

National exchange rate policies and international debt crises: how Brazil did not follow Argentina into a default in 2001–2002

BRYAN ANDREW KENYON JOHNSON*

This paper examines how exchange rate policies and IMF Stand-By Arrangements affect debt crises using econometrics and a comparison between Argentina and Brazil. It refines an existing diagram outlining crisis development to propose crisis prevention strategies. Flexible exchange rate policies reduce a country's probability of default by over 4%, but Stand-By Arrangements increase it by an inconsequential percentage. Unlike Argentina, Brazil avoided a default via a freely-floating exchange rate system, fiscal deficit reduction, and a cooperative and coordinated relationship with the IMF. The results provide policymakers from developing countries with lessons to manage their countries' default risks more effectively.

Key-words: exchange rate policies, IMF Stand-By Arrangements, probability of default

JEL classification: B23, C12, C23, E44, E61, F34.

INTRODUCTION

Recent financial crises in developing countries have highlighted unsuitable exchange rate policies and unsustainable debt levels. Currency crashes have preceded as well as followed debt crises, which leads one to ask the following questions: Is there a link between these two events? What variables signal currency crises and debt defaults? These types of questions point to an inquiry worthy of study: Why can some countries prevent debt crises while others cannot?

This study reviews the literature on exchange rate policy and debt defaults,

* Analyst of HSBC Bank plc, 8 Canada Square, London. E-mail: bryan.a.johnson@gmail.com. Submitted: August, 2005; Accepted: March, 2006.

and it points to mixed results regarding a causal relationship between the two variables. Edwards (1984) considers exchange rate devaluation as one of many determinants of bond spreads.¹ Calvo (1998) and Arrelano (2003) point to real exchange rate appreciation as a cause for high interest rates and a sudden stop in capital flows in Argentina.² On the other hand, Blanchard (2004) develops a model showing how an increase in Brazil's probability of default increased the rate of currency devaluation.³ Reinhart (2002) identifies a link between the two events for a panel of countries, but her results do not support a causal relationship.⁴ What these mixed results unveil is the issue of reverse causality between exchange rate policy and debt defaults. Some contributions have identified this problem, namely Dreher et al. (2005) and Herz and Tong (2003).⁵

This study examines the link between exchange rate policy and the *probability* of default following the models developed by Jahjah and Montiel (2003) and Jahjah and Yue (2004).⁶ This link should be examined closely, given the mismatch between the local currency denomination of a government's revenues and the hard-currency denomination of that government's principal and interest payments on its foreign-currency denominated debt issues. If this mismatch is considerably large, then a particular exchange rate system may be unsuitable because it will make principal and interest payments unsustainable at certain debt levels. In other words, some exchange rate regimes may make a country more prone to enter a debt crisis. Therefore, this mismatch compels one to re-evaluate the suitability of countries' exchange rate policies and the sustainability of their debt levels. From Bangkok to Buenos Aires and from Mexico City to Moscow, currency crashes and debt crises between 1994 and 2002 led experts to reconsider how developing countries manage their default risk. Two countries stand out in these reconsiderations: Argentina and Brazil.

Argentina and Brazil are emblematic cases of the aforementioned inquiry because of the belief that the 2001 Argentine debt crisis would spread to Brazil in 2002. In December 2001, Argentina declared a partial default on its external debt⁷ that amounted to US\$81.8 billion in unpaid principal and interest.⁸ Beginning in April 2002, the *real's* steady devaluation led to speculation regarding Brazil's ability to service principal and interest payments that amounted to approximately 100 billion *reals* (or US\$36 billion).⁹ While Brazilian sovereign spreads in 2001

¹ Edwards (1984).

² Jahjah and Zhanwei Yue (2004: 3-4). Also see Arrelano (2003) and Calvo (1998).

³ Blanchard (2004).

⁴ Reinhart (2002).

⁵ See Dreher, Herz, and Karb (2005) and Herz, and Tong (2003).

⁶ See Jahjah and Yue (2004) and Jahjah and (2003).

⁷ Takagi et al. (2004).

⁸ Nucci (2005).

⁹ *The Economist* (2002).

were lower than those in Argentina, these spreads began to increase at a similar rate in early 2002.¹⁰ By mid 2002, investors feared that a Brazilian default would trigger a new international financial crisis. One question naturally followed from this fear: Would Brazil be next?

Yet Brazil was not next. Brazil did not default. This mismatch between credible expectations and surprising realizations leads one to refine the original inquiry of how countries prevent debt crises, and ask: How did Brazil prevent a debt crisis like that of Argentina? This study finds that several factors made Brazil fundamentally different from Argentina. The combination and coordination of exchange rate, fiscal, and monetary policies with IMF recommendations prevented a crisis from developing in Brazil.

This paper will use the comparison between Argentina and Brazil to extract lessons for other developing countries that aim to reduce their default risk. This paper is organized as follows: Section II presents my hypothesis and diagram for financial crisis development and prevention in emerging markets. Section III reviews terminology. Section IV covers a regression on a panel of developing countries. Section V considers how the regression results apply to Argentina and Brazil. Section VI concludes and discusses policy implications.

ANALYTICAL FRAMEWORK

This section presents a framework to structure the investigation of how Brazil prevented a crisis like that of Argentina.

