had to contend during the sample period. The diagram also includes Australia, which was used by Calvo and Reinhart (2002) as a benchmark floating economy.[11]

"Fear of floating" can be clearly observed in this figure although interestingly it is far from uniform as a *de facto* characterization of emerging market floating exchange rates. According to this crude measure of exchange rate flexibility, few emerging markets have exchange rate regimes which are more flexible than Australia. Only Brazil and the newly independent floating regimes of Chile, Indonesia and Thailand appear to have more flexibility. Mexico and South Africa while having a similar policy stance to Australia appear to

[10] Reinhart and Rogoff (2004) assign these regimes to a separate category of "freely falling" in their *de facto* analysis arguing that floating exchange rates are qualitatively different under very high inflation.
[11] They argue that unlike the G-3, which are not useful comparators for emerging markets due to the fact that their currencies are held as international reserves, Australia has a freely floating policy and is subject to similar external shocks to many emerging markets.

face more volatile external conditions. At the other extreme Pakistan and India behave very similarly to pegs.

However, as discussed above it is difficult to draw policy implications from this diagram, as it is not possible to determine the circumstances which have led to these policy choices. To address this question we need to compare exchange rate flexibility across periods with and without external pressure. Table 1 presents the evidence on the flexibility of the exchange rate and instruments controlling for whether the country is faced by external pressure. The effects are estimated by running a regression of a binary variable taking a value of 1 if the variable is within the band and 0 otherwise and our indicator of periods of external pressure. This procedure is equivalent to comparing the probability that each variable is within the relevant band in periods with and without external pressure. We will use this evidence to address two questions. To what extent are there emerging markets which are not characterized by "fear of floating" and among those which are, is there any evidence of state-contingent flexibility when faced with external pressure?

Figure 5 presents this data in a diagram, with a combined measure of instrument volatility as used in Figure 1. Again the slope of the line connecting each point to the origin can be interpreted as exchange rate flexibility. The two panels compare exchange rate flexibility under the base case with that when the country faces external pressure. Two findings stand out from this diagram. First, this analysis appears to confirm that Brazil, Chile, Indonesia and Thailand are characterized by more exchange rate flexibility under the normal circumstances of the base case. These countries are not accurately characterized by "fear of floating". Second there appears to be evidence of state-contingent flexibility for some countries. In particular both South Africa and Mexico, while exhibiting similar flexibility to Australia during normal times seem to have a higher degree of flexibility during periods of external pressure. Figure 6 will develop a more transparent representation of this state-contingent flexibility.

Under the interpretation of the Figures 4 and 5 above the flexibility of the exchange rate changes in periods of external pressure if and only if the slope of line connecting each point to the origin changes. Figure 6 develops a simple way of testing this hypothesis. In particular define the exchange rate flexibility during normal times and under external pressure as F^G and F^B.

$$F^G = P(Pol\_in\_band / no\_shock) / P(NER\_in\_band / no\_shock)$$

$$F^B = P(Pol\_in\_band / shock) / P(NER\_in\_band / shock)$$

The exchange rate regime is more flexible under external pressure if and only if $F^B > F^G$ which can be written, after taking logarithms and rearranging:

$$\Leftrightarrow \ \ln P(Pol\_in\_band / shock) - \ln P(Pol\_in\_band / no\_shock)$$
$$> \ln P(NER\_in\_band / shock) - \ln P(NER\_in\_band / no\_shock)$$

$$\Leftrightarrow \ \Delta(Policies) > \Delta(NER)$$

Thus Figure 6 plots the change (in logs) of the policy response against the change in the nominal exchange rate response. Points above the diagonal represent countries that are more flexible during periods of external pressure while points below the diagonal exhibit the opposite behavior. As is apparent, many countries are located on or around the diagonal suggesting that these countries do not exhibit much state contingency. Some of these countries as Chile present high levels of flexibility in both normal and shocks periods, while other as Pakistan present low levels of flexibility in both situations. However, Argentina, Brazil, the more recent Colombian regime, South Africa, Israel, and Mexico do appear to exhibit some state-contingency. At the other extreme a few countries, such as India, Indonesia, and Thailand lie below the diagonal suggesting that these countries are pursuing more flexible policies during normal times that during periods of external pressure. However, although this is a potentially a further form of "fear of floating", Thailand and Indonesia are being compared to a relatively high base level of flexibility so this interpretation is not necessarily appropriate. Finally, Australia is also included in this figure as a falsification exercise. HYS shocks should not have a significant effect on Australia and so we would not expect to observe any difference in flexibility during periods of external pressure. This is exactly what we observe.

In summary the figures suggest two basic findings. First, in the unconditional data there are several countries which are exhibiting less "fear of floating" than the Australia benchmark. Second it is possible to identify a few countries that while exhibiting "fear of floating", do on average allow more exchange rate flexibility during periods of external pressure. South Africa in particular stands out in this regard, although contingent

flexibility seems to be an aspect of exchange rate behavior for Brazil, Colombia and Mexico as well. Argentina also appears to fall in this category, although it is not clear whether the increased flexibility is a result of choice or necessity.[12] The next section will investigate these findings in more detail by carrying out a more formal time series analysis of exchange rate flexibility which will allow us to attribute statistical significance to the findings.

4. Exchange Rate Flexibility Index: Time Series Analysis

To provide further support to the claims developed above we undertook a more formal analysis of exchange rate flexibility. For this purpose we constructed a time series index of flexibility analogous to that presented in Calvo and Reinhart (2002). The exchange rate flexibility index is defined as:

$$F = \frac{\sigma^2_{\hat{E}}}{\sigma^2_{\hat{R}} + \sigma^2_{|i|}},$$

where $\sigma^2_{\hat{E}}$ denotes the variance of the nominal exchange rate, $\sigma^2_{\hat{R}}$ the variance of reserves and $\sigma^2_{|i|}$ the variance of the interest rate. To implement the measure we construct at each point in time *t* a 13-month rolling window centered on *t* and compute the sample variance of each component variable. In this manner we derive a time series measure of exchange rate flexibility. The interpretation of this indicator is similar to the analysis above. To evaluate the degree of flexibility of an exchange rate regime we incorporate information about flexibility of both the exchange rate and instruments. In more flexible regimes we should observe a high degree of volatility of the exchange rate vis-à-vis instruments, and hence a high value of *F*, while in less flexible regimes the flexibility index should be close to 0. We use a symmetric window incorporating both leads and lags of each variable since we want to evaluate the effect of shock comparing the exchange rate and policies before and after.

[12] Furthermore the analysis in Section 4 finds that the apparent state-contingency is not statistically significant.

Before implementing the analysis the index was corrected for two sources of bias in cross-country comparisons. The unconditional average of the index for each country was regressed against dummy variables for the index rate series used to control for the fact that in some countries more volatile market interest rates were used, while in other countries more stable policy interest rate series are available. A further potential source of bias arises from the fact that the floating exchange rate might be more volatile for some countries than others due to different terms of trade shocks. A variable measuring the volatility of terms of trade shocks was also added to the regression. The index of exchange rate flexibility was then corrected with the coefficients from this cross-country regression.

