Why IMF Stabilization Programs Fail To Prevent Currency Crises in Some Financially Distressed Countries But Not Others?*

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Abstract: A critical function of the International Monetary Fund (IMF) is to prevent currency crises in the international monetary system. Yet recent episodes of currency crashes and a dataset on currency crises in 82 countries (1974-2002) reveal that the IMF's short-term stabilization program –which is explicitly designed to prevent currency crashes -- failed to prevent currency crises in some but certainly not all (i.e. most) of the financially distressed countries that participated in the stabilization program. What explains this variation? I construct a model of speculative trading that examines how the IMF's ability to prevent currency crashes via its stabilization program crucially depends on the degree of institutionalized state intervention in the financial sector of countries that participate in the IMF's stabilization program. The model predicts that the greater (lesser) the extent of institutionalized state intervention in the financial sector of a financially troubled country that participates in the IMF's stabilization program, the harder (easier) it is for that country to credibly commit ex ante to financial sector reforms, as required by the stabilization program. Weak (strong) commitment to IMF reforms increases (decreases) the incentives for currency traders to engage in a speculative attack against the country's currency and this increases (decreases) the likelihood of a currency crisis. Results from Spatial Autoregressive (SAE) Bivariate Probit models provide strong statistical support for the model's main prediction.

* **Note:** An earlier version of this paper was presented at the IMF. The findings presented in this paper do not represent the IMF's views on this issue. I thank Sergio Bejar for research assistance. The usual disclaimer applies.

1. Introduction

The 1990s and the early years of this decade were turbulent times in the international monetary system. The turbulence began with hyperinflation in the former Soviet bloc, passed through the Tequila crisis in Mexico in 1994 and was followed by successive financial crises – characterized by currency crashes – in Thailand, Indonesia and Malaysia. It then spread to Russia where the rouble collapsed in 1998 and was transmitted to Argentina, Brazil, Uruguay and Turkey. The costs of the financial crises in the affected countries were devastating: savings were wiped out, millions of jobs were eliminated in few days, several families were confronted with the grim reality of poverty and food riots occurred regularly. Moreover, the crisis led to a bloody civil strife in Indonesia, fostered the resurgence of anti-democratic forces in Russia and engendered serious political instability in other affected countries.

With each successive crisis, policy-makers, academics and the media increasingly accused the International Monetary Fund (IMF) of negligence and asked why it could not prevent these crises? After all, the critics suggested that since the IMF is obliged by Article IV of its own constitution to minimize currency crashes, it should have prevented the currency crises that occurred. Some critics even charged that the conditional loans provided by the IMF to ostensibly prevent a currency crisis in financially "distressed" countries – suffering from severe balance of payments problems, high external debt and low reserves – that ironically turned to the IMF for help increased the likelihood of currency collapse in these countries (Stiglitz 2002; Barro 1999). Officials from the IMF, including its director-general at the time Stanley Fischer, however, suggested that the anti-IMF accusations were unfair and that the IMF's *short-run stabilization program* (which is different from its long-run structural adjustment programs) prevented currency crashes and financial catastrophes in most if not all countries participating in IMF stabilization programs. The recrimination and finger-pointing between the IMF and its critics triggered the following unresolved debate:

Does the IMF's stabilization program for financially troubled countries increase or decrease the likelihood of a currency crisis?

With the benefit of hindsight and some preliminary data analysis, we now know that IMF stabilization programs prevented currency crises in some financially distressed countries but failed to prevent a currency collapse in other financially troubled countries that also turned to the IMF for assistance. In fact, a dataset of 82 countries between 1974 and 2002 reveals – the first recorded currency crash in the data, which is described later, occurred in Argentina in 1975-- that in this time period almost 40% of a total of 531 IMF short-run stabilization programs for financially distressed countries failed to prevent a currency crisis, but the remaining 60% of the programs prevented currency crashes. For instance, the IMF's stabilization program and conditional financial assistance for Brazil (March 1999) prevented a speculative attack on their respective currencies and thus prevented a full-fledged currency crisis. In contrast, IMF programs in Indonesia (1998) and Russia (1998) ended in unmitigated disaster and could not prevent the collapse of the Indonesian rupiah and the Russian rouble; this is graphically illustrated in the smoothed transition probabilities for the Indonesian case in figure 1.

<<Insert figure 1 about here>>

The intriguing finding in my data and the examples mentioned above leads to the central puzzle addressed in this paper: Why have IMF short-run stabilization programs failed to prevent currency crises in some financially distressed countries but not others?

Before summarizing my answer to the aforementioned question, let me briefly mention here that scholars have surprisingly not addressed the issue of why there is substantial variation in the efficacy of IMF stabilization programs with respect to preventing currency crises. For instance, several studies have examined the impact of IMF structural adjustment programs on macroeconomic outcomes such as growth, unemployment, inflation and fiscal deficits

(Vreeland 2003; Stone 2002; Dreher & Vaubel 2004a; Hutchison 2003; Fischer 2004; Barro & Lee 2003). But none of these studies analyze the varied impact that IMF stabilization programs have on *currency markets*. Political scientists have also theorized and tested claims about the impact that domestic political institutions have on the likelihood of currency crises (Leblang 2001, 2003; Leblang and Bernhard 2001; Leblang & Satyanath 2006). While insightful, these studies ignore the potential impact that the IMF may have in terms of negatively (or positively) influencing the likelihood of currency crises. In contrast some economists have studied whether or not IMF conditional loans to financially troubled countries lead to moral hazard problems (Conway 2002; Knight & Sanaletta 2000). However, instead of studying how IMF programs affect currency markets, as done here, they restrict their analysis to studying the effect of IMF programs on domestic equity markets or interest rates in countries that borrow from the IMF. Finally, the few works on the IMF and crisis-prevention are analytically insufficient since they only focus on the IMF's failures in the 1990s, which is tantamount to sample selection (Desai 2003; Stiglitz 2002).

To answer this paper's central question posited above, I construct a model of speculative trading that studies how the IMF's ability (or inability) to prevent currency crashes via its stabilization program crucially depends on the degree of institutionalized state intervention in the financial sector of financially "distressed" countries that participate in the IMF's stabilization program. In particular, the formal model presented in this paper studies how strategic interaction between three actors affects the likelihood of a currency crisis: (i) the government of a financially distressed country that participates in the IMF's stabilization program to avoid a speculative run on its currency (ii) the IMF that provides a short-run stabilization package to the troubled country conditional on the latter's promise that it will implement financial sector reforms and (iii) currency traders that trade the distressed country's currency in international capital markets.

The model predicts that the greater (lower) the extent of institutionalized state intervention in the financial sector –captured by the extent of state-ownership of financial services and its role in financial intermediation – of a financially troubled country that turns to the IMF for help, the higher (lesser) the likelihood that IMF stabilization program will foster a currency crisis in that country. Specifically, a higher level of institutionalized state intervention in the financially troubled country's financial sector leads to greater political resistance to financial sector reforms that the IMF attaches as a condition to its stabilization program. Consequently, the credibility of the government's commitment to implement *ex post* financial sector reforms suggested by the IMF weakens. When the financially troubled government fails to credibly commit to IMF-requested financial reforms, traders rationally anticipate that the country's macroeconomic fundamentals will improve. This, in turn, provides incentives to traders to opt for a speculative attack against the country's currency in a rational expectations equilibrium, which leads to a currency crisis. Conversely, distressed countries that borrow from the IMF under its stabilization program but have a low degree of state intervention in the financial sector are more likely to credibly and successfully commit to implement financial sector reforms ex post. This will reduce the incentives for traders to engage in a speculative and thus prevent a currency crisis.

I present and estimate an original statistical model in this paper called the spatial autoregressive error (SAE) bivariate probit model to account for both selection/participation of financially troubled countries in IMF stabilization programs and spatial dependence in the data when testing my theoretical claims. Results from the SAE bivariate probit model estimated on a data set of 82 countries between 1974 and 2002 statistically corroborate my model's prediction.

The findings presented in this paper have several important implications that are briefly previewed here but are discussed in more detail in the conclusion. First, more broadly, this paper is among the first to not only study the impact of IMF programs on currency markets that has been overlooked so far but also carefully address' variation in the effect of IMF stabilization programs on preventing currency crises. By doing so, it fills a large gap in the literature since extant studies almost entirely focus on the effect of IMF programs on macroeconomic outcomes. Second, a key policy implication of this study is that the IMF should either scale back or increase the time span for carrying out the financial sector reforms that it requests from countries that participate in its stabilization program. Indeed, IMF stabilization programs should not be completely overhauled or stopped, as suggested by several critics.

In the next section I present my model of speculative trading that provides some testable hypotheses. In sections 3 and 4, I describe the data, variables, statistical methodology and empirical results. I conclude with a brief summary of the study and discuss the implications of the research presented in this paper.

2. The model

I present a simple model of speculative trading in this section to examine the conditions under which IMF short-run stabilization programs are likely to prevent a currency collapse in financially troubled countries that turn to the IMF for financial help. Specifically, the formal model presented below studies how interaction between three players affects the likelihood of a currency crisis: (i) the government of a financially troubled country – suffering from balance-of-payments and external debt problems -- that participates in the IMF's stabilization program to avoid a speculative run on its currency (ii) the IMF that provides financial aid via a short-run stabilization package to the troubled country conditional on the latter's promise that it will implement fiscal policy reforms and (iii) currency traders/ speculators that trade the troubled country's currency in capital markets. The model presented below builds on existing models of currency crises by Morris and Shin (1998) and Heinemann and Illing (2003), but differs in two key respects.

First, unlike existing models of currency crises that ignore either the role of the IMF or the government of financially troubled/debtor countries, a key innovation of my model is that it studies how strategic interaction between three players (mentioned above), i.e. the IMF, currency traders and the financially troubled country, affects the likelihood of a currency crisis. Second, the model presented here specifically examines how domestic politics associated with financial sector reforms influences the impact of IMF stabilization programs on currency markets, which has not been done earlier.

2.1 Players and their Payoff functions

In the model there exists a continuum of currency traders $i \in [0,1]$. The traders strategic choice is to either "attack" or "not attack" the currency of the financially troubled country based on their expectations of the macroeconomic "fundamentals" in the troubled country, which is defined by the continuous parameter $\theta \in [0,1]$. If a speculative attack is successful, then traders get the reward $r(\theta)$, which is normalized, without loss of generality, to 1. Attacking the currency, however, leads to transaction costs for the currency traders that is labeled as *t*. Hence, the net payoff to a trader from a speculative attack is $1-t$, while the payoff to an unsuccessful attack is given by *-t*.

