

Learning to Trust Lula: Contagion and Political Risk in Brazil

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ABSTRACT

We examine whether Brazilian sovereign spreads of over 20 percent in 2002 could be due to contagion from Argentina or to domestic politics -- or both. Treating unilateral debt restructuring as a policy variable gives rise to the possibility of *self-fulfilling* crisis, which can be triggered by contagion. We explore the *political-economy* explanation of panic in financial markets inspired by Alesina (1987), which stresses market fears of an untried Left-wing candidate. In Brazil, fears of a radical Left-wing President imitating Argentine default may have served as a channel for contagion.

A crucial feature of the Brazilian experience was that Lula learned to become market-friendly and shifted his announcements during the campaign accordingly: together with market learning of his newly adopted policies, this led to a fall in sovereign spreads. We also discuss how IMF support helped provide time for these adjustments of policy and perception to take place.

Keywords: Sovereign Spreads, Political Risk, Bayesian Learning, Time-Consistency

JEL Classifications: E61, E62, F34.

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“If Argentina could ultimately be forced into doing what it tried so hard to avoid...can [international investors] be certain that a Brazil run by a president with a past record of sympathizing with default will not take the easy way out?” Williamson (2002)

1. Introduction

To the dismay of those who believed that emerging market lenders could “quarantine” individual countries in crisis, the collapse of the Argentine currency board in late 2001 was followed by a rise in Latin American sovereign spreads as capital flows to the region came to a “Sudden Stop” (Calvo et al, 2002a). Brazil -- the dominant economy of the region, operating with a floating exchange rate, inflation targets, and an internationally respected central bank governor -- suffered more than the average. As Figure 1 shows, in 2002 sovereign spreads in Brazil rose to more than twice the EMBI+ (without Brazil). Although Brazil’s public debt appeared to be sustainable, following a substantial reduction in its external debt during the preceding four years, the country was nevertheless exposed it to the risk of self-fulfilling crisis.¹ While the debt-to-GDP ratio would decline if real interest rates moved to single figures²; debt could become an unsustainable burden with sustained high interest rates and/or low growth.

Global factors were not propitious: following the collapse of Enron in the United States, fears of corporate malpractice pushed US junk bond rates well over 500 basis points for a year, from mid-2002 to mid-2003 (see Figure 1). Returns on US high yield

¹ In the view of Sebastian Edwards, for example, Brazil’s debt ratio was expected to decline as long as the primary surplus was maintained, “Brazil’s only hope of avoiding collapse,” *The Financial Times*, August 5, 2002. See also Williamson (2002) and Goldstein (2003) for discussion of debt sustainability.

² The current primary surplus of 3.75 per cent of gross domestic product guarantees a declining debt to GDP ratio as long as the inflation-adjusted interest rate paid by the government on its publicly traded debt does not exceed GDP growth by more than 7 percentage points. This is quoted from Fraga and Goldfajn (2002).

bonds provided an effective floor to emerging market sovereign spreads, and as fears of lack of accountability undermined trust in emerging market EMBI+ spreads (without Brazil) were pushed to a peak of about 1,000 basis points in the second half of 2002. Although Calvo and Talvi (2002b) have put primary emphasis on the “Enron Effect” in explaining Brazilian sovereign spreads, Figure 1 suggests that other factors were in play as Brazilian country risk rose to a peak of over 2000 basis points in late 2002, far higher than the average of other emerging market countries.

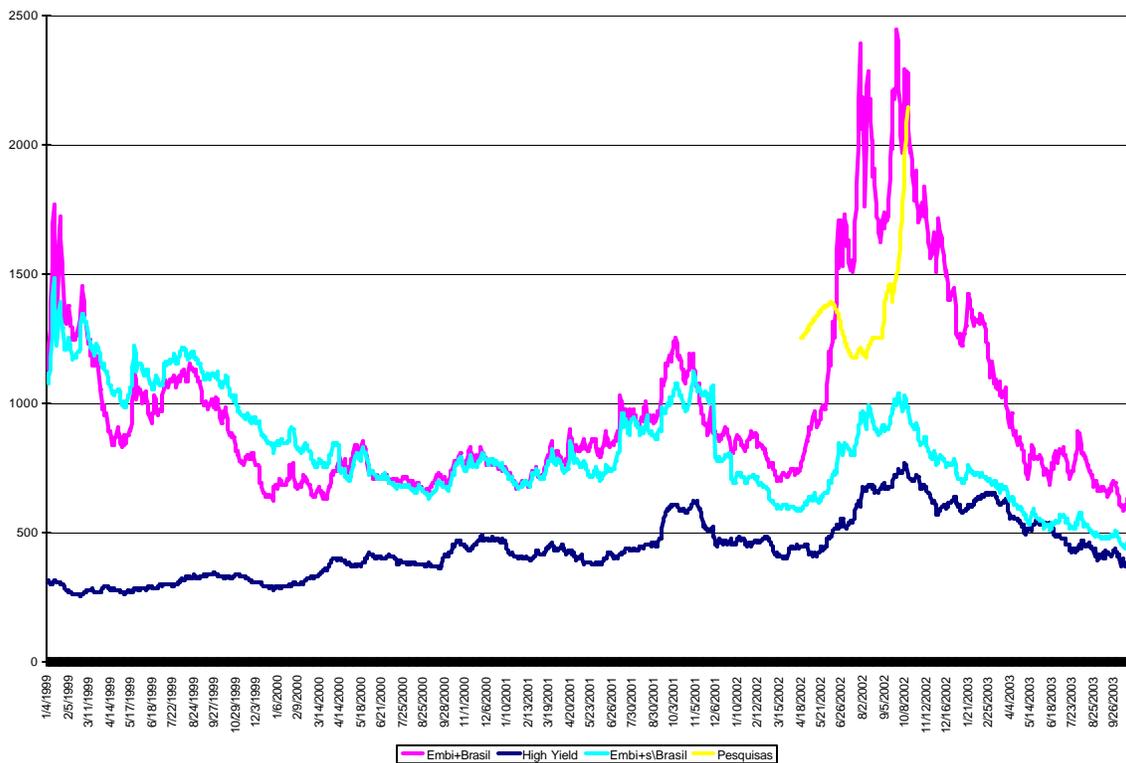


Figure 1: Sovereign spreads, US Junk bond rates and opinion polls

Source: Supplied by Marcio Garcia, PUC-Rio

In the light of East Asian experience, regional contagion is surely an issue to be considered. Argentina had defaulted in December 2001/January 2002, leading to the largest bond restructuring in history. Some empirical tests for contagion are reported below. But what appeared to “spook” financial markets in summer of 2002 was domestic politics -- in particular the upcoming October election. With Lula da Silva, the charismatic leader of the Left-wing Workers’ Party (PT), as the front-running candidate, markets feared unilateral debt restructuring. As foreign banks carried substantial

exposure to Brazil, it is hardly surprising that, as the polls swung in his favour, sovereign spreads increased sharply. The sovereign spreads widened from around 7 percent in March to around 20 percent in September, as Lula moved from less than 30 percent to over 40 percent in the public opinion polls. Figure 2 gives the opinion poll results for the four presidential candidates for almost a year preceding the election; the index of Lula's popularity (rescaled) is also shown in Figure 1 for the six months right before the election.

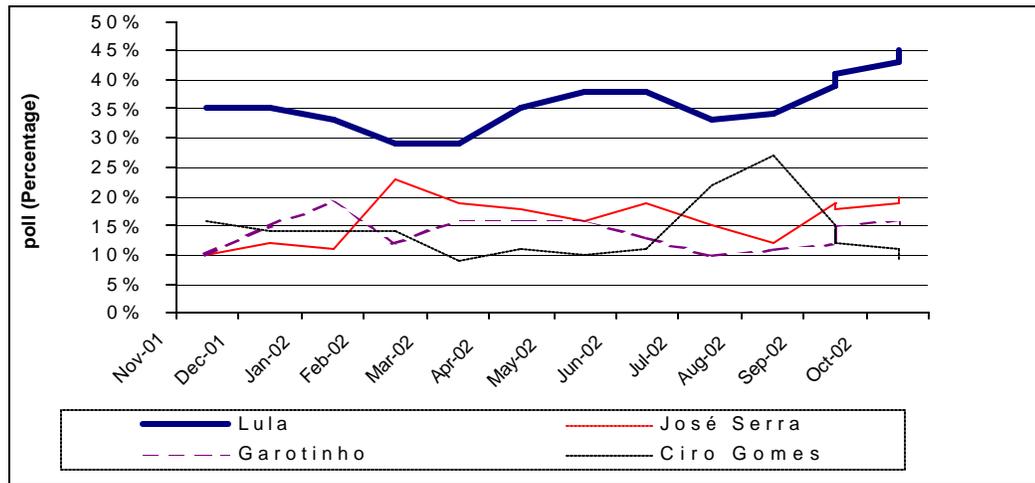


Figure 2: Opinion polls prior to the presidential election

Source: Opinion Polls realised by IBOPE (OPP169-OPP422)

In the months following Lula's victory, however, Brazil's sovereign spreads on the country's bonds declined from a peak of 23 percent to around 13 percent in January 2003. It fell below 6 percent in October 2003, which we take as evidence that markets recovered from the initial panic over the prospect of a Left-wing administration.