For each episode (i.e. regime included in the analysis) we run the following regression on the corrected flexibility index:

$$F_t = \alpha + \sum_{m=0}^{M} \beta_m HYS_{t-m} + \sum_{n=1}^{N} \gamma_n F_{t-n} + \varepsilon_t$$

Thus we identify $\frac{\alpha}{1-\sum_{n=1}^{N}\gamma_n}$ as the long-run basis regime effect (i.e. when there is no external pressure from the HYS and after incorporating the dynamics of *F*), $\frac{\sum_{m=0}^{M}\beta_m}{1-\sum_{n=1}^{N}\gamma_n}$ as the long-run difference in the flexibility index between normal and (potential) crises times. In order to choose the optimal lag structure of the model we use the Schwarz information criterion. Table 2 presents a summary of the results of these regressions.

The results of this analysis mostly confirm the less formal stylized facts presented in section 3, although some important differences will be discussed below. Regimes are classified as Contingent (C), Non-Contingent (NC) and Discretionary (D) according to the following algorithm. The coefficients for the long-run base effect, and contingent flexibility are calculated from the time series analysis. The contingent

regimes are identified as those for which the coefficient $\frac{\sum_{m=0}^{M}\beta_m}{1-\sum_{n=1}^{N}\gamma_n}$ is significantly different from zero at 5% significance according to a Wald test. The other two regimes are distinguished according to a comparison of the base level of flexibility with two benchmark floating regimes, Singapore and Australia. If the coefficient $\frac{\alpha}{1-\sum_{n=1}^{N}\gamma_n}$ for a regime is significantly less than that of Australia or Singapore for the same time period, on the basis of a one-tailed Wald test, then the regime is classified as discretionary ("fear of floating").[13] Otherwise it is classified as non-contingent floating.

This algorithm produces a classification similar to the picture obtained in Figure 4. Table 2 suggests that only four countries, Brazil, Colombia (1999-), South Africa, and Mexico exhibit contingent flexibility. [14] South Africa, apparently exhibits a high degree of base-line flexibility that is not statistically different to either Australia or Singapore, suggesting its contingent flexible is in addition to a flexible exchange rate. The other three contingent regimes do exhibit significantly less flexibility than the benchmarks in the base case, suggesting that there are indeed circumstances in which exchange rate rigidity is desirable provided that it does not undermine insurance. The other regimes do not exhibit contingency, but they do exhibit significant differences in flexibility. The regimes classified as discretionary exhibit "fear of floating" in all states of nature. These countries show an apparent inability to commit to floating exchange rates. The countries in the sample classified as discretionary are Argentina, Chile (-1999), Colombia (-1999)[15], India, Pakistan, Peru, Philippines. Finally the non-contingent, flexible regimes are Chile (1999-), Indonesia, Israel and Thailand. Australia and Singapore would also be considered members of this category, although they were defined as such for the purposes of categorizing the other regimes.

[13] Note that although the base level coefficient for Australia is less than that for Singapore, the sample for each significance test differences according to the dates of each regime. Thus it is necessary to carry out both tests in each case.

[14] It should be noted that the statistical analysis does not identify Argentina as a member of this group despite appearances to the contrary in Figure 5.

5. The Benefits of a Commitment to Floating

The above discussion classified regimes with state contingent policies. However to interpret the classification it is important to understand the extent to which the choice of exchange rate regime is associated with insurance against external shocks This question can be addressed on two separate levels. The interpretation of exchange rate behavior is complicated by the fact that as discussed in Caballero and Krishnamurthy (2004) alternative insurance mechanisms are available that can substitute for exchange rate flexibility, such as capital controls, reserve requirements, and sterilization of capital inflows. We first examine the extent to which our classification of discretionary regimes can actually be characterized more generally as "uninsured regimes", by investigating these substitutes. However examining policies alone is not sufficient to determine that the choice of exchange rate regime is important. Thus, we proceed to examine the extent to which floating exchange rates are associated with improved insurance against external shocks in terms of outcomes. We examine two pieces of evidence: the relationship between sudden stops and the exchange rate regime, and the dynamics of private holdings of foreign exchange reserves.

Table 3 accounts for other substitute insurance policies. Controlling capital inflows directly can prevent the under-insurance arising but at the cost of limiting integration with international capital markets. Capital controls are measured according to the index in Kaminsky and Schmukler (2003). It is clear that capital controls are more prevalent in countries with discretionary regimes, suggesting that this policy substitutes for exchange rate flexibility. Nevertheless capital controls must be considered an extremely sub-optimal response to the under-insurance problem. Capital controls provide insurance only at the expense of isolation from international capital markets.

[15] Although the statistical analysis did not select Colombia (-1999) as significantly less flexible than either Australia or Singapore, the regime was qualitatively very similar to Chile (-1999) and was classified accordingly as discretionary.

The second policy option suggested by Caballero and Krishnamurthy (2004) is sterilization of capital inflows. Although the efficacy of such a policy has been questioned our goal here is simply to examine the facts. In order to evaluate how important sterilized interventions are we utilize the methodology of Bofinger and Wollmershaeuser (2001). We run the following regression for each country using monthly data for the relevant period for each regime:

$$\Delta(NDA)_t = \alpha + \beta\Delta(NFA)_t + \gamma\Delta(NDA)_{t-1} + \varepsilon_t$$

where *NDA* is net domestic assets of the monetary authority and NFA is net foreign assets. With full sterilization we expect β to be equal to -1 and with partial sterilization β should be less than 0 but greater than -1. This regression is a very crude measure of sterilization that may suffer from biases related to omitted variables and potential endogeneity, so we are going to focus in comparing the estimates across groups, more than focusing on the estimated levels. Column (2) of Table 3 presents estimates of β for each regime. This evidence is less clear. The results suggest that while discretionary regimes do use sterilization, suggesting a further substitute insurance mechanism, non-contingent floating regimes do so even more. It appears that as credibility for the floating exchange rate is gained, sterilization is a complementary rather than a substitute policy. State contingent regimes, which as it will be shown later can be associated with higher levels of credibility, sterilize least of all, suggesting that when credibility has been gained, it is no longer necessary to complement floating with additional policies.

Finally we present measures of financial regulation from Abiad and Mody (2003) and Barth et al. (2003). Better supervision and prudential regulation can monitor balance sheet mismatches and help prevent the build up of excessive dollar liabilities. At the same time better functioning and well-developed financial markets increase the stock of assets that can be presented as collateral. Table 3 shows that financial development does not substitute for flexible exchange rates, in fact it is the opposite. The least liberalized financial markets are found in countries with discretionary regimes. Although the differences are small, the most liberalized financial markets are found among the state contingent regimes. In summary there is some weak evidence that discretionary regimes undertake alternative policies to insure themselves against external

shocks. However policies such as capital controls can be very costly and are unlikely to be superior to a well-managed open economy with flexible exchange rates.