Hypothesis

The hypotheses in this study identify variables that can explain how Brazil avoided a debt crisis in 2002. Following Jahjah and Montiel (2003) and Jahjah and Yue (2004), this study will consider a country's exchange rate policy. Media coverage of the Argentine crisis in 2001 and the impending Brazilian crisis in 2002 also points to IMF Stand-By Arrangements as a source of stabilization for exchange rates and bond spreads. Therefore, this study will test two hypotheses:

Primary Hypothesis: Flexible exchange rate policies reduce the probability of default; and

Secondary Hypothesis: IMF Stand-By Arrangements reduce the probability of default.

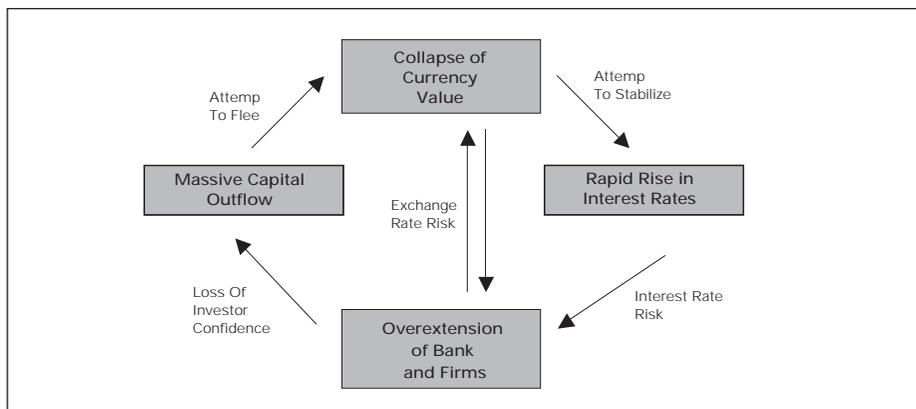
This study does not consider the impact of these two independent variables in a vacuum. It also considers how these variables can be coordinated with fiscal and monetary policies, in order to produce different equilibrium outcomes.

¹⁰ See Takagi et al. p. 13, and *The IMF and recent capital account crises: Indonesia, Korea, Brazil* (2003) Washington, DC: International Monetary Fund, p. 129.

Diagram

The diagram in this section outlines how the independent variables can reduce the probability of default. It offers a prediction of how Brazil's case differed from that of Argentina. The diagram is based on Figure 1, which describes how financial crises develop in emerging markets.¹¹

Figure 1: Anatomy of a modern emerging financial market (EFM) crisis



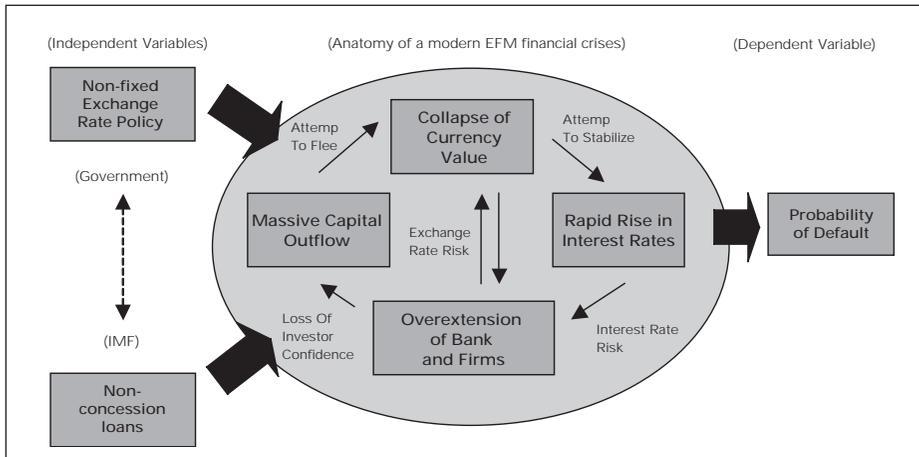
Source: *Emerging Financial Markets*, p. 294.

In this illustration, the authors portray a financial crisis as a vicious cycle. Any of the four variables can trigger the crisis. As the crisis develops, each variable contributes indefinitely to that vicious cycle. Three delimitations stand out in this illustration: (1) no method to distinguish between financial markets in pre, during, and post-crisis periods; (2) no unit of measurement to determine if the crisis has begun, how severe it is, or when it will end; and most importantly (3) the absence of any variables that could break that vicious cycle, which implies that a crisis cannot be stopped.

The main contribution of this section's diagram is the inclusion of exogenous variables that predict how Brazil's equilibrium outcome differed from that in Argentina. Figure 1.1 presents this diagram, which is an extension of Figure 1.

¹¹ Beim and Calomiris (2001).

Figure 1.1: Crisis prevention in EFM



Source: Diagram inside the oval comes from *Emerging Financial Markets*. All other material my refinement of the model.

This diagram offers additional contributions for this study that the original illustration could not. First, it predicts that crises can be stopped by exogenous variables that break the vicious cycle of crisis development. Second, it allows one to consider the coordinative effort of different policy instruments. For example, the impact of flexible exchange rate policies on interest rate levels would consider the role of monetary policy in crisis prevention.

This diagram also addresses some of the delimitations in the original illustration. It does not resolve the first delimitation of identifying a crisis period. Since the purpose of this diagram is to outline a strategy for crisis prevention and not describe crisis development, it is assumed that a country is in a pre-crisis period. However, this diagram does address the second and third delimitations in the original illustration. The dependent variable provides a measurement of the likelihood of a crisis occurring. The independent variables illustrate how that likelihood can be reduced. Each independent variable can affect the crisis development process at any of the four original variables. Changes in the dependent variable indicate whether or not the independent variables were successful at preventing the crisis.