In this paper we analyse the behaviour of sovereign spreads in an environment where an untested Left-wing candidate is expected to win an election. According to Williamson (2002) the main fear among investors was that Lula government would imitate the Argentine default, and we agree that the experience of neighboring countries is indeed used as a guide to the behavior of an incoming government, so domestic politics can provide a powerful channel for contagion.

But what if Lula was *not* intending to renege on Brazil's debts, and had decided to adopt market-friendly policies due, say, to the persuasive efforts of the Ministry of Finance and the central bank? As debts are honoured and repudiation resisted, sovereign spreads should decline, since expectation of future radical repudiation are revised downward.

Our key contributions in this paper are twofold: first, we show that contagion and political risk are not mutually exclusive, i.e., that political risk can be a channel for contagion. Second, we show that, due to contagion, a successful transition from Right to Left in Brazil involved both the adoption of market-friendly policies by the incoming government and the restoration of market confidence. We also provide an analysis of the IMF's role in providing policy pre-commitment and liquidity support, which extended the time available for the market to learn to trust the Lula government.

The paper proceeds as follows. In section 2, we report empirical evidence from econometric studies of contagion and of multiple equilibria, and review some of the relevant theoretical literature, including on Global Games approach, which generates unique equilibrium.

In section 3, we introduce a Sudden Stop model. This model allow us to see how capital flows lead to high sovereign spreads in a political climate driven by fears of debt default and restructuring. A similar interpretation of the 1994/95 Mexican crisis was given by Sachs, Tornell, and Velasco (1996), but our model differs in that the policy choice for the government is the rate of default on debt rather than how fast debt is inflated away.

The macroeconomic implications of domestic politics in the run-up to an election are analysed in section 4. Along the lines proposed by Alesina (1987), we distinguish between the political preferences of Right and Left (where the latter are more prone to default on debt), and calculate sovereign spreads endogenously, using election probabilities. To understand events after the election, it is necessary to consider different varieties of Left-wing behaviour, which we characterise as Far-left and Moderate-left. In the appendix we describe an extended two-sided process in scenarios where Lula shifts his policy preferences toward being market friendly and where the markets use Bayesian updating to reduce their expected default probability if he does not default. In section 5,

however, we postulate that Lula promptly shifts his policy preferences from Far-left to Moderate-left, and the market, which initially expects default with a high probability, follows by revising the default probability down to zero so long as no default takes place when Lula assumes office. This is a special case of Bayesian Learning. The role of IMF in dealing with the confidence crises is discussed in terms of providing liquidity support in exchange for policy pre-commitments endorsed by all candidates for election. In section 6, we offer some concluding remarks.

2. Literature Survey: Empirical Evidence and Theory

2.1 Empirical Evidence: Contagion, Multiple Equilibria and Politics

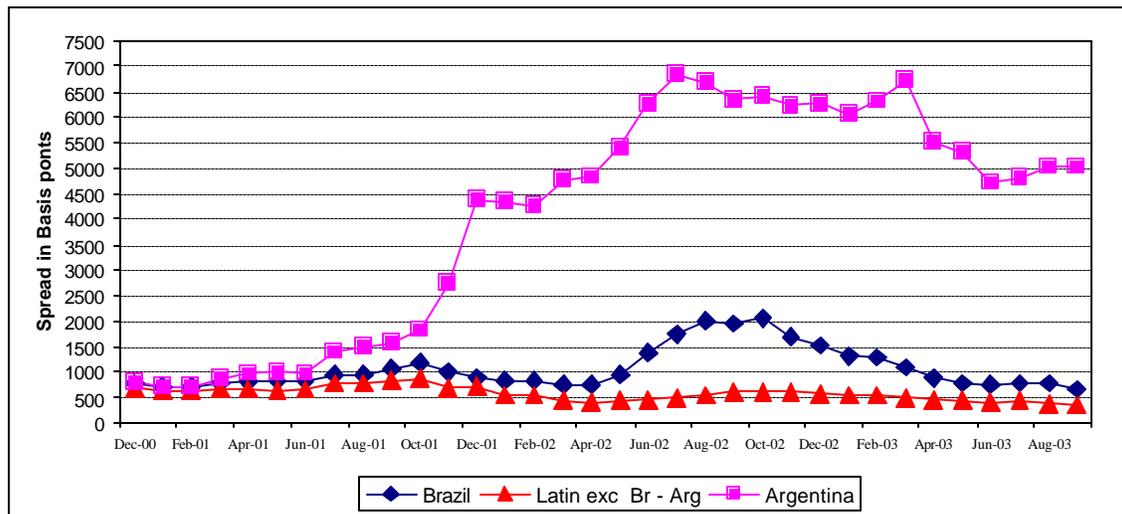


Figure 3: Sovereign Spreads for Brazil, Argentina and the rest of Latin America (excluding Brazil and Argentina)

Source: Monthly average sovereign spreads obtained from JP Morgan and EMTA

The evidence from currency crises in emerging markets during the 1990s suggests an important role for contagion across countries, as well as weak fundamentals and exogenous shifts in expectations (Agénor et al. 1999, Claessens and Forbes 2000). Contagion is the core explanation in an empirical study of Markov-switching regimes by Marcel Fratzscher (2000, 2002) for example. In another time-series study by Jung Yeon

Kim (2001), a latent variable measuring contagion was found to have an important role in causing a series of crises in East Asian emerging markets.

Figure 3 focuses on Latin America sovereign spreads, showing separately the rates for Brazil, Argentina, and the rest of Latin America. Two factors indicate a role for contagion in the Brazilian crisis. First is that an event as the Argentine default is the type of public signal which could co-ordinate private agents' expectations on the bad equilibrium³ (Masson 1999), and second, by analogy, is the fundamentals-driven crisis in Thailand in mid-1997 that led to a full blown liquidity crisis in Korea the following Christmas. Is Argentina to Brazil, what Thailand was to Korea? The econometric evidence is suggestive rather than conclusive.

Using a VAR approach, Boschi (2003) detects a small but noticeable reaction of Brazilian spreads to the Argentine turmoil, but the analysis of correlation coefficients (corrected for heteroscedasticity) shows no evidence of contagion. These results suggest that Argentina is an isolated case.

Based on forward rates in the bond market, Favero and Giavazzi (2002) offer evidence for the role of political factors in explaining Brazilian interest rates. They note that the upward shift in the term structure of forward risk that occurred between February 2002 and May 2002 could be linked to electoral uncertainty, and that forward-looking data as of mid-2002 indicates another upward shift in spring 2003, when the new government would take office after the election. They conclude that Brazilian term premia reveal markets' concerns about the sustainability of the debt, before the IMF target for fiscal surplus was adopted (and later increased).

Fitting a non-linear Markov-switching model to daily data for Brazilian sovereign spreads from November 2001 to October 2002, Gorette and Taylor (2004) and Gorette (2004) provide evidence in favour of financial contagion from the Argentine crisis as well as of political uncertainty during the pre-election period in Brazil. In the latter study, political developments, together with US high-yield spreads and news of IMF actions, are

³ Atkeson (2000), Boonprakaikawe and Ghosal (2000) and Hellwig (2002) show how the existence of public signals can generate multiple equilibria even in models with private signals.

included as factors which can trigger a regime shift from “tranquillity” to “turmoil”.⁴ In the equation determining Brazilian spreads, Goretti (2004) finds that the state variable for this regime shift adds some 600 basis point to Brazilian country risk: so political factors have a distinctly non-linear impact on Brazilian spreads. The direct effect of regional financial contagion on the latter is captured by a size-dependent coefficient on Argentine spreads, 0.125 for spreads above 60%, but only 0.031 for spreads below this threshold.

Goretti’s econometric findings indicate that Brazilian spreads of about 20% could be accounted in large part by direct contagion from Argentina in default (7 or 8 percentage points) augmented by financial “turmoil” triggered by political and other factors indicated above (adding 6 more percentage points); the remainder is given by a constant term. The substantial direct influence attributed to regional contagion and the relatively limited effect of domestic politics are in contrast with the account developed below, where we examine how and why the Argentine default may have had its impact *through political channels*.

2.2 Theoretical Literature:

2.2.1 Self-fulfilling Crises and Coordination failure

In their interpretation of the Mexican crises of 1994/95, Sachs, Tornell and Velasco (1996), hereafter STV, use a political-economy model to show that a government with a sufficiently high debt-income ratio can face a self-fulfilling crisis if creditors charge high interest rates, anticipating that the government is about to inflate the debt away and devalue its currency. In the STV model, multiple equilibria can occur at some

⁴ In the equation determining the probability of transition to turmoil, the variable measuring Lula’s popularity is statistically significant and positive; but high yield spreads in developed markets have a stronger impact on the transition probability, though statistically less significant: in addition there is a positive effect of a dummy variable for bad news from IMF.

levels of a relevant state variable, debt-to-income ratio, but not at other levels. In situations of indeterminacy, rumours are important, and events, such as Chiapas uprisings and the assassination of presidential candidate Luis Donaldo Colosio, can become focal points for drastic shifts in creditor expectations. Their opinion is that the Tequila crisis of 1994/95 was a consequence of the shift to a panic equilibrium.