The next results examine the extent to which the choice of exchange rate regime, and in particular flexibility during potential crises is associated with better insurance outcomes. The Caballero and Krishnamurthy (2004) model argues that better insurance occurs through the mechanism of altering private sector incentives to conserve international liquidity. Although such a proposition is difficult to test directly, some evidence in this direction is provided in Table 4. In this table, regression results are presented that link the exchange rate regime to the international liquidity held by domestic residents in banks. Two specifications are estimated, with and without lags of the dependent variable for absolute and relative measures of private reserves.

$$\log(PR)_{it} = \alpha + \beta \log(GDP)_{it} + \chi F_{it} + \delta HYS_t + \phi HYS_t * F_{it} + \eta \log(PR)_{it-1} + \mu_i + \varepsilon_{it}$$

$$(PR/(PR + PuR))_{it} = \alpha + \beta \log(GDP)_{it} + \chi F_{it} + \delta HYS_t + \phi HYS_t * F_{it} + \eta (PR/(PR + PuR))_{it-1} + \mu_i + \varepsilon_{it}$$

In these equations, *i* represents the country, *t* represents the month, *PR* represents private reserves, as measured by international liquid assets in banks (IFS), *PuR* represents the international reserves held by the Central Bank, as utilized in previous sections (IFS), *GDP* represents GDP in dollars (IFS), *F* is the (corrected) flexibility index used above, and *HYS* is the index of (potential) crises developed above. Also included are country dummies. As can be observed in Table 4, there is a robust relationship between private reserves and exchange rate flexibility, both in absolute level and as a share of the total reserves of the country. As flexibility increases, the private sector hoards more dollar reserves. The interaction term is not significant, so it is exchange rate flexibility *per se* that is important and not only flexibility during crises.

The second set of regressions investigates the link between exchange rate flexibility and sudden stops. The hypothesis underlying these regressions is that the high yield spread series that we have used for classifying exchange rate regimes is a common external shock. However, whether such a shock develops into a sudden stop depends on how insured the country is, and in particular the dollar reserves on which it can draw during

such an episode. To investigate this hypothesis it is necessary to define sudden stops. The series constructed is based on Calvo *et al* (2004), with the series updated to 2003. Calvo *et al* (2004) defines a sudden stop as a phase that meets the following conditions: (i) it contains at least one observation where the year-on-year fall in capital flows lies at least two standard deviations below its sample mean, and (ii) the phase ends once the annual change in capital flows exceeds one standard deviation below its sample mean. The beginning of a sudden stop is determined by the first time the annual change in capital flows falls one standard deviation below the mean. The Appendix presents a complete list of the sudden stops identified by this methodology. The following equation is estimated:

$$Sudden_{it} = \alpha + \beta HYS_t + \chi F_{it} + \delta HYS_t * F_{it} + \mu_i + \varepsilon_{it}$$

where *Sudden* is a dummy taking a value of 1 if there is an (actual) sudden stop and 0 otherwise. *F* is the (corrected) flexibility index described above and the *HYS* is the dummy taking the value 1 if there is a (potential) external crisis, as defined above. (Random or fixed) country-specific effects are included in some specifications.

Table 5 shows the results of estimating the equation described above with a probit model, a linear probability model and a logit model (without country effects, with country fixed effects, and with country random effects).[16] In all the cases the coefficient of the interaction term is negative and significant. Exchange rate flexibility during a (potential) crisis significantly reduces the probability that the shock will develop into a sudden stop. In the three models the marginal effect of increasing flexibility from 0 to 1 during a crisis is to reduce the probability of a sudden stop by between 7.9% and 12.2%, which is quantitatively large in comparison to the average sample probability of a sudden stop during a (potential) crisis of 12.4%.[17] It is important to stress that it is the interaction, not the main effect which is significantly negative, thus from the

[16] Recall that fixed effect estimates using the probit model with panel data are severely biased due to the "incidental parameters problem" (Wooldrige, 2002), therefore we do not present them.

[17] In the case of the logit model with fixed effects, 5 countries (710 observations) were dropped due to all negative outcomes (these countries did not have sudden stops during the period). In this case the marginal effect of moving the flexibility index from 0 to 1 is -27.9%, which is an effect of large magnitude considering that the probability these countries have a sudden stop during a crisis is 16.8%.

point of view of insurance against sudden stops, it is only the commitment to floating during periods of external financial pressure which leads to better protection.

We can link this analysis with the earlier discrete classifications of exchange rate regimes. The crisis dummy is intended to pick up only one plausible source of exogenous external pressure, to enable the classification of exchange rate regimes. Likewise the results in Table 5 measure the extent to which that same source of external pressure (which is a common shock) converts into a sudden stop (which is a country-specific outcome). However, if the classification is valid there should be a significant relationship between the regime classification and the likelihood of being subject to a sudden stop, even if that sudden stop were not associated with a high yield spread shock on which we have focused. Table 6 addresses this question and illustrates the sudden stops that occurred during the sample period and the exchange rate regime according to the classification in Table 2. The link between exchange rate regimes and sudden stops appears to hold more generally. In particular sudden stops only occurred in countries with discretionary regimes.

6. Determinants of State Contingent Regimes

It has been demonstrated that there is considerable variation in emerging market exchange rate regimes and that this variation is associated with important differences in the extent to which countries are insured against external shocks. However, what determines the choice of exchange rate regime? If the benefits to floating and in particular state contingent regimes are so clear why is "fear of floating" so pervasive? The analysis suggests that an important obstacle to floating is the need to develop credibility for the exchange rate regime. With this in mind we examine two hypotheses, that the exchange rate regime is related systematically to the overall credibility of the monetary policy framework, and that credibility takes time to acquire so that among floating exchange rates, contingent floating is more likely to be found among countries with longer experience with a floating exchange rate regime.

Table 7 tests these hypotheses. Monetary policy credibility is measured by the commitment to inflation targeting. We measure inflation targeting using the classification developed by Carare and Stone (2003) which identifies countries that have implemented full-fledged inflation targeting (FFIT) regimes. They

characterize FFIT countries as those having a medium to high level of credibility, a clear commitment to their inflation target, and an institutionalization of this commitment in the form of a transparent monetary framework that fosters accountability of the central bank. This measure fits particularly well our notion of inflation credibility. The table shows that this measure of credibility lines up with the theoretical analysis in section 2. State-contingent regimes are more likely to have high levels of monetary policy credibility, non-contingent floating regimes are intermediate, and the regimes with the lowest degree of credibility exhibit, in general, discretionary "fear of floating".

Regarding the time to acquire credibility for floating, the table does not exhibit very clear results. Among the floating regimes, the unconditional average age of non-contingent regimes is only slightly less than that for contingent regimes. However regime misclassifications might be weakening these results. In particular both Brazil and Colombia (1999-) switched to more flexible regimes in the aftermath of a sudden stop, and are classified as involuntary transitions according to the index developed by the IMF (2004), and although they have avoided suffering additional external crises, it is perhaps too early to tell whether they are floating more out of choice or necessity. Furthermore, Israel was a borderline case in the classification as it exhibited a quantitatively large coefficient in the measure of state contingency which was nevertheless statistically insignificant. More in line with this hypothesis, it can be noted that Chile and Indonesia are more recent entrants to the group of floating exchange rates. On the other hand the state-contingent regimes contain some of the most experienced emerging market floaters, including Mexico and South Africa. Nevertheless such analysis must be considered an *ex post* rationalization, and hence the hypothesis remain only weakly proven.
Also included in this table is a measure of derivatives market development, based on data from the Bank for International Settlements. It has been argued that the development of derivatives markets fosters the development of exchange rate flexibility, by enabling the allocation of exchange rate risk to those most able to bear it, and by fostering a more sophisticated approach to financial risk management. Such instruments might also substitute for contingency in policies and hence aid the transition to floating exchange rates. The data loosely support this hypothesis, and derivatives market development is most stunted in those countries with discretionary exchange rate regimes. Comparisons between the contingent and non-contingent floating regimes are harder to make as there are few data points, and several significant outliers. Furthermore it is impossible to ascertain whether derivatives markets foster flexible exchange rate, flexible exchange rates

foster derivatives markets, or both developments are jointly determined by some underlying fundamental cause. As such this remains a correlation.