Note that ex ante traders in international capital markets do not fully know the value and are thus uncertain about the future state of θ. This is not surprising given that they are uncertain about whether or not macroeconomic fundamentals will improve ex post in the financially troubled country after the latter receives financial assistance from the IMF. However, following extant models (see Morris and Shin 1998; Corsetti et al 2004), each speculator *i* observes a private signal s_i about θ with some "noise":

$$s_i = \theta + \sigma\varepsilon_i \qquad (1)$$

where $\sigma > 0$ is a constant[1] and the noise term ε_i is independently and identically distributed (i.i.d) across traders with density function $f(.)$ and cumulative distribution function $F(.)$.[2] Given s_i, each trader's strategy is an action that maps the realization of his signal to one of two actions: attack or not attack the currency in question. In other words, each trader's strategy is defined as the function $a_i : \Re \rightarrow \{0,1\}$ where $a_i(s_i) = 1$ indicates that the trader attacks the country's currency after observing his signal, while $a_i(s_i) = 0$ indicates that he refrains from attacking the currency.

Following extant models of currency crises (see Morris and Shin 1998; Corsetti *et al* 2004; Heinemann & Illing 2002), the traders in my model of speculative trading choose to attack the currency of the financially troubled country under two conditions: (i) when they expect the country's macroeconomic fundamentals will be lower than some threshold value θ^* even after the country receives the IMF's financial assistance when it participates in the institution's financial assistance program and (ii) if the signal s_i they receive about θ falls below some threshold value s^* which results from greater uncertainty about the future state of θ. Formally, since $s_i = \theta + \sigma\varepsilon_i$ and ε_i is i.i.d with density *f* and cdf *F*, the probability *p* with which a trader both receives a signal s_i below s^* and thus attacks the currency is:

$$p(s_i \leq s^* \mid \theta) = F\left(\frac{s^* - \theta}{\sigma}\right) \qquad (2)$$

From (2) and given that ε_i is i.i.d with density *f* and cdf *F*, the condition on the threshold value of θ^* under which a speculative attack occurs with some probability is

$$F\left(\frac{s^* - \theta^*}{\sigma}\right) = \theta^* \qquad (3)$$

[1] The parameter $\sigma > 0$ captures heterogeneity in the "quality" of realized private signals. This is natural considering that the realized information content from the private signal will vary across traders.
[2] It is assumed here that ε_i is normally distributed. However, the results from the model presented in this section hold even if ε_i has an uniform or log-normal distribution.

Suppose the currency trader realizes the signal s_i given θ^*. Then from (2) and (3), the conditional probability of a successful attack on the currency of is

$$q(\theta \leq \theta^* \mid s_i) = F\left(\frac{\theta^* - s^*}{\sigma}\right) = t \tag{4}$$

In international capital markets, traders will attack a country's currency only if 1-*t* > 0 or 1 > *t*. Hence, the "cut-off" point of s^* from (4) is

$$F\left(\frac{\theta^* - s^*}{\sigma}\right) = t \tag{5}$$

Using the condition in (3) and (5), I solve below for the equilibrium value of the thresholds θ^* and s^*. Doing so, as shown later, allows one to derive explicit comparative static results on the conditions under which IMF financial assistance via its stabilization program to the financially troubled fails (or succeeds) in preventing a currency crisis. But before solving for the thresholds values mentioned above and describing the IMF's and the financially troubled country's payoff function, I prove the following Lemma:

Lemma 1: *A speculative attack on the financially troubled country's currency – that borrows from the IMF under its stabilization program – will occur with probability 1 for any realization of (i) the fundamental* θ *below* θ^* *and (ii) the signal* s_i *below* s^**,*

$$a_i(s) = \begin{cases} 1 \ \ if \ \ \theta < \theta^* \\ 0 \ \ if \ \ \theta > \theta^* \end{cases} \qquad a_i(s) = \begin{cases} 1 \ \ if \ \ s_i < s^* \\ 0 \ \ if \ \ s_i > s^* \end{cases} \tag{6}$$

The prediction in Lemma 1 –which is a standard result in models of currency crises with multiple traders (see Morris and Shin 1998) – provides two main theoretical findings. First, *if* traders rationally expect a decline in the macroeconomic fundamentals of the financially troubled country after receiving the IMF's financial assistance –more formally, if θ strictly decreases such that $\theta < \theta^*$—then in a rational expectations equilibrium traders will always attack the currency with probability 1. Second, if traders uncertainty about the future state of θ increases, implying lower precision in the signal s_i, and thus $s_i < s^*$, they will also have rational incentives to attack the currency. The intuition behind this result, that is explained in detail in Morris and Shin (1998), is simple: when traders anticipate that macroeconomic fundamentals will decline and are more uncertain about the future state of the fundamentals, they have incentives to short-sell the troubled country's currency since it is profitable to do so given their expectations and their rational conjecture of the behavior of other traders. Once a speculative attack starts, the transaction costs of attacking further declines and this provokes a large-scale speculative attack that engenders a currency collapse. The result in Lemma 1 has critical substantive implications that are explored in greater detail below.

I now describe the IMF's payoff function. The IMF's objective is to prevent a speculative attack on the financially troubled country's currency and thus minimize the likelihood of a currency crisis. To that end, the IMF provides financial help usually in the form of *short-term* conditional loans or aid to the financially distressed country –that approaches the IMF—in order to help it overcome financial problems such as low reserves, severe external debt and/or balance-of-payments problems. In reality, the IMF provides a variety of conditional assistance packages. However, in this paper, I focus both theoretically and empirically (as described later) on the impact of financial assistance provided by the IMF only for the purpose of short-term financial stabilization such as rapidly augmenting depleted reserves of financially troubled countries. That is, I focus on the effect of *short-run stabilization programs* that are given on the condition that the recipient nation undertakes financial sector reform (not structural adjustment or fiscal policy reform) in order to resolve its financial problems. I do not examine the impact of conditional assistance provided by the IMF that is used for long-term economic and structural adjustment reform.

More formally, then, the IMF provides financial assistance to the distressed country that is labeled as bm where $b > 0$ is a positive constant. *If* the financially distressed country that borrows from the IMF implements the reforms suggested by the IMF, which leads to (i) an improvement of its fundamentals and (ii) allows the country to pay back the loan, then the IMF earns some return from providing *m* that is defined by the function $\alpha(\theta, m)$. The IMF's payoff function is thus given by:

$$\beta(\theta, m) \equiv \begin{cases} \alpha(\theta, m) - bm & \text{if} \quad \theta \geq \theta^* \\ -bm & \text{if} \quad \theta < \theta^* \end{cases} \tag{7}$$

Finally, I define the expected payoff function of the government of the financially troubled country that borrows from the IMF. The government's expected payoff function is defined by certain parameters that are described below and the government's *ex ante* uncertainty on whether the economy will be in a tranquil/non-crisis state or in a situation of financial crisis.

To begin with, observe that a financially distressed country that borrows *m* from the IMF and thus participates in the IMF's stabilization program has to implement certain financial sector reforms, which is a mandatory condition for obtaining *m*. The extent to which the recipient country that borrows *m* implements the reform measures suggested by the IMF is given by the continuous parameter $l \in [0,1]$.[3] Implementing financial sector reforms entail political and economic costs.[4] Hence, the cost that the government incurs from implementing reform is given by the quadratic cost function $c(l) = l^2$.

The extent to which IMF-suggested reforms is implemented by financially troubled countries that borrow *m* varies. For instance, in recent years, Brazil (1999) and Philippines (1999) that participated in IMF stabilization programs sincerely implemented IMF induced reforms, while Indonesia (1998) and Thailand (1997) that also received financial assistance from the IMF did not implement financial sector reforms requested by the IMF. I examine

[3] I assume, without loss of generality, that *l* is bounded between 0 and 1. Changing this assumption by allowing *l* to be unbounded substantially increases the technical complexity of the model without adding any substantive insights.

[4] Policy reforms may be politically costly for the government if the reform measures alienate constituents that lose from the reform process. Economic costs, on the other hand, results from the transaction costs that the government incurs when implementing reform.

in the model how the existing degree of state intervention in the distressed country's financial sector may account for variation in compliance to the conditions required by IMF stabilization programs and the consequence that this has with respect to the effect of IMF stabilization programs on the likelihood of currency crises. The degree of state intervention in the financial sector essentially refers to the extent to which state-owned financial institutions (including public sector banks and state-owned credit agencies) play a role in financial intermediation and providing financial services. I focus on the state's role in the financial sector because as I show below, the pre-existing extent of state intervention in the financial sector determines the political incentives of governments to carry out financial sector reforms in countries that participate in the IMF's stabilization program. Specifically, in the model, the degree of state intervention in the financial sector is determined by the continuous parameter $v \in [0,1]$; the higher (lower) the value of *v*, the greater (lesser) the extent of institutionalized state intervention in the financial sector.

Apart from the specific parameters l, $c(l)$ and *v*, the government's expected payoff is determined by its probabilistic expectation of whether the economy in general and not just macroeconomic fundamentals (θ) will be in a tranquil or crisis state in the future. For simplicity, it is assumed that the expected state of the economy is given by the stochastic variable $x_j \in [0,1]$ where *j*=*G* is the "good" state that corresponds to a tranquil period, while *j*=*B* denotes a "bad" economic state that occurs in a financial crisis period. Given x_j and l, the probability of financial insolvency that speculators take note of when deciding to attack the country's currency is defined in the model as $\pi_j = 1-(x_j l+\theta)$. Because the state of the economy will in all likelihood be affected by *v* and since *v* directly affects *l*, I thus define the ex ante probability of financial insolvency as $\pi_j = 1-(vl+\theta)$.

C is the economic and political cost that the government incurs in a financial crisis given that it expects to become financially insolvent in a crisis period with probability π_j. However, in the crisis state, the government will utilize the financial assistance m provided by the IMF and implement $l \in [0,1]$ reforms requested by the IMF therein generating positive returns ml (since $m > 0$ and $l > 0$). Hence the government's payoff in a crisis state is $\pi_j(ml - C)$. It is assumed that even in the tranquil period, i.e. the "good" economic state where the expectation of insolvency is $(1-\pi_j)$, the government implements some policy measures directed toward the financial sector (again captured by the parameter l). The returns from doing so is μl where μ is the revenue from implementing l in the good economic state. I assume, without loss of generality, that $\mu < m$. Changing this assumption does not alter the results derived from the formal model. In short, the government's payoff in the tranquil period is therefore $(1-\pi_j)\mu l$.

Gathering the description of the parameters in the government's payoff function together, one can now define the government's expected payoff which is:

$$\arg\max_{l} U_G = \pi_j(ml - C) + (1-\pi_j)\mu l - l^2 \tag{8}$$

Because $\pi_j = 1-(wl+\theta)$ and $(1-\pi_j) = wl - \theta$, the government's expected payoff function can be written in full form as

$$\arg\max_{l} U_G = (1 - wl - \theta)(ml - C) + (wl - \theta)\mu l - l^2 \tag{9}$$

Given the players' respective payoff functions as described above, I solve for the model's equilibrium solution below and then conduct comparative statics to derive testable hypotheses.