While STV go on to develop a game theoretic model of events, Cole and Kehoe (1996), in their account of the same crisis, focus on general equilibrium considerations. In this consideration, investors, fearing that Mexico would not be able to honour its commitments, were not willing to buy new Mexican government bonds. The investor panic that ensued made the financing problem facing the government, sustainable with normal rollover, suddenly become impossible. They found that this sort of self-fulfilling prophecy was possible for government debt in an interval they called the crisis zone. The size of the crisis zone would depend crucially on the average length of maturity of government debt (a low level of debt to GDP can still lead to crisis if the maturity of debt is very short). The selection of equilibrium is attributed to sunspots, i.e., random variables not connected with fundamentals of the model. In their numerical calibration, Cole and Kehoe concluded that Mexico was in the crisis zone, and they characterised the Tequila crisis as a self-fulfilling crisis. In their recent analysis of alternative monetary regimes for Latin America, Araujo and Leon (2003) adopt a similar multiple-equilibria approach and find that Brazil is in the crisis zone as well and thus exposed to the risk of self-fulfilling crisis.

2.2.2 Global Games and the Uniqueness of Equilibrium

The literature discussed above have effectively assumes there is a representative creditor, so the issue of coordination among creditors is not explicitly addressed. It may, however, be the lack of coordination among creditors that leads to the Sudden Stop⁵ and forces the country to default on its debt (Radelet and Sachs 1998; Ghosal and Miller

⁵ This resembles the bank-run equilibrium of Diamond and Dybvig (1983) in that it can take place when fundamentals are in good shape.

2003). In marked contrast to the multiple-equilibria approach is newly emerging paradigm, where agents act with individual rationality and with private information. The result is a unique equilibrium, as crises only occur when fundamentals fall to a critical threshold. This so-called rational model of crises was developed by Morris and Shin (1998), who appeal to the Global Games paradigm of Carlsson and van Damme (1993). In Morris and Shin's classic account of a speculative attack, agents obtain private but correlated signals on economic fundamentals. They then use the signals to coordinate their actions by calculating a critical common-knowledge threshold for attacking the currency.

The Morris-Shin model has recently been extended to include the role of the IMF by Corsetti, Guimares and Roubini (2003), hereafter CGR. The CGR model assumes there are a large number (a continuum) of fund managers who have lent on a short-term basis to a small open economy and who face the decision of whether or not to roll over lending, with payoffs depending on taking a "right decision". To determine when to withdraw, creditors use a trigger strategy based on their private signals of the rate of return achieved by the borrower, the Global Games Approach ensures a unique level of fundamentals when all creditors exit. They go on to show that when the IMF is willing to provide liquidity support and faces similar economic incentives as the fund managers, the threshold level of returns triggering creditors' exit remains unique and it is lower the larger the size of IMF intervention.

To get this interesting result, it is assumed that the IMF moves simultaneously with other creditors. But this leaves open the question of what would happen when a large player makes *sequential moves*. Can "herding" emerge? CGR do briefly consider the case where the IMF moves before the withdrawal decision by fund managers; and observe that "one can build examples in which fund managers will disregard their private signal, and just conform to the IMF move: they will roll over debt if the IMF opens contingent credit lines to the country, and withdraw otherwise." This is dubbed "strong herding behaviour". But note that with sequential moves the action of IMF becomes a public signal, so it can play the role of a "sunspot" in coordinating the decisions of fund managers. (In a recent paper Angeletos et al. (2003) show that multiple equilibria may

also arise because the reaction of the central bank to the crisis generates *endogenous* public signals.)

Another interesting feature of their analysis is the possible strategic complementarity between the provision of liquidity by the IMF and the reform efforts of the domestic government. Our interpretation of role of the IMF also stresses strategic complementarity, but this is secured by the explicit use of IMF's "conditionality".

2.2.3 Domestic Politics

In his IIE policy brief Williamson (2002) examines the pessimism about Brazil's economic prospects that gripped financial markets in the summer of 2002. Appealing to the theory of self-fulfilling crisis discussed above, he judged that Brazil's fundamentals, both in regard to domestic and external debt, were in what he calls an "intermediate situation", the zone where things are ripe for self-fulfilling crisis to arise. He goes on to argue that the market's choice between focusing on the good versus bad equilibrium is strongly influenced by the political situation in Brazil and discusses the way in which sovereign spreads before the election reflect political development. However, he notes that there is a prospect after election for the Brazilian "sovereign spreads to drop furthest under a Left-wing government that shows itself to be responsible, because the market's ever-present fear of a Left-wing government renouncing Brazil's debts would be once and for all laid to rest," (Williamson 2002, p.15)

Most of the existing self-fulfilling crisis models assume a single sovereign decision maker, but the ideas can be carried to a two-party case, Left and Right, as in Alesina (1987). Assume, for concreteness, that rollovers lead to satisfactory debt service by whichever party is responsible, while panic leads to default by Left but not Right. Then the appointment of a Left-wing government will lead to multiple equilibria but a Right-wing government will be associated with a unique, no-default equilibrium. (If there is an election pending so that the nature of the party responsible is not determined, the prospect of the Left-wing gaining power may be enough to ensure multiple equilibria.)

In a highly relevant study, Chang (2002) analyses the way in which electoral uncertainty and capital flows interact in a small open economy. Two candidates run for

office, one “pro-business” and the other “pro-labour” platforms, with objectives biased toward entrepreneurs or workers, respectively. The electoral outcome matters for the investment decision because of its implication for the choice of tax policy. A pro-labour electoral victory results in a Sudden Stop in investment and capital flows. This is because the pro-labour government is known to favour a capital levy and, given its social preferences, cannot commit not to impose excessively high taxes on investment return. A pro-business victory promises low capital income taxes, so capital inflows continue. In the “politico-economic” equilibria before the election, self-fulfilling multiple crises are possible, and it is shown that pre-electoral policy agreements, where the pro-labour party ties its hands, can contribute not only to financial stability but also to the chances of a pro-labour victory in the elections.⁶

3. Determining of Sovereign Spreads

3.1 Chronology of Events and Time Line

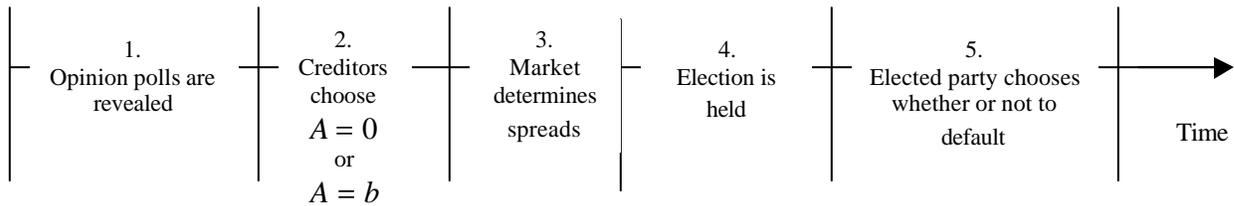
The chronology of events is as follows. First, the public opinion polls are revealed, indicating the *ex ante* probability of each party being elected. Second, the creditors determine whether or not to roll over their short-term lending, i.e. set A . $A \in \{0, b\}$ is the amount of debt that is rolled over, where b is the amount of existing debts. When $A = 0$, the creditors panic and refuse to roll over.⁷ or to use Calvo’s phrase, capital flows to the country have come to a Sudden Stop.⁸ The possibility of a crisis triggered by rollover failure is discussed in more detail in Alesina et al (1990), where the confidence crisis reflects a coordination problem among investors making investment decisions at different dates. When $A = b$, the creditors roll over their lending. Third, the

⁶ Chang stresses, as we do, that recent market volatility in Brazil cannot be fully understood without reference to the electoral outlook, but his account omits the uncertainty as to Left-wing policies and the role of the IMF in helping to avoid default while learning takes place.

⁷ As in Mexico in 1994, the signal of the impending crisis was the failure of the government to place its debt in the auction.

⁸ Employing an infinite-horizon model, they found that there exists a possibility of multiple equilibria: one in which the investors roll over and the government honours its obligations; and the other in which investors refuse to buy any public debt, anticipating that future investors will do likewise. So the government is forced to repudiate.

market forms (rational) expectations of the government's default rate, d^e , which determines the sovereign spreads on its borrowing, Ab ; in another words, creditors use the *ex ante* probability for each party to be elected to form the expected rate of default or the interest rates. Then, the election is held. Finally, the elected party chooses whether to default by minimising its losses subject to given default expectations. The sequence of events is presented in the following time line:



3.2 The Model

Consider a small open economy with substantial government held debt in private hands, where inflation is checked by inflation targets operated by an independent central bank. To service the debt, the government can choose either to tax or to default, using involuntary debt restructuring to lengthen the term of the debt for example, or possibly to write it down. Where t is the tax rate, and d the default rate, a measure of how costly the debt restructuring will be to creditors⁹, the government minimises the following loss function:

$$\min_d \{I_i y^2 + t^2 + I_d C_i(d)\} \quad (1)$$

where y is a percentage deviation from full employment (natural rate), λ indicates the importance of welfare losses associated with output to the government. (Here we index the parameters I and C by i , indicating different possible political parties.) In addition to welfare losses associated with output and taxes, we assume that there are extra costs related to debt default, $I_d C(d)$, where I_d is an indicator function that is equal to 1 if there is a default and zero otherwise. The extra costs of default may reflect direct sanctions imposed by creditor countries, the temporary suspension of the borrowing country from

⁹ A low value of d could involve debt rollover, while a high level could indicate outright default.

world capital markets, or other transaction costs associated with restructuring and repudiation. Specifically, we assume that the cost of default is quadratic in d :

$$C_i(\mathbf{d}) = Z_i + \mathbf{a}_i \mathbf{d}^2, \quad (2)$$

where both Z_i and \mathbf{a}_i are positive because the costs imposed reflect ‘punishment’ for the act of default itself (breaking the terms of the debt contract) and for the degree of debt restructuring (value loss to creditors).

