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Does the IMF Help or Hurt? The Effect of IMF Programs on the Likelihood and Outcome of Currency Crises

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Summary. — We empirically analyze the effect of International Monetary Fund (IMF) involvement on the risk of entering a currency crisis and, respectively, the outcome of such a crisis. Specifically, we investigate whether countries with previous IMF intervention are more likely to experience currency crises. In a second step, we analyze the IMF's impact on a country's decision to adjust the exchange rate, once a crisis occurs. We find that IMF involvement reduces the probability of a crisis. Once in a crisis, IMF programs significantly increase the probability that the authorities devalue the exchange rate. The amount of loans and compliance with conditionality have no impact.

Key words — IMF programs, growth, compliance, conditionality, world

"*The Purposes of the International Monetary Fund are:*

(iii) To promote exchange stability, to maintain orderly exchange arrangements among its members [...]
(v) [... to provide] them with opportunity to correct maladjustments in their balance of payments [...]
(vi) [...] to shorten the duration and lessen the degree of disequilibrium in the international balances of payments of members"
Article I, IMF Articles of Agreement

1. INTRODUCTION

When the International Monetary Fund (IMF) was created in 1945 its founders envisioned a Fund that would promote exchange stability and would help its member countries to adjust to disequilibria in their balance of payments. Despite these high goals, the IMF has come under increased scrutiny and attack in recent years (e.g., Stiglitz, 2002). Some of the most intense criticisms aim at the ineffectiveness of the Fund's programs and conditionality to promote good policy and economic outcomes in the recipient countries (e.g., Dreher, 2006; Przeworski & Vreeland, 2000; Vreeland, 2003). A large amount of literature has emerged that investigates how IMF programs and their implementation affect countries' balance of payments, the current account, inflation, and economic growth rates (for recent surveys see Bird (2007), Joyce (2004), Steinwand & Stone (2009)).

In face of this abundance of studies, it is surprising that few of them have investigated the Fund's performance with regard to one of its most generic purposes: the promotion of a stable international exchange rate system. [1] One of the rare exceptions is Muckherjee (2006), who reports that the IMF's stabilization programs failed to prevent currency crises in countries with a high degree of state intervention in the financial sector, but not in others. Hutchison (2003, chapter 10) reports that 28% of currency crises were associated with a contemporaneous short-term IMF program, while 18% of such programs were associated with a contemporaneous currency crisis. However, he does not provide an analysis of the causal direction of this empirical relationship. Finally, Bird and Mandilaras (2009) find some evidence that countries that have had an IMF program hold higher levels of foreign reserves. [2] To the extent that foreign reserves deter speculative attacks on currencies, this result suggests that IMF involvement mitigates crisis risk.

Overall, we know little about whether IMF programs increase or decrease a country's risk of experiencing a currency crisis or how programs affect a country's strategies to resolve such a crisis. Given the paucity of evidence, it is not surprising that we know even less about the channels by which the IMF influences crisis risk and the outcome of currency crises. In theory, the Fund can influence economic policies and outcomes by its available or disbursed money, the policy conditions it attaches to its loans and, more generally, its policy advice. An

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equally important, but more indirect, channel is what we call the "scapegoat-channel." By allowing policymakers to shift the blame for unpopular policies onto the Fund and thus increasing their chances of political survival, the IMF can enhance the chances that economically sensible policies will in fact be implemented (Vreeland, 1999). Finally, the second indirect channel is the "moral-hazard" potentially associated with IMF lending, which might affect macroeconomic policies negatively (Vaubel, 1983). As IMF lending may be interpreted as income insurance against adverse shocks, this insurance cover might induce the potential recipients to lower their precautions against such damages. The overall effect of the IMF depends on the net effect of these channels. In this paper we therefore examine how IMF programs, disbursed loans, and compliance with conditionality affect the risk of currency crises and the outcome of such crises. [3] Specifically, we investigate whether countries with previous IMF intervention are more or less likely to experience currency crises.

In a second step, we test for the IMF's impact on a country's decision to adjust the exchange rate, once a crisis occurs. Even though the IMF aims to prevent currency crises in the first place, these crises have been a regular feature of the international exchange system. Once crises occur, the Fund's goal is to limit their severity, resolve them quickly, and thus prevent them from having systemic implications. Protracted crises often result from the authorities' attempt to delay a necessary adjustment of the exchange rate for too long. One of the most frequent pieces of advice the IMF gives to countries experiencing such crises therefore is an adjustment of the exchange rate. Even though IMF loans bolster countries' reserves, this advice, or even conditionality, coupled with the opportunity to blame the IMF for a devaluation, should lead to an increased propensity for exchange rate adjustment caused by IMF crisis involvement.

To anticipate our main results, we find that IMF involvement reduces the probability of a crisis. Once in a crisis, IMF programs significantly increase the probability that the exchange rate devalues.

The next section discusses the various channels by which the IMF can influence crises; section three describes the method and data employed. Section 4 presents the empirical analysis, while Section 5 provides extensions. The final section concludes.

2. CHANNELS FOR THE IMPACT OF THE IMF ON CURRENCY CRISES

There are a multitude of channels by which the IMF can influence economic outcomes. We discuss three direct channels—money, conditionality, and policy advice—and two more indirect ones: the role of the IMF as a scapegoat for unpopular policies and its role in inducing moral hazard with the borrowing countries.

(a) *IMF programs and the risk of currency crises*

Let us first discuss the channels through which the IMF can affect the risk that a currency crisis occurs in a country. First, IMF program approval is associated with a certain amount of money. [4] The effect of this money is, however, not obvious. In theory, IMF credit is meant to bolster reserves. Since low levels of foreign currency reserves increase the likelihood of speculative attacks, a boost in reserves can help prevent such a crisis. When central banks' have plenty of international reserves, this will not only deter speculators from attacking the currency but will also reassure domestic and foreign investors so as to not to withdraw their funds. This in turn gives governments enough breathing space to reform and stabilize the economy in response to an economic shock. IMF credit should thus decrease the risk of currency crises.

The second channel through which the IMF might affect the risk of currency crises is conditionality. The Fund attaches policy conditions to its loans. These conditions contain measures which the Fund believes to be adequate to overcome an overt or smouldering economic crisis. If these measures are adequately designed and implemented, macroeconomic conditions should improve in the wake of an IMF program and currency crises should become progressively less likely. In addition, the research on currency crises has shown that crises become more likely when investors lose confidence in a government's willingness to sacrifice domestic policy goals (such as low unemployment) in exchange for maintaining its exchange rate peg (Obstfeld, 1994, 1996; for an overview over these so-called second-generation models see Flood and Marion (1998)). IMF conditionality can thus indirectly decrease the likelihood of crises by increasing investors' confidence that the government will adjust its macroeconomic policies.

With regard to the effect of IMF conditions, emphasis is put on *implemented* conditions, however. Many studies have shown that non-compliance and program interruptions are quite frequent. [5] The IMF (2001) itself reports that countries complied with structural benchmarks in only 57% of all programs during 1987–99. Compliance with performance criteria was almost 10 percentage points higher, while prior actions have been implemented in 80% of the programs analyzed. The worst implementation rates were found for conditions relating to privatization (45%), the social security system (56%), and public enterprise reforms (57%). These data are not without problems, however, because they do not include programs that are interrupted or permanently canceled and classify compliance as high even if the borrower implements many minor conditions but fails to implement the important ones (Bird & Willett, 2004). Killick (1995) proposes an alternative indicator of compliance. This indicator is the most widely used measure of program implementation. Specifically, IMF loans agreed but left undrawn at program expiration are used as an indicator of performance under a program. As Killick (1995, p. 58) points out, credit agreed but left undrawn may be a useful indicator of performance. After concluding an arrangement, part of the credit associated with it will be paid out immediately. The rest is payable in tranches. Since IMF credits are highly subsidized, countries have incentives to draw all the money available immediately. However, the money is conditional on observance of several performance criteria. Unless a waiver is granted, non-compliance results in program interruptions. Therefore, if there are large unused credit lines, non-compliance and interruptions are likely to be the cause.

Bird and Willett (2004) summarize the disadvantages of this approach. Resources may not be withdrawn, because of improvements in the economy. Sometimes programs are approved on a precautionary basis only, without intentions to draw at all. On the other hand, the Fund might disburse its money even though implementation of conditions has been poor, for example, because it feels that significant progress has been made, or even for political reasons.