This diagram provides a setup to test the hypotheses quantitatively and qualitatively. For the econometric regression, “non-fixed exchange rate policy” replaces “flexible exchange rate policy” and “non-concession loan” replaces “Stand-By Arrangements.” Flexible exchange rate policy and Stand-By Arrangements are examples of the set of non-fixed exchange rate policies and non-concession loans that different countries can adopt. The variables in the diagram temporarily replace the variables in the original formulation of the hypotheses because it is simpler to apply these sets to the panel of developing countries. If these sets are statistically significant in the regression, which covers

several debt crises, then it will be logical to test the hypotheses in their original formulation in a comparative study of the 2001 Argentine debt crisis and the impending Brazilian crisis in 2002.

One limitation in this diagram is its emphasis on variables instead of actors. This diagram identifies, but does not capture, the role of and relationship between actors at the national and international levels of analysis. The government and IMF are mentioned because only they hold control over the independent variables being tested, whereas many actors can affect the other variables in the diagram. These actors can use flexible exchange rate policies and Stand-By Arrangements as tools for crisis prevention. Their decisions are inherently independent, but it is necessary that they be coordinated to intervene in the economy to reduce the probability of default. The subtlety of independent, but coordinated, actions between actors at the national and international levels of analysis is explored in the comparison of Argentina and Brazil.

TERMINOLOGY

The literature that was reviewed for this study is not uniform in its treatment of debt crises. It presents competing and imprecise definitions for certain terms, and several studies do not categorize the important variables in a consistent manner. This section reviews the terminology, in order to test the hypotheses without ambiguity and to distinguish this study's results from those of previous contributions in the literature.

Definitions

The variables are defined with specific parameters and quantitative measures that remove any ambiguity. A debt crisis event is best defined by Standard and Poor's, which classifies a country as being in default when that country's debt instruments receive a D credit rating.¹² This definition applies to all of a country's debt instruments from local-currency and foreign-currency denominated bonds to loans from multilateral institutions. Non-concession loans are a type of loan instrument used by the IMF to lend capital to countries experiencing balance of payment problems.¹³ A Stand-By Arrangement is a type of non-concession loan designed to address short-term balance of payment problems.¹⁴ Frankel and Rose (1996) define a currency crash as a nominal depreciation of at least 25% that is also at least a 10% increase in the rate of depreciation.¹⁵

¹² Standard and Poor's (2002).

¹³ "IMF Lending" (2005) Available at www.imf.org/external/np/exr/facts/howlend.htm, p. 1.

¹⁴ "IMF Lending" (2005: 2).

¹⁵ Frankel and Rose (1996).

This study uses an interaction term as a proxy for exchange rate policy because the latter encompasses not only the exchange rate system, but also the currency level. Both exchange rate misalignment and exchange rate system capture these two dimensions of exchange rate policy. If a currency devalues, a country must have more local currency to make its hard-currency denominated payments. However, what determines if the stock of local currency is able to make those payments is not only the degree to which that currency is misaligned, but also the exchange rate system that dictates the extent to which that currency is permitted to devalue. Exchange rate misalignment measures the degree to which the official exchange rate is not consistent with the real exchange rate. The exchange rate regime tells one if a currency's exchange rate is fixed. While there are more exchange rate systems than a purely fixed or floating,¹⁶ this variable tests for a general effect of a non-fixed exchange rate policy on the probability of default.

Dependent and Independent Variables

The calculation and encoding of the variables is discussed separately from their definitions. Debt crisis is a binary dependent variable, in accordance to several papers that have used probit and logit regressions to develop early warning systems for crises.¹⁷ It is equal to 1, if there is a crisis. It is equal to 0, if otherwise. The variable for net financial flows of IMF nonconcessional loans replaces the Stand-By Arrangement variable in the regression. It is calculated as the total U.S. dollar disbursements of loans and credits less repayments on principal.¹⁸

The calculations for exchange rate policy are simply those for the proxy variables. Exchange rate misalignment is a continuous variable that is calculated as the percentage deviation of the official exchange rate from a three-year moving average of that exchange rate.¹⁹ The exchange rate system is a binary variable, which was encoded according to the exchange rate classification in Reinhart and Rogoff (2002).²⁰ If the exchange rate system is fixed through a pre-announced peg, no separate legal tender, or a currency board, it is equal to 1. It is equal to 0, if otherwise.

Control Variables

This study also incorporates other variables that are tested in the literature as control variables. Given that there are many control variables, this study

¹⁶ Jahjah and Yue (2004: 6).

¹⁷ For the use of probit models, see Frankel and Rose (1996) and Detragiache and Spilimbergo (2001). For the use of the logit model, see Manasse, Roubini, and Schimmelfennig (2003).

¹⁸ WDI Online. World Bank.

¹⁹ Manasse and Schimmelfennig (2003: 6).

²⁰ Reinhart and Rogoff (2002).

categorizes them so as to steer the analysis towards which sets of variables are most significant at reducing the probability of default. The following categories are drawn from the work of Manasse, Roubini, and Schimmelpfennig (2003) and Frankel and Rose (1996):

- Foreign variables — an indicator for the global financial environment.
- Macroeconomic variables — a focus on a country's financial environment.
- Debt composition variables — an indicator of the currency denomination and type of debt issues.
- Solvency variables — a measure of debt levels.
- Liquidity variables — a focus on the ability to service principal and interest payments.