2.2 Equilibrium Solution and Comparative Static Results

The model's equilibrium solution is formally stated as:

Lemma 2: *There exists a Nash equilibrium in the model where* *(i) The optimal amount of reform implementation by the government of the financially troubled country after receiving financial assistance m from the IMF is:*

$$l^* = \frac{vC + m - \theta(\mu - m)}{2(1-(\mu - m)v)} \tag{10}$$

(ii) The threshold value of θ^* *and* s^* *is given by*

$$\begin{aligned} \theta^* &= 1 - t \\ s^* &= 1 - t - \sigma F^{-1}(t) \end{aligned} \tag{11}$$

(iii) The IMF's payoff from providing m is strictly positive (i.e.* $\beta(\theta, m^*) > 0$*) for all* $\theta \geq \theta^*$ *and* $\beta(\theta, m^*) < 0$ *for all* $\theta < \theta^*$.

Proof: See Appendix.

The result in Lemma 2 formally characterizes the Nash solution of the model. The explicit characterization of θ^* and s^* in Lemma 2 particularly useful because it provides the necessary technical benchmark that allows one to formally analyze when $\theta < \theta^*$ and $s_i < s^*$ and this, in turn, provides hypotheses that can be tested on data. While useful, the result in lemma 1 does not provide substantive insights *per se*. Rather, comparative statics conducted on the Nash solutions in Lemma 1 provide the central substantive result from the model, which is stated formally as

Proposition 1: *If the degree of state intervention in the financial sector is high and increasing, then*

(i) *Implementation of reforms suggested by the IMF declines in equilibrium,* $\frac{\partial l^*}{\partial v} < 0$

(ii) *For strictly decreasing* l^* *and thus* $\lim l^* \to 0$*,* $\theta < 0$ *which implies that macroeconomic fundamentals decline in the short-run and*

(iii) *When* $\theta < 0$*, it follows that* $\theta < \theta^*$ *and* $s_i < s^*$*. Consequently, from Lemma 1 attacking the financially troubled country's currency becomes a dominant strategy for currency traders and this will substantially increase the likelihood of a currency crisis.*

Proof: See Appendix.

Proposition 1 predicts that the greater the extent of state intervention in a financially troubled country's financial sector, the more likely it is that the financial assistance provided by the IMF under its short-run stabilization program will lead to a currency crisis. The causal intuition that explains the claim in Proposition 1 directly follows from the technical results in parts (i), (ii) and (iii) in the proposition and is briefly discussed below. To begin with, note that when the extent of state intervention in the financial sector is high, political resistance to reforms requested by the IMF under its short-run stabilization program will be strong both within and outside the state. Two reasons explain this claim.

First, it is well known (and well publicized) that the IMF provides financial assistance under its stabilization program to a financially distressed country –that voluntarily participates in the stabilization program –on the condition that the country adopts in the short-run three main financial sector reform measures: (i) limit government-directed credit allocation, (ii) substantially reduce non-performing loans and non-performing assets by public sector banks and (iii) increase as well as institutionalize financial disclosure of government-owned banks. It is not difficult to discern that political actors *within the state* in countries where state ownership of the banking sector is extensive will particularly resist the IMF reform measure of reducing government-directed credit allocation schemes even if the concerned state participates in the IMF's stabilization program. This is because political actors in countries with extensive state intervention in banking are more likely to use government-directed credit allocation as a tool for providing political patronage to constituents and business groups that support them politically, which, in turn, helps to maximize their political survival in office. In addition to political patronage, government sponsored credit allocation is also likely to be used by the state to provide subsidies and welfare that also benefits the state politically. Since reduction of government-directed credit allocation will endanger the political survival of politicians as well as force the government to cut back on its welfare programs that may be politically costly, both specific politicians and the state in general will either overtly or indirectly resist reduction of government-directed credit allocation.

Second, in countries where government intervention in the financial sector is high, actors outside the state – including representatives from public sector banks and industry groups—will actively resist the IMF's financial reform measure that calls for substantial reduction of non-performing loans and financial assets. Public sector banks will resist a substantial cut-back on non-performing loans as this may lead to a serious erosion of their client-base. Industry groups, on the other hand, that benefit from non-performing loans – which, in effect, provides them with free capital – will also exert political pressure on the government to not formally implement a reduction in non-performing loans and assets. The combined political resistance of actors within and outside the state to IMF financial sector reforms will thus provide political incentives to governments in countries where state intervention in the financial sector is high to resist cutting back on NP loans. This will consequently weaken implementation of reform measures in such countries as demonstrated formally by the comparative static result $\partial l^*/\partial v < 0$ in part (i).

Incomplete or weak implementation of financial sector reform measures suggested by the IMF as part of its stabilization program will have two immediate effects. First, the IMF's financial assistance to a country where government ownership and intervention in the financial sector is high will engender a serious moral hazard problem. In particular, it is plausible that IMF loans may be (mis)used in countries with extensive state involvement in the financial sector to postpone serious financial sector reform for purposes of political expediency and to protect inefficient public sector banks (with a high percentage of NPAs) rather than for carrying out the intended reform. Second, if IMF financial packages under its stabilization program indeed leads ton the moral hazard problem described above, then the financially troubled country will lack the necessary financial resources to restore its macroeconomic fundamentals and this will lead to a decline in the fundamentals as shown by the comparative static in part (ii) $\lim l^* \to 0,\ \theta < 0$.

The model predicts that a decline in θ (that is, $\theta < 0$) in cases where the IMF provides conditional financial assistance via its stabilization program has two deleterious consequences. For one, traders in international capital markets will seriously doubt the credibility of the financially troubled country's commitment to carry out IMF-requested financial sector reforms when the country participates in the stabilization program. Thus, notwithstanding the financially distressed country's participation in the stabilization program, currency traders will rationally expect the country's fundamentals to fall below the threshold value of θ^*, therein resulting in $\theta < \theta^*$. Second, when the credibility of the participating country's commitment to implementing IMF reform measures falters thus leading to $\theta < \theta^*$, traders also become more uncertain ex ante about the future state of θ. Indeed, because of higher uncertainty, their realized signal becomes more "noisy" and thus falls below the threshold s^*, i.e. $s_i < s^*$ (this is proved formally in the proof of proposition 1 in the appendix). As stated in Lemma 1, when $\theta < \theta^*$ and $s_i < s^*$, traders find it profitable to attack the currency of the financially troubled country. And once speculative attacks on the currency begin, it generates self-fulfilling expectations that not only leads to more speculative attacks but eventually to a currency collapse.

Put together, the preceding discussion leads to the following hypothesis that is carefully tested in the next section:

Hypothesis 1: IMF stabilization programs will increase the likelihood of currency crises in financially troubled countries only if the degree of state intervention in the financial sector in countries that borrow from the IMF under the latter's stabilization program is high.

In contrast to the prediction in hypothesis 1, it is not too difficult to discern that IMF stabilization programs will have the desired effect of decreasing the likelihood of currency crises in financially troubled countries –participating in the program – where the extent of state intervention in the financial sector is low and decreasing. Two reasons derived from the model explain this claim. First, participating countries with lower levels of institutionalized government intervention in the economy are more likely to be characterized by lower political resistance to financial sector reforms suggested. Such countries that borrow from the IMF will therefore be in a position to commit more strongly to the reforms requested by the IMF under its stabilization program. As a result, currency traders will believe that macroeconomic fundamentals will improve such that $\theta > \theta^*$ and will be less uncertain about the future state of θ therein implying that $s_i > s^*$. When $\theta > \theta^*$ and $s_i > s^*$ the incentives for speculators to engage in a speculative attack against the country's currency reduced dramatically and this prevents a currency crisis. More formally,

Corollary 1: For increasing l^* (resulting from lower v), $\theta > 0$ which leads to $\theta > \theta^*$ and $s_i > s^*$ and IMF stabilization programs thus have a negative effect on the likelihood of a currency crisis.

I now turn to test hypothesis 1 in the next section.

3. Statistical Methodology:

3.1 The Spatial Autoregressive Error (SAE) Bivariate Probit Model

In principle, one can use a standard discrete-choice model to test the prediction that IMF stabilization programs increase the likelihood of a currency crisis when the degree of state intervention in the financial sector is in financially troubled countries that turn to the IMF for financial help. Estimating a standard discrete choice model, however, ignores two methodological problems that confront a researcher testing the impact of IMF stabilization programs on the likelihood of currency crises. First, there is a sample selection problem since the participation of countries in IMF stabilization programs is non-random and this may bias the effect of IMF programs on the likelihood of currency crises. In fact, although the model presented earlier primarily focuses on when IMF programs prevent currency crashes, it also suggests that only particular countries –in this case, financially troubled countries with balance of payments and debt problems – voluntarily select into a IMF stabilization program. That is, my model also provides some explanatory variables that account for when countries participate in IMF stabilization programs and this should be incorporated when estimating the impact of IMF stabilization programs on currency crises.

Second, diagnostic tests, specifically the Moran *I* statistic, on my data reveals that there is some degree of spatial dependence in the data associated with the occurrence of currency crises *and* the participation of countries in IMF stabilization programs. This is not surprising given that financial contagion exists in the international financial system and that this can lead to the spread of currency crises and/or engender financial problems across countries in a region severe enough to encourage these countries to turn to the IMF for financial help. Hence, while I do not suggest theoretically that spatial dependence is the key causal variable in my study –clearly governments neither strategically "adopt" a currency crisis nor participate in IMF stabilization programs because other neighboring countries are doing so – one needs to explicitly account for spatially autocorrelated disturbances in the data since it may be a "nuisance" that may bias key parameters of interest.

To account for both sample selection and spatially autocorrelated disturbances –when participation in IMF stabilization programs and the likelihood of a currency crisis are both discrete choice processes—I estimate a bivariate probit model with spatial autoregressive errors (SAE) in both the selection and outcome equations. The spatial autoregressive error bivariate probit model (hereafter, SAE bivariate probit model), specifies spatially autocorrelated disturbances (after dropping subscript *t* for time for notational convenience):

$$y_{1i}^{*} = \alpha_0 + x_{1i}'\alpha_1 + u_{1i}, \quad u_{1i} = \delta \sum_{j \neq i} c_{ij} u_{1j} + \varepsilon_{1i} \qquad (12)$$

$$y_{2i}^* = \beta_0 + x_{2i}'\beta_1 + u_{2i}, \quad u_{2i} = \gamma \sum_{j \neq i} c_{ij} u_{2j} + \varepsilon_{2i} \tag{13}$$

where y_{1i}^* and y_{2i}^* are latent variables with $y_{1i}^* = 1$ if $y_{1i}^* > 0$ and $y_{1i} = 0$ otherwise, and $y_{2i}^* = 1$ if $y_{2i}^* > 0$ and $y_{2i} = 0$ otherwise. In the SAE bivariate probit model, equation 11 (i.e. y_{1i}^*) is the selection equation that accounts for participation of countries in IMF's stabilization programs. Equation (12), namely y_{2i}^*, is the outcome equation that accounts for the likelihood of a currency crisis where y_{2i}^* is a currency crisis that occurs in a particular country-year.