It is not surprising that authors who concentrate on proxies that examine the percentage of IMF loans agreed but left undrawn have found even higher non-compliance rates as compared to those using the Fund's MONA data. For example, Dreher (2003) finds that in the period 1970–99 an average of 61.3% of programs per year suffered from non-compliance. If conditions are not implemented, of course, they cannot have

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any (direct) impact on economic outcomes.[6] Whether the IMF has an effect on the risk of currency crisis should thus also be a function of compliance. When conditions are designed to redress macroeconomic imbalances, more compliant countries should be less likely to experience crises.[7]

A third channel by which the IMF can affect the probability of crisis is its policy advice (Boockmann & Dreher, 2003). Advice of the IMF is often discussed publicly and may influence politics in the longer run (Killick, 1994, p. 156). Therefore, the impact of the IMF on crisis resolution might reach beyond the direct effects of conditions and finance. According to Fischer (2001, p. 237), one of the IMF's main contributions to reforms is that it stands consistently for a particular approach to economic policy. Chwieroth (2006) argues that the IMF provides information encouraging particular policies when there is already domestic inclination for that policy, so the information can help to reduce uncertainty and cajole domestic opponents, facilitating reform. The IMF encourages countries to pursue prudent economic policies and to avoid the emergence of major macroeconomic imbalances. The IMF's policy advice is thus geared toward creating an economic environment in which the emergence of a currency crisis is unlikely. In this context one can also argue that markets see IMF programs as "seal of approval" for the country's economic policies, and therefore choose not to attack the exchange rate. At the same time, critics point out that the IMF might give misguided policy advice (such as premature capital account liberalization), which might in fact increase the risk of crises (e.g., Stiglitz, 2002).

Fourth, the IMF may induce moral hazard with its borrowers. The "moral-hazard hypothesis" was originally proposed in Vaubel (1983). According to Vaubel, IMF lending may be interpreted as a (subsidized) income insurance against adverse shocks. The insurance cover induces the potential recipients to excessively lower their precautions against such damages (or even to intentionally generate a crisis). It is easy to show that balance of payments crises "can be produced at will, virtually overnight" by an inappropriate monetary or exchange rate policy (see Niehans, 1985, p. 67). There is also a considerable body of evidence that the balance of payments problems of IMF borrowers have been largely of their own making and that macroeconomic performance during inter-program years has been deteriorating as the number of past programs increased (Evrensel, 2002).[8] The term "moral hazard" is sometimes also used in a wider sense describing an incentive to abuse the claim to an indemnity once the accident has occurred or an incentive to abuse a loan. What we are looking at may be called "direct moral hazard" because we are analyzing the behavior of the direct recipients of insurance payments—the governments of the member states. This ought to be distinguished from indirect moral hazard effects on the lending behavior of their creditors, that is, the "bail-out" of foreign banks (Dreher & Vaubel, 2004). If the IMF really induces moral hazard with its borrowers, we would expect crises to become more likely.

Finally, currency crises can best be avoided when imbalances are redressed in due time. This requires the authorities to implement reforms that tend to be painful in the short run. Politically, such reforms are difficult to be implemented. An important indirect function of the IMF in this context is its function as a scapegoat (Vreeland, 1999). Having an IMF program allows policymakers to blame the IMF for "forcing" them to implement painful reforms. By easing the political pressures on these policymakers, the IMF therefore enhances their ability to implement necessary reforms despite public opposition. When these reforms are successfully implemented, they should decrease the risk of a currency crisis in the future.

To sum up, there are strong theoretical reasons to expect that IMF programs should affect currency crisis risk. The effect of money dispersed through these programs is ambiguous and can either mitigate or exacerbate crisis risk. Conditionality and the IMF's policy advice should reduce crisis risk, while the more indirect channels may offset one another: by providing a "scapegoat," IMF programs reduce political obstacles to reform, but the "moral hazard" inherent in these programs may give politicians incentives to further delay reform. Overall, theory does not provide a definite answer as to whether the net effect of IMF programs should be positive or negative.

(b) *IMF programs and the outcome of currency crises*

Faced with speculative pressure on their currency, governments can either stabilize (or "defend") their exchange rate by selling foreign reserves and increasing short-term interest rates, or devalue the exchange rate to a level at which the speculative pressure subsides. The empirical evidence shows that both types of policy outcomes occur quite frequently (Eichengreen, 2003; Leblang, 2003; Sattler & Walter, 2008; Walter, 2009). Which policy response policymakers choose depends on their evaluation of the political and economic costs of each option. For example, in a setting of the first-generation crises, which are caused by bad macroeconomic fundamentals, the exchange rate is often significantly overvalued and the economy exhibits substantial disequilibria. While devaluation can be very painful in such a setting, adjusting the exchange rate is often the necessary first step in the recovery process. Nevertheless, the political costs of devaluation can at times outweigh its benefits.[9] IMF programs can again affect policymakers' calculus of costs and benefits of the available policy options through five main channels: money, conditions, advice, moral hazard, and as scapegoat for unpopular policies.

IMF money directly affects the range of policy options available to the national authorities. One robust finding in the research on currency crisis outcomes in developing countries is that higher levels of foreign reserves significantly decrease the probability that the exchange rate will be adjusted (Leblang, 2003; Sattler & Walter, 2008). Since countries can use the funds disbursed in the wake of an IMF program to bolster their foreign reserves, a high amount of such funds should increase the likelihood that the authorities defend their exchange rate. This tendency might be enhanced by moral hazard.

In addition, conditions and advice going along with IMF programs should affect the outcome of currency crises as well. Conditions usually require countries to adjust their exchange rates in order to address their balance of payments imbalances. If such conditions accompany IMF programs—and if the authorities comply with these conditions—programs should decrease the likelihood of a currency defense and instead increase the likelihood of devaluation. Even if not formally included as condition, the IMF's advice might achieve the same.

Finally, IMF programs can have an important indirect effect on the outcome of currency crises. In this context it is important to understand that policymakers' political survival tends to be on the line during currency crises: finance ministers and prime ministers are significantly more likely to lose office if they devalue the currency (Cooper, 1971; Frankel, 2005; Walter, 2009). No matter how necessary and beneficial devaluations can be in the long run, they often have very painful short-term consequences. By increasing the price of imports and inflation, as well as foreign-currency denominated debt, they have a direct negative effect on consumers and hence voters (Blomberg, Frieden, & Stein, 2005; Walter, 2008). From

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politicians' perspective, devaluations are therefore highly unpopular. In such a setting an IMF program often allows policymakers to shift the blame onto the Fund. By using the Fund as a scapegoat and claiming to be devaluing only because of IMF conditionality, policymakers can simultaneously implement economically sensible policies and ensure their political survival (see Smith & Vreeland, 2003; Vreeland, 1999). This indirect effect of IMF programs should therefore decrease the likelihood that the exchange rate will be defended.

To summarize, the conditionality-, the advice-, and the scapegoat-channel suggest that the existence of an IMF program should overall decrease the probability of an exchange rate defense and increase the likelihood that the authorities adjust the exchange rate by responding with devaluation. As the money disbursed by the Fund can be used to defend the exchange rate, however, the money and moral hazard channels suggest a decreased likelihood of devaluation. As with the risk of crises, the net effect of IMF involvement on the likelihood of a quick exchange rate adjustment is ambiguous theoretically.

3. METHOD AND DATA

We examine how IMF programs, disbursed loans, and compliance with conditionality affect the risk of currency crises and the outcome of such crises. In a first step, we investigate whether countries with previous IMF intervention are more likely to experience currency crises. In a second step, we test for the IMF's impact on a country's decision to adjust the exchange rate, once a crisis occurs. The analysis covers the period 1975–2002 and extends to a maximum of 68 countries. [10] Since some of the data are not available for all countries or periods, the panel data are unbalanced and the number of observations depends on the choice of explanatory variables.

(a) *Data*

For the evaluation of crisis risk, our dependent variable is a dummy indicating the occurrence of a currency crisis. This variable is taken from Sattler and Walter (2008) and follows the conventional approach of identifying currency crises as periods of extreme pressure in the foreign exchange market (Eichengreen, Rose, & Wyplosz, 1995). Foreign exchange market pressure (EMP) is measured on a monthly basis with a weighted index of exchange rate changes, reserve changes, and changes in the interest rate differential relative to the interest rate in a stable reference country. [11] The rationale for this index is that governments can respond to currency crises either by devaluing or floating their currency, by tightening monetary policy, or by spending foreign reserves. Large values of the EMP index indicate that speculative pressure is high. Even though this index is not without problems (for a discussion see Pontines & Siregar, 2008), this approach has become standard in the literature on currency crises, since so far no satisfactory alternative to measuring speculative pressure with the EMP index has been developed. The data needed for calculating this index are available from the IMF's (2006) International Financial Statistics. To identify crises episodes, we follow Eichengreen *et al.* (1995) and define crises as those periods where the index exceeds the mean by at least two standard deviations. [12] The monthly data are then aggregated by year. The resulting sample of crises is listed in Appendix C. It includes many well-known crisis events such as the Mexican Peso crisis in December 1994 and the speculative attacks on the Thai baht in 1997. [13]

The dependent variable in the second part of our analysis is the outcome of a currency crisis. We examine whether the government devalued the exchange rate within 6 months following upon the initial attack. If the exchange rate was not adjusted during the 6-month period, it is coded as a defense. It then takes the value of one and is zero otherwise.