Let all debts be short term (one period) so that the government faces the following budget constraint:

$$t + \mathbf{d}b + A = (1 + \mathbf{d}^e)b, \quad (3)$$

where b is the quantity of debt as a fraction of GDP, A is the amount of debt that is rolled over, and \mathbf{d}^e is the expected default rate. In the derivations that follows, we first characterise equilibrium for given A in the absence of a fixed cost Z , and then we look at how bringing in the fixed cost changes the equilibrium selection.

We begin with the assumption that $A = b$, in which case government is unlikely to avail itself of the option to default. But what if creditors panic and refuse to roll over? To analyse this case, a Sudden Stop to use Calvo’s phrase¹⁰, we later set $A = 0$ and find that default and restructuring are real possibilities.

We assume that creditors move first to determine whether to roll over the existing debts, then the interest rate for debt contracts is determined by rational expectations before the government chooses its policy. Actual default is beneficial to the government since it reduces taxes. But an increase in the default rate will increase expected default rate in the equilibrium.

Given the foreign interest rate r^* , we assume that interest parity condition holds for this small open economy, and that there will be no expected depreciation or appreciation of the domestic currency, so sovereign spreads reflect the expected default rate:

$$r = r^* + \mathbf{d}^e, \quad (4)$$

where r is the domestic interest rate.

Aggregate demand is simply given by

$$y = -r,$$

where y measure the percentage deviation from full employment level of output, for simplicity we ignore the effect of taxes on output . Normalising the foreign interest rate to zero, we arrive at

$$y = -\mathbf{d}^e. \quad (5)$$

The government's decision is specified as a one period problem. The chronology in this single period is as follows: (1) creditors determine whether or not to roll over their short-term lending, i.e. set A ; (2) given A , creditors form expectations of the government's default rate, \mathbf{d}^e (which determines the sovereign spread on its borrowing, Ab); (3) conditional on these expectations, the government decides whether or not to default. As it moves last, the government clearly faces a time-consistency problem, which may lead to multiple equilibria, as in Sachs et al (1996) and Obstfeld (1996).

Minimising the loss function in (1), subject to the given expected default rate of \mathbf{d}^e , gives rise to the following best response function for the government:

$$\mathbf{d} = \frac{(1 + \mathbf{d}^e)b^2 - Ab}{(\mathbf{a}_i + b^2)}. \quad (6)$$

Substituting (2), (5), and (6) into (1) yields minimum losses under given expected default rate

$$L^D = Z_i + \mathbf{l}_i(-\mathbf{d}^e)^2 + (1 + \mathbf{d}^e)^2 b^2 - 2bA(1 + \mathbf{d}^e) + A^2 - \frac{[(1 + \mathbf{d}^e)b^2 - Ab]^2}{(\mathbf{a}_i + b^2)}. \quad (7)$$

The rational expectations on the part of creditors imply that

$$\mathbf{d}^e = \mathbf{d}. \quad (8)$$

In the absence of fixed cost Z , we obtain the *time consistent equilibrium* as

$$\begin{cases} \mathbf{d}_D^e = \mathbf{d}_D = \frac{b^2 - Ab}{\mathbf{a}_i} \\ \mathbf{t}_D = b - A \end{cases} \quad (9)$$

¹⁰ See Calvo et al (2002a).

If the creditors decide to completely roll over their lending, i.e. set $A = b$, $\mathbf{d}_D^e = \mathbf{d}_D = 0$ and $\mathbf{t}_D = 0$. Now consider what Calvo describes as a Sudden Stop, which we represent as complete rollover failure so that creditors set $A = 0$. In that case, $\mathbf{d}_D^e = \mathbf{d}_D = \frac{b^2}{\mathbf{a}_i}$ and $\mathbf{t}_D = b$. This may seem as an extreme assumption as typically not all debt is short-term, falling due for repayment at the same time. It is, however, common in the analysis of crisis (e.g., see for Sachs et al 1996) as a reflection perhaps of the fact that failure to service longer term debt can trigger “acceleration clauses”, calling for immediate repayment: even long-term debt becomes payable on demand in the crises.

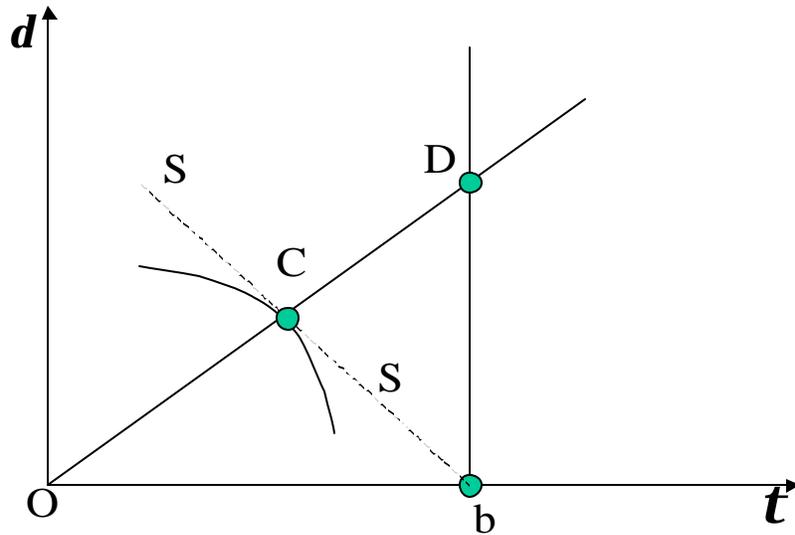


Figure 4: Time-consistent and pre-commitment equilibria

The Sudden Stop equilibrium is illustrated in Figure 4, where the horizontal and vertical axes indicate tax rate and actual default rate, respectively. It can be seen from (1) that the absolute minimum (given $C(\mathbf{d})$) is at the origin. Part of an ellipse sketched in Figure 4 indicates one iso-loss function. The budget constraint for $\mathbf{d}^e = 0$ is given by a downward-sloping line SS going through point b . Under this budget constraint, the government’s optimal default rate would be at point C (which gives a strictly positive default rate). This shows that *in the absence of lump sum costs of default*, government promises of no default are not credible. Varying \mathbf{d}^e traces on the line OD all the “short-run” optimal choices of the government; this is government’s best response function

described by (6), setting $A = 0$. Substituting the rational expectations requirement (8) into (3), with $A = 0$, gives the best response function of the creditors' (indicated by vertical line Db in the figure). The intersection between OD and bD gives the time-consistent (Nash) equilibrium at D . However, under the complete rollover, $A = b$, there also exists another time-consistent (Nash) equilibrium at O .

It is clear from the figure that with rational expectations on the part of creditors, equilibrium must satisfy the restriction that $t = b$ after a Sudden Stop. In normal times the budget constraint would be far closer to the origin: technically, with r^* set to zero, it would be at the origin if $A = b$ so one interprets the tax rate as the extra taxes needed to finance the Sudden Stop.

If there is a complete rollover, i.e., creditors have chosen $A = b$, the unique time consistent equilibrium is $d = 0$ and $t = 0$ (regardless of a_i). However, if creditors have decided not to roll over the debt, i.e., $A = 0$, whether the government would default depends on the fixed cost Z . If $Z < \frac{b^4}{(a_i + b^2)}$, default will be the unique time-consistent equilibrium, but if $Z > \frac{b^4(a_i + b^2)}{a_i^2}$, no default will be the only time-consistent equilibrium. In what follows, we assume that the former case represents the Left-wing party and the latter case the Right-wing party.

4. Sovereign Spreads and Political Risk

In the presidential election, Lula da Silva, a charismatic former trade union leader, was the candidate of the Left-wing Workers' Party (PT). Despite the verbal commitments by the PT regarding the maintenance of economic stabilisation policies (inflation control, contractual obligations, and a primary budget surplus needed to service debt obligations of 3.75 percent of GDP in 2003), uncertainty over as to his economic proposals has triggered a panic in financial markets fearing the use the unilateral repudiation as the tool to deal with the debt problems facing Brazil.

4.1 A Simple political economy model with no default by the Right-Wing

To analyse how political factors can determine sovereign spreads, we modify the model along the line of Alesina (1987) by introducing two political parties with different preferences: Left-wing (L) and Right-wing (R), see Thampanishvong (2002). We denote by \mathbf{p} the *ex ante* probability of the Left-wing party being elected, as indicated by the pre-election polls for example.¹¹ To simplify the analysis, moreover, we follow Rodrik and Velasco (1999) by assuming that *the Right-wing party always repays debt* in the face of a Sudden Stop: while the *Left-wing party always chooses to default and restructure*. Conditional on the Sudden Stop¹², the sequence of events is as follows: (1) creditors use the *ex ante* probability for each party to be elected to form the expected rate of default \mathbf{d}^e , (2) the election is held, and (3) the elected party chooses whether to default by minimising its losses subject to given default expectations.