The correlation between the residuals u_{1i} and u_{2i} is given by ρ, which is standard in bivariate probit models.[5] Note that each of these two equations (11 and 12) exhibit spatial dependence in their respective error term, as u_{1i} and u_{2i} depend on the other u_{1j} and u_{2j} through their location in space, as given by the spatial weights c_{ij} and the spatial autoregressive parameters δ and γ. I briefly discuss the operationalization of the spatial weights in (11) and (12) below. At this stage, observe that the errors ε_{1i} and ε_{2i} in (11) and (12) are *iid* $N(\mathbf{0}, \Sigma)$.[6] Hence, the SAE bivriate probit model can be written conveniently as

$$y_{1i}^* = \alpha_0 + x_{1i}'\alpha_1 + \sum_j w_{ij}^1 \varepsilon_{1j} \tag{14}$$

$$y_{2i}^* = \beta_0 + x_{2i}'\beta_1 + \sum_j w_{ij}^2 \varepsilon_{2j} \tag{15}$$

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[5] ρ is the correlation among the residuals where $\begin{pmatrix} u_{1i} \\ u_{2i} \end{pmatrix} \sim N\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix} \begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix}\right)$

[6] $\Sigma = \begin{pmatrix} \sigma_1^2 & \sigma_{12} \\ \sigma_{12} & \sigma_2^2 \end{pmatrix}$

where the weights w_{ij}^1 and w_{ij}^2 are the *(i,j)* elements of the inverse matrices $(1-\delta C)^{-1}$ and $(1-\gamma C)^{-1}$, respectively, with *C* the matrix of spatial weights c_{ij}.[7]

Numerous weighting schemes can be used to operationalize w_{ij} in spatial models. For e.g., in a linear spatial regression model, Simmons and Elkins (2004: 178) use directed trade-flow shares of country *j* in country *i*'s total for w_{ij}, while Franzese and Hays (2006: 174) code $w_{ij} = 1$ for countries *i* and *j* that share a border and $w_{ij} = 0$ for countries that do not. Since I focus on accounting for spatial autocorrelated disturbances that are more of nuisance in the data, I use a geographic measure of spatial contiguity that is operationalized as the inverse distance between states *i* and *j*, where $w_{ij} = 1/d_{ij}$. As the distance between states *i* and *j* increases (decreases), w_{ij} increases (decreases), thus giving less (more) spatial weight to the state pair when $i \neq j$. While there is no consensus on how distance between cross-sectional units should be measured, I follow Busch and Reinhardt (2006) and consider the distance between population centers of countries. The results reported below remain robust when other measures of spatial contiguity including inverse distance squared, trade-flow shares and whether or not states share a border.

The technique used to estimate the SAE bivariate probit model is described more formally in the appendix. Given that SAE engenders a non-spherical VCV matrix that leads to inconsistent estimates, I propose in the appendix a GMM estimator that also takes into account heteroskedasticity induced by the SAE process. Specifically, I use Pinske and Slade's (1998) estimation technique, which not only provides consistent estimates of all parameters including the SAE parameter, but also allows one to use the GMM framework for estimation.

3.1 Data and Dependent Variable

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[7] Both sets of weights w_{ij}^1 and w_{ij}^2 depend upon the unknown parameters δ and γ.

To test the prediction in hypothesis 1, I put together a time-series-cross-sectional (TSCS) dataset of 82 countries over the period 1974 to 2002. These countries are listed in Table 1. I include countries that both did and did not experience a severe currency crisis/speculative attack during the 1974-2002 sample period. Doing so allows one to make inferences about the conditions distinguishing countries encountering crises and others managing to avoid crises. And this, in turn, helps to effectively evaluate the effect of IMF stabilization programs on the incidence of currency crises in my sample.

<<Insert Table 1 about here>>

Unlike existing empirical studies on the incidence of currency crises in which the sample is restricted to few countries or years, a key advantage of my sample is its comprehensiveness with respect to the number of countries and the years in which these countries are observed. Indeed, the comprehensiveness of my sample provides an opportunity to make much more generalizable claims about the conditions under which IMF stabilization programs prevent currency crashes if my hypothesis is supported by the empirical evidence. That said, the sample used here only starts from 1974 and not earlier primarily because the lack of data on some critical economic and political control variables (described below) for many developing countries prevented one from extending the temporal range of the sample.

Recall that the dependent variable in the outcome equation of the bivariate probit model is the dichotomous variable *Currency Crisis*. To operationalize this variable, I first identified currency crises in the data by constructing a measure of monthly exchange rate pressure and date each by the year in which it occurs. Specifically, currency crises are defined as "large" changes in a monthly index of currency pressure, measured as a weighted average of monthly real exchange rate changes and monthly (percent) reserve losses.[8] Following

[8] Real exchange rate changes are defined in terms of the trade-weighted sum of bilateral real exchange rates against the U.S. dollar, the German mark, and the Japanese yen, where the trade-

convention (e.g. Kaminsky and Reinhart, 1999), the weights attached to the exchange rate and reservation components of the currency pressure index are inversely related to the variance of changes of each component over the sample for each country. The exchange rate data is drawn from Reinhart and Rogoff (2004), while the data for reserves is taken from the IMF's (2004) *International Financial Statistics* CD-Rom.

The measure described above presumes that any nominal currency changes associated with the exchange rate pressure should affect the purchasing power of the domestic currency, i.e. result in a change in the real exchange rate. This condition excludes some large depreciations that occur during high inflation episodes, but it avoids screening out sizable depreciation events in more moderate inflation periods for countries that have occasionally experienced periods of hyperinflation and extreme devaluation. Large changes in exchange rate pressure are defined as changes in the pressure index that exceed the mean plus 2 times the country-specific standard deviation, provided that it also exceeds 5 percent.[9] The first condition insures that any large (real) depreciation is counted as a currency crisis, while the second condition attempts to screen out changes that are insufficiently large in an economic sense relative to the country-specific monthly change of the exchange rate.

For each country-year in the sample, I construct a binary measure of currency crises, as defined above where 1 =*Currency Crisis* and 0 = *No currency crisis*. A currency crisis is deemed to have occurred for a given year if the change in currency pressure for any month of that year satisfies the criteria described above (i.e. two standard deviations above the mean

weights are based on the average of bilateral trade with the United States, the European Union, and Japan in 1980 and 1990 (taken from the IMF's (2004) *Direction of Trade Statistics*). Extant measures of currency crises in empirical studies by Kaminsky, Lizondo, and Reinhart (1998) and Kaminsky and Reinhart (1999) define the currency pressure measure in terms of the bilateral exchange rate against a single foreign currency. By defining the effective rate in terms of the three major nations likely to be main trading partners of most countries, the approach I use provides a broader measure than these other studies and is computationally easier to construct than a multilateral exchange rate measure defined in terms of all of a country's trading partners.

[9] The results reported below remain robust for different cut-off points including 3 and 4 percent.

as well as greater than five percent in magnitude). To reduce the chances of capturing the continuation of the same currency crisis episode, I impose windows on the data. In particular, after identifying each "large" monthly change in currency pressure, I treat any large changes in the following 24-month window as part of the same currency episode and skip the years of that change before continuing the identification of new crises. All the currency crises in the data and the country-years in which they occurred are listed in Table 2.

<<Insert Table 2 about here>>

In addition to *Currency Crisis*, one also needs to develop a dichotomous measure for *IMF Stabilization Program,* which is the dependent variable in the selection equation of the SAE bivariate probit model. The dummy *IMF Stabilization Program* (labeled as *IMF Program* for convenience) is equal to 1 for countries that voluntarily participate in the IMF's stabilization program when they encounter balance-of-payments problems and thus obtain IMF funds that are specifically designed meet to short-run balance-of-payments objectives. Because the dummy *IMF Program* is also an independent variable in the outcome equation of the SAE bivariate probit model, I describe in more detail how this variable is operationalized.

3.2 Independent and Control Variables

To test the prediction in hypothesis 1, we need two key independent variables in the outcome equation for the SAE bivariate probit model. As mentioned above, the first independent variable is the dummy *IMF Program* that is coded as 1 when the IMF provides funds to countries – that voluntarily opt for IMF stabilization programs – in order to (i) assist them in dealing with the effects of externally generated and temporary export shortfalls, (ii) to provide financial assistance for exceptional balance-of-payments difficulties, (iii) to increases reserves and (iv) finally to increase confidence in financial markets. Financing by the IMF under its short-run stabilization program almost always includes two conditions: (i) financial sector reforms including reduction of government-directed credit allocation and non-performing loans and (ii) institutionalizing financial disclosure. Note that IMF short-run stabilization programs do *not* include programs for long-term economic reform and structural adjustment. Following the criterion described, six types of IMF funding are provided under its stabilization program: (1) Standby Arrangements (SBA), (2) Contingency funding facility (CFF), (3) Buffer Stock funding facility (BSFF), (4) Currency Stabilization funds (CSF), (5) Supplementary Reserve Facility (SRF) and the (6) Extended Fund Facility (EFF). Therefore, the dummy *IMF program* is coded as 1 when the IMF provides either one or some combination of the six types of funds mentioned above to financially distressed countries that opt to participate in its stabilization program. Among the six types of funds mentioned above, the EFF has been used in some (few) cases for financing structural adjustment in low-income developing countries. Hence, I estimate additional statistical models where the dummy *IMF program* excludes EFF but includes the remaining type of IMF funding facilities. Finally, it should be noted that fund facilities such as the Structural Adjustment Fund (SAF) and the Poverty Reduction and Growth Facility (PRGF) are not included in the *IMF program* dummy as these funds are used only for long-run structural adjustment. Data for *IMF program* is drawn from the IMF's (2004) *Review of Fund Facilities* and Hutchison (2001).

The second independent variable is the degree of state intervention in the financial sector of each country. Note that this does not imply financial depth and sophistication of credit markets within countries. Rather, it refers to the extent to which state-owned financial institutions plays a role in financial intermediation and providing financial services. I use two measures to operationalize this variable. The first measure is the ratio of state owned commercial banks credit to GDP (labeled as *State Credit/GDP*).[10] The second measure is the

[10] Unlike most studies, I carefully deflate those financial intermediary statistics, which are expressed as a ratio to GDP. Specifically, financial stock items are measured at the end of the period, while

ratio of financial assets of state-owned banks and credit allocation firms to the total of financial assets of all banking and credit institutions (state and non-state); this is labeled as *State Finance/total credit*). Both the measures described above nicely capture the degree of state intervention in the financial sector of each country. For brevity, however, I only report below the results from the first measure *State Credit/GDP*. Data for these two measures are drawn from *Global Financial Data* (2004); the IMF's *Government Financial Statistics* (2005) and GTAP (2005) database, version 7.