7. Conclusions

We have reexamined the "fear of floating" phenomenon from the perspective that policymakers in emerging markets face a tradeoff when determining exchange rate policy between limiting exchange rate volatility and allowing the exchange rate to float. "Fear of floating" during normal times might indeed be the optimal policy for these economies, excess exchange rate volatility is legitimately feared for its effects on inflation, or firm balance sheets. However, there are also occasions when "fear of floating" is not the optimal policy since a commitment to floating would improve insurance against potential sudden stops. We have attempted to categorize exchange rate regimes in the light of this framework. Policy makers with little commitment will only be able to implement discretionary policies with little exchange rate flexibility, and "fear of floating" will be the result. With intermediate levels of commitment, floating during crises will be feasible, but to demonstrate the commitment to floating, non-contingent policies must be used. Finally with full commitment, the optimal regime is state-contingent, floating during (potential) crises, but retaining the option to intervene, if necessary, on other occasions.

With this framework in mind we have explored the empirical evidence on exchange rate flexibility in emerging markets. We have covered some of the same ground as Calvo and Reinhart (2002) in their original paper on "fear of floating" although we have found much evidence that the picture is significantly more complicated than this one dimensional characterization. There is indeed a lot of "fear of floating" in emerging markets as they found, but our analysis of state-contingent flexibility allows us to be more certain both in attributing this to an inefficient discretionary equilibrium and to argue that more commitment to exchange rate flexibility would be beneficial for the insurance of these economies against sudden stops. These economies seem to choose to control capital flows rather than undertake any substitute insurance

policies in the context of open capital markets, and the overall credibility of their monetary policy frameworks tends to be low.

At the same time we have found several emerging markets that are not characterized by "fear of floating" at all. Chile and Indonesia, recent converts to floating, appear to be serious about developing a reputation for floating and are forgoing exchange rate intervention to demonstrate this. In accordance with the theoretical analysis these economies can be characterized as having intermediate levels of credibility. Other analyses have also highlighted the exchange rate flexibility of these economies. Hernandez and Montiel (2001) identify Indonesia as the only Asian country to move to free floating following the crisis and Frankel (2003) discusses Indonesia as one of the examples which is commonly cited as a successful floating exchange rate, due to its subsequent recovery despite being hit with the worst of the Asian crisis.

Finally we have found that several of the more mature floating exchange rates exhibit precisely the state-contingent flexibility that our theoretical analysis suggests would be optimal in this environment. They appear to be able to intervene under certain circumstances without compromising their commitment to floating during potential sudden stops, when floating is really important. Such economies exhibit high levels of monetary policy credibility. The clearest examples of such countries that emerge from our analysis are South Africa and Mexico.[18] These two countries have been more or less able to isolate their economies from the periods of extreme external turbulence during the late 1990s. For instance, while allowing big movements in the nominal exchange rate in the late 1990s, neither of them have had sudden stops during the same period (Calvo et al. 2004) and their decline in growth rates have been quite mild in comparison with other countries.

The South African case presents a particularly interesting study for emerging market floating regimes. It is an open middle income country that between the end of the Bretton-Woods system and 1985 experienced seven currency crises (Bordo and Eichengreen (2002)), which is high even by current standards of emerging market volatility. Nevertheless, since 1985 South Africa has a history of floating and its commitment to this

[18] South Africa is perhaps a more appropriate benchmark that Australia, with which emerging market exchange rate regimes are commonly compared. The particular financial market shocks on which we have focused clearly have an impact on South Africa, while they have no impact on the Australian exchange rate regime, and for which it is probably safe to say they do not represent external shocks at all.

regime does not appear to be in doubt.[19] The South African Reserve Bank has explicitly stated that it does not target the level of the exchange rate, although it has a policy of interventions aimed to "smooth out large short-term fluctuations in the exchange rate" according to Mboweni (2004). The commitment to floating has clearly been tested on several recent occasions; however during the period starting in 1998 South Africa did not experience a sudden stop despite the turmoil in emerging markets (Calvo et. al 2004). It appears that a floating exchange rate is not only a feasible policy for emerging markets; it is a policy that can be successfully used to insure the economy against external volatility without forgoing the option to occasionally intervene in turbulent markets. For more recent floaters such as Chile, this experience should prove an invaluable guide.

[19] It is one of the few emerging markets that the Reinhart and Rogoff (2004) classification reports as a freely floating exchange rate. It is classified as such from 1995, prior to which it is classified as a managed float.