To determine whether and when countries devalued, we follow the approach of Sattler and Walter (2008) and use a behavioral criterion evaluating exchange rate behavior based on the pre-attack type of the (*de facto*) exchange rate regime (see Appendix A). This criterion grants flexible and intermediate regimes more policy flexibility than fixed exchange rate regimes. A small depreciation of the exchange rate may be in accordance with the rules of a relatively flexible regime, such as a pre-announced crawling band, but might violate the requirements of a stricter regime, such as a hard exchange rate peg. Our devaluation criterion therefore grants regimes with little *de facto* exchange rate flexibility less freedom to depreciate than countries that follow more flexible exchange rate regimes. It takes into account two different criteria: the amount of depreciation in each individual month compared with the previous month and the overall amount of depreciation since the speculative attack with the pre-attack level of the exchange rate. The first month in which either of these criteria indicates a devaluation is counted as the month of devaluation. According to this operationalization, governments defended their exchange rate in 45 of all 171 cases. Ninety-one speculative attacks resulted in a swift adjustment of the exchange rate within the month of the attack, while governments initially defended, but subsequently devalued during the following 6 months in response to the remaining 20.5% of all speculative attacks in the sample.

Since we are mainly interested in the effect of IMF programs on crisis risk and the outcome of currency crises, we use a variety of measures to capture the effects of the various channels of influence discussed above (money, conditionality, advice, and indirect channels such as moral hazard and the Fund's role as a scapegoat). Only one of these channels can be directly measured: IMF loans disbursed. The amount of IMF credit is operationalized as the sum of net financial flows in the previous 5 years for all IMF program types in percent of GDP.

To proxy the degree of compliance with conditionality, [14] we use a dummy variable, which is coded as 1 if the country was compliant with its IMF program in the previous 5 years. A country is coded as compliant when at most 25% of the amount agreed under an IMF arrangement remained undrawn at program expiration and as zero otherwise. [15] While this is an admittedly crude measure, other available measures suffer from even greater problems. For example, the IMF provides data on the implementation of performance criteria and structural benchmarks that have been implemented under its programs in its database on Monitoring Fund Arrangements (MONA). However, as discussed above, since only those programs which have been reviewed by the Executive Board are included in the database, programs that are interrupted or permanently canceled will not be covered. This is likely to overstate compliance. As another problem, these data do not take the importance of conditions into account. If the borrower implements many minor conditions but fails to implement the important ones, compliance might nevertheless be classified as being high. Finally, the database does not cover a sufficient number of years to allow longer term economic analysis (Bird & Willett, 2004). [16]

The individual effects of IMF advice-, moral hazard-, [17] and the scapegoat-channel on the likelihood of a currency crisis cannot be tested directly, because they are all associated with

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having an IMF arrangement in place. We proxy these effects jointly by looking at the mere existence of an arrangement. For this purpose, we use a dummy variable that records whether a country had any kind of IMF program during the previous 5 years. We consider four types of programs: Stand-By-Arrangements (SBA), Extended Fund Facility (EFF), the Structural Adjustment Facility (SAF), and the Poverty Reduction and Growth Facility (PRGF). [18] Since we include fixed country effects in the first part of the analysis, the IMF program dummy measures the effects of IMF programs even in the case of severe recidivism, and not a country effect. Countries that are always (or never) under an IMF program are consequently excluded by construction. When controlling for the amount of credit and compliance with conditionality, this dummy variable for the existing IMF programs thus at least partly captures the combined effect of advice-, moral hazard-, and the scapegoat-function. [19]

For the analysis of the IMF's effect on currency crisis risk, we focus on the previous 5 years because the economic reforms induced by an IMF program might need some time to strengthen the macroeconomic situation enough to prevent crisis. We therefore investigate whether the existence of an IMF program in the previous 5 years affects the probability of a crisis. As a test for robustness, however, we also investigate the effect of IMF programs in a shorter time period below. Clearly, the analysis should cover only those arrangements that were in effect over much of the respective period in question. Only those years are thus coded as program years where an arrangement has been active over at least 5 months in a given calendar year. [20] For the analysis of the government's decision to devalue, we use the same variables measuring IMF involvement but employ contemporaneous values.

We employ two sets of control variables. For the first part of our analysis about the probability of experiencing a crisis, we use economic and political variables that have been suggested in the literature as predictors of currency crises (e.g., Kaminsky *et al.*, 1998; Leblang, 2002). These variables include the interest rate differential, the level of foreign reserves, export share, the de jure exchange rate regime, and capital account openness. We also included the following variables in some estimations: inflation, current account deficit, domestic credit/M2, the budget deficit, *per capita* GDP, and an election year dummy. Except for capital account openness, all these variables were lagged by 1 year. A detailed description of these variables can be found in Appendix A. Appendix B provides summary statistics. In the second part of the analysis, which examines the authorities' decision to devalue, the explanatory variables include inflation, foreign currency reserves relative to money, GDP growth, export growth, and a lagged election year dummy. Inflation is included to proxy for the causal mechanism underlying the first-generation models, which predict that bad economic fundamentals will inevitably lead to a devaluation as the outcome of currency crises (Krugman, 1979). International reserves measure a country's technical ability to defend the exchange rate. [21] The second-generation models focus more on the current economic situation (Obstfeld, 1994). We therefore include GDP growth to control for the state of the domestic economy. The size of the export sector and the election dummy control for political factors. Since export-oriented firms tend to prefer more depreciated exchange rates (Frieden, 1991), the authorities in more export-oriented countries tend to face politically powerful demands for a downward adjustment of the exchange rate, making an exchange rate defense less likely. Devaluations tend to be unpopular with voters, however, so that exchange rate adjustments tend to be less likely when elections are pending (Méon, 2001, 2004; Walter, 2009).

(b) *Method*

In the first part of the analysis we estimate the likelihood that a country experiences a currency crisis. Since the dependent variable is binary, we estimate this first stage model employing conditional fixed effects Logit, as suggested by Chamberlain (1980). We also include a dummy for each year, as these proved to be jointly significant at the 1% level.

One of the major challenges in estimating the effects of IMF involvement on currency crisis risk is the potential for endogeneity of the IMF variables. Obviously, IMF programs are usually concluded in times of economic crisis, and involvement becomes more likely, the more severe the crisis is. The effect reported for the program variable might thus not reflect the consequences of the program itself but those of the severity of the underlying crisis. In other words, there might be a selection problem. [22]

An additional source of potential bias arises in the second step of our analysis. Since the sample of countries experiencing speculative pressure is not a random sample (e.g., Leblang, 2003), we face a second selection problem in this part of the analysis. When analyzing the effect of the IMF on governments' behavior once the country is experiencing a crisis, we thus have to account for sample selection again.

There are various methods to deal with these selection problems, and the literature on the IMF is rich with applications. Most studies pursue either some variant of Heckman's (1979) estimator or an instrumental variables approach; recently the method of matching has also been applied. [23] All three of these approaches have their benefits, but also imply drawbacks. Estimating the participation equation and then including the inverse Mills ratio, as suggested by Heckman (1979), depend implicitly on auxiliary restrictions such as assumptions about the distribution of error terms (Barro & Lee, 2005) and the "correct" specification of the participation equation. The challenge with the instrumental variables approach, clearly, is in finding variables that affect the probability of program participation but do not affect crisis risk other than through their impact on participation. The problem of finding the correct variables is even more severe with respect to the matching approach, where matching of "treatment" and "control" groups would only result in unbiased estimates, when the decision to enter IMF programs could be accounted for by the matching procedure (see Przeworski & Limongi, 1996).

We pursue two strategies to address the potential endogeneity of IMF programs. First, we use instruments available for participation in IMF programs. The recent empirical literature on political influences on the Fund shows that developing countries get better terms from the IMF when they have closer ties with the Fund's most important shareholders, as measured by their voting behavior in the UN General Assembly (Barro & Lee, 2005; Dreher & Jensen, 2007; Stone, 2002; Thacker, 1999). [24] Arguably, UN General Assembly voting is uncorrelated with the decision to devalue the exchange rate, providing a natural instrument. We follow Barro and Lee (2005) and employ the fraction of times a country votes the same as France, Japan, Germany, Great Britain, and, respectively, the United States of America (either both voting yes, both voting no, both abstaining, or both being absent). Of course, it could be argued that UN voting captures the moral hazard propensity of borrowers because countries and speculators can gauge whether or not they will be bailed out in the event of a crisis,

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thus making them invalid as instruments. However, testing for the exogeneity of UN voting shows countries' voting behavior to be a valid instrument for IMF loans. The overidentifying restrictions are not rejected at conventional levels of significance. When included to the outcome (second stage) regression, the voting variables are jointly completely insignificant (Prob $> \chi^2 = 0.89$).

As our second approach to deal with the potential endogeneity of the explanatory variables, we employ the system GMM estimator as suggested by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998). The dynamic panel GMM estimator exploits an assumption about the initial conditions to obtain moment conditions that remain informative even for persistent data. It is considered most appropriate in the presence of endogenous regressors. Results are based on the two-step estimator implemented by Roodman (2005) in Stata, including Windmeijer's (2005) finite sample correction. We apply the Sargan–Hansen test on the validity of the instruments used (amounting to a test for the exogeneity of the covariates) and the Arellano–Bond test of the second-order autocorrelation, which must be absent from the data in order for the estimator to be consistent. We treat the lagged dependent variable as endogenous and all other variables as predetermined. As before, we include time dummies in the regression. In order to minimize the number of instruments in the regressions we collapse the matrix of instruments as suggested in Roodman (2006).[25] As Hyslop (1999) and Janvry, Finan, Sadoulet, and Vakis (2006) argue, such linear probability models are more tractable and flexible in the handling of unobserved heterogeneity than non-linear models are. We therefore also use this model to control for potential endogeneity of selection into IMF programs in the 5 years preceding a crisis. To anticipate the results, the Sargan–Hansen test and the Arellano–Bond test do not reject the GMM specifications at conventional levels of significance.