Instead of a myopic approach on the effect of individual variables, these categories help identify the impact of different sets of variables on the probability of default. This type of diagnosis will be more helpful for policymakers in developing countries to draft policies that will resolve balance of payments and other structural deficiencies in their domestic markets.

QUANTITATIVE TEST — WHAT DO THE DATA SAY ABOUT DEVELOPING COUNTRIES?

This econometric regression tests for the effect of different variables on the probability of default for a panel of countries. Since annual data collected for Argentina and Brazil would only span 32 years, it was not possible to perform a separate regression for Brazil and Argentina because an estimation on 32 data points per variable would not yield any results. Therefore, the acceptance or rejection of this study's hypotheses at this quantitative level is indispensable. It will form a base to compare Argentina and Brazil qualitatively, and show how the situations of those two countries in 2001 — 2002 are examples of the broader range of cases across developing countries.

Data

The data set used for the regression is a panel of 40 developing countries between 1970 and 2002. Table 1 in Appendix A shows the list of countries used in this study. The data was collected on an annual basis from the IMF's International Financial Statistics and the World Bank's World Development Indicators and Global Development Finance databases. In addition to the dependent variable, there are a total of 18 independent and control variables.

Econometric Regression

This study uses a logit regression because the dependent variable is binary. This in line with Manasse et al. (2003), who conclude that this non-linear

estimation method is the most appropriate when the data contains an uneven distribution of the two possible values for the binary dependent variable. The regression used for this study is presented below in matrix form:

(1) Logit: $\Pr(\text{Crisis} = 1) = \lambda(\beta_0 + \beta_1 \text{Nonconcession loans} + \beta_2 \text{Exchange rate system} + \beta_3 \text{Exchange rate misalignment} + \beta_4 \text{Interaction term} + \beta_x \text{Control variables} + u_i)$

Results

The results support the primary hypothesis that flexible exchange rate policies reduce the probability of default. Table 2 in Appendix B shows the estimation outputs, and confirms statistically significant results for the interaction term. The interaction term indicates that a highly misaligned currency under a fixed exchange rate system increases the probability of default by 4.27%.

A closer interpretation of the interaction term reveals how this result supports the primary hypothesis. This interaction term states that the impact of exchange rate policy on the probability of default is dependent on the effect of the exchange rate system and a certain level of misalignment. In other words,

(5) if $Y = \beta_1 \text{Exchange Rate System} + \beta_2 \text{Exchange Rate Misalignment} + \beta_3 (\text{Exchange Rate System} * \text{Exchange Rate Misalignment})$

(6) then $dY/d \text{Exchange Rate System} = \beta_1 + \beta_3 \text{Exchange Rate Misalignment}$.

These equations are linear, but the intuition behind the derivative holds for non-linear estimations as well. The impact of exchange rate policy depends on the coefficients of the exchange rate system and the interaction term as well as the level of exchange rate misalignment. Table 2 shows that the coefficients for the exchange rate system variable and the interaction term are statistically significant, and that the coefficient for exchange rate system is negative, while the coefficient for the interaction term is positive. This means that the derivative can be positive or negative, depending on the value of the exchange rate misalignment variable. When the derivative is positive, a fixed exchange rate system increases the probability of default. When it is negative, it reduces the probability of default.

This interpretation supports the primary hypothesis because governments can choose to switch their exchange rate system when their currency is highly misaligned. If the derivative is positive for a given level of misalignment, the probability of default increases. If that level of misalignment is held constant, then the government can reduce that probability by switching to a non-fixed exchange rate system. When this switch occurs, the exchange rate system variable and the interaction term in the regression are equal to 0, so the coefficients cannot affect the probability of default. Consequently, one can conclude that for certain levels of misalignment, a switch from a fixed to non-fixed exchange rate system reduces the probability of default by 4.27%.

This interaction term captures a subtle, but important, implication about the government's choice of its exchange rate system. While crises like that of Argentina

emphasize the negative effects of a fixed exchange rate system, these results offer a more balanced view of how this type of exchange rate regime affects the dependent variable. One must consider the degree of exchange rate misalignment before concluding that a fixed exchange rate system will increase or decrease the probability of default.

One cannot accept or reject the secondary hypothesis because the results point to reverse causality. Both estimation methods yield statistically significant positive coefficients for nonconcession loans. While the coefficients are practically 0, this relationship suggests that an increase in nonconcession loans will increase the probability of default. This relationship implies, however, that a country's probability of default is only reduced by fixing its structural deficiencies, not temporarily alleviating them through these types of loans. This implication is investigated further in the comparison between Argentina and Brazil.

Table 2 also shows that the control variables have the expected impact on the probability of default. The regressions included the debt crisis variable as a variable lagged one year, in order to test if a country's previous crisis would affect its probability of default. This lagged variable was statistically significant and showed an increase in the dependent variable. Foreign variables like the U.S. T-Bill rate were not statistically significant, but all other categories had statistically significant variables. Macroeconomic indicators like increases in the inflation, solvency variables like total debt to gross national income, and currency composition indicators like the amount of external debt issued in U.S. dollars all increased the probability of default. Liquidity variables like increases in reserves relative to total debt and debt services relative to exports decreased that probability. The regression revealed two counter-intuitive results; an increase in the current account and government balances increased the probability of default. Different estimations with the inclusion or removal of variables did not change the sign of those coefficients.