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Figures

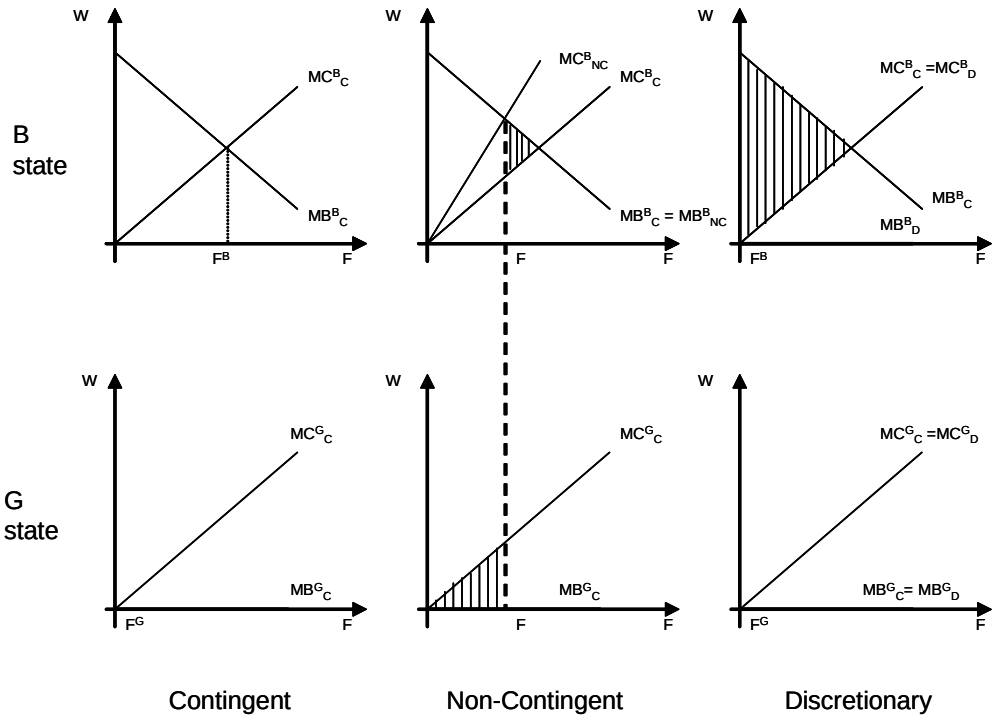


Figure 1: Contingent, Non-contingent and Discretionary Exchange Rate Flexibility

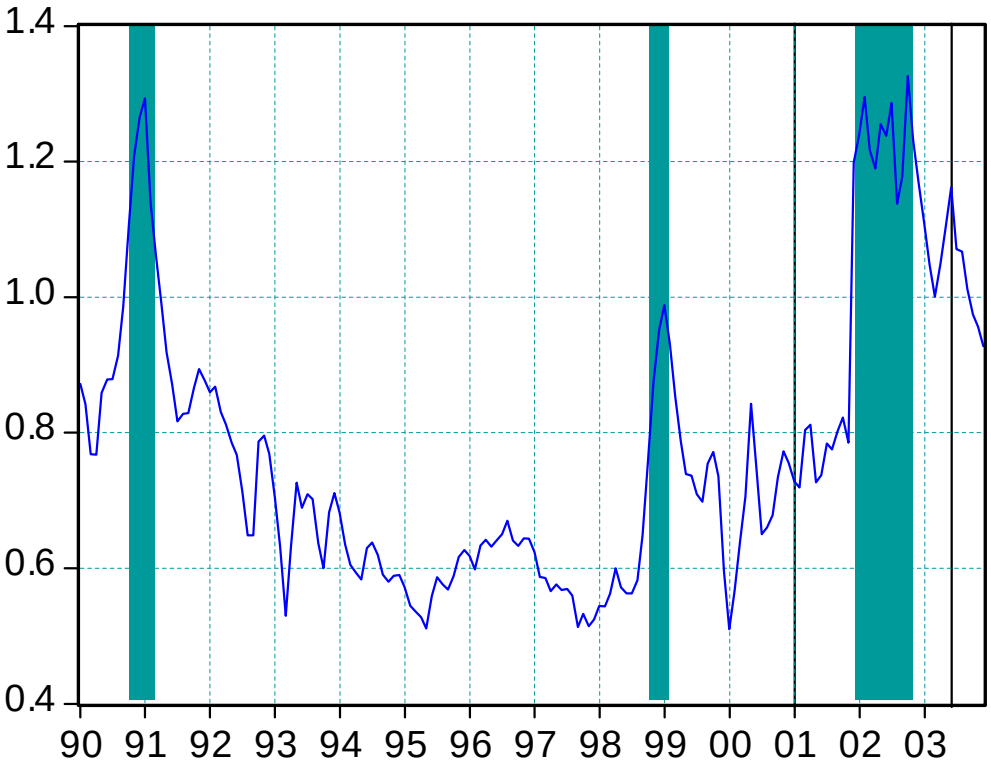


Figure 2: The High Yield Spread Index (line) and Potential Sudden Stops (gray area)