With political uncertainty, rational expectations on the part of creditors imply that

$$\mathbf{d}^e = E(\mathbf{d}) = \mathbf{p}\mathbf{d}(\text{L}) + (1-\mathbf{p})\mathbf{d}(\text{R}), \quad (10)$$

where E denotes the mathematical expectation, $\mathbf{d}(\text{L})$ and $\mathbf{d}(\text{R})$ are the *ex post* default rates for the Left- and Right-wing parties respectively.¹³ These results may be summarised in the following proposition:

Proposition 1 *Sovereign spreads and political uncertainty*

Assuming creditors fail to rollover debt before an election, where both parties have the same preference parameter (\mathbf{a}) but the Left-wing has a significantly lower fixed cost (Z). So default by an incoming government will depend on the fixed cost. We further assume that the Left-wing government prefers to default while the Right-wing government prefers to honour its debts. Pre-election sovereign spreads will be increasing in the perceived probability \mathbf{p} of a Left-wing victory.

¹¹ Ideally, one would explain how these probabilities are determined.

¹² Note that in the case that creditors voluntarily roll over, i.e., $A = b$, the result is trivial whichever party wins the election. The sovereign spreads would be zero.

¹³ In a more complete model of the political process, this probability would be endogenous as the candidates selected programs to gain votes.

Formally, let $a_L = a_R = a$, $Z_L \leq b^4 / (a + b^2)$ and $Z_R \geq b^4 (a + b^2) / a^2$, then the expected default rate is given by $d^e = pb^2 / [a + (1-p)b^2]$ which is increasing in p . If the Left-wing party is elected, the post election outcomes are $d_L = b^2 / [a + (1-p)b^2] > 0$ and $t_L = ab / [a + (1-p)b^2] < b$. If the Right-wing party is elected, the outcomes are $d_R = 0$ and $t_R = (a + b^2)b / [a + (1-p)b^2] > b$.

Figure 5 illustrates. (The axes are as defined in Figure 4, but here we also use vertical axis to represent the mathematical expectation of the default rate.) As the Left-wing government always defaults and the Right-wing always honours its debts, the corresponding reaction functions (conditional on gaining office) are LL and the horizontal axis, respectively. Before the election, the mathematical expectation of the default rate, $E(d)$, is a weighted average of these two reaction functions, as shown by SS in the figure. This mathematical expectation matches the expected rate of default d^e at point E where SS crosses 45-degree line labelled OR, where the rational expectation constraint is satisfied. Immediately after the election, the Left-wing is expected to default at the rate X_L , with no default by the Right-wing (see X_R). The predicted *ex post* jump in sovereign spreads, EX_L , will shrink as the pre-election polls swing to Left, shifting SS closer to LL.

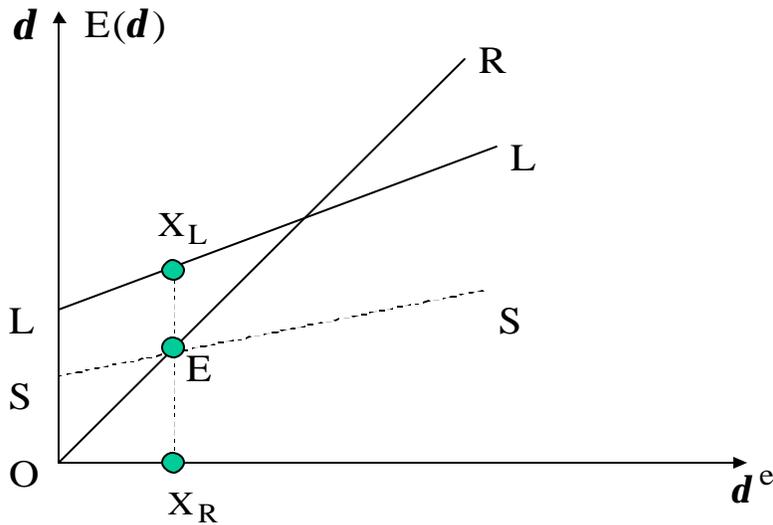


Figure 5: Sovereign spread and political uncertainty

Consider the situation when the Right-wing party holds power, but an election looms, as in Brazil in 2002. Clearly the prospect of the Left-wing being elected will increase sovereign spreads even though the current government has no intention of defaulting. This is consistent with surges in Brazilian spreads as and when Mr da Silva's popularity soared: but note that if Lula is almost sure to win, there will be little *ex post* jump in the spread.

5. Policy Adaptation, Market Learning and IMF Intervention

The Alesina-style model outlined above assumes that the policy preferences of both parties are well known. But there was in fact considerable uncertainty about what Lula's economic policies might be, Williamson (2002). In terms of market indicators, the interest rate term structure, using the pre-election forward rate data, was expected to rise in early 2003 the date on which Lula took office, and go on rising for some time thereafter, Favero and Giavazzi (2002). This seems to be consistent with expectation of a Left-wing government that will default. As noted above, however, sovereign spreads have declined steadily since the election as shown in Figures 1 and 3. An additional important feature of the Brazilian experience was that Lula learned to become market-friendly and shifted his announcements during the campaign accordingly. But the default premium also depended on how the market perceived the change in policy stance of Lula. In this section we provide a stylised account of Lula's policy adaptation, together with instant Bayesian learning by the market as default is avoided, to explain a prompt decline in sovereign spreads.¹⁴ (In the Appendix we give a more realistic, two-sided process, where Lula gradually shifts his policy toward being market-friendly, and the markets use Bayesian updating steadily to reduce their expected default probability if he does not default.)

¹⁴ See Driffill and Miller (1992) and Altug et al (2000) for other applications of Bayesian learning that might arise under political and economic regimes.

Note that the political-economy approach with learning allows a channel for contagion. Where should the market get its ideas of what a new government in Brazil might do? Why not look at what happened in its southern neighbour less than a year before the Brazilian election, where the departure of Argentine President de la Rúa led to debt repudiation? *The Economist* (2003, pp. 39) takes such a view: “Over the past year, fears of default, stoked by Argentina’s insolvency and the past radicalism of Lula and his Workers’ Party (PT), helped push up interest rates and the value of the dollar.”

5.1 Sovereign Spreads: Going Up or Going Down?

In Figure 6 we summarise the state of expectations before Lula’s adoption of Moderate-left policy and the market’s learning about this. Thus the pre-election “political equilibrium” shown as E is as described in the previous figure. If we assume that debt contracts signed before the election last for some time after the election, the forecast rate of default conditional on Lula’s victory will increase as indicated by the jump from “political equilibrium” to the point labelled “conditional post-election forecast” (D_0) as the election uncertainty is resolved. After Lula has taken office, and it is time to revise short-term debt contracts signed before the election, the equilibrium would shift to the “time-consistent” outcome shown as D_1 , a forecast characterised by the perceived response function for the Left-wing party labelled “Market’s belief of Lula’s type”. This line is a weighted average of the response function for the Far-left and that of the Moderate-left with considerable weight (possibly 1) on the former.

Thus, while conditional forecast of interest rates given a Right-wing victory is that they will fall to zero and stay there, the *conditional* forecast of interest rates given a Left-wing victory is that they rise first to D_0 and then to D_1 . This is, of course, qualitatively consistent with the *unconditional* market expectations of rising interest rates noted by Favero and Giavazzi, indicated by the arrow from E to F (where E is an unconditional forecast of the spreads immediately before the election, and F is a weighted average of the two time-consistent equilibria 0 and D_1 .)

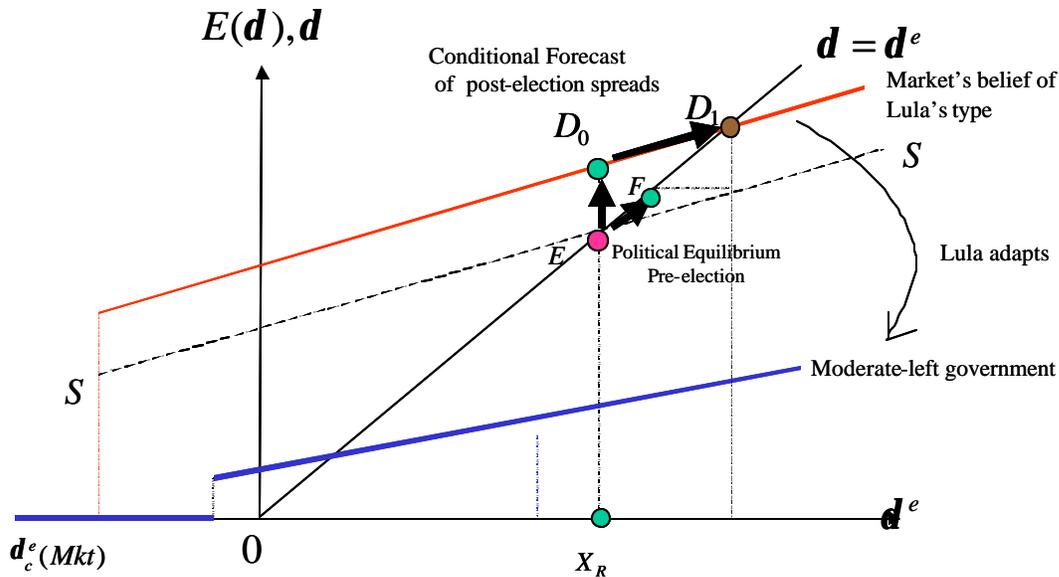


Figure 6: Forecasts of Post-election Default Rates

These forecasts reflect the fear that the incoming administration would stick to the Far-left policies described in the Worker’s Party programme of December 2001 (PT, 2001) which “spoke of denouncing the existing agreement with the IMF and auditing and renegotiating the external debt...[and of] a complete revision of the policy of giving priority to the payment of debt service,” (Williamson 2002, p. 12). As Williamson goes on to remark that “it is hardly surprising that foreign investors should have taken fright at the prospect of a party with such a policy agenda coming to power.” There were, in fact, determined efforts made by Ministry of Finance and the central bank to warn Lula that such policies would lead to a state of financial crisis and to persuade him that adapting his policies to avoid crisis would be in his own political interest. Although the incoming president had made a commitment to replace head of the central bank and the Minister of Finance, he nevertheless decided to retain in post other key policymakers in both institutions. Furthermore the prospect of a successful transition was boosted by raising the target for primary budget surplus above that promised to the IMF by the outgoing administration (see below).