Sensitivity Analysis

The regression results support the primary hypothesis, but an important limitation of the misalignment term must be acknowledged. This variable is flawed because it uses official exchange rates, not real exchange rates, to calculate the degree of a currency's misalignment. The use of official exchange rates does not produce reliable results for countries that maintained fixed exchange rate systems for over 3 years. In these cases, the misalignment variable is equal to 0%, and it implies that the exchange rate perfectly reflects the currency's true value. This variable is more appropriate for countries with flexible exchange rate policies, in which variations of the official exchange rate provide some indication of over — or undervaluation. Data on real exchange rates was not available for all countries in the sample, and this method had the least shortcomings.

Another criticism towards the estimation method is the question of reverse causality. While the primary hypothesis supports the idea that a currency crisis

may lead to a debt crisis, the reverse may also be true. This alternate relationship has already been posited by Blanchard (2004), and Dreher et al. (2005), and Herz and Tong (2003) have also considered this reverse causality in greater depth. One possibility would be to re-estimate the model according to the two-equation simultaneous equation model developed by Amemiya (1978). He proposes an estimation using two dependent variables in which one is observed in full, while the other is only observed to the extent that it is positive.²¹ This estimation method could not be used for this data set because both dependent variables would always be fully observed, as they are binary and positive. While a currency crisis variable is not used, it would take values of 0 and 1 only like the debt crisis variable, so that the results could indicate the probabilities of either debt or currency crises occurring. As a result, these two dependent variables would not fall under the rubric set out by Amemiya (1978), and the alternate results could be deceptive.

This study did not consider certain political variables, namely a dummy variable for electoral cycles. This was not included in this quantitative section because there was a concern that poor data could skew the results. The data set for this study includes countries that are not democracies in which presidential elections do not take place, as well as countries where presidential election results are often criticized as being fraudulent. One could argue that these factors subject these countries to a different form of political risk and reputational risk, when it comes to honoring debt obligations. Therefore, it would be misleading to use this type of data together with that of Argentine and Brazilian presidential elections to arrive at a meaningful result.

Nevertheless, this type of dummy variable is certainly important in the case of Argentina and Brazil. The latter did indeed have a historical presidential election with the first-time victory of the left-wing presidential candidate Mr. Luiz Inácio Lula da Silva. Argentina, albeit not having presidential elections, did have important provincial elections that affected the country's spending and debt issuance patterns. These specific factors are considered in the qualitative analysis of this paper.

The results from this study are consistent with the findings of other contributions in the literature. Detragiache and Spilimbergo (2001) and Manasse et al. (2003) show that liquidity variables like the growth in reserves reduce the probability of default.²² In addition to a lagged crisis indicator with a positive coefficient, Manasse et al. (2003) use a dummy rather than a continuous variable for inflation as a macroeconomic indicator, and find a positive correlation with the probability of default.²³ This study's results also show a higher McFadden R^2 term than some in the literature. The McFadden R^2 of 0.45 in the probit regression

²¹ Amemiya (1978).

²² Detragiache and Spilimbergo (2001: 20).

²³ Manasse and Schimmelfennig (2003: 22).

exceeds that of 0.20 in Frankel and Rose (1996) and those of Detragiache and Spilimbergo (2001) that range between 0.14 and 0.16.²⁴ However, the McFadden R^2 of 0.45 in the logit regression does not exceed that of 0.66 in Manasse et al (2003).²⁵

These results support some of the predictions from Figure 1.1. The primary hypothesis is accepted for certain levels of exchange rate misalignment, which implies that abandoning a currency board or a fixed peg is a suitable exchange rate policy under certain circumstances. The secondary hypothesis is not accepted or rejected, but the results challenge previous assumptions about the role of the IMF in financial crises. These results are considered next in the context of Argentina and Brazil.

QUALITATIVE TEST – A COMPARISON BETWEEN ARGENTINA AND BRAZIL

This section examines how the different exchange rate policies in Argentina and Brazil affected the cycle of crisis development outlined in Figure 1.1. It also discusses the different effects of IMF Stand-By Arrangements in each country.

Primary Hypothesis — Flexible exchange rate policies reduce the probability of default

A country's exchange rate policy can affect the probability of default because of its link to that country's fiscal and monetary policies. Exchange rate, fiscal, and monetary policies are instruments that governments can use to maintain principal and interest payments on debt. These policy instruments are independent of each other; however, they can be coordinated to produce different equilibrium outcomes. The choice of exchange rate policy can determine which fiscal and monetary policy instruments are available to the government.

Exchange rate policies and fiscal and monetary policies

Exchange rate policy can affect fiscal policy indirectly through changes in the value of a local-currency denominated fiscal surplus or deficit relative to the hard-currency denominated principal and interest payments. A depreciation in a currency's exchange rate has two effects: (1) it increases real output, which increases government tax and other revenues; and (2) it reduces the foreign

²⁴ Detragiache and Spilimbergo (2001: 20), and Frankel and Rose (1996: 361).

²⁵ Manasse, Roubini, and Schimmelpennig (2003: 22).

²⁶ Jahjah and Montiel (2003: 12).

currency value of a country's primary surplus.²⁶ Therefore, the degree of a currency's misalignment affects the level of government revenues and the value of the primary surplus. The exchange rate system determines the extent to which misalignment can contribute to these changes.

Exchange rate policy exerts a more direct effect on monetary policy. A depreciation in the currency leads to an increase in interest rates, so as to reflect greater demand for local currency. A government will borrow from its local economy, in order to have enough local currency to service principal and interest payments. The direct relationship between exchange rate depreciation and interest rates increases implies that highly depreciated currencies correspond to more stringent monetary policies.