As discussed above, we face an additional selection problem in the second part of the analysis, which investigates the impact of the IMF on whether or not governments devalue the exchange rate, because the analysis only includes countries already experiencing a crisis. To address this problem, we make use of our results in the first part of the analysis and use the model on currency crisis risk to calculate the inverse Mills ratio. We then use the inverse Mills ratio to control for sample selection bias in the second stage (Heckman, 1979). The resulting dataset contains up to 148 episodes of speculative pressure as units of observation. Rather than employing conditional fixed effects Logit we estimate Logit and Probit models and cluster the standard errors for observations from the same country.[26] To address the potential endogeneity of IMF programs we use both instrumental variables and GMM. In the second stage model, dummies for each year are not significant at conventional levels, so we exclude them from the analysis. The next section reports the results.

4. RESULTS

(a) *Does the IMF affect the likelihood of experiencing a currency crisis?*

Table 1 reports the effects of IMF involvement in the previous 5 years on the likelihood of the occurrence of a currency crisis. Columns 1 and 2 include a dummy for the existence of an IMF arrangement over the previous 5-year period. Column 1 reports the results of the full model, while column 2 excludes all control variables that are not statistically significant at the 10% level at least.[27] Crises become more likely with higher money supply relative to international reserves and lower exports relative to GDP, at least at the 5% level of significance. This is in line with the first-generation crisis models (Krugman, 1979), which predict that worsening fundamentals will drain foreign reserves and lead to speculative attacks. Countries with more flexible de jure exchange rate regimes are more likely to experience a crisis, with coefficients statistically significant at the 1% level. A possible explanation for this finding is that many countries that officially declare to follow a flexible exchange rate regime in fact intervene heavily and thus have *de facto* intermediate exchange rate regimes (Reinhard & Rogoff, 2004). Since such intermediate regimes tend to be particularly crisis-prone (Angkinand, Chiu, & Willett, 2009; Obstfeld & Rogoff, 1995), the positive coefficient is probably evidence for the unstable middle hypothesis.[28] Restricted capital accounts also make countries more crisis-prone, at the 1% level of significance. The interest rate differential is marginally insignificant according to column 1 and completely insignificant once the additional insignificant variables are excluded (column 2).

Turning to our variable of main interest, the results show that crises become significantly less likely with the existence of an IMF program in the previous 5 years. This effect is significant in both substantive and statistical terms. IMF programs reduce crisis risk by about 20 percentage points (when the marginal effect is calculated at the mean of the independent variables and assuming that the fixed effects are zero), compared to a baseline probability that the dependent variable is zero of 0.47. The effect is statistically significant at the 5% level. This implies that, overall, the effect of IMF programs is positive. As discussed above, however, different aspects of IMF involvement can have opposing effects. In the next step we therefore disaggregate the overall effect of IMF programs into the individual effects of the different channels through which IMF programs can affect the likelihood of crisis. To test for the effect of conditionality, we include our measure of average compliance with IMF conditions. The effect of increased funds is tested by including average IMF loans (in percent of GDP) over the previous 5-year period. When included instead of the program dummy in columns 3 and 4, both of them show a negative coefficient, but only compliance is statistically significant (at the 10% level). Including the three IMF variables jointly and thus making the effect of conditions and money conditional on the existence of an IMF program (column 5), it was shown that none of the three IMF variables is statistically significant at conventional levels, in the case of compliance potentially due to the high correlation between IMF programs and compliance.[29]

Column 6 addresses the potential endogeneity problems related to IMF programs. It replicates the analysis employing the system GMM estimator instead of conditional Logit. Note that the Arellano–Bond test and the Sargan–Hansen test do not reject the specification at conventional levels of significance. While the results for the covariates change substantially, we obtain a negative effect of IMF programs on crisis risk, at the 10% level of significance, while compliance and loans are not statistically significant at conventional levels. The results show that the existence of an IMF program over the previous 5 years reduces the probability of currency crises by about 10 percentage points (with the in-sample mean of the dependent variable being 0.13). This result holds when excluding the insignificant covariates (in column 7), increasing the number of observations substantially. Note that the IMF program dummy is now significant at the 5% level, while the quantitative impact declines somewhat. IMF loans and our

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Table 1. *IMF involvement and currency crises, 1976–2000*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
IMF program in previous 5 years	−0.809**	−0.805**			−0.836	−0.095*	−0.074**
	(1.97)	(2.37)			(1.46)	(1.73)	(2.20)
Compliant with IMF program, 5 years			−0.746*		−0.402	0.002	−0.015
			(1.80)		(0.74)	(0.03)	(0.39)
IMF loans (percent of GDP), 5 years				−0.197	−0.055	−0.004	−0.008
				(1.49)	(0.32)	(0.31)	(1.11)
Interest rate differential ($t-1$)	0.002	−0.000	−0.000	0.009	0.016	0.006***	0.006***
	(1.61)	(0.12)	(0.12)	(1.31)	(0.89)	(2.73)	(4.70)
Reserves/M2 ($t-1$)	−0.543**	−0.529***	−0.591***	−0.595***	−0.558**	0.004	
	(2.57)	(2.71)	(2.95)	(2.69)	(2.36)	(0.23)	
Exports/GDP ($t-1$)	−5.373***	−6.095***	−7.997***	−5.969***	−7.628***	0.146	
	(2.59)	(3.41)	(3.93)	(3.06)	(3.43)	(1.32)	
Flexible exchange rate regime ($t-1$)	0.140***	0.127***	0.131***	0.133***	0.153***	−0.004	
	(3.04)	(3.04)	(2.69)	(2.85)	(2.63)	(0.78)	
Capital account openness	−0.600***	−0.610***	−0.524***	−0.321*	−0.265	−0.010	
	(3.38)	(3.68)	(2.94)	(1.77)	(1.28)	(0.71)	
Inflation ($t-1$)	−0.000						
	(0.35)						
Current account/GDP ($t-1$)	0.489						
	(0.22)						
Domestic credit/M2 ($t-1$)	0.104						
	(1.08)						
Budget deficit/GDP ($t-1$)	−3.185						
	(1.23)						
(log) GDP p.c. ($t-1$)	0.380						
	(0.86)						
Election, dummy ($t-1$)	0.172						
	(0.59)						
Lagged dependent variable						−0.029	0.030
						(0.33)	(0.45)
Observations	759	868	769	695	602	607	897
Number of countries	50	53	50	46	43	59	78
Method	Logit	Logit	Logit	Logit	Logit	GMM	GMM
Fixed country effects	Yes	Yes	Yes	Yes	Yes	No	No
Fixed time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log likelihood	−203.08	−233.93	−195.42	−199	−159.38		
Prob > $\chi 2$	0.00	0.00	0.00	0.00	0.00		
Arellano–Bond test (p-level)						0.55	0.92
Sargan test (p-level)						0.16	0.14

Notes: The dependent variable is a dummy variable that takes the value of one when at least one speculative attack occurred in a certain year, and zero otherwise.
Absolute value of z-statistics is given in the parentheses.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

measure of compliance are again not significant at conventional levels.

Overall, our results point toward the importance of the existence of IMF programs *per se*, rather than toward that of IMF money or compliance with conditionality. In light of our theoretical arguments described above, it therefore seems that the more indirect channels such as IMF advice and its "seal of approval," as well as its function as a scapegoat are more valuable than its money and conditions. Overall, the result also suggests that these positive indirect effects outweigh the potential negative effect of IMF programs in terms of moral hazard.

In Table 2 we look at different definitions of the IMF program variable, focusing on the specification given in column 2. Do the results hold when looking at contemporaneous IMF involvement? Do they hold when looking at IMF involvement in the previous one, two, three, or 4 years, respectively? While the 5-year period is our preferred focus, we admit that this choice is arbitrary and it would threaten the reliability of our conclusions would the result crucially depend on this choice. As can be seen, however, the program dummy has a negative coefficient throughout. With the exception of IMF programs in the same year, the impact is significant at the 10% level at least. The insignificant coefficient for contemporaneous programs is not surprising as in many cases programs will be the consequence of a currency crisis rather than the cause. We conclude that our results are rather robust to the choice of the 5-year horizon we focus on. [30]

(b) *Does the IMF affect the policy response to speculative pressure?*

Table 3 turns to the impact of IMF involvement on exchange rate devaluation. As our sample includes only crisis episodes, the number of observations is reduced to a

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Table 2. *IMF programs and currency crises, 1976–2000, conditional Logit*