We postulate that in the light of such considerations, Lula shifted his policy preferences from Far-left to Moderate-left before assuming office: but the market, which

initially expected default with high probability, only revised the default probability down to zero¹⁵ when no default was observed after Lula took office in January 2003. Even if Lula was planning to pursue the policies of a Moderate-left government, would this be sufficient in and of itself to avoid default when he took office? To answer this question, we include in Figure 6 the response function of a Moderate-left government (where we simply use a higher value for \mathbf{a} to illustrate the adaptation of policy). The policy shift shown in the figure has the property that despite the increase in the critical value \mathbf{d}_c^e , a Moderate-left government is still forced into default because the political equilibrium based on the market's fears generates default expectations above the critical level of such an administration, $\mathbf{d}^e(E) > \mathbf{d}_c^e(\text{Moderate-left})$. To avoid default in such circumstances, it is essential not only that Lula adopts market-friendly Moderate-left policies but also that the market knows and believes that he has done so. To buy time needed for such a process of "learning to trust Lula", other policy actions may be necessary.

In fact the IMF approved Brazil's request for a 15-month standby credit of US\$ 30 billion (7 ½ times Brazil's IMF quota of \$4 billion) to support the country's economic and financial program (of which \$10 billion was made available under the Supplemental Reserve Facility "adding that much extra to the funds potentially available to defend the real before the election," (Williamson, 2002). To ensure policy compliance, the IMF agreed to disburse \$24 billion of the promised funds in 2003 only after the new government took office and accepted the conditions, including the target for a public sector primary surplus of 3.75 percent of GDP in 2003 (and no less than this for 2004/2005.¹⁶ Although the candidates were not formally required to endorse the program as proposed by Truman (2002) on the model Korea 1997, nevertheless, its Letter of Intent (IMF, August 2002), the incumbent government assured that Fund that "the core elements of the program have been explained to the leading candidates, and they have

¹⁵ This is a special case of Bayesian Learning. It is qualitatively similar to the more general two-sided process, described in the Appendix, where Lula shifts his policy preferences increasingly to be more market-friendly and the markets reduce their expected default probability accordingly.

¹⁶ The Lula government raised the target to 4.25 percent, further reassuring overseas investors, Financial Times (2003), p. 22, March 31.

committed to support them,” an assurance that the IMF publicly accepted (IMF, September 2002).

In understanding the declining path of interest rates, “the biggest event when Lula came to office in 2003 is that nothing happened.”¹⁷ We capture this idea in a model of Bayesian learning where not defaulting is enough to persuade the market that Far-left policies have been dropped. Formally, we postulate that the market’s belief of Lula’s type is a weighted average of a Far- and Moderate-left, where the former has a far higher propensity to default than the latter. This is to say, we assume the Far-left will default for sure, but the Moderate-left will only do so when interest rates are very high.¹⁸

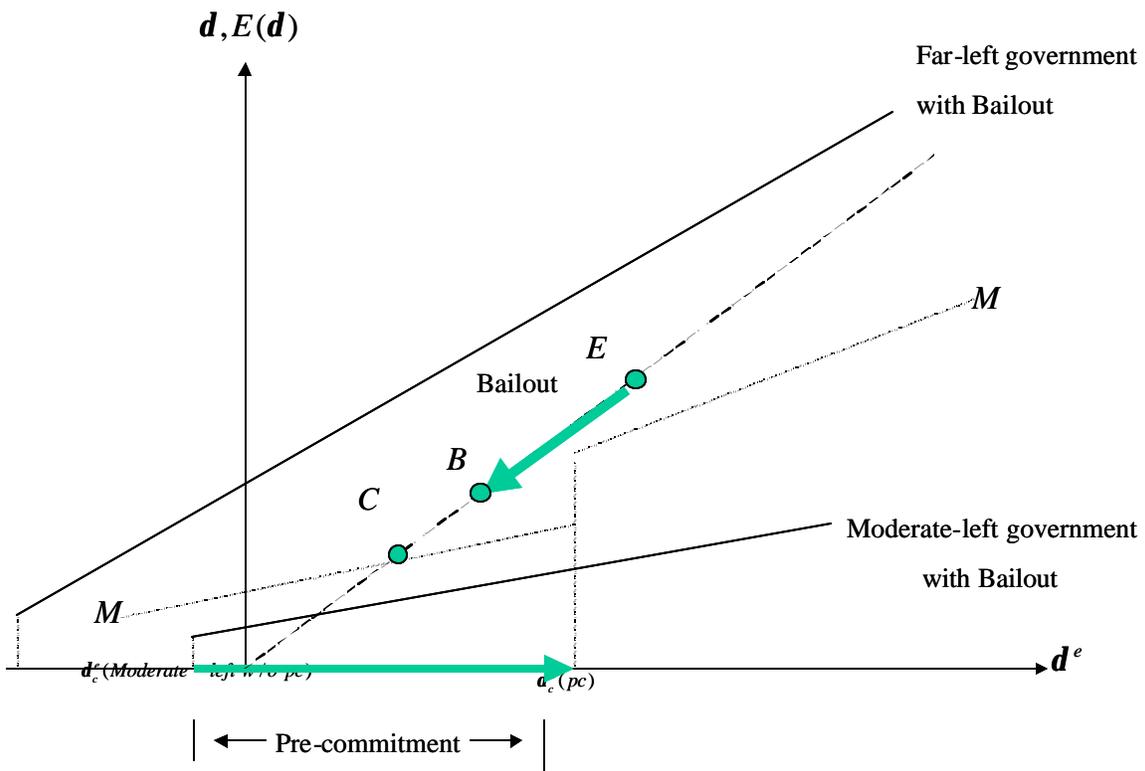


Figure 7: Bailouts and Policy Pre-commitment

¹⁷ Arminio Fraga’s comments at the PUC-Rio meeting.

¹⁸ Hence, if only the Moderate-left can avoid default for one period, market interest rates should fall sharply as the market learns its true type.

Since Lula has shown his willingness to adapt to the reality of taking power, we indicate in Figure 7 how IMF support can help implement a successful transition. (To focus on the process of learning, we assume in Figure 8 that Lula's election was seen as a sure thing, i.e., $\mathbf{p} = 1$, which rules out the postelection jump in spreads and implies that unconditional market expectations of post-election spreads depend only on the response function of the Left-wing. So point A corresponds to D_1 in Figure 6.) Where A represents the political equilibrium after a Sudden Stop, a partial bailout will lower country risk, as shown by the arrow from A to B in the figure (and a complete bailout will cut sovereign spreads to zero). Incorporating the bailout in the response functions for Moderate- and Far-left government and taking a weighted average gives the upper portion of the schedule MKM shown in the figure, passing through B on the 45-degree line ($\mathbf{d} = \mathbf{d}^e$) with a step down at K, where $\mathbf{d}^e = \mathbf{d}_c^e$ (Moderate-left without pre-commitment). Formally, in the absence of pre-commitment, the response function for the Left-wing government is obtained as

$$\mathbf{d} = (1 - P_0) \frac{(1 + \mathbf{d}^e)b^2 - Ab}{(\mathbf{a}_F + b^2)} + P_0 \frac{(1 + \mathbf{d}^e)b^2 - Ab}{(\mathbf{a}_M + b^2)}, \quad (11)$$

or, alternatively,

$$\mathbf{d} = \frac{(b^2 - Ab)(1 - P_0)}{(\mathbf{a}_F + b^2)} + \frac{P_0(b^2 - Ab)}{(\mathbf{a}_M + b^2)} + \left(\frac{(1 - P_0)b^2}{(\mathbf{a}_F + b^2)} + \frac{P_0b^2}{(\mathbf{a}_M + b^2)} \right) \mathbf{d}^e, \quad (11')$$

where P_0 is the prior probability attached to the prospect of the Left-wing being moderate. Note in the figure that, in the absence of policy pre-commitment, market expectations will force the Moderate-left government to default even with the provision of liquidity support as the point labelled B far exceeds the default trigger for Moderate-left government without pre-commitment.

If, however, policy pre-commitment succeeds in shifting the default trigger to the right of B, as shown by the arrow on the horizontal axis, there need be no default by the Moderate-left government. From the fiscal conditionality attached to the loan, it is clear that the IMF was concerned to check the moral hazard effects of providing a bailout many times the Brazilian quota. As fiscal policies are not formally incorporated in the

model, we represent the commitment to the IMF fiscal targets by increasing the lump-sum cost of default Z_M , which increases d_c^e , the expectation trigger, defined as

$$d_c^e = \frac{\sqrt{Z_M(a_M + b^2)}}{b^2} + \frac{A}{b} - 1.$$

Increasing the default trigger for the Moderate-left government as shown in the figure has the effect of shifting the “step” in the market response function to the right. As a result market interest rates fall to point C , where lower portion of the schedule $MK'M$ now intersects the 45-degree line.¹⁹ Note that the line segment of $MCK'M$ to the left of $d_c^e(pc)$ is the weighted average of the schedule “Far-left government with bailout” and the horizontal axis, where the weights are P_0 and $1 - P_0$ respectively.