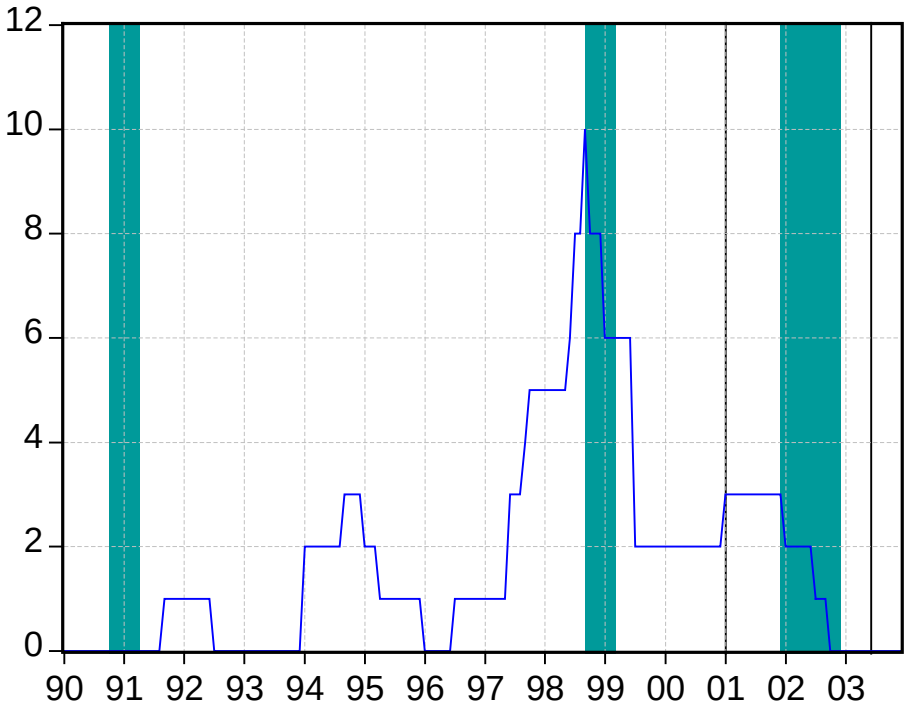


Figure 3: Actual (line) and Potential (gray) Sudden Stops

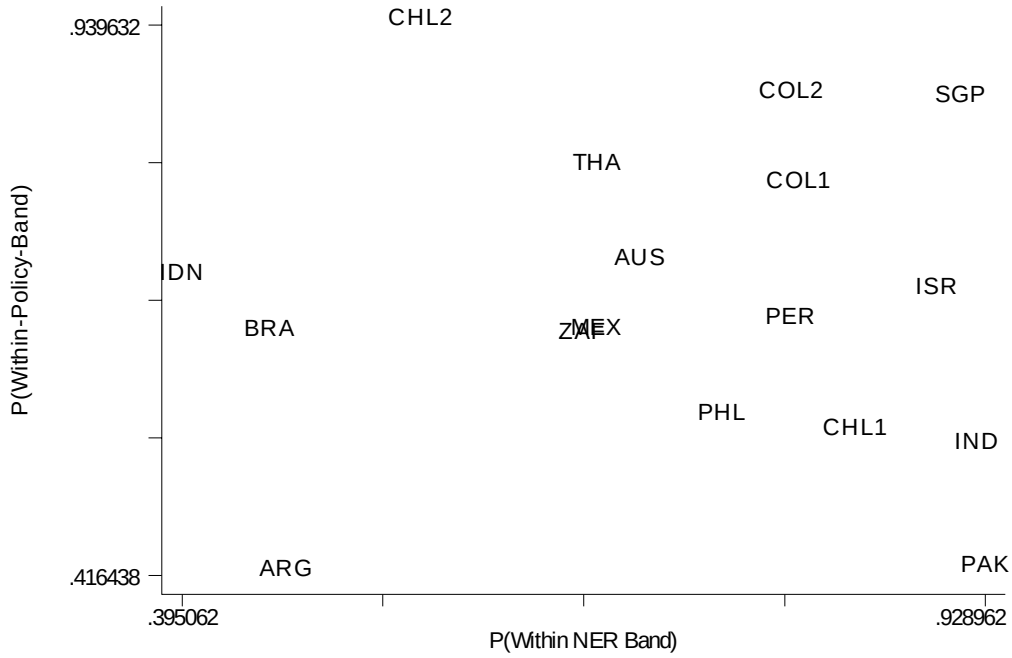
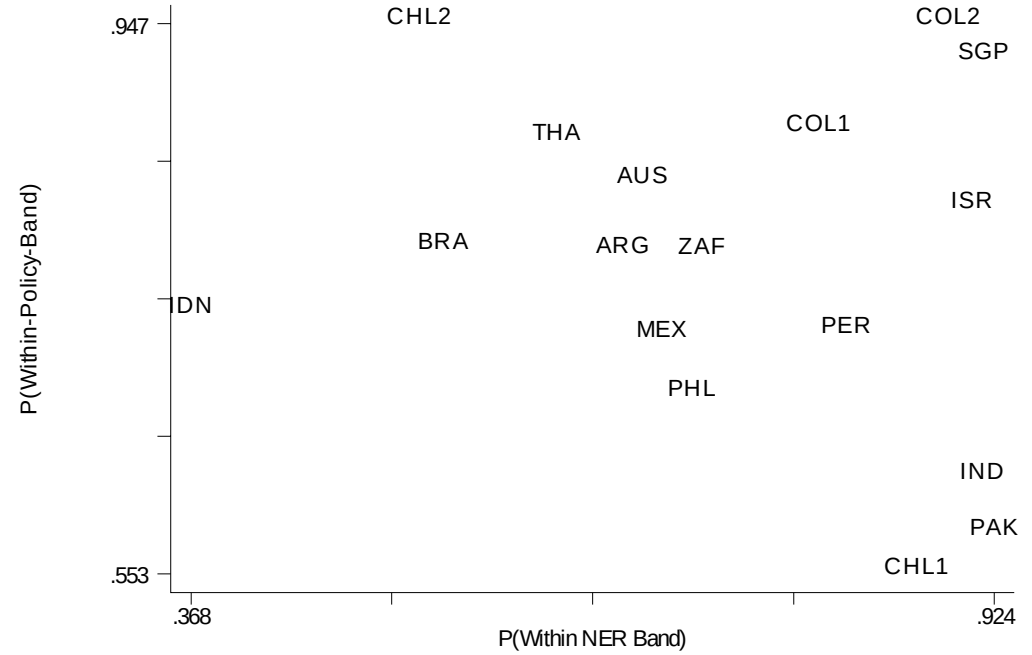