	(1)	(2)	(3)	(4)	(5)
IMF program in same year	−0.383				
	(1.39)				
IMF program in previous year		−0.723**			
		(2.43)			
IMF program in previous 2 years			−0.555*		
			(1.83)		
IMF program in previous 3 years				−0.637**	
				(2.00)	
IMF program in previous 4 years					−0.571*
					(1.77)
Interest rate differential ($t-1$)	−0.000	−0.000	−0.000	−0.000	−0.000
	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
Reserves/M2 ($t-1$)	−0.566***	−0.524***	−0.546***	−0.547***	−0.547***
	(2.95)	(2.72)	(2.81)	(2.80)	(2.80)
Exports/GDP ($t-1$)	−6.332***	−6.233***	−6.341***	−6.210***	−6.176***
	(3.54)	(3.49)	(3.53)	(3.46)	(3.45)
Flexible exchange rate regime ($t-1$)	0.123***	0.138***	0.134***	0.130***	0.124***
	(2.96)	(3.25)	(3.18)	(3.11)	(2.99)
Capital account openness	−0.552***	−0.581***	−0.586***	−0.587***	−0.585***
	(3.42)	(3.58)	(3.58)	(3.59)	(3.57)
Observations	868	868	868	868	868
Number of countries	53	53	53	53	53
Log likelihood	−235.77	−233.71	−235.06	−234.73	−235.18
Prob > $\chi 2$	0.00	0.00	0.00	0.00	0.00

Notes: The dependent variable is a dummy variable that takes the value of one when at least one speculative attack occurred in a certain year, and zero otherwise. Dummies for each year are included.
Absolute value of *z*-statistics is given in the parentheses.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

maximum of 148. Column 1 reports the results estimated with Logit, while column 2 reports the results estimated with Probit instead. The results are fairly similar. Consistent with the first-generation models of currency crises, which predict that bad fundamentals will lead to speculative attacks that inevitably result in a devaluation (Krugman, 1979), higher rates of inflation (as a proxy for the quality of a country's macroeconomic fundamentals) increase the probability that the exchange rate will be devalued in response to a crisis, with a coefficient significant at the 5% level according to both estimates. Again being statistically significant, the results also show that lower GDP growth increases the likelihood of an exchange rate adjustment. This is in line with predictions from the second-generation models (Obstfeld, 1994, 1996) that the authorities are less willing to defend the exchange rate when the economy is in recession and the trade-off between exchange rate stability and growth and employment is high. Elections in the previous year increase the likelihood of a defense, but the effect is not statistically significant. The positive coefficient of the post-election dummy contradicts the results reported in Walter (2009) but is in line with those reported in Leblang (2003). Replacing the post-election dummy with a dummy for contemporaneous elections, the expected negative coefficient was obtained at the five (Logit) and one (Probit) percent level of significance (not reported in the table). Exports as a share of GDP and foreign reserves relative to money do not significantly affect the probability of defense.

Most importantly, however, the coefficient of the IMF program dummy is consistently negative and is statistically significant at the 10% level at least in all specifications. Countries, that have an IMF program in place in the crisis year, are more likely to adjust their exchange rate in response to speculative pressure. Holding all other variables at their means, having an IMF program increases the likelihood that the authorities will devalue the exchange rate by around 12 percentage points. Overall, the IMF thus seems to succeed in encouraging countries in adjusting their exchange rate when faced with speculative pressure.

Since currency crises are no random events, these results might suffer from selection bias. To correct for the potential selection problem, we include the inverse Mills ratio (calculated from the selection equation given in column 2 of Table 1) to our specification. Column 3 shows that the results remain unchanged, while the inverse Mills ratio itself is not significant at conventional levels. To account for the potential endogeneity of contemporaneous IMF programs, we then re-estimate our results employing instrumental variables Probit (column 4). As described above, countries' voting behavior in the UN General Assembly is used as instrument. Column 4 shows that our results hold when we instrument for IMF programs. The existence of IMF programs increases the probability of an exchange rate adjustment at the 10% level of significance. The corresponding marginal effect shows that the effect of IMF programs amounts to about 31 percentage points—and is thus substantially stronger as compared to the results reported above. This result remains when the inverse Mills ratio is included to the regression (column 5). As an alternative correction to the potential endogeneity of IMF programs, column 6 replicates the analysis employing the system GMM estimator for comparison. While the results for the covariates again differ to some extent as compared to the previous estimates, the impact of the IMF is significant at the 5% level. As before, the negative coefficient

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Table 3. *IMF involvement and defense, 1976–2001*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
IMF program	−1.069**	−0.569**	−0.609**	−1.498*	−1.691**	−0.112**	−0.569**	−1.630**	−0.122**
	(2.07)	(2.04)	(2.10)	(1.92)	(2.12)	(2.24)	(2.04)	(2.41)	(1.97)
Compliant with IMF program							0.089	0.175	0.025
							(0.50)	(0.94)	(0.73)
IMF loans (percent of GDP)							−0.244	0.144	−0.069
							(0.56)	(0.31)	(0.69)
Inflation ($t-1$)	−0.041**	−0.021**	−0.023*	−0.019*	−0.019	−0.000	−0.022**	−0.019**	−0.000
	(2.13)	(2.03)	(1.91)	(1.87)	(1.61)	(0.41)	(2.25)	(2.00)	(0.15)
GDP growth ($t-1$)	3.522**	1.820*	2.031*	1.587*	1.634	0.014	1.905**	1.634*	0.001
	(2.08)	(1.96)	(1.87)	(1.78)	(1.54)	(0.30)	(2.17)	(1.91)	(0.03)
Exports/GDP ($t-1$)	−0.038	−0.008	−0.831	−0.490	−1.247*	0.108	−0.051	−0.552	0.145
	(0.04)	(0.01)	(0.96)	(0.77)	(1.83)	(0.54)	(0.09)	(1.04)	(0.69)
Reserves/M2 ($t-1$)	−0.328	−0.193	−0.183	−0.174	−0.190	−0.028	−0.190	−0.158	−0.018
	(1.45)	(1.59)	(1.51)	(1.39)	(1.63)	(1.35)	(1.59)	(1.26)	(0.91)
Election, dummy ($t-1$)	0.885	0.491	0.511	0.397	0.355	0.138	0.523	0.384	0.145
	(1.62)	(1.50)	(1.37)	(1.33)	(1.04)	(1.49)	(1.62)	(1.27)	(1.56)
Inverse Mills ratio			0.189		0.179				
			(1.10)		(1.28)				
Lagged dependent variable						0.119			0.127
						(1.30)			(1.25)
Constant	−0.899**	−0.543**	−0.578**	−0.003	0.069	0.173***	−0.533**	0.039	0149***
	(2.40)	(2.39)	(2.42)	(0.01)	(0.12)	(2.71)	(2.33)	(0.08)	(2.58)
Observations	148	148	133	147	132	148	148	147	148
Number of countries	63	63	55	63	55	63	63	63	63
Method	Logit	Probit	Probit	IV Probit	IV Probit	GMM	Probit	IV Probit	GMM
Log pseudolikelihood	−72.45	−72.87	−64.13	−160.97	−142.34		−72.55	−154.63	
Prob > $\chi 2$	0.258	0.23	0.11	0.06	0.01	0.07	0.10	0.01	0.13
Arellano–Bond test (p-level)						0.32			0.33
Sargan test (p-level)						0.24			0.25

Notes: The dependent variable is zero if the exchange rate was devalued within the 6 months following the first months of a speculative attack, and one otherwise.
Absolute value of z-statistics is given in the parentheses.
Instruments used in columns (4), (5), and (8): voting coincidence with Germany, Italy, Japan, the United Kingdom, and the United States in the UN General Assembly.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

suggests that countries with IMF programs are more likely to adjust their exchange rate in response to a crisis.

To break down the overall adjustment-enhancing effect of IMF programs into the different channels discussed above, columns 7–9 replicate the analysis including the amount of IMF loans disbursed and compliance with conditionality in addition to the IMF program dummy. As in the regressions on crisis risk, IMF programs as such remain statistically significant (at the 5% level) and negative, while the coefficients for loans and compliance are not significant at conventional levels. This implies that, as above, it is the overall effect of programs rather than the individual effects of money and compliance that drives the results. To some extent—holding disbursed money and compliance with conditions constant—the program dummy can be interpreted as proxy for the IMF's advice and scapegoat function. This implies that IMF involvement can indeed facilitate exchange rate adjustments by advising policymakers to adjust and allowing them to shift the political blame for this decision onto the IMF. The results are much in line with Dreher (2005), showing IMF programs to improve fiscal and monetary policies, while money disbursed and the degree to which programs are completed have no significant impact on policies. This suggests that IMF programs have important indirect effects that go far beyond the Fund's conventional tools in terms of money and conditions.

5. EXTENSIONS AND TESTS FOR ROBUSTNESS

We employ a number of tests to gauge the robustness of our results. First, we use different thresholds in the EMP index to identify speculative attacks. Our results are robust to using a more restrictive 3-standard deviation threshold. Furthermore, when we identify crises based solely on changes in the interest rate and the level of foreign reserves, and hence excluding changes in the exchange rate in the construction of the index, we find that the effect of IMF programs on the outcome of speculative attacks continues to increase the chances of exchange rate adjustment, at the 10% level of significance in one model and at least at the 5% level of significance in all other models. [31]

Second, we further disaggregate the analysis on the effect of the IMF on exchange rate adjustment. For this purpose, we measure both whether and how long the exchange rate was defended against speculative pressure. Following Sattler and Walter (2008), we count how many months the authorities kept the exchange rate stable after it was first attacked. If the exchange rate was not adjusted during a 13-month period, it is coded as a defense. The dependent variable thus takes values between 1 and 13, where 1 represents a case in which the exchange rate was devalued within the same month in which it was first attacked. A value of 13 represents cases in which

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the exchange rate was defended for at least 13 months after the onset of speculative pressure.