Fixed and flexible exchange rate policies therefore have different effects on fiscal and monetary policies. A fixed exchange rate system like Argentina's currency board will not affect the value of government revenues, nor will it reduce the value of a primary surplus. Fixed exchange rate systems do eliminate autonomy regarding monetary policy. A country's central bank must follow the monetary policy of the country to which its currency is fixed. Moreover, this exchange rate regime can lead to appreciated currencies, and such misaligned exchange rates lead to high premiums in external borrowing.²⁷

Flexible exchange rate systems provide greater maneuverability for a country's fiscal and monetary policies. Depreciations may lead to fluctuations in the foreign-currency value of a government's primary surplus, while generating increases in government revenues via real output growth. This system is more volatile, and it is common to see short-term speculation with over-and under-shooting of the actual value of the exchange rate, as the market self-adjusts. Despite short-run volatility, flexible exchange rates prevent currencies from being the targets of speculative attacks. Flexible exchange rate policies grant countries' central banks more autonomy regarding monetary policy. The positive correlation between exchange rates and interest rates holds so long as the country's central bank does not artificially set the interest rate at an alternate level, in order to pursue another objective.

Empirical evidence in Argentina and Brazil

The increase in Brazil's default risk after Argentina's default resulted from investors' adverse reactions to economic indicators suggesting that Brazil was in a similar macroeconomic situation to Argentina. The ratio of external debt to GDP increased progressively in both countries since 1995.²⁸ While the peso's devaluation occurred after the default, many investors believed that the real's devaluation in early 2002 signaled a higher probability of default.

²⁷ If the primary surplus is small and there is a high degree of misalignment, then the cost of external borrowing is higher than otherwise. See Jahjah and Montiel (2003: 19).

²⁸ WDI Online. World Bank.

However, Argentina and Brazil differed remarkably according to other indicators. First, Brazil was less indebted than Argentina with its external debt level at 44.5% of GDP compared to Argentina's at 50.8%.²⁹ Second, Argentina's currency board placed more constraints on its monetary policy than Brazil's freely-floating rate. Third, Brazilian laws and financial institutions were more effective at reducing fiscal deficits and generating fiscal surpluses. These indicators suggest that the Argentine crisis would not spread to Brazil through severe structural deficiencies in the Brazilian economy, but rather would ensue from herd behavior and panic by investors.

The coordination, or lack thereof, between exchange rate, fiscal, and monetary policies in Argentina and Brazil allows one to predict the effect of exchange rate policy on the probability of default in these countries. Based on the regression results from the previous section and the appraisal above, one can expect that Argentina's currency board increased the probability of default and that Brazil's gradual transition to a flexible exchange rate system reduced that probability.

An overvalued exchange rate under a currency board and a weak fiscal policy increased the probability of default in Argentina. Argentina's maintenance of its currency board throughout the 90's led to a highly misaligned and overvalued peso, whose real exchange rate index exceeded 170 in 2001.³⁰ Argentina also exercised little fiscal discipline, as provincial governors were allowed to increase spending in their provinces without carrying much of the tax collection cost.³¹ These factors combined with a high premium for external borrowing under the currency board led many experts to predict Argentina's debt crisis.

Once Argentina defaulted in December 2001, these factors led to an emblematic case of an emerging financial market crisis as outlined in Figure 1. The collapse of the currency board in January 2002 led to a rapid devaluation of the peso by 40% in the first month followed by a 39.40% devaluation between February and March.³² This currency crash sparked a sharp rise in interest rates with deposit and money market rates rising from 5.53% and 39.02% in January to 45.99% and 91.19% in April, respectively.³³ Consequently, banks and firms were overextended, as evidenced by the increase in domestic credit from 130.3 to 200.3 million pesos between January and June.³⁴ Net claims on the central government followed the same pattern, increasing from 66.1 to 134.9 million pesos in the same time period.³⁵ This contributed to the depletion of reserves that

²⁹ International Financial Statistics. International Monetary Fund.

³⁰ Takagi et al. (2004: 19).

³¹ *Idem.*; *Ibidem.* (2004: 82).

³² International Financial Statistics.

³³ *Ibidem.*

³⁴ *Ibidem.*

³⁵ *Ibidem.*

began as early as January 2001 from 13.7 billion dollars in January 2002 to as low as 9 billion dollars in July 2002.³⁶

The case of Brazil differed because a flexible exchange rate policy and greater fiscal discipline decreased the probability of default as predicted in Figure 1.1. Brazil's real effective exchange rate was not overvalued.³⁷ There was greater investor confidence because Brazil maintained an overall primary balance of 3.7% and 3.9% in 2001 and 2002.³⁸ Yet investors still feared that the real's devaluation could lead to a default.

The different circumstances in Brazil prevented this fear from becoming a reality. There was never a currency crash in 2001–2002 because the devaluation rate never exceeded 14%.³⁹ The highest devaluation rate of 13.89% in October 2002 was due mainly to uncertainties regarding the outcome of the presidential elections and the next president's commitment to maintain existing economic policies.