Clearly, for default to be avoided, the trigger value achieved by the pre-commitment has to lie above the level of sovereign spreads achieved by the bailout alone, i.e. the two arrows in the figure must overlap. (The fact that the pre-commitment itself brings down market rates of interest raises the possibility of multiple equilibria. This occurs when the default trigger for Moderate-left government lies between point B and C in the diagram: so market expectation will trigger the default, point B , or no default, point C .) In the Brazilian case it appears that the effect of the partial bailout together with policy conditionality was sufficient for Lula to avoid strategic default.

5.2 Contagion

While it may appear that the financial crisis is “home grown”, our account includes a powerful channel for contagion, namely the source of the response functions we characterise as Far-left and Moderate-left and the weights attached to them. Brazil may differ from Argentina in many respects, but both have sufficiently high level of external debts to make them vulnerable to a crisis of confidence in the international capital market (Williamson 2002). Possibly the image of Moderate-left behaviour reflects that of Social Democratic parties in Chile and elsewhere as Williamson suggests. But could the image of the certain-to-default Far-left not be based on events in Argentina that took place less than a year before the Brazilian election? Contagion can raise country risk

¹⁹ Obtained by setting to zero the second term on the right hand side of equation (11).

by shifting prior beliefs about the nature of an incoming Far-Left government. It could also raise country risk by changing the weight attached to the prospect of a Far-left government. The potential link between politics and contagion implied by equation (11) can be summarised as follows:

Proposition 2 *Contagion and Politics*

Default expectations depend on parameters \mathbf{a}_F and $1 - P_0$, which are subject to contagious infection: a decline in \mathbf{a}_F and/or P_0 increases the likelihood of default.

As learning is immediate, in section 5.1 we gave merely a simplified account. We ignored, for example, efforts made by the incoming administration to “manage expectation”. In fact, as *the Economist* (p.39, January 4, 2003) noted, “Since the final weeks of the election campaign, Lula has worked hard to turn investor panic into mere wariness. He has stressed that Brazil means to pay its debt and has chosen ministers who seem ready to carry that promise through”. Moreover the target for the primary fiscal surplus was increased to 4.25 percent of GDP, thus raised by half a percent above what was promised to the IMF (*Financial Times* 2003). So, instead of simple Bayesian updating, beliefs could be subject to manipulation by the new government.²⁰

6. Conclusion

In this paper, we interpreted the high Brazilian country risk in 2002 and the Sudden Stop in capital flows as reflecting “political equilibrium” in a context where, for the first time, a charismatic Left-wing leader had a strong run for office. We show how, for reasons suggested by Alesina, sovereign spreads will move in line with opinion polls, rising with the popularity of Left-wing president. It is argued that as the behaviour of the potential Left-wing president was uncertain, the situation was ripe for contagion from neighbouring Argentina, where default followed the end of a Right-wing administration.

²⁰ Models of strategic learning that may be useful in this context include Cripps (1991), Ellison and Valla (2001) and Rosal and Spagat (2003)

The finding of a regime shift in mid-2001 reported by Gorette and Taylor (2004) and Gorette (2004) provides some econometric support for what we describe as a Sudden Stop -- and the latter gives evidence of political and other factors which may have triggered it. Gorette's (2004) estimates also indicate substantial regional contagion -- but only when Argentine spreads pass a threshold of 60%. By contrast, our account makes the transmission of contagion depend on Brazilian political developments: this 'interaction effect' helps us to account for what has happened outside Gorette's sample period, namely the rapid decline in sovereign spreads as Lula took office and pursued prudent policies.

We conclude that the evidence clearly support the existence of panic equilibrium (with no rollover and high sovereign spreads) associated with the anticipation of the Left-wing victory. Avoiding default was achieved, in our view, by process of transition in which Lula was first persuaded to adjust his policies and then the market learned to trust Lula. If over time Lula becomes more market friendly, prior probabilities of radical repudiation will be revised as debts are honoured and repudiation resisted, bringing down real interest rates and allowing for continued growth without default. IMF support, both financially and in the formation of credible policy, appears to play a key role in buying time for this transition process.

References

- Agénor, P., M. Miller, D. Vines, and A. Weber (eds.) (1999), *The Asian Financial Crisis: Causes, Contagion and Consequences*, Cambridge University Press.
- Alesina, A. (1987), "Macroeconomic Policy in a Two-Party System as a Repeated Game," *The Quarterly Journal of Economics*, Vol. 102, No. 3, pp. 651-678.
- Alesina, A., A. Prati and G. Tabellini (1990), "Public confidence and debt management: a model and a case study of Italy," in R. Dornbusch et al (eds.), *Public debt management: theory and history*, Cambridge University Press, pp. 94-124.
- Altug, S., F. Demers, and M. Demers (2000), "Political Risk and Irreversible Investment: Theory and An Application To Quebec," CEPR, Discussion Paper DP 2405, March 2000.
- Angeletos, G-M, C. Hellwig and A. Pavan (2003), "Coordination and Policy Traps," presented at the CEPR European Summer Symposium in Macroeconomics (ESSIM) in Athens (May).
- Araujo, A. and M. Leon (2003), "Speculative Attacks on Debts and Optimum Currency Area: A Welfare Analysis."
- Atkeson, A. (2000), "Comment on Morris and Shin," *NBER Macroeconomics Annual*, Vol. 15: pp. 162-171. Cambridge: MIT Press.
- Boschi, M. (2003), "International Financial Contagion: Evidence from the Argentine Crisis of 2001-2002," mimeo, University of Essex.
- Boonprakaikawe, J. and S. Ghosal (2000), " Bank runs and noisy signals," mimeo, University of Warwick.
- Calvo, G. A., A. Izquierdo and E. Talvi (2002a), "Sudden Stops, the Real Exchange Rate and Fiscal Sustainability: Argentina's Lessons", mimeo, Inter-American Development Bank (July).
- Calvo, G. A. and E. Talvi (2002b), "Lula Effect? Look Again!" Washington D.C., October 23, 2002.
- Chang, R. (2002), "Electoral Uncertainty and Volatility of International Capital Flows." (Also available at <http://econweb.rutgers.edu/chang/brazil1.pdf>)
- Claessens, S. and K. Forbes (2001), "International Financial Contagion."

- Cole, H. and T. Kehoe (1996), "A self-fulfilling Model of Mexico's 1994-1995 debt crisis," *Journal of International Economics*, 41, pp. 309-330.
- Colitt, R. (2002), "The Americas: Lula has first-round Brazilian poll victory in sight," *The Financial Times*, September 19.
- Corsetti, G., B. Guimares and N. Roubini (2003), "The Tradeoff Between an International Lender of Last Resort to Deal with Liquidity Crisis and Moral Hazard Distortions. A Model of the IMF's Catalytic Finance Approach."
- Cripps, M. (1991), "Learning Rational Expectations in a Policy Game," *Journal of Economic Dynamic and Control*, vol. 15, pp. 297-315.
- Dornbusch, R., Y.C. Park and S. Claessens (2000), "Contagion: how it spreads and How it can be stopped."
- Driffill, J. and M. Miller (1992), "Learning and inflation convergence in the ERM", *The Economic Journal*, vol. 103(417), pp. 369-378.
- Economist, The (2003), "Lula's burden of hope," January 4, pp. 39-40.
- Edwards, S. (2002), "Brazil's only hope of avoiding collapse," *The Financial Times*, August 5.
- Ellison, M. and N. Valla (2001), "Learning, Uncertainty and Central Bank Activism in an Economy with strategic factors," *Journal of Monetary Economics*, vol. 48, pp. 153-171.
- Favero, C. and F. Giavazzi (2002), "Why are Brazil's Interest Rates so High?," IGIER, Università Bocconi, Milano, July 14, 2002.
- Financial Times, "Lula's 100 days," March 31, p. 22, London.
- Fraga, A. and I. Goldfajn (2002), "Trust Brazil," *The Financial Times*, September 18, London.
- Fratzscher, M. (2000), "What Causes Currency Crises: Sunspots, Contagion or Fundamentals?" mimeo, EUI. (Also available at www.csgr.org)
- Fratzscher, M. (2002), "On Currency Crises and Contagion". ECB Working Paper No. 139, April 2002.
- Ghosal, S. and M. Miller (2002), "Co-ordination Failure, Moral Hazard and Sovereign Bankruptcy Procedures," mimeo, University of Warwick. (Also available at www.csgr.org)