Table 4 presents duration models with a lognormal distribution to estimate the effect of IMF programs on the duration of exchange rate defenses. Column 1 treats IMF programs as exogenous. Column 2 adds the inverse Mills ratio, accounting for selection into the crisis. Columns 3 and 4 replicate the analysis but instrument IMF programs with the voting variables.[32] The results confirm our earlier finding that IMF involvement facilitates exchange rate adjustment. In particular, having an IMF program in place significantly speeds up exchange rate adjustment, while compliance with conditionality and the amount of IMF loans disbursed are again not statistically significant in any model. The model given in column 1 predicts that governments in countries with no IMF program attempt to defend their exchange rate on average 2.7 months longer as compared to countries with an IMF program in place (who adjusted the exchange rate after an average of 1.7 months). As before, compliance and the amount of money disbursed have no statistically significant effect on the policy response chosen. Since the Mills ratio itself is statistically significant at the 5% level in column 2, we replicated the analysis bootstrapping the standard errors (with 200 replications). The results are robust to this change. Instrumenting for IMF programs, columns 3 and 4 show a similar picture. At the 10% and 5% level of significance, respectively, having an IMF program substantially and statistically significantly speeds up exchange rate adjustments.

As our third test for robustness, Table 5 tests whether excluding industrial countries from the analysis affects the results. While industrial countries turned to the Fund until the late 1970s (and only recently again since Iceland's arrangement in 2008),[33] it might be argued that the effect of the IMF on policies is different in such countries. As can be seen, however, our results are much in line with those reported previously. IMF programs increase the probability of devaluation at the 1% level of significance (taking account of the potential endogeneity of programs).

Finally, in Table 6 we separately analyze the impact of concessional programs as compared to unconcessional programs on devaluations. Columns 1–4 show that the impact of unconcessional programs is marginally insignificant, while concessional programs are statistically significant at the 5% and 1% level of significance, respectively.[34] The size of the coefficients on IMF programs, however, is very similar across the different models. Note that we also tried to include the dummies for concessional and unconcessional IMF programs at the same time. Since the instrumental variables regressions did not converge we used Probit without instruments. A Wald test shows that

Table 4. *IMF involvement and months of defense, 1976–2001*

	(1)	(2)	(3)	(4)
IMF program	−0.428***	−0.455***	−0.957*	−0.893**
	(2.65)	(2.80)	(1.75)	(2.04)
Compliant with IMF program	−0.017	−0.024	−0.037	−0.030
	(0.17)	(0.12)	(0.40)	(0.16)
IMF loans (percent of GDP)	−0.096	0.041	−0.312	−0.245
	(0.38)	(0.16)	(1.33)	(0.95)
Inflation ($t-1$)	−0.000	−0.001	−0.002**	0.001
	(1.05)	(1.22)	(2.04)	(0.95)
GDP growth ($t-1$)	0.019	0.031	0.123	−0.217
	(0.31)	(0.51)	(1.51)	(1.58)
Exports/GDP ($t-1$)	0.256	−0.783	0.105	−1.285*
	(0.54)	(1.33)	(0.20)	(1.86)
Reserves/M2 ($t-1$)	−0.069	−0.086	−0.041	0.000
	(1.23)	(1.46)	(0.71)	(0.01)
Elections, dummy ($t-1$)	0.233	0.241	0.189	0.079
	(0.85)	(0.78)	(0.64)	(0.24)
Inverse Mills ratio		0.261**		0.253**
		(2.19)		(2.04)
Constant	0.923***	0.903***	0.406	0.456**
	(4.67)	(4.38)	(1.63)	(2.13)
Observations	148	133	147	132
Number of countries	63	55	63	55
Method	Duration (lognormal)	Duration (lognormal)	IV Duration (lognormal)	IV Duration (lognormal)
Ln(Sigma)	0.005	−0.003	0.015	0.004
Log pseudolikelihood	−210.81	−188.38	−210.77	−187.87
Prob > $\chi 2$	0.03	0.01	0.01	0.02

Notes: The dependent variable counts how many months the authorities kept the exchange rate stable after it was first attacked. If the exchange rate was not adjusted during a 13-month period, it is coded as a successful defense. The dependent variable takes values between 1 and 13, where 1 represents a case in which the exchange rate was devalued in the month in which it was attacked. A value of 13 represents cases in which the exchange rate was defended for at least 13 months after the onset of speculative pressure.

Absolute value of z-statistics is given in the parentheses.

Instruments used in columns (3) and (4): voting coincidence with Germany, Italy, Japan, the United Kingdom, and the United States in the UN General Assembly.

* Significant at 10%.

** Significant at 5%.

*** Significant at 1%.

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Table 5. *IMF involvement and defense, without industrial countries, 1976–2001*

	(1)	(2)	(3)	(4)
IMF program	−0.48*	−0.53*	−1.65***	−1.90***
	(1.79)	(1.88)	(2.94)	(3.74)
Compliant with IMF program	0.22	0.18	0.29	0.23
	(0.75)	(0.52)	(0.97)	(0.70)
IMF loans (percent of GDP)	−0.09	0.07	0.24	0.41
	(0.21)	(0.18)	(0.55)	(0.89)
Inflation ($t-1$)	−0.02**	−0.03**	−0.02**	−0.02*
	(2.46)	(2.28)	(2.25)	(1.76)
GDP growth ($t-1$)	2.17**	2.29**	1.71**	1.47*
	(2.40)	(2.24)	(2.16)	(1.68)
Exports/GDP ($t-1$)	−0.16	−0.87	−0.69	−1.44**
	(0.28)	(0.90)	(1.47)	(2.34)
Reserves/M2 ($t-1$)	−0.17	−0.15	−0.14	−0.16
	(1.40)	(1.26)	(1.18)	(1.45)
Elections, dummy ($t-1$)	0.17	0.06	0.13	0.01
	(0.55)	(0.17)	(0.49)	(0.03)
Inverse Mills ratio		0.16		0.17
		(0.80)		(1.22)
Constant	−0.56**	−0.59**	0.12	0.26
	(2.49)	(2.44)	(0.28)	(0.64)
Observations	137	123	136	122
Number of countries	59	51	59	51
Method	Probit	Probit	IV Probit	IV Probit
Log pseudolikelihood	−64.88	−56.39	−142.79	−125.98
Prob > $\chi 2$	0.08	0.09	0.00	0.00

Notes: The dependent variable is zero if the exchange rate was devalued within the 6 months following the first months of a speculative attack, and one otherwise.
Absolute value of z-statistics is given in the parentheses.
Instruments used in columns (3) and (4): voting coincidence with Germany, Italy, Japan, the United Kingdom, and the United States in the UN General Assembly.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

the coefficients are not significantly different from one another. [35]

6. CONCLUSION

This paper has examined how IMF programs affect the risk of currency crises and the outcome of such crises. This is an important question, as the preservation of stability in the global financial system constitutes one of the Fund's prime functions. To evaluate whether the Fund fulfills this function in the context of speculative pressure in international currency markets, we used panel data for 68 countries over the period 1975–2002 and investigated whether countries with previous IMF intervention are more likely to experience currency crises and how IMF programs impact a country's decision to adjust the exchange rate once a crisis occurs.

Our results suggest that the IMF—contrary to the Fund's critics—does indeed fulfill its functions of promoting exchange rate stability and helping its members to correct macroeconomic imbalances. The existence of an IMF program significantly decreases the risk of a currency crisis and increases the likelihood that the exchange rate will be adjusted once a crisis is underway. Most interestingly, in both cases the existence of an IMF program drives this result, rather than money in terms of disbursed loans or compliance with conditionality. This suggests that the more indirect aspects of IMF programs, such as IMF advice, its function as a "seal of approval" and its ability to reduce the political costs of implementing unpopular policies might be more relevant than the amount of money the IMF places at countries' disposal or countries' compliance with IMF conditions.