Consequently, the other crisis indicators changed slightly in early 2002, but these changes could not contribute to a crisis. The lending, money market, Treasury bill, savings, and time deposits rates all decreased between January 2002 and March 2002. With the exception of the period of presidential elections, money market, Treasury bill, savings, and lending rates were generally stable.⁴⁰ Banks and firms in Brazil did not become severely overextended. Overextension did increase between January 2001 and December 2002,⁴¹ but this increase was not accelerated by the real's devaluation or the slight hike in interest rates. Finally, the changes in reserve levels were not indicative of a massive capital outflow. The 11% decrease in Brazil's reserves between June 2002 and December 2002 was less than the 34.31% decrease in Argentina's reserves six months after its default.⁴² In fact, Brazil's US\$37.7 billion in reserves in December 2002 was higher than the US\$35.2 billion level in January 2001.⁴³

Secondary Hypothesis — IMF Stand-By Arrangements reduce the probability of default

The effect of Stand-By Arrangements on the probability of default must be considered carefully because the results from other studies in the literature, the quantitative analysis in this study, and the media coverage in 2001–2002 display different results. Corsetti, Guimarães, and Roubini (2003) argue that IMF Stand-

³⁶ International Financial Statistics.

³⁷ The IMF and recent capital account crises: Indonesia, Korea, Brazil (2003: 125).

³⁸ *Ibidem*.

³⁹ International Financial Statistics.

⁴⁰ *Ibidem*.

⁴¹ *Ibidem*.

⁴² *Ibidem*.

By Arrangements may provide incentives for governments to adopt better policies, despite their lack of popularity, and thus reduce the probability of default. Lane and Phillips (2000) even make a case that analysts have in the past exaggerated over the risk of default in financial crises. The media coverage in Argentina and Brazil in support these views in the short-run. Daily fluctuations in the spreads of Argentine and Brazilian debt issues reveal a negative relationship between the increase in Stand-By Arrangements and the probability of default. However, the regression results from the previous section identify a positive relationship between the net financial flows of nonconcession loans and the probability of default. The cause for different short- and long-run effects points to the importance of the relationship that each country had with the IMF.

Short-and long-run effects of IMF Stand-By Arrangements

IMF Stand-By Arrangements increase the probability of default in the long-run because these loans merely alleviate short-run balance of payments problems. A country's ability to borrow from the IMF to cover principal and interest payments does not resolve its inability to generate the capital to make those payments. The solution to this structural deficiency in an emerging market rests in policy prescriptions, which the IMF can recommend, but not enact, on the country's behalf.

This type of nonconcession loan decreases the probability of default in the short-run. This is merely a temporary effect because Stand-By Arrangements cannot mitigate factors that increase the probability of default. This is verified by the fluctuations in bond spreads of Argentine and Brazilian debt in 2001–2002. Bond spreads decreased to pre-crisis levels in January 2001 for Argentina and in October 2002 for Brazil because new Stand-By Arrangements were signed with those countries.⁴⁴ The default risk decreased because investors perceived that these loans would provide both countries with the necessary liquidity to service principal and interest payments. Bond spreads rose shortly after because domestic factors signaled that there was a chance that those payments would not be made. Both the suspension of decrees to reform pension and health care systems in Argentina⁴⁵ and uncertainty regarding presidential candidate Luiz Inácio Lula da Silva's commitment to continue President Fernando Henrique Cardoso's economic policies in Brazil reduced investor confidence in the two countries.

The relationship between Argentina and Brazil with the IMF

This divergence between short-and long-run effects highlights the importance of a coordinated effort by the government and the IMF to reduce the probability

⁴⁴ Takagi et al. (2004: 46).

⁴⁵ Idem.; *ibidem*.

of default. Stand-By Arrangements can reduce this probability because they do provide liquidity. However, government decisions or political uncertainty can offset this short-run effect because the IMF can only guide, not dictate, policymakers' decisions. One should then expect that a coordinative and cooperative relationship between a government and the IMF can reduce, or at least maintain, a given probability of default.

The Argentina-IMF relationship became increasingly uncoordinated by December 2001. Policy decisions by the Argentine government following the January 2001 increase in Argentina's Stand-By Arrangement reduced investor confidence. The suspension of reforms in February 2001 preceded a quick turnover of Argentina's Ministers of Economy. In March 2001, there were three different Ministers of Economy, as José Luis Machinea and later Ricardo López Murphy were forcefully replaced by Domingo Cavallo at the request of the president.⁴⁶ Cavallo in turn adopted a more radical stance, and Argentina announced new tax incentives to promote competitiveness and a debt exchange without any IMF consultation.⁴⁷ Argentina quickly shifted from being a country that always relied on the IMF to one that acted alone without regard to the consequences of their policy decisions on the international community.

The Brazil-IMF relationship, on the other hand, developed into a coordinated and cooperative effort to reduce the probability of default. Since 1997, the IMF assisted Brazil with debt management, fiscal statistics, and fiscal accounting, in order to manage the country's fiscal deficits.⁴⁸ This relationship has not been without contention with occasional disputes over the government's interests to float the exchange rate and the IMF's insistence to maintain the crawling peg. In 2002, the Brazilian Central Bank's president Arminio Fraga met with the four presidential candidates and successfully lobbied for their commitment to maintain President Cardoso's economic policies if they were elected. This effort on the Brazilian front reflected the coordinated and cooperative relationship of that country with the IMF. It also signaled to the investment community Brazil's commitment to continue with a disciplined fiscal policy and to service its principal and interest payments.

The findings for the primary hypothesis mirror the results from the econometric regression. The investigation into the relationship that each country had with the IMF reveals subtleties that the quantitative analysis did not capture. These results reaffirm the findings from the econometric analysis, and confirm a strategy for crisis prevention.

⁴⁶ Takagi et al. (2004: 46)..

⁴⁷ Takagi et al. (2004: 46).

⁴⁸ The IMF and recent capital account crises: Indonesia, Korea, Brazil (2003: 21).