Note that hypothesis 1 predicts that the impact of IMF stabilization programs on the likelihood of currency crises is *conditional* on the degree of state intervention in the financial sector of a country that borrow from the IMF under the latter's stabilization program. To test this claim, I therefore interact *IMF program* with *State Credit/GDP* and introduce the interaction term *IMF Program* x *State Credit/GDP* in the outcome equation of the SAE bivariate probit model where the dichotomous dependent variable is *Currency Crisis*. From hypothesis 1, I expect that the coefficient of *IMF Program* x *State Credit/GDP* will be positive in the outcome equation. I also control for the individual components of this interaction term in the outcome equation.

3.3 Control variables for Selection and Outcome equation

I first briefly list the control variables included in the outcome equation of the bivariate probit model before listing the controls in the selection equation. Several economic and political control variables are included in the outcome equation. The economic controls in the outcome equation –where *Currency Crisis* is the dependent variable – is primarily based on Kamin, Schindler and Samuel (KSS) (2001) and Leblang and Satyanath's (2006) discrete-choice

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GDP is measured over the period. Simply dividing financial stock items by GDP can therefore produce misleading measures of financial development. This paper deflates end-of-year financial balance sheet items by end-of-year consumer price indices (CPI), and deflates the GDP series by the annual CPI. I then compute the average of the real financial balance sheet item in year *t* and *t-1*, and divide this average by real GDP measured in year *t*.

of empirical models of currency crises. This is because the economic controls included in the specification used by these authors mentioned above are both exhaustive as well as derived from a vast theoretical literature in economics that studies the impact of economic "fundamentals" and other economic variables on the incidence of currency crises. Specifically, the economic variables used by KSS (2001) and Leblang and Satyanath (2006) that are included as economic controls in the outcome equation are: *Real GDP growth, GDP per capita, Current Account/GDP, (US) real interest rate, terms of trade growth, Money Supply (M2)/Reserves, Export growth, Real Effective Exchange Rate (REER) valuation, Reserves to Short-Term Debt, External debt/exports, Current Account/GDP* and the lag of *Currency Crisis*. To conserve space, I do not describe how each of the aforementioned variables and their expected correlation with the dependent variable, *Currency Crisis*, in the outcome equation. Rather interested readers can refer to especially KSS (2001) for a discussion on how each of the aforementioned economic controls is operationalized and their expected correlation with the incidence of currency crises. Apart from the economic controls listed above, I include the following political controls in outcome equation of the SAE bivariate probit model that are based on Leblang and Satyanath's (2006) specification: the lag of *Government Turnover* , the *Polity IV* index and the dummy variable *Divided* that is coded as 1 for divided governments in the sample.

Similar to the outcome equation, I include a set of economic and political controls in the selection equation of the bivariate probit model. The formal model in the preceding section suggests that financially distressed countries—that is, countries suffering from low reserves (which engenders a balance-of-payments problem), high external debt and deficits— often turn to the IMF for immediate financial help and are thus more likely to participate in the IMF's short-run stabilization program. Thus, I include the following variables in the selection equation: foreign exchange reserves to imports ratio (*Forex Reserves/Imports*), ratio of external debt to export earnings (*External debt/earnings*) and *Current*

Account Balance as a percentage of GDP. Extant studies suggest that countries with "bad" economic fundamentals including high inflation, low GDP growth, low GDP per capita, low levels of domestic investment and higher real exchange rate volatility are more likely to participate in IMF short-run stabilization programs. Therefore, I also control for the following variables in the selection equation: *GDP per capita*, Lag of *Inflation*, Lag of *GDP per capita growth*, *Real Effective Exchange Rate* (REER) *valuation*, and *Investment* as a percentage of GDP. From recent episodes of currency crises in especially Asia in the 1990s, we also know that some countries participate in short-run stabilization programs only *after* a currency crisis has occurred. A one-period lag of the dummy *Currency Crisis* is included in the selection equation to account for this phenomenon. In addition to economic variables, the selection equation also contains some political controls (i) *Veto Players*, which is drawn from the *Checks* variable in the World Bank's DPI (Beck et al 2003) and (ii) the dummy variable *Latin America* for countries from this region since a fairly large and disproportionate number of Latin American countries have participated in the IMF's stabilization programs in the past.

4. Findings and Analyses

The results from the outcome equation of the estimated bivariate probit models are reported in models 1 to 3 in Table 3, while the estimates from the selection equation of models 1,2 and 3 are reported in table 4. Because I am primarily interested in the effect of *IMF Program* x *State Credit/GDP* on *Currency Crisis* –which essentially tests the key theoretical prediction from the formal model—I focus below on analyzing the results from the outcome equation and then briefly discuss the results from the selection equation.

<<Insert Table 3 about here>>

The coefficient of *IMF Program* x *State Credit/GDP* is positive and highly significant at the 1% level in the outcome equation of the SAE bivariate probit model for the global sample. This result statistically corroborates the prediction in hypothesis 1 from the formal model. With respect to the individual components of *IMF Program* x *State Credit/GDP*, one finds that *IMF Program* is negative but insignificant in model 1. The other component *State Credit/GDP* is also positive but statistically insignificant. This suggests that neither IMF short-run stabilization programs nor the degree of state intervention in the financial sector in countries that receive loans from the IMF *individually* have a significant and substantive effect on the likelihood of currency crises in a fully specified empirical model. Put differently, neither IMF short-run stabilization programs nor *State Credit/GDP* are doing all the statistical work here. Rather, it is the interaction of *IMF Program* with *State Credit/GDP* that substantively and significantly increases the probability of a currency crisis, as predicted by the formal model.

With respect to substantive marginal effects, one finds from the estimate for *IMF Program* x *State Credit/GDP* in model 1 that when *State Credit/GDP's* companion variable *IMF Program* is set equal to 1 and other variables in the outcome equation are held at their mean in the sample, increasing *State Credit/GDP* by one standard deviation above it's mean increases the probability of a currency crisis under a short-run IMF stabilization program from x to x, i.e. in other words by almost 17%. Likewise, when *State Credit/GDP's* companion variable *IMF Program* is set equal to 1 and other variables in the outcome *and* selection equation are held at their mean, increasing *State Credit/GDP* by one standard deviation above it's mean decreases the probability of a currency crisis under a short-run IMF stabilization program by 16%. The substantive effects reported above is quite large and is illustrated in Figure 2A, which shows that increasing *State Credit/GDP* by one standard deviation above its mean increases the predicted probability of currency crises by 17% when an IMF provides funds via its stabilization program.

<<Insert Figure 2 about here>>

I estimated an additional SAE bivariate probit model on a sample where 7 advanced industrial countries were dropped, while the remaining developing countries were retained.

The purpose of estimating this model is to check whether or not the formal model's main prediction finds statistical support in a sample that only includes developing countries because currency crises occur more frequently in developing countries compared to developed nations. The results from the outcome equation of the SAE bivariate probit model estimated for the sample of developing countries are reported in model 2, Table 3. The coefficient of *IMF Program* x *State Credit/GDP* remains positive and highly significant in model 2, while the individual components of this interaction term (*IMF Program* and *State Credit/GDP*) are, as before, insignificant. Hence, the formal model's central claim finds statistical support when 7 advanced industrial countries are excluded from the sample.

As an initial test of robustness, the SAE bivariate probit model is again estimated on the global sample where the *IMF program* dummy excludes the EFF type of funding by the IMF but includes the remaining 5 types of IMF funding facilities under its stabilization program. Results from the outcome equation of the SAE bivariate probit model with this new *IMF program* dummy is presented in model 3, table 3. The estimated coefficient of *IMF Program* x *State Credit/GDP* is positive and highly significant in model 3. Moreover, the individual components of this interaction term, *IMF Program* and *State Credit/GDP*, are each insignificant in model 3. The prediction in hypothesis 1 thus continues to find statistical support in model 3.

Unlike the strong statistical support one obtain for the prediction in hypothesis 1, the estimates of the economic and political control variables in the outcome equation in models 1 to 3 are largely insignificant. For example, the estimate of *Polity IV* and the *Divided Government* dummy are each insignificant. However, the coefficient of the lag of *Turnover* is positive and significant in each model in Table 3. This suggests that Leblang and Satyanath's (2006) claim that higher government turnover increases the possibility of currency crashes is statistically corroborated in the SAE bivariate probit models. Interestingly, the economic controls fare poorly in the outcome equation in each model. For instance, the estimates of *External Debt, Real*

Effective Exchange Rate (REER) Valuation, Reserves to Short-Term Debt, Export Growth, Current Account/GDP and *Real Interest Rate* are each insignificant in every model. However, *Money Supply (M2)/Reserves* and *Terms of Trade Growth* have the predicted sign and are significant.

Turning to the estimates of the selection equation of models 1, 2 and 3 –that are reported in Table 4 -- we find a familiar story in that most economic controls are for the most part statistically insignificant. For example, the estimate of the lag of *Inflation*, the lag of *GDP per capita growth*, *Real Effective Exchange Rate Valuation* and *Investment* (as a % of GDP) is statistically insignificant in the selection equation of each model. However, *Forex Reserves/Imports* is positive and highly significant in the selection equation of all the models. The political variable in the selection equation *Veto Players* is unfortunately insignificant in the estimated models.

The estimate of the SAE parameter δ is positive and highly significant in the outcome equation of all the SAE bivariate probit models, while the estimate of the SAE parameter γ is particularly weakly significant. The significance of δ in the outcome equation is particularly because it indicates that accounting for spatial effects – that arguably results from financial contagion -- in the currency crisis outcome equation is critical when estimating the effect of other parameters on the likelihood of currency crises in order to avoid biased and inconsistent parameter estimates. Furthermore, the estimate of ρ is significant in the outcome equation as well, which clearly indicates the selection issues in the data that needs to be accounted for as well in the estimation process.

4.1 Robustness Tests and Diagnostics

To check the econometric validity and consistency of the results reported earlier, I conducted a three main robustness tests and a series of diagnostic checks. First, I added two control variables to the outcome equation of the baseline SAE bivariate probit specification in model 1and then re-estimated the model, including the selection and the augmented outcome equation. The two additional control variables in the outcome equation are *Veto Players* and *Number of Past Currency Crises*. The *Veto Players* variable is added to the outcome equation since Macintyre (2002) suggests that higher number of veto players in government impedes adjustment to economic shocks and this increases the likelihood of currency crashes. Likewise, I control for *Number of Past Currency Crises* since it is plausible that countries that have suffered from several incidents of currency crises in the past are more vulnerable to currency crashes. In model 4, Table 5 I report the results from the outcome equation of the SAE bivariate probit model that includes the two additional controls mentioned above (the selection equation of this model is not reported to conserve space).