Future research should concentrate on further disentangling the effects of these different channels and investigating more deeply the mechanisms by which different IMF programs affect policy outcomes. Clearly, better proxies for the different channels are needed. While we can accurately measure the amount of IMF money received, an alternative interpretation of our results regarding compliance might arguably be that the proxy employed here is too crude to lead to significant results. With this grain of salt, our finding has implications for the design of conditionality. Whether or not the IMF should impose conditions on sovereign countries has been highly debated upon from the very beginning of the IMF's operations. The empirical results of this paper have shown that compliance with conditionality does not have a statistically significant effect on currency crisis risk or the government's decision to devalue its currency. This finding complements other studies, which have shown that the Funds' conditions do not (or only marginally) affect economic policies and outcomes (Dreher, 2005, 2006). One interpretation of these results is that conditions imposed by outside factors can be circumvented, even if the officially agreed criteria have been met. In order to lend more effectively, it would therefore be most important for the IMF to detect factors influencing ownership and thus the

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Table 6. *IMF involvement and defense, 1976–2001, concessional versus unconcessional*

	(1)	(2)	(3)	(4)
IMF program, unconcessional	−1.841	−1.998		
	(1.23)	(1.47)		
Compliant, unconcessional		−0.110		
		(0.22)		
IMF loans, unconcessional		−0.068		
		(0.41)		
IMF program, concessional			−1.830**	−2.010***
			(2.01)	(2.64)
Compliant, concessional				[a]
IMF loans, concessional				−0.079
				(0.26)
Inflation ($t-1$)	−0.024**	−0.023**	−0.015	−0.015
	(2.29)	(2.31)	(1.41)	(1.37)
GDP growth ($t-1$)	2.036**	1.976**	1.263	1.197
	(2.23)	(2.26)	(1.32)	(1.29)
Exports/GDP ($t-1$)	−0.422	−0.521	−0.176	−0.231
	(0.63)	(0.86)	(0.33)	(0.47)
Reserves/M2 ($t-1$)	−0.095	−0.088	−0.252**	−0.245**
	(0.60)	(0.57)	(2.44)	(2.48)
Election, dummy ($t-1$)	0.404	0.383	0.423	0.350
	(1.15)	(1.09)	(1.44)	(1.18)
Observations	147	147	147	145
Number of countries	63	63	63	63
Method	IV Probit	IV Probit	IV Probit	IV Probit
Fixed country/time effects	No	No	No	No
Log likelihood	−92.75	−88.76	−151.96	−147.84
Prob > $\chi 2$	0.11	0.12	0.00	0.00

Notes: The dependent variable is zero if the exchange rate was devalued within the 6 months following the first months of a speculative attack, and one otherwise.
Absolute value of z-statistics is given in the parentheses.
Instruments used in all columns: voting coincidence with Germany, Italy, Japan, the United Kingdom, and the United States in the UN General Assembly.
[a] Variable shows no variation and is dropped from the regression.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

willingness to reform. Arguably, if the IMF would support reform-minded governments, its loans might make a difference (even if its advice might not) by helping governments to implement these reforms against political opposition (by acting as a scapegoat for unpopular policies) and by giving a "seal of approval" to these governments. The results also allow a different interpretation, however. According to the IMF, conditions are the outcome of a bargaining process between the government and the Fund. They might therefore reflect the government's agenda instead of being imposed by the IMF. As a consequence, compliance with conditionality does not make a difference with respect to economic policies, because the same policies would have been implemented without the Fund's conditions. Whatever be the underlying causal mechanism, conditionality would not be necessary.

In terms of policy advice, our results therefore suggest that the IMF's surveillance and technical assistance might be more important than its lending and conditionality. Placing greater emphasis on the former might thus well be worthwhile.[36] To some extent this is in line with the route recently chosen, in particular with the creation of the Flexible Credit Line in March 2009.

NOTES

1. However, some literature investigating the impact of the IMF on bond spreads exists (e.g., Mody & Saravia, 2006).

2. However, these results are not robust across all specifications.

3. As explained in some detail below, currency crisis episodes are identified based on a monthly weighted exchange market pressure index of exchange rate changes, reserve changes, and changes in the interest rate differential, following Eichengreen, Rose, and Wyplosz (1995).

4. In addition to the Fund's own resources, IMF programs might exert a catalytic effect on other financial flows. Empirical support for this hypothesis is, however, rather weak. For an excellent summary of this literature see Bird and Rowlands (2002).

5. Joyce (2003) and Vreeland (2006) summarize the recent literature on compliance with IMF conditionality.

6. Marchesi and Thomas (1999) develop a model where the adoption of an IMF program signals a country's productivity.

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7. One might argue that the first tranche of an IMF program might be sufficient to overcome the crisis, so compliance would be unnecessary. However, even the first tranche usually depends on the implementation of some prior actions.

8. Evrensel (2002) shows that budget deficits, inflation rates, and domestic credit, among others, are higher in the second inter-program period than in the first inter-program period. According to Conway (1994, 2007), participation in IMF programs is more likely the more frequently the country participated in the past.

9. This is particularly true at times of elections and with partisan governments. See Méon (2001, 2004), and Walter (2009).

10. Country selection is driven by data availability.

11. As suggested by Kaminsky, Lizondo, and Reinhart (1998), we use either the US Dollar or the Deutsche Mark/the Euro as reference currency. The US dollar is the reference currency for all countries except for the Eastern European countries. For Eastern Europe the Deutsche Mark (until 1998) and the Euro (from 1999 onwards) act as reference currencies.

12. This is the threshold most frequently used in the literature. The results are robust to using a more restrictive threshold, such as three standard deviations.

13. Some other well-known crises (such as the Russian crises 1998) are excluded from the sample because of missing data in the control variables. Since there is little consensus about how to classify the nature of individual currency crises in the literature, we do not distinguish the type of crisis a country is experiencing.

14. One would also like to control for the degree of conditionality. Dreher (2004) used the number of conditions included in the IMF program as proxy. Stone (2008) focuses on the scope of IMF conditions. However, those data are not available for a sufficient number of years and therefore cannot be used here.

15. This follows Dreher (2006, 2003), Killick (1995), among others.

16. We tried to replicate the analysis using an indicator based on the Fund's MONA data as test for robustness. However, due to missing data the number of observations is substantially reduced.

17. In their study of fiscal and monetary policies Dreher and Vaubel (2004) used a country's undrawn quota with the Fund to test for moral hazard. However, as Conway (2006) points out, this variable could equally be interpreted as a measure of the degree of implementation of IMF programs within the country. We therefore do not use this variable here.

18. Prior to 1999, the PRGF was labeled Enhanced Structural Adjustment Facility (ESAF).

19. As an alternative one could argue that the amount of IMF credit a country receives proxies the direct effect of advice and moral hazard on policies, However, since advice, moral hazard, and credit volumes are probably not proportional, the dummy variable is arguably a better measure for advice and moral hazard than the amount of IMF credit a country receives (Boockmann & Dreher, 2003; Dreher & Rupprecht, 2007).

20. Over the period of study, 548 country-years have been for at least 5 months under an IMF Stand-By Program, 182 under an EFF arrangement, 98 under an SAF-arrangement, and 307 under a PRGF program.

21. Following Leblang (2003) we include international reserves over money.

22. Vreeland (2003) provides an extensive discussion of the selection problem in the context of IMF programs. For a detailed representation of the underlying formula, see Atoyan and Conway (2006) or Goldstein and Montiel (1986).

23. With respect to the IMF and economic growth, the Heckman methodology has been employed, among others, by Przeworski and Vreeland (2000). Hardoy (2003) uses "matching" as preferred choice, while Atoyan and Conway (2006) compare results derived with the method of matching with those derived employing the IV estimator. Barro and Lee (2005), Easterly (2005), and Nsouli, Mourmouras, and Atoian (2005, chap. 9) apply an instrumental variables approach. The latter approach seems to be the most popular in estimating the impact of the IMF on economic and political variables (a selection of recent papers is Abouharb & Cingranelli, 2009; Jensen, 2004; Li, 2003; Marchesi, 2003).

24. See McKeown (forthcoming) and Reynaud and Vauday (2009) for recent discussions of geopolitical involvement in the Fund.

25. It is necessary to limit the number of instruments because the power of the Sargan–Hansen test is low when many instruments are used (see Bowsher, 2002).

26. The results are robust to using random effects Logit and Probit models.

27. We also tested whether past crises affect current crises and included the lagged dependent variable. The coefficient of the lagged dependent variable is completely insignificant while the impact of IMF programs is significant at the 1% level. When including a variable indicating the presence of currency crises in the previous 5 years, the IMF program dummy also remains significant at the 5% level, with a similar coefficient.

28. These results are robust to using dummy variables for fixed and intermediate exchange rate regimes, respectively, instead of the continuous variable. The results of these robustness checks support the notion that de jure flexible exchange rate regimes appear to be most crisis-prone.

29. Correlation of programs with compliance is 0.64; with loans it is only 0.12. Correlation between loans and compliance is 0.04, highlighting the importance of treating compliance with conditionality and the money associated with IMF programs as two separate channels. Note that the measure of compliance stays insignificant when included with the IMF program dummy, independent of whether or not the insignificant control variables are included. We also restricted the sample to middle and low income countries, respectively, as defined by the World Bank. Again, compliance is completely insignificant.

30. We also replicated the analysis focusing on the GMM regression given in column 7 in Table 1. With the exception of the 4-year horizon, where the coefficient of IMF programs remains negative, but is not significant at conventional levels, the results are very similar to those reported in Table 2. These results are available on request.

31. These results are available from the authors upon request.

32. Note that these results hold when we treat the months of defense as a count variable and estimation is with Negative Binomial Regression instead.

33. Italy's latest Stand-By-Arrangement, for example, ended in 1978; the United Kingdom had an arrangement in effect over the years 1977–79.

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34. Note that the proxy for compliance with concessional programs is dropped from the estimates reported in column 4. The reason is that in the 34 concessional programs in this estimation sample, compliance is coded "zero" in all of them, so there is no variation in this variable.

35. We also separated IMF programs in those programs that were concluded before the onset of the crisis and those that started after the emergence of the crisis. Both coefficients are not significant at conventional levels.