CONCLUSION

This study tests for the effect of flexible exchange rate policies and IMF Stand-By Arrangements on the probability of default. At the quantitative level, flexible exchange rate policies reduce the probability of default by 4.27% for certain values of exchange rate misalignment. IMF Stand-By Arrangements increase that probability. At the qualitative level, the primary hypothesis is also validated. The mismatch between short-and long-run effects highlights the importance of a government's relationship with the IMF. The comparison between Argentina and Brazil indicates that greater coordination and cooperation with the IMF at the very least prevents an increase in the probability of default.

These results contend that governments can use certain policy instruments towards crisis prevention. Therefore, Figure 1.1 outlines a valid strategy for crisis prevention with a flexible exchange rate policy. However, a similar strategy cannot be outlined with IMF Stand-By Arrangements. Countries should still maintain a coordinated and cooperative relationship with the IMF to signal to the investment community its commitment to sound policies.

Brazil prevented a crisis in 2002 because it combined the strategy of a flexible exchange rate policy with that of a cooperative and coordinated IMF relationship. Brazil had already switched from a crawling peg adopted in 1994 to a freely-floating rate in 1999 to make internal adjustments.⁴⁹ The choice to work closely with the IMF to prevent a crisis reaffirmed Brazil's commitment to maintain President Cardoso's economic policies, despite political uncertainties regarding President Lula's future agenda.

Lessons can be extracted from these results for developing countries facing high default risk. The theme underpinning these lessons is that policymakers in developing countries hold the primary responsibility to initiate, maintain, and complete the reforms that will resolve structural deficiencies in their financial markets. Their responsibility supercedes that of the IMF because they are generally more proximate, aware, and capable to propose such reforms. These lessons include:

- Suitable exchange rate systems can be better selected by assessing the degree of exchange rate misalignment and that system's effect on the premium to external borrowing.
- Policymakers should be aware of macroeconomic developments and the total debt stock, and their decisions should not compromise the country's liquidity.
- The currency denomination of new sovereign debt issues must constantly be re-evaluated. If debt issuance in local currency is not viable, avoid

⁴⁹ Goldfajn (2003: 11).

issuing the majority or all of the sovereign debt in one currency like the U.S. dollar.

- A coordinated and cooperative relationship with the IMF signals to investors that a government is willing to fix balance of payments problems and will continue to service principal and interest payments.

As the number of developing countries being recognized as “emerging markets” grows, the results and lessons from this study compel further research into the link between exchange rate policy and the probability of default. Research can be undertaken to discern between the impacts of different flexible exchange rate policies on that probability. The role of past IMF performance targets on the issuance or extension of financing instruments should also be considered. New contributions in this niche of the currency crash and debt crisis literatures will undoubtedly assist policymakers in developing countries to become more effective at managing their countries’ default risks.

APPENDIX A

Table 1: Countries used in the panel data regression
(40 countries; 1970 — 2002)

Algeria	Czech Rep	India	Morocco	Russia
Argentina	Dominican Rep	Indonesia	Pakistan	Slovak Rep
Bolivia	Ecuador	Jamaica	Panama	Thailand
Brazil	Egypt	Jordan	Paraguay	Tunisia
Chile	El Salvador	Kazakhstan	Peru	Turkey
China	Estonia	Latvia	Philippines	Ukraine
Colombia	Guatemala	Malaysia	Poland	Uruguay
Costa Rica	Hungary	Mexico	Romania	Venezuela

Note: This set of countries was chosen because they are representative of developing countries across the world as well as of different exchange rate regimes and debt crises. This list is combination of the countries used by Reinhart and Rogoff (2002), Bubula and Otker-Robe (2002), and Manasse, Roubini, and Schimmelpfennig (2003).

APPENDIX B

Table 2: Regression results

Explanatory Variables	(1)
IMF Non-concessional Loans, net financial flows	3.19E-10 (2.195404)**
Fixed Exchange Rate System	-1.091621 (-2.468236)**
Exchange Rate Misalignment	-0.011715 (-0.567994)
Interaction Term	4.273835 (2.237635)**
Lagged Dependent Variable (one year)	1.171704 (4.087680)*
U.S. Treasury Bill Rate	0.035024 (0.659406)
GDP Growth (annual %)	-0.066992 (-2.328952)**
Inflation, consumer prices (annual %)	0.006980 (2.247598)**
Overall Budget Balance (% of GDP)	0.255256 (6.701324)*
Current Account Balance (% of GDP)	0.069396 (2.345689)**
Total Debt (% of Gross National Income)	0.137902 (2.350002)**
Long-term Debt in USD (% of total debt)	-0.004704 (-0.260746)
Total External Debt (% of GDP)	-16.52333 (-2.584080)*
Long-term Debt in USD*Total External Debt	0.069501 (2.189813)**
Short-term Debt (% of total external debt)	-0.023245 (-1.676042)
Debt Service (% of exports of goods & services)	-0.019482 (-1.989878)**
Reserves (% of total debt)	-0.089561 (-7.188137)*

M2 to Gross International Reserves Ratio	0.001449 (0.853397)
Constant	1.525683 (1.173584)
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Dependent variable	Crisis
Estimation method	Logit
Standard Error of regression	0.321262
Sum of squared residuals	72.76252
Log likelihood	-238.9240
Restr. Log likelihood	-437.7705
LR Statistic (18 df)	397.6930
McFadden R-squared	0.454226
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z-statistics are in parentheses; * – statistically significant at the 5% level; ** – statistically significant at the 1% level	
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