Observe that the estimate of *IMF Program* x *State Credit/GDP* is positive and significant at the 1% level n the outcome equation reported in model 4 while *IMF Program* and *State Credit/GDP* are individually insignificant in this specification. These results are consistent with the estimates reported earlier in Table 3. Interestingly, *Veto Players* is statistically insignificant in model 4, while *Number of Past Currency Crises* is significant.

Second, I check the robustness of the results reported earlier on two alternative measures of the dependent variable in the outcome equation of the bivariate probit model, *Currency Crisis*. This is done in order to check that the estimates obtained so far are not driven merely by the operationalization of the dichotomous measure of *Currency Crisis* in this paper (as described earlier) even though this measure is widely used in extant studies. The two alternative measures of the dependent variables that are used for the robustness tests are drawn from Kamin, Schindler and Samuel (2001) and Bussiere and Fratzscher (2002). Kamin et al (2001) code a currency crisis as occurring when the index of exchange market pressure (a weighted average of changes in the real exchange rate and reserve holdings) exceeds its average value by 1.75 standard deviations. Using monthly data they identify a crisis as occurring during a year when any month experiences a crisis. Bussiere and Fratzscher

(2002), on the other hand, code a crisis as occurring when the weighted average of the change in the real effective exchange rate, the change in the interest rate, and the change in reserves is more than 2 standard deviations away from each country's average.

Using these two operational definitions of currency crashes, I first operationalize the Kamin et al (2001) measure of currency crashes (labeled as *Crisis (KSS)*) based on their definition given above and then operationalize Bussiere and Fratzscher's (2002) definition of currency crises (labeled as *Crisis (BF)*) in the global sample. After doing so, I separately estimate two models; in the first model, the dependent variable in the outcome equation is the Kamin et al (2001) dichotomous measure of currency crashes (*Crisis (KSS)*) and in the second model, the dependent variable in the outcome equation is Bussiere and Fratzscher's (2002) dichotomous measure *Crisis (BF)*.[11] The results from these two bivariate probit models are reported in models 5 and 6 respectively in Table 5. The estimated coefficient of the interaction term *IMF Program* x *State Credit/GDP* is positive and significant at the 1% level n the outcome equation in model 5 and 6. Moreover, *IMF Program* and *Credit/GDP* are each individually insignificant in the outcome equation of model 5 and 6. Thus the results reported earlier remain robust when alternative operational definitions of the dependent variable, *Currency Crisis*, are used in the outcome equation.

In addition to the robustness tests, I conducted standard diagnostic checks. First, diagnostic test indicate that none of the empirical models suffer from multicollinearity.[12] Second, I implemented Gourieroux, Monfort and Trognon's (1982) score test of the null of serially uncorrelated errors for each model. The p-values from this score test failed to reject the null of no serial correlation in each specification, thus suggesting that serial correlation is not a problem

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[11] The dependent variable in each of these two models is *IMF program*.

[12] Chatterjee, Price and Haidi (1999) suggest that multicollinearity exists if the largest Variance Inflation Factor (VIF) is greater than 10 and the mean VIF is larger than 1. The mean and largest VIF value in each empirical model is substantially lesser than these threshold values. Hence, multicollinearity is not a problem.

in the models. Third, as an additional check for specification robustness, I added the following variables to each model: *Nominal Interest Rate* and the dummy *Capital Controls*. Inclusion of these variables did not substantively or significantly alter the results reported above.

5. Conclusion

Why do IMF stabilization programs fail to prevent currency crashes in some financially distressed countries that voluntarily participate in these stabilization programs but not other financially troubled countries? The simple model of speculative trading constructed in this paper suggests that the IMF's ability (or inability) to prevent currency crashes via its stabilization program crucially depends on the degree of institutionalized state intervention in the financial sector of financially distressed countries that participate in the IMF's stabilization program. More specifically, the greater (lower) the extent of institutionalized state intervention in the financial sector of a financially troubled country that turns to the IMF for help, the higher (lesser) the likelihood that the IMF stabilization program will fail to prevent a currency crisis in that country. Results from several spatial bivariate probit models that accounts for both selection bias and spatial dependence in the data provide strong statistical support for the model's key theoretical prediction.

The research presented here has important implications. First, the rapid increase in the volume of currencies traded in capital markets ($ 2 trillion dollars were traded *daily* in 2004) has especially made developing countries –that are opening their capital markets –vulnerable to financial problems and currency crashes. These countries are likely to turn to the IMF in the future to resolve their financial problems. We thus need to explain rigorously and understand more generally, and not on a case-by-case basis, when IMF stabilization programs may fail or succeed in preventing currency crises, as done theoretically and empirically in this paper. Second, many journalists and policy analysts in the recent past claimed that unchecked speculation by rapacious and greedy currency traders (i.e. Soros) and "crony capitalism" caused or exacerbated the currency crises of the 1990s. This paper suggests that it is neither crony capitalism nor speculation by traders but rather the politics surrounding financial sector reform –which is influenced by the degree of institutionalized state intervention in the financial sector – that provides a fairly cogent for the occurrence of currency crises in financially troubled countries.

Third, as noted earlier, much of extant literature on the impact of the IMF's role in the global economy focus on the effect that IMF programs have on growth, inflation and unemployment but do not analyze the IMF's role in currency crisis-prevention. This is unfortunate since the IMF's main goal is to promote monetary stability and prevent currency crises. This paper, therefore, fills a large gap in the literature and address variation in the effect of IMF stabilization programs on preventing currency crises. Fourth, existing policy prescriptions by policy-analysts and even the Meltzer Commission report (sanctioned by the US congress) in 2000 primarily focus on institutional reform of the IMF as the panacea for preventing IMF failures in the future. While the aforementioned policy prescription is not wrong *per se*, it overlooks the fact that the IMF's ability or inability to prevent currency crashes around the globe critically depends on the domestic politics of financial sector reform in countries that borrow from the IMF and participate in the IMF's stabilization program.

The key policy implication that emerges from this study is that the IMF should either scale back or increase the time span for carrying out financial sector reforms that it requests from countries participating in its stabilization programs. Giving governments of financially distressed countries --that have an entrenched political class opposed to financial reforms – more time to carry out financial sector reforms will allow them to either build a minimal winning coalition that favors reform or spread the costs of financial reforms across time. This may ease political opposition against reforms and give the government an opportunity to carry out financial sector reforms more extensively that will help to promote better macroeconomic fundamentals. Whether or not this policy prescription is feasible is a matter for future research.

Appendix

Proof of Lemma 1: Since each trader's private signal is conditional on θ, the pdf of s_i given θ is *g*, while its cdf is $G(s_i \mid \theta)$. Likewise, let the density of θ given s_i be *h* and its cdf as $H(\theta \mid s_i)$. I assume, wlog, that *g* and *h* are uniformly distributed such that

$$h(\theta \mid s_i) = \begin{cases} 1/2\varepsilon & if \;\; s_i - \varepsilon \le \theta \le s_i + \varepsilon \\ 0 & \text{otherwise} \end{cases} \qquad g(s_i \mid \theta) = \begin{cases} 1/2\varepsilon & if \;\; \theta - \varepsilon \le s_i \le \theta + \varepsilon \\ 0 & \text{otherwise} \end{cases} \tag{A1.1}$$

Let $p : \Re \to [0,1]$ be the proportion of speculators required for a successful speculative attack.
Let $P(\pi) \equiv \{\theta \mid \delta(\theta, \pi) \ge p(\theta)\}$ be the event of successful attacks with probability 1 where $\delta(\theta, \pi)$ is the fraction of traders that attack the currency with probability 1. The expected payoff for a trader is $u(s_i, a) = \int_{P(\pi)} r(\theta) h(\theta \mid s_i) d\theta - t$. From theorem 1 in Heinemann and Illing (2002) and Proposition 2.1 (Coresetti et al 2004), if *h* and *g* are uniformly distributed, then $u(s_i, a)$ strictly decreases in *s* and θ. Hence, $a_i(s) = 1$ when $\theta < \theta^*$ and $s_i < s^*$ **QED.**

Proof of Lemma 2: (i) Differentiating (x) with respect to *l* and after some algebra,

$$l^* = \frac{vC + m - \theta(\mu - m)}{2(1 - (\mu - m)v)} \tag{A1.2}$$

(ii) From $F\left(\dfrac{\theta^* - s^*}{\sigma}\right) = t$ (equation 4), one obtains after some simple algebra $\theta^* = s^* + \sigma F^{-1}(t)$;

substituting this expression in equation 3 in the text leads to $\theta^* = 1 - F(F^{-1}(t)) = 1 - t$. Substituting $\theta^* = 1 - t$ in $\theta^* = s^* + \sigma F^{-1}(t)$ yields $1 - t = s^* + \sigma F^{-1}(t)$. Solving for s^* from this expression leads to $s^* = 1 - t - \sigma F^{-1}(t)$.

(iii) Since the IMF optimally sets *m**, $\beta(\theta, m^*) > 0$ if fundamentals improve such that $\theta \ge \theta^*$. If $\theta < \theta^*$, the IMF does not earn returns and pays the cost *–bm*. Thus $\beta(\theta, m^*) < 0$ for $\theta < \theta^*$ **QED**.

Proof of Proposition 1: (i) $\dfrac{\partial l^*}{\partial v} = \dfrac{(2 - 2\mu v + 2mv)C - (vC + m - \theta\mu + \theta m)(2m - 2\mu)}{[2(1 - (\mu - m)]^2}$ which

after some algebra yields $\dfrac{\partial l^*}{\partial v} = \dfrac{C + m((\mu - m) + \theta(\mu - m)) - \mu^2\theta}{[2(1 - (\mu - m)]^2} < 0$ since $\mu < m$.

(ii) From (A1.2), one can implicitly define θ as $\theta = \frac{vC + m - 2l^*(1-(\mu - m)v)}{(\mu - m)}$. Since $l \in [0,1]$ and l^* strictly decreases for increasing *v*, it follows that $\lim l^* \to 0$ in this case. Note that for $\lim l^* \to 0$, $\theta = \frac{vC + m}{\mu - m} < 0$ since $\mu < m$.