36. See Fratzscher and Reynaud (2007) for an interesting discussion for the politics involved in IMF surveillance. See Meltzer (2006) and Krueger (2006) for a broader discussion of how to reform the IMF.

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APPENDIX A. DEFINITIONS AND DATA SOURCES

Dependent variables

Currency crisis dummy (Crisis = 1)
Currency crisis episodes are identified based on a monthly weighted exchange market pressure index of exchange rate changes, reserve changes, and changes in the interest rate differential (Eichengreen *et al.*, 1995). When at least one speculative attack occurred in a given year, the variable is coded as 1. The data were aggregated from a monthly to a yearly level.
Source: Sattler and Walter (2008)

Crisis outcome dummy (Defense = 1)
Dummy variable that is coded as 1 if the exchange rate (IFS line rf) was devalued within 6 months following the month of the first speculative attack. The devaluation criterion is based on the pre-attack type of a country's *de facto* exchange rate regime
Devaluation criteria according to Sattler and Walter (2008), based on the *de facto* exchange rate regime type (Reinhard & Rogoff, 2004):

	Coded as devaluation if...	
	...monthly depreciation exceeds	...overall depreciation exceeds
Preannounced peg (RR 2)	1%	1%
Preannounced horizontal band (RR 3)	2%	2%
De facto peg (RR 4)	2%	2%
Preannounced crawling peg (RR 5)	2.5%	5%
Preannounced crawling band (RR 6)	2.5%	5%
De facto crawling peg (RR 7)	4%	8%
De facto crawling band (RR 8)	4%	8%
Preannounced crawling band (5%) (RR 9)	5%	10%
De facto crawling band (5%) (RR 10)	5%	10%
Noncrawling band (2%) (RR 11)	5%	10%
Managed float (RR 12)	10%	20%
Free float (RR 13)	20%	25%
Freely falling (RR 14)	25%	25%

IMF variables

IMF program dummy
Coded as 1 if the country had an IMF Program (SBA, EFF, PRGF, or SAF) for at least 5 months in a certain year
Source: IMF Annual Reports, various years

Compliance dummy (1 = compliance)
Coded as 1 if the country was compliant with its IMF program. Non-compliance is recorded if more than 25% of the amount agreed for an IMF program remains undrawn at program termination (as suggested by Killick (1995))
Source: IMF (2006)

IMF loans
Sum of net financial flows for all IMF programs (in percent of GDP)
Source: World Bank (2006)

Control variables

Interest rate differential
Difference between domestic interest rate ((short-term) money market rates (IFS line 60b) as the first choice and discount rates (IFS line 60) as the second choice if money market rates are not available) and domestic interest rate in reference country

Level of foreign reserves
Foreign reserves (IFS line 1ld) divided by M2 in current US dollars (IFS line 35 divided by IFS line rf)

Export share
Exports (IFS line 78a) divided by GDP in current US dollars (IFS line 99B)

De jure exchange rate regime
De jure exchange rate classification from Ghosh, Anne-Marie, & Holger (2003), where 1 = dollarized and 15 = float with no intervention

Inflation
% Change in the consumer price index (IFS line 64)

Current account deficit
Current account balance in US dollars (IFS line 78A) divided by GDP in current US dollars (IFS line 99B)

Domestic credit/M2
Domestic credit (IFS line 32) relative to Quasi-Money (M2) (IFS line 35)

Budget deficit
Budget deficit (IFS line 80) divided by GDP (IFS line 99B)

***Per capita* GDP**
GDP (IFS line 99B) divided by population (IFS line 99Z)

Election dummy
Dummy variable, which takes the value of 1 if an election took place. Elections are defined as legislative elections and additional presidential elections in presidential systems
Source: Beck, Clarke, Groff, Keefer, & Walsh (2001)

GDP growth
GDP change with respect to previous year (IFS line 99B)

Export growth
Export/GDP change with respect to previous year (IFS line 78A)

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APPENDIX B. DESCRIPTIVE STATISTICS (ESTIMATION SAMPLE, TABLE 1, COLUMN 5)

Variable	Mean	Std. dev.	Min	Max
Currency crisis, dummy	0.17	0.38	0.00	1.00
IMF program, dummy	0.47	0.50	0.00	1.00
Compliant with IMF program, dummy	0.26	0.44	0.00	1.00
IMF loans (percent of GDP)	0.03	1.04	−6.19	8.71
Interest rate differential ($t-1$)	6.92	17.61	−10.70	301.91
Exports/GDP ($t-1$)	0.31	0.27	0.02	1.66
Exchange rate regime ($t-1$)	7.44	4.17	2.00	15.00
Capital account openness	−0.15	1.31	−1.71	2.68
Inflation ($t-1$)	11.53	19.89	−8.43	304.69
Current account/GDP (I − 1)	−0.02	0.09	−0.45	0.54
Domestic credit/M2 ($t-1$)	2.68	4.22	−4.40	42.95
Budget deficit/GDP ($t-1$)	−0.02	0.06	−0.27	0.39
(log) GDP p.c. ($t-1$)	7.25	1.44	4.69	10.52
Devaluation, dummy	0.04	0.20	0.00	1.00
Inflation ($t-1$)	11.53	19.89	−8.43	304.69
GDP growth ($t-1$)	0.16	0.20	−0.34	2.72
Reserves/M2 ($t-1$)	0.94	1.54	0.00	14.74
Election, dummy ($t-1$)	0.17	0.38	0.00	1.00
Voting in line with the United States	0.20	0.11	0.00	0.80
Voting in line with France	0.44	0.13	0.00	0.87
Voting in line with Germany	0.49	0.16	0.00	0.99
Voting in line with Japan	0.54	0.13	0.00	0.94
Voting in line with the United Kingdom	0.41	0.14	0.00	0.90

APPENDIX C. CRISIS EPISODES IDENTIFIED IN THE ANALYSIS

Argentina	1989	Colombia	1997	Guatemala	1986
Belarus	1999	Colombia	1999	Guatemala	1990
Belarus	2000	Republic of Congo	1994	Honduras	1990
Bolivia	1984	Costa Rica	1978	Honduras	1993
Bolivia	1985	Costa Rica	1981	Hungary	1993
Botswana	1980	Costa Rica	1991	Hungary	1995
Botswana	1981	Cyprus	1982	Indonesia	1997
Botswana	1985	Cyprus	1987	Israel	1983
Botswana	1986	Cyprus	1992	Israel	1985
Botswana	1991	Cyprus	1995	Kenya	1993
Botswana	1992	Czech Republic	1997	Kenya	1995
Botswana	1998	Denmark	1976	Kenya	1997
Brazil	1994	Denmark	1982	Korea	1980
Bulgaria	1996	Denmark	1993	Korea	1997
Burkina Faso	1980	El Salvador	1986	Kuwait	1981
Burundi	1997	El Salvador	1990	Kuwait	1986
Burundi	2000	El Salvador	2000	Kuwait	1988
Cameroon	1980	Estonia	1997	Kuwait	1993
Cameroon	1981	Finland	1991	Kyrgyz Republic	1998
Cameroon	1994	Georgia	1998	Lesotho	1981
Chad	1994	Ghana	1981	Lesotho	1985
Chile	1984	Ghana	1983	Lesotho	1988
PR China	1993	Ghana	1990	Lesotho	1989
Colombia	1985	Guatemala	1981	Lesotho	1998
Lesotho	2001	Nigeria	1999	Swaziland	1998
Madagascar	1994	Norway	1978	Swaziland	2001
Malaysia	1980	Norway	1982	Sweden	1981
Malaysia	1981	Norway	1986	Thailand	1985
Malaysia	1984	Norway	1992	Thailand	1997
Malaysia	1986	Norway	1998	Togo	1980
Malaysia	1997	Pakistan	1993	Togo	1981

(*continued on next page*)

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APPENDIX C (*continued*)

Mali	1994	Pakistan	1995	Togo	1994
Mauritius	1979	Pakistan	1998	Tunisia	1986
Mauritius	1981	Pakistan	2000	Tunisia	1991
Mauritius	1997	Paraguay	1992	Turkey	1994
Moldova	1998	Peru	1990	Turkey	2001
Morocco	1981	Philippines	1983	Uganda	1986
Morocco	1983	Philippines	1986	Uganda	1988
Myanmar	1980	Philippines	1990	Uruguay	1982
Myanmar	1981	Philippines	1997	Uruguay	1984
Myanmar	1990	Philippines	1998	Uruguay	1989
Nepal	1980	Romania	1997	Uruguay	1992
Nepal	1981	Saudi Arabia	1994	Venezuela, Rep. Bol.	1984
Nepal	1984	Singapore	1997	Venezuela, Rep. Bol.	1986
Nepal	1991	Slovak Republic	1998	Venezuela, Rep. Bol.	1989
Nigeria	1980	Sri Lanka	1977	Venezuela, Rep. Bol.	1990
Nigeria	1986	Swaziland	1980	Venezuela, Rep. Bol.	1994
Nigeria	1992	Swaziland	1981	Zambia	1989
Nigeria	1993	Swaziland	1985	Zimbabwe	1991

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