Figure 4: Fear of Floating – The Unconditional Evidence

Base Case



High Yield Spread Shocks

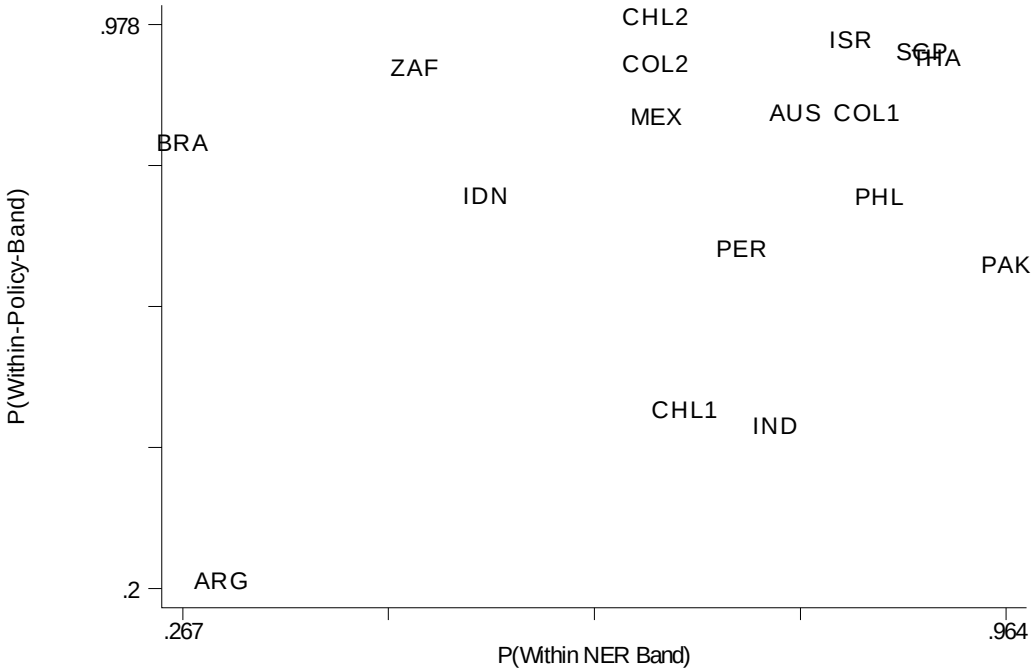


Figure 5: Contingent Flexibility

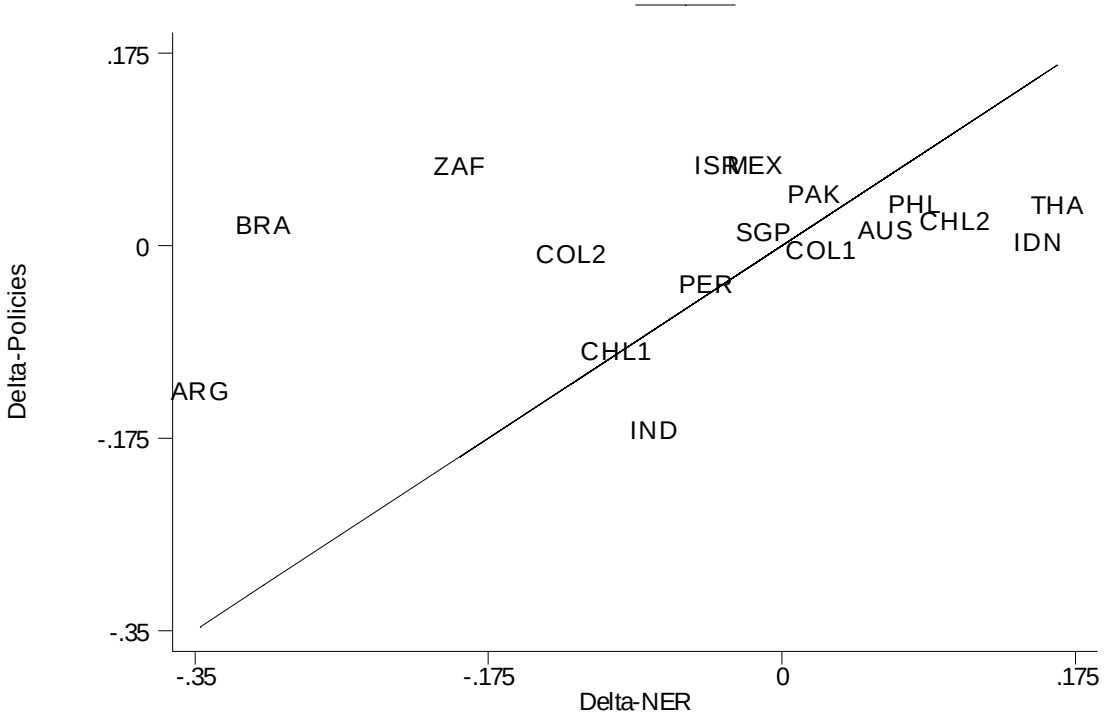


Figure 6: Contingent Flexibility – High Yield Spread Shocks

Tables

Table 1: Volatility of Exchange Rates, Reserves and Interest Rates

Country	IMF Classification	Start	End	Nominal Exchange Rate		Reserves		Interest Rates	
				Basis case	HYS shock	Basis case	HYS shock	Basis case	HYS shock
Argentina	Managed Float	200201	200412	0.667	0.300*	0.333	0.200*	1.000	0.200*
Australia	Ind. Float	198901	200412	0.681	0.786	0.500	0.536	1.000	1.000
Brazil	Ind. Float	199901	200412	0.543	0.267*	0.478	0.400	0.935	1.000*
Chile	Managed Float	198901	199908	0.870	0.692	0.620	0.539	0.520	0.385
Chile	Ind. Float	199909	200412	0.526	0.667	0.895	0.933	0.973	1.000
Colombia	Managed Float	198901	199909	0.802	0.846	0.663	0.846*	0.970	0.846
Colombia	Ind. Float	199910	200412	0.892	0.667*	0.838	0.733	1.000	1.000
India	Managed Float	198901	200412	0.916	0.769	0.430	0.385	0.713	0.429
Indonesia	Ind. Float	199708	200412	0.368	0.524	0.719	0.667	0.750	0.762
Israel	Managed Float	199112	199912	0.909	0.833	0.432	0.833*	1.000	1.000
Mexico	Ind. Float	199501	200412	0.693	0.667	0.480	0.706*	0.841	0.905
Pakistan	Managed Float	198901	200412	0.924	0.964	0.160	0.179	0.785	0.857
Peru	Ind. Float	199008	200412	0.822	0.741	0.619	0.407	0.778	0.778
Philippines	Ind. Float	198901	200412	0.715	0.857*	0.420	0.464	0.806	0.857
Singapore	Managed Float	198901	200412	0.917	0.893	0.762	0.786	1.000	1.000
S. Africa	Ind. Float	198901	200412	0.722	0.464*	0.347	0.714*	0.993	1.000*
Thailand	Ind. Float	199707	200412	0.621	0.905*	0.724	0.762	0.931	1.000*

Source: Authors' calculations based on *International Financial Statistics*, International Monetary Fund
Notes:
1 – Nominal Exchange Rate Volatility - Probability that the monthly change is within a +/-2.5% band
2 – Reserves - Probability that the monthly change is within a +/-2.5% band
3 – Interest Rates - Probability that the monthly change is within a +/-400 b.p. band
* identifies a situation when the value in the basis case and the HYS shock are significantly different at the 5% level.

Table 2: Exchange rate flexibility index

Country	IMF Classification	Start	End	$\frac{\alpha}{1-\sum_{n=1}^{N}\gamma_n}$	$\frac{\sum_{m=0}^{M}\beta_m}{1-\sum_{n=1}^{N}\gamma_n}$	Dynamic structure (M,N)	Category
Argentina	Managed Floating	200201	200412	0.2486#	0.2186	(0,1)	D
Australia	Independent Floating	199001	199912	0.4204	0.1733	(1,1)	Benchmark
Brazil	Independent Floating	199901	200412	0.2559#	0.4711*	(1,1)	C
Chile (-1999)	Managed Floating	198901	199908	0.0720#	-0.0195	(0,1)	D
Chile (1999-)	Independent Floating	199909	200412	0.6504	0.2778	(1,2)	NC
Colombia (-1999)	Managed Floating	198901	199909	0.1512	0.3797	(0,1)	D
Colombia (1999-)	Independent Floating	199910	200412	0.2882#	1.2369*	(0,1)	C
India	Managed Floating	198901	200412	-0.0078#†	0.0516	(0,1)	D
Indonesia	Independent Floating	199708	200412	1.2486	-1.1495	(0,1)	NC
Israel	Managed Floating	199112	199912	0.6078	4.7612	(2,5)	NC
Mexico	Independent Floating	199501	200412	0.3028#	0.4450*	(0,1)	C
Pakistan	Managed Floating	198901	200412	-0.0713#†	-0.0271	(1,4)	D
Peru	Independent Floating	199008	200412	0.1034#†	-0.1455	(1,1)	D
Philippines	Independent Floating	198901	200412	0.2826#	0.2299	(0,1)	D
Singapore	Managed Floating	198901	200412	0.6044	0.1291	(0,1)	Benchmark
South Africa	Independent Floating	198901	200412	0.2820	0.2079*	(0,3)	C
Thailand	Independent Floating	199707	200412	0.7609	-0.2832	(0,1)	NC

Source: Authors' calculations based on *International Financial Statistics*, International Monetary Fund.
* indicates a regime with significant contingency at the 5% level using a Wald test.
# indicates base case significantly lower than Singapore 5% level using a Wald test for the same period of time.
† indicates base case significantly lower than Australia 5% level using a Wald test for the same period of time.
Covariance matrix computed with Newey-West standard errors.
Lag structure determined by Schwarz information criterion.
Flexibility index is corrected by differences in the variance of terms of trade and difference in the variance of the interest rate used to compute the index.

Table 3: Substitute Insurance Mechanisms

Country	Capital Controls (1)	Sterilization (2)	Quality of Bank Supervision (3)	Reserve Requirements (4)
Contingent regimes				
Brazil	1.8	0.11	3	16.4
Colombia (1999-)	1.0	-1.15	2	12.7
Mexico	1.0	-0.67	2	15.7
South Africa	2.1	0.18	3	11.4
Average	*1.5*	*-0.38*	*2.5*	*14.1*
Median	*1.4*	*-0.28*	*2.5*	*14.2*
Non-contingent (floating)				
Chile (1999-)	1.0	-0.53	3	12.7
Indonesia	3.0	-0.91	n.a.	n.a
Israel	1.5	-1.14	2.5	9.5
Singapore	1.5	-0.83	3.5	18.4
Thailand	1.1	-0.84	3	11.4
Average	*1.6*	*-0.85*	*3.0*	*13.1*
Median	*1.5*	*-0.84*	*3.0*	*12.1*
Discretionary ("fear of floating")				
Argentina	3.0	-0.60	2	8.8
Colombia (-1999)	2.2	-0.78	2	12.7
Chile (-1999)	2.0	-0.23	3	12.7
India	3.0	-0.26	2	11.9
Pakistan	3.0	-1.14	1	8.8
Peru	1.1	-0.57	3	12.8
Philippines	2.5	0.21	2.5	14.5
Average	*2.4*	*-0.48*	*2.2*	*11.7*
Median	*2.5*	*-0.57*	*2.0*	*12.7*

Definitions:
(1) from Kaminsky-Schmukler (2003), 3=high controls, 1=low/no controls;
(2) update of the results from Bofinger and Wollmershaeuser (2001); the estimate corresponds to the coefficient of the change in net foreign assets in a regression of the change in net domestic assets on net foreign assets and lagged net domestic assets, monthly data from IFS, lines 11 to 17;
(3) Computed using the definition in Abiad and Mody (2003) using data from Barth et al. (2003); 4=best quality, 0=worst quality. The index incorporates information on banks' adoption of a capital adequacy regulation in line with standards developed by the Bank for International Settlements; (2) the independence of the supervisory agency from the executive's influence and whether it has sufficient legal power and (material) supervisory power; (3) the absence of exemptions to mandatory actions if an infraction is observed and (4) the extent to which supervision covers all financial institutions.
(4) From Barth et al. (2003); the actual risk-adjusted capital ratio in banks as of year-end 2001, using the 1988 Basle Accord definitions.