(iii) Because $\theta \in [0,1]$, it follows that when θ strictly decreases $\lim \theta \to 0$. When $\lim \theta \to 0$, $\theta < \theta^*$ since from lemma 1 $\theta^* = 1 - t > 0 \ \ \forall t \in [0,1]$. Likewise, when θ strictly decreases and $\lim \theta \to 0$, $s_i = \sigma \varepsilon_i$ which $\Rightarrow s_i < s^*$. From the proof of Lemma 1, we know that currency traders will attack the currency of the troubled country with probability 1 for $\theta < \theta^*$ and $s_i < s^*$ thus leading to a currency crisis **QED.**

Estimation of Spatial Bivariate Probit Model: Suppose that:

$$\mathrm{var}(u_{1i}) = \sigma_1^2 \sum_j \left(\omega_{ij}^1\right)^2 \tag{A1.3}$$

$$\mathrm{var}(u_{2i}) = \sigma_2^2 \sum_j \left(\omega_{ij}^2\right)^2 \tag{A1.4}$$

$$E(u_{1i}, u_{2i}) = \sigma_{12}^2 \sum_j \left(\omega_{ij}^1 \omega_{ij}^2\right)^2. \tag{A1.5}$$

Let $\theta_1 = \{\alpha_{0,} \alpha_1^{'}, \delta\}$ be the parameters to be estimated in the spatial probit model, and $\psi_i(\theta_1) = \frac{\alpha_0 + x_{1i}^{'}\alpha_1}{\sqrt{\mathrm{var}(u_{1i})}}$ in the index function of the probit model weighted by the standard deviation of the residual. The "generalized residuals" of this model are:

$$\tilde{u}_{1i}(\theta_1) = \{y_{1i} - \Phi[\psi_i(\theta_1)]\} \cdot \frac{\phi[\psi_i(\theta_1)]}{\Phi[\psi_i(\theta_1)]\{1 - \Phi[\psi_i(\theta_1)]\}}. \tag{A1.6}$$

The GMM estimates for θ_1 can be obtained as follows:

$$\hat{\theta}_{1,GMM} = \underset{\theta_1 \in \Theta_1}{\arg\min}\, S_N(\theta_1)^{'} M_N S_N(\theta_1) \tag{A1.7}$$

where $S_N(\theta_1) = \frac{1}{N} z_N^{'}\, u_{1N}\left(\hat{\theta}_1\right), z_N$ is a data matrix of regressors plus at least one instrument (to identify the extra parameter δ, $\tilde{u}_{1N}(\theta_1)$ is the vector of generalized residuals with elements as shown in (A1.6), and M_N is a positive definite matrix such that $M_N \xrightarrow{p} M$. Pinkse and Slade (1998) prove that this estimator is consistent and asymptotically normal. From the consistent estimates of θ_1, one can construct the IMR to correct for sample selection bias in the outcome equation as follows:

$$E\left[y_{2i} \middle| y_{1i} > 0 = \beta_0 + x_{2i}^{'}\beta_1 + E\left[u_{2i} \middle| u_{1i}\right] > -\left(\alpha_0 + x_{1i}^{'}\alpha_1\right)\right]$$

$$= \beta_0 + x_{2i}^{'}\beta_1 + \frac{E(u_{1i}, u_{2i})}{\sqrt{\text{var}(u_{1i})}} \cdot \frac{\phi[-\psi_i(\theta_1)]}{\{1 - \Phi[-\psi_i(\theta_1)]\}}$$

$$= \beta_0 + x_{2i}^{'}\beta_1 + \frac{\sigma_{12}\sum_j \omega_{ij}^1 \omega_{ij}^2}{\sqrt{\sigma_1^2 \sum_j \left(\omega_{ij}^1\right)^2}} \cdot \frac{\phi[-\psi_i(\theta_1)]}{\{1 - \Phi[-\psi_i(\theta_1)]\}}$$

$$= \beta_0 + x_{2i}^{'}\beta_1 + \frac{\sigma_{12}}{\sigma_1} \cdot \frac{\sum_j \omega_{ij}^1 \omega_{ij}^2}{\sqrt{\sum_j \left(\omega_{ij}^1\right)^2}} \cdot \frac{\phi[-\psi_i(\theta_1)]}{\{1 - \Phi[-\psi_i(\theta_1)]\}}$$

Therefore, the selectivity correction implies the following "adjusted" IMR:

$$\lambda_i \equiv \frac{\sum_j \omega_{ij}^1 \omega_{ij}^2}{\sqrt{\sum_j \left(\omega_{ij}^1\right)^2}} \cdot \frac{\phi[-\psi_i(\theta_1)]}{\{1 - \Phi[-\psi_i(\theta_1)]\}}. \tag{A1.8}$$

Once estimated $\left(\hat{\lambda}_i\right)$, the "adjusted" IMR may be included as an additional variable in the outcome equation, which in turn could be estimated spatial methods for probit models. I use GMM to estimate simultaneously all parameters of the sample selection model by rewriting it as a sequential estimator (Newey 1984) composed of the Pinske and Slade (1998) and KP-SAE estimators. Stacking the corresponding moment conditions leads to $g(z_N, \theta) = \left[s(z_{1N}, \theta)^{'}, m(z_{2N}, \theta)^{'}\right]^{'}$, $\theta = \left\{\alpha_{0,} \alpha_1^{'}, \delta, \beta_0, \beta_1^{'}, \mu, \gamma\right\}$ with $s(z_{1N}, \theta) = z_{1N}^{'}\tilde{u}_{1N}(\theta)$, $\tilde{u}_{1N}(\theta)$ and $m(z_{2N}, \theta) = \left[y_{1N} \cdot z_{2N}\right]^{'}\tilde{u}_{2N}(\theta)$, $\tilde{u}_{2N}(\theta) = y_{2N} - \beta_0 - x_{2N}^{'}\beta_1 - \mu\hat{\lambda}_N(\delta, \gamma)$ where N denotes the corresponding matrix of data, we let $z_N^{'} = \left(z_{1N}^{'}, \left[y_{1N} \cdot z_{2N}\right]^{'}\right)^{'}$, z_{1N} and z_{2N} includes the regressors from the selection and outcome equation respectively with the estimated "adjusted" IMR in the outcome equation represented as $\hat{\lambda}_N(\delta, \gamma)$ to make explicit its dependence on both SAE parameters. Let $\tilde{u}_N(\theta) = \left(\tilde{u}_{1N}^{'}(\theta), \tilde{u}_{2N}^{'}(\theta)\right)^{'}$; then the parameters of the SAE sample selection model can be estimated as:

$$\hat{\theta}_{GMM} = \arg\min_{\theta \in \Theta} g_N(\theta)^{'} M_N g_N(\theta) \tag{A1.9}$$

where $g_N(\theta) = \frac{1}{N} z_N^{'}\tilde{u}_N(\theta)$, for a conformable positive definite M_N such that $M_N \xrightarrow{p} M$.

Table 1. Countries Included in the Dataset, 1974-2002

Country	Country
Argentina	Madagascar
Bangladesh	Malawi
Belgium	Malaysia
Belize	Mali
Bolivia	Malta
Botswana	Mauritius
Brazil	Mexico
Burundi	Morocco
Cameroon	Mozambique
Chile	Myanmar
Colombia	Nepal
Costa Rica	Nicaragua
Cyprus	Nigeria
Czech republic	Pakistan
Denmark	Panama
Dominican Republic	Paraguay
Ecuador	Peru
Egypt	Philippines
El Salvador	Poland
Equatorial Guinea	Sierra Leona
Ethiopia	Singapore
France	South Africa
Ghana	Spain
Grenada	Sri Lanka
Guatemala	Swaziland
Guinea-Bissau	Syria
Guyana	Sweden
Haiti	Thailand
Honduras	Trinidad & Tobago
Hong Kong	Tunisia
Hungary	Turkey
Italy	Uganda
India	United Kingdom
Indonesia	United States
Italy	Uruguay
Jamaica	Venezuela
Jordan	Zambia
Kenya	Zimbabwe
Korea	
Lao P.D. Republic	

Table 2: Incidence of Currency Crises, 1974-2002

Country	Currency Crises	Country	Currency Crises
Argentina	1975,1982, 1989, 2002	Madagascar	1984, 1986, 1991, 1994
Bangladesh	1975	Malawi	1982, 1985, 1992, 1994
Belgium	1992		
Belize		Malaysia	1986, 1997
Bolivia	1981, 1983, 1988, 1991	Mali	1993
Botswana	1984, 1996	Malta	
Brazil	1982, 1987, 1990, 1995	Mauritius	1979
Burundi	1976, 1983, 1986,1989, 1997	Mexico	1976, 1982, 1985, 1994
Cameroon	1982, 1984, 1994	Morocco	1983, 1990
Chile	1985	Mozambique	1993, 1995
Colombia	1985	Myanmar	1975, 1977
Costa Rica	1981	Nepal	1975, 1981, 1984, 1991, 1995
Cyprus	1976, 1989	Nicaragua	1993
Denmark	1992		
Dominican Republic	1985, 1987, 1990	Nigeria	1986, 1989, 1992
Ecuador	1982, 1985, 1988	Pakistan	None
Egypt	1979, 1989	Panama	None
El Salvador	1986, 1990	Paraguay	1984, 1986, 1988, 1992
Equatorial Guinea	1991, 1994	Peru	1976, 1979, 1987
Ethiopia	1992	Philippines	1983, 1986, 1997
Fiji	1986	Poland	1997
France	1992	Sierra Leona	1988, 1990, 1997
Ghana	1978, 1983, 1986	Singapore	1975
Grenada	1978	South Africa	1987
Guatemala	1986, 1989	Sri Lanka	1977
Guinea-Bissau	1991, 1996	Spain	1992
Guyana	1987, 1989	Swaziland	1975, 1979, 1982, 1984
Haiti	1977, 1991	Syria	1977, 1982, 1988
Honduras	1990	Thailand	1981, 1984, 1997
Hong Kong	1998	Trinidad & Tobago	1985, 1988, 1993
Hungary	1994, 1997	Tunisia	1993
India	1976, 1991, 1995	Turkey	1978, 1985, 2002
Indonesia	1978, 1983, 1986, 1997	Uganda	1981, 1987, 1989
Italy	1978, 1992	United Kingdom	1992
Jamaica	1978, 1983, 1990	Uruguay	1982
Jordan	1983, 1987, 1989, 1992	Venezuela	1984, 1986, 1989, 1994
Kenya	1975, 1981, 1985, 1993, 1995, 1997	Zambia	1985, 1994
Korea	1980, 1997	Zimbabwe	1982, 1991, 1994, 1997
Lao P.D. Republic	1995		