Table 4: Private Reserve Accumulation and the Exchange Rate Regime

	(1)	(2)	(3)	(4)
Dependent Variable: Private Reserves				
Log(GDP)	1.4258**	1.398***	0.050***	0.051***
	(.7039)	(0.294)	(0.016)	(0.016)
F	0.3748***	0.449***	0.013***	0.010
	(0.0435)	(0.075)	(0.005)	(0.008)
HYS		0.182*		-0.002
		(0.114)		(0.007)
*F *HYS*		-0.097		0.006
		(0.079)		(0.009)
$Log(PR)_{t-1}$			0.967***	0.967***
			(0.010)	(0.011)
Dependent Variable: Share of Private Reserves in Total Reserves				
Log(GDP)	0.046	0.049	-0.040***	-0.042***
	(0.123)	(0.121)	(0.014)	(0.013)
F	0.022**	0.020	0.011***	0.009***
	(0.010)	(0.018)	(0.002)	(0.003)
HYS		0.019		0.009
		(0.030)		(0.007)
*F *HYS*		-0.001		0.002
		(0.020)		(0.004)
$(PR/(PR+PuR))_{t-1}$			0.413***	0.411***
			(0.057)	(0.057)
Observations	14 countries (1280 obs.)	14 countries (1280 obs.)	14 countries (1274 obs.)	14 countries (1274 obs.)

Source: Authors' calculations based on *International Financial Statistics*, International Monetary Fund.
Fixed effect estimates. Standard errors robust to clusters at the country level. Standard errors in parentheses
*,**,*** denote a variable is significant at 10%, 5%, and 1%, respectively.

Table 5: Exchange Rate Regimes and Sudden Stops

Model	Panel-Probit Model		Panel-Linear Probability Model			Panel-Logit Model		
F	0.327***	0.656***	0.069***	0.145***	0.140***	0.609***	1.223***	1.181***
	(0.094)	(0.104)	(0.022)	(0.026)	(0.021)	(0.170)	(0.202)	(0.177)
	[0.061]	[0.114]				[0.059]	[0.304]	[0.099]
HYS	0.172	0.113	0.033	0.020	0.021	0.327	0.231	0.230
	(0.116)	(0.138)	(0.023)	(0.021)	(0.022)	(0.222)	(0.250)	(0.245)
	[0.034]	[0.021]				[0.032]	[0.056]	[0.016]
*F *HYS*	-0.442**	-0.627***	-0.091**	-0.122***	-0.120***	-0.822**	-1.127**	-1.078**
	(0.199)	(0.240)	(0.040)	(0.037)	(0.037)	(0.391)	(0.441)	(0.430)
	[-0.082]	[-0.109]				[-0.079]	[-0.279]	[-0.090]
Country effects	No	Random effects	No	Fixed effects	Random effects	No	Fixed Effects	Random effects
Number of observations	2279	2279	2279	2279	2279	2279	1569	2279
Number of countries	14	14	14	14	14	14	9	14

Standard errors in parentheses, marginal effects in brackets.
*,**,*** denote a variable is significant at 10%, 5%, and 1%, respectively.

Table 6: Country Episodes and Sudden Stops

Sudden Stop		No Sudden Stop	
Country	Regime	Country	Regime
Colombia (-1999)	Discretionary	Argentina	Discretionary
Chile (-1999)	Discretionary	Brazil	Contingent
Peru	Discretionary	Chile (1999-)	Non-contingent
Philippines	Discretionary	Colombia(1999-)	Contingent
		India	Discretionary
		Indonesia	Non-contingent
		Israel	Non-contingent
		Mexico	Contingent
		Pakistan	Discretionary
		Singapore	Non-contingent
		South Africa	Contingent
		Thailand	Non-contingent

Source: Authors' calculations.

Table 7: Determinants of Exchange Rate Regimes

Country	Inflation Targeting (1)	Voluntary Regime Change (2)	Age (3)	Derivatives market development (4)
Contingent regimes				
Brazil	0.9	0.0	62	0.9
Colombia (1999-)	1.0	0.0	61	0.3
Mexico	0.6	0.0	103	1.5
South Africa	0.3	1.0	180	13.5
Average	*0.7*	*0.3*	*101.5*	*4.1*
Median	*0.8*	*0.0*	*82.5*	*1.2*
Non-contingent (floating)				
Chile (1999-)	1.0	1.0	62	2.2
Indonesia	0.0	0.0	67	n.a.
Israel	0.6	1.0	96	0.9
Singapore	0.0	1.0	180	258.6
Thailand	0.5	0.0	83	3.9
Average	*0.4*	*0.6*	*97.6*	*66.4*
Median	*0.5*	*1.0*	*83.0*	*3.1*
Discretionary ("fear of floating")				
Argentina	0.0	0.0	29	0.1
Chile (-1999)	0.1	1.0	110	1.7
Colombia (-1999)	0.0	1.0	111	0.0
India	0.0	1.0	180	n.a.
Pakistan	0.0	1.0	180	n.a.
Peru	0.0	0.0	132	n.a.
Philippines	0.0	0.0	112	n.a.
Average	*0.0*	*0.6*	*122.0*	*0.6*
Median	*0.0*	*1.0*	*112.0*	*0.1*

Definitions:

(1) from Carare and Stone (2003). The number in column (1) corresponds to the percentage of time in each regime with a full-fledged inflation targeting regime in operation.

(2) From IMF (2004). A voluntary transition is a transition which is not driven by a crisis. Crisis-driven transitions are defined as those that are associated with a depreciation vis-à-vis the U.S. dollar of more than 20 percent, at least a doubling in the depreciation rate compared with the previous year, and depreciation in the previous year of less than 40 percent.

(3) Age: is defined as the number of months that the country has been under the regime until the end of the regime defined in Table 2 *and* the regime is not classified as a *de facto* free-falling regime by Reinhart and Rogoff (2004).

(4) Forex Derivatives Transactions to GDP from BIS (1998, 2001)

Appendix

This appendix presents the definition of sudden stops, based on the updated Calvo *et al* (2004) methodology, which was used in Figure 3 and Section 5.

Table A1: Sudden stops by country-period

Country	Period
Argentina	1994.09-1995.12
	1999.02-1999.12
	2001.01-2002.09
Brazil	1997.10-1999.06
Chile	1998.06-1999.06
Colombia	1998.07-2000.06
India	-
Indonesia	1997.06-1998.09
Israel	-
Mexico	1994.01-1995.03
Pakistan	-
Perú	1997.09-1998.12
Philippines	1991.09-1992.06
	1997.06-1999.06
Singapore	-
South Africa	-
Thailand	1996.07-1998.09

Source: Authors' calculations

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