Table 3: Results from Outcome Equation of SAE Bivariate Probit Models

	IMF program		IMF program (excluding EFF)	
	Global	Developing	Global	Developing
	Model 1	**Model 2**	**Model 3**	**Model 4**
GDP per capita	-.047***	-.051**	-.040***	-.037*
	(.015)	(.027)	(.018)	(.020)
Real GDP Growth	.047	.040	.032	.030
	(.041)	(.043)	(.044)	(.036)
Current Account/GDP	-.031	-.025	-.020	-.021
	(.022)	(.021)	(.020)	(.022)
IMF program	-.073	-.031	-.050	-.033
	(.082)	(.040)	(.046)	(.037)
IMF program x state credit/gdp	.112***	.138***	.137***	.125***
	(.036)	(.044)	(.055)	(.040)
State credit/gdp	.098	.065	.023	.067
	(.077)	(.092)	(.084)	(.119)
(US) Real Interest Rate	.027	.021	.022	.021
	(.048)	(.020)	(.031)	(.040)
Terms of Trade Growth	-.021**	-.044***	-.034**	-.059*
	(.009)	(.020)	(.017)	(.035)
M2/Reserves	.023***	.025***	.037**	.051***
	(.011)	(.012)	(.018)	(.020)
Export Growth	-.047	-.068	-.039	-.022
	(.043)	(.112)	(.077)	(.055)
Reserves/short-term debt	.028	.030	.039	.012
	(.071)	(.022)	(.041)	(.008)
External debt/exports	.01	.03	.02	.04
	(.01)	(.02)	(.01)	(.05)
REER valuation	.078	-.057	.064	-.095
	(.071)	(.052)	(.059)	(.086)
Polity IV	-.027	-.038	-.036	-.035
	(.023)	(.073)	(.032)	(.037)
Divided Government	.06	.08	.05	.08
	(.04)	(.09)	(.03)	(.07)
Government Turnover	.031*	.024*	.033*	.051*
	(.019)	(.013)	(0.18)	(.027)
Lagged Currency Crisis	.053*	.040*	.042*	.041*
	(.031)	(.022)	(.023)	(.022)
Constant	.551***	.672***	.447***	.424**
	(.045)	(.056)	(.062)	(.061)
Rho	-.112***	-.098***	-.103***	-.125***
	(.047)	(.032)	(.028)	(.041)
SAE parameter (γ)	.045**	.040***	.035***	.033***
	(.020)	(.017)	(.011)	(.012)
Log Likelihood	-214.36	-177.23	-182.78	-148.09
N	2174	1889	2174	1889
χ^2	29.43	36.25	40.78	51.76

Notes: ***, **, *: 1%, 5% and 10% levels of significance. Numbers in parentheses are robust standard errors. Coefficient of adjusted IMR $(\hat{\lambda}_i)$ not reported to save space.

Table 4: Results from Selection Equation of Spatial Bivariate Probit models

	IMF program		IMF program (excluding EFF)	
	Global	Developing	Global	Developing
	selection equation for Model 1	**selection equation for Model 2**	**selection equation for Model 3**	**selection equation for Model 4**
Investment	-.053*	-.040*	-.042*	-.041*
	(.031)	(.022)	(.023)	(.022)
Forex Reserves/Imports	-.047***	-.051***	-.038***	-.031***
	(.015)	(.019)	(.015)	(.012)
Lag Inflation	.047	.040	.032	.030
	(.041)	(.043)	(.044)	(.036)
Trade Openness	-.198	-.065	-.123	-.067
	(.177)	(.092)	(.184)	(.119)
External debt/export earnings	.031	.025	.020	.021
	(.022)	(.021)	(.020)	(.022)
Current Account Balance	.073	.031	.050	.033
	(.082)	(.040)	(.046)	(.037)
GDP per capita growth	-.027	-.021	-.022	-.021
	(.048)	(.020)	(.031)	(.040)
Lag Currency Crisis	.023***	.055***	.027**	.051**
	(.010)	(.014)	(.011)	(.025)
State credit/gdp	.032**	.059**	.039**	.020***
	(.016)	(.025)	(.018)	(.006)
GDP per capita	-.040	-.068	-.039	-.022
	(.043)	(.112)	(.077)	(.055)
REER valuation	.028	.030	.039	.012
	(.071)	(.022)	(.041)	(.08)
Veto Players	.027	-.078	.036	-.035
	(.023)	(.073)	(.032)	(.037)
Latin America Dummy	.06	.08	.02	.04
	(.04)	(.09)	(.01)	(.05)
Constant	.721***	0.508***	0.743***	0.605***
	(.0077)	(.0068)	(.0079)	(0.083)
SAE parameter (δ)	.021*	.032*	.028*	.022*
	(.012)	(.020)	(.016)	(.012)
Log Likelihood	-412.52	-380.47	-324.65	-315.10
N	2174	1889	2174	1889
χ^2	21.154	20.324	19.439	18.259

Notes: ***, **, *: 1%, 5% and 10% levels of significance. Numbers in parentheses are robust standard errors

Table 5: Outcome Equation Results from Robustness tests: Global Sample

	Additional Controls	KSS Measure of Currency Crisis	FS Measure of Currency Crisis
	Model 5	**Model 6**	**Model 7**
GDP per capita	-.025***	-.031**	-.028**
	(.011)	(.016)	(.015)
Real GDP Growth	.053	.065	.057
	(.043)	(.097)	(.067)
Current Account/GDP	-.024	-.031	-.035
	(.028)	(.030)	(.034)
IMF program	-.047	-.038	.029
	(.033)	(.042)	(.075)
IMF program x state credit/gdp	.104***	.121***	.122***
	(.041)	(.038)	(.043)
State credit/gdp	.098	.065	.023
	(.077)	(.092)	(.084)
(US) Real Interest Rate	.012	.023	.025
	(.08)	(.020)	(.016)
Terms of Trade Growth	-.029**	-.020**	-.024***
	(.007)	(.008)	(.007)
M2/Reserves	.035***	.041**	.046***
	(.011)	(.010)	(.009)
Export Growth	-.050	-.054	-.042
	(.046)	(.041)	(.039)
Reserves/short-term debt	.059	.021	.044
	(.050)	(.019)	(.031)
External debt/exports	.008	.010	.009
	(.014)	(.011)	(.012)
Polity IV	-.035	- .021	-.026
	(.037)	(.033)	(.035)
Divided Government	.001	.002	.001
	(.001)	(.002)	(.003)
Government Turnover	.068**	.051**	.033***
	(.030)	(.021)	(.010)
Veto Players	.011		
	(.029)		
Number of Prior Crises	.021**	.040*	.032**
	(.009)	(.012)	(.010)
Constant	.339***	.290***	.316***
	(.072)	(.089)	(.078)
Rho	-.091***	-.087***	-.093***
	(.030)	(.024)	(.025)
SAE parameter (γ)	.047***	.040**	.032***
	(.021)	(.020)	(.011)
Log Likelihood	-137.45	-142.26	-170.91
N	2073	2136	2088
χ^2	63.87	71.25	81.44

Notes: ***, **, *: 1%, 5% and 10% levels of significance. Numbers in parentheses are robust standard errors. Coefficient of adjusted IMR $(\hat{\lambda}_i)$ not reported to save space.

Figure 2A: Marginal Effect of *IMF Program × State Credit/GDP* on Currency Crisis

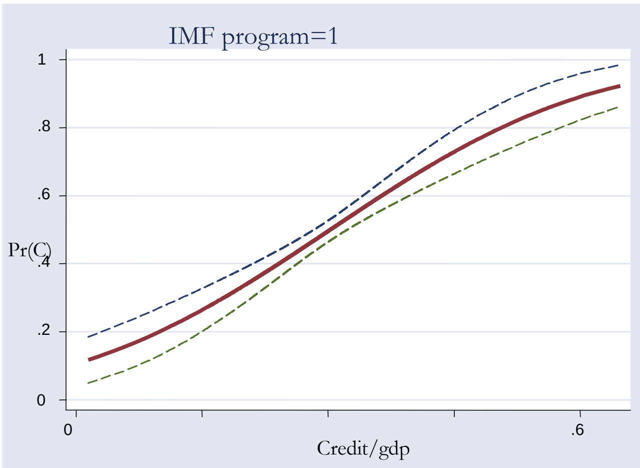


Figure 2B: Marginal Effect of *IMF Program* x *Inverse of State Credit/GDP* on Currency Crisis

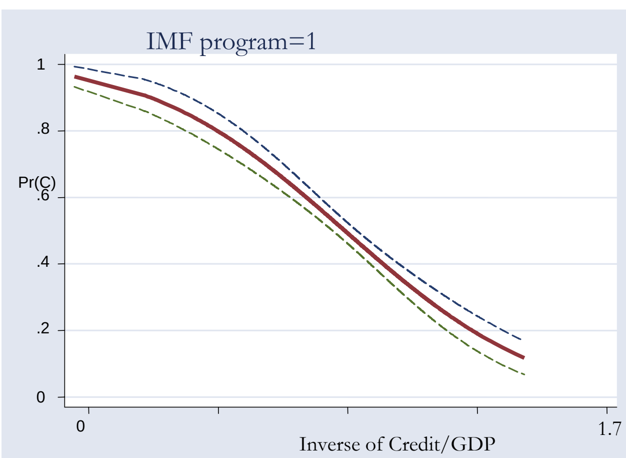
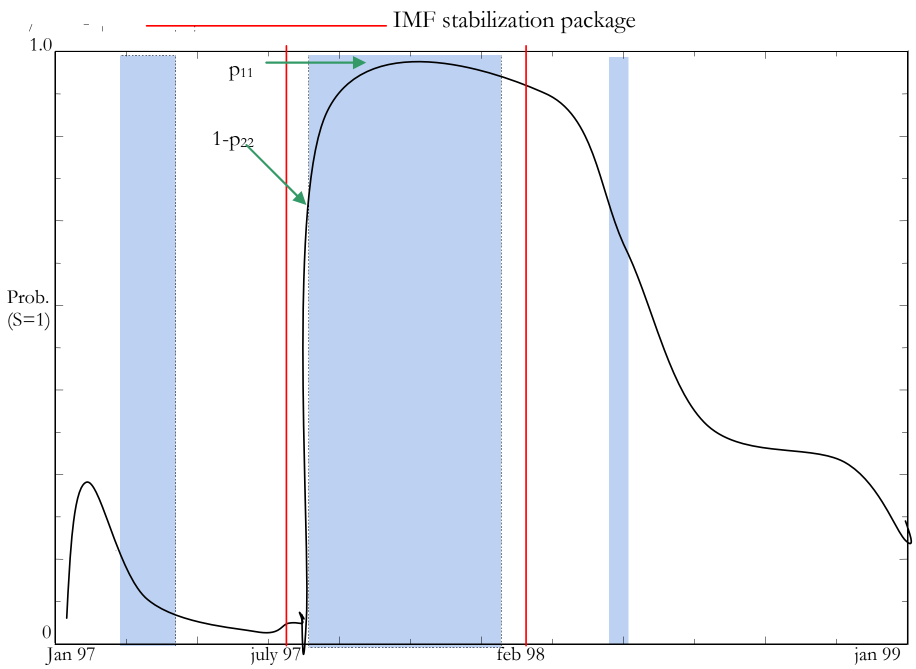


Figure 1: Smoothed transition probability of Currency Crisis (S=1) in Thailand 1997-1999



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