- Giannini, C. (2003), ‘Who’s the cheapest-cost avoider in the sovereign debt market? Restating the case for the SDRM and greater restraint in IMF lending,’ Mimeo, International Relations Department, Banca D’Italia.
- Goldstein, Morris (2003), “Debt Sustainability, Brazil, and the IMF,” Institute for International Economics, Working Paper 03-1, February 2003.
- Goretti, M. (2004), “Undertanding the Brazilian currency turmoil in 2002: An empirical analysis”, mimeo, University of Warwick.
- Goretti, M. and M. P. Taylor (2004), “Brazil and the 2002 Currency Turmoil: A story of financial contagion and political mistrust?” mimeo, University of Warwick.
- Hellwig, C. (2002), “Public Information, Private Information, and the Multiplicity of Equilibria in Coordination Games,” *Journal of Economic Theory*, vol. 107 (2), pp. 191-222.
- IMF (2002a) “Brazil – Letter of Intent, Memorandum of Economic Policies, and Technical Memorandum of Understanding,” International Monetary Fund, August 29, 2002.
- IMF (2002b) “IMF Approves US\$30.4 Billion Stand-By Credit for Brazil,” International Monetary Fund, Press Release No. 02/40, September 6, 2002.
- Kim, J. Y. (2001), “Currency Crisis Contagion, Capital Flows, and Sovereign Ratings: Empirical Studies on (Asian) Emerging Markets,” Ph.D dissertation, University of Warwick.
- Masson, P. (1999), “Contagion: monsoonal effects, spillovers and jumps between multiple equilibria,” in P. Agénor et al (eds.) *The Asian Financial Crisis: Causes, Contagion and Consequences*, Cambridge University Press, pp. 265-280.
- Miller, M. (2002), “Sovereign Debt Restructurings: New Articles, New Contracts –or No Change?” *International Economics Policy Briefs*, Number PB02-3, April 2002.
- Miller, M., P. Weller and L. Zhang (2001), ‘Moral Hazard and the US Stock Market: Analysing the ‘Greenspan put’,’ *The Economic Journal*, March 2002.
- Miller, M. and L. Zhang (2000), “Sovereign Liquidity Crises: the Strategic Case for a Payments Standstill,” *Economic Journal*, vol. 110, pp. 335-362.
- Morris, S. and H. S. Shin (1998), “Unique Equilibrium in a Model of Self-Fulfilling Currency Attacks,” *American Economic Review*, vol. 88, 3, pp. 587-597.

- _____ (2000), "Rethinking Multiple Equilibria in Macroeconomic Modelling," *NBER Macroeconomics Annual*, Vol. 15: pp. 139-161. Cambridge: MIT Press.
- _____ (2003), "Catalytic Finance: When does it work?" Cowles Foundation Discussion Paper No. 1400, February.
- _____ (2003), "Liquidity Black Holes," presented at Liquidity Conference, LSE, September 26, 2003.
- Obstfeld, M. (1996), "Models of Currency Crises with Self-Fulfilling Features," *European Economic Review*, April 1996, 40(3-5), pp. 1037-1047.
- PT (Partido dos Trabalhadores) (2001), "Concepção e Diretrizes do Programa de Governo do PT para o Brasil," (also available at <http://www.pt.org.br> see under Diretrizes).
- Rodrik, D. and A. Velasco (1999), "Short-Term Capital Flows," *NBER Working Paper Series*, Working Paper 7364, <http://www.nber.org/papers/w7364>.
- Rosal, J. M. and M. Spagat (2003), "Structural uncertainty and central bank conservatism: the ignorant should shut their eyes", mimeo, Royal Holloway College, University of London, January.
- Roubini, N. (2002), "Do we need a new bankruptcy regime? Comments on Bulow, Sachs and White", *Brookings Papers on Economic Activity*, no. 1, pp. 321-333.
- Sachs, J., A. Tornell and A. Velasco (1996), "The Mexican peso crisis: Sudden death or death foretold?," *Journal of International Economics*, vol.41, pp. 265-283.
- Thampanishvong, K. (2002), "Incorporation of Electoral Uncertainty into the Crisis Model with Self-fulfilling Feature" MSc dissertation, University of Warwick.
- Truman, E. M. (2002), "Brazil Needs Help," *Financial Times*, June 25.
- Williamson, J. (2002), "Is Brazil next?" *International Economics Policy Briefs*, PB02-7, Washington DC: Institute for International Economics.
- Wolf, M. (2003), "Why Debt is such a burden to Latin American Countries," *Financial Times*, January 22, p. 19, London.

Appendix

Modelling the Adjustment of Policy and Perception

A crucial feature of the Brazilian experience was that Lula learned to become market friendly and shifted his announcements during the campaign accordingly: together with market learning of his revised policies, this led to a fall in sovereign spreads. In this appendix we model the former as a random choice of preference between those of the Far-left and those of Moderate-left, where the probability of Lula selecting Moderate-left policies increases monotonically over time (e.g., due to the good offices of both the Central Bank and the Ministry of Finance): market learning is described by a Bayesian process of updating, where the prior attached to Lula being Moderate-left steadily increases in the absence of default.

Let \mathbf{r} denote the probability per unit of time of drawing a low-valued preference parameter \mathbf{a}_L (which leads to default) and let $1 - \mathbf{r}$ be the complementary probability of drawing a high-valued preference parameter \mathbf{a}_H (which leads to no default). We define two (constant) extreme types of left-wing government: the Far-left which defaults for sure ($\mathbf{r}_F = 1$) and the Moderate-left which never defaults ($\mathbf{r}_M = 0$).

To capture the fact that Lula shifted his policy stance substantially towards Moderate-left during and after the election, we use a model of Bayesian learning. As described next paragraph, this requires an upper bound of the market belief of Lula's type which declines over time. Let this be given by $\mathbf{r}_{lula}(t) = \mathbf{w}(t)\mathbf{r}_M + [1 - \mathbf{w}(t)]\mathbf{r}_F$, where $\mathbf{w}(t)$ lies between 0 and 1, $0 \leq \mathbf{w}(t) \leq 1$, and increases to 1 over time. Obviously, $0 \leq \mathbf{r}_M \leq \mathbf{r}_{lula}(t) < 1$, and $\mathbf{r}_{lula}(t)$ declines toward \mathbf{r}_M .

To incorporate Bayesian learning in an analytically tractable way, we first assume that markets believe that Lula can be one of two different types, either defaulting with a high probability $\mathbf{r}_{lula}(t)$, as defined above, or with a low probability. Just after the election, the financial markets attach a prior probability P_0 to the belief of the prospect

that Lula is Moderate-left of \mathbf{r}_M (and the complementary probability $1 - P_0$ to the prospect that it is $\mathbf{r}_{lula}(t)$).

How will these priors evolve over time? Let P_t be the market's prior belief at time t that Lula is moderate-left, conditional on observing that he has not defaulted in the previous t periods. If there is no default at period t , the prior belief of a Moderate-left government at period $t + 1$ can be obtained using the Bayesian updating rule

$$P_{t+1} = \frac{P_t(1 - \mathbf{r}_M)}{P_t(1 - \mathbf{r}_M) + (1 - P_t)(1 - \mathbf{r}_{lula}(t))}. \quad (\text{A1})$$

The complementary probability is

$$1 - P_{t+1} = \frac{(1 - P_t)(1 - \mathbf{r}_{lula}(t))}{P_t(1 - \mathbf{r}_M) + (1 - P_t)(1 - \mathbf{r}_{lula}(t))}.$$

Dividing the two equations above yields

$$\frac{P_{t+1}}{1 - P_{t+1}} = \frac{1 - \mathbf{r}_M}{1 - \mathbf{r}_{lula}(t)} \frac{P_t}{1 - P_t} \quad (\text{A2})$$

Let $V_t = \frac{P_t}{1 - P_t}$, then (A2) becomes a first-order difference equation

$$V_{t+1} = \frac{1 - \mathbf{r}_M}{1 - \mathbf{r}_{lula}(t)} V_t$$

with the solution

$$V_t = f(t)V_0, \quad (\text{A3})$$

where $f(t) = \frac{(1 - \mathbf{r}_M)^t}{[1 - \mathbf{r}_{lula}(t-1)][1 - \mathbf{r}_{lula}(t-2)] \cdots [1 - \mathbf{r}_{lula}(0)]}$.

Solving for P_t yields

$$P_t = \frac{f(t) \frac{P_0}{1 - P_0}}{1 + f(t) \frac{P_0}{1 - P_0}} \quad (\text{A4})$$

Consider a simple case where $\mathbf{r}_M = 0$, i.e., the Moderate-left government never defaults. As long as Lula has not defaulted, the process of Lula's adoption of moderate-

left policies will imply that $\mathbf{r}_{Lula}(t) \rightarrow \mathbf{r}_M$ or the default probability of Lula will decline asymptotically over time.

Since $\mathbf{r}_M \leq \mathbf{r}_{Lula}(i) < \mathbf{r}_{Lula}(i-1)$, it is obvious that $\frac{1 - \mathbf{r}_M}{1 - \mathbf{r}_{Lula}(i-1)} > \frac{1 - \mathbf{r}_M}{1 - \mathbf{r}_{Lula}(i)} \rightarrow 1$. This implies both $f(t)$ and P_t are increasing overtime.

So, as Lula adapts his policies, markets would believe that Lula is less likely to default.

How would learning affect the ex ante default rate? If market believes Lula is of the type of Moderate-left, the resulting default rate must be

$$\mathbf{d}_M = 0.$$

If, however, the market believes that Lula is of the type of $\mathbf{r}_{lula}(t)$ for sure, the default rate will be

$$\mathbf{d}_F = \frac{b^2}{\mathbf{a}_L + b^2} (1 + \mathbf{d}_t^e).$$

Given the market's priors, the *ex ante* spreads for Lula in the presence of learning and policy adaptation can be expressed as

$$\begin{aligned} \mathbf{d}_t^e &= E_t(\mathbf{d}_t) = P_t[\mathbf{r}_M \mathbf{d}_F + (1 - \mathbf{r}_M) \mathbf{d}_M] + (1 - P_t)[\mathbf{r}_{Lula}(t) \mathbf{d}_F + (1 - \mathbf{r}_{Lula}(t)) \mathbf{d}_M] \\ &= (1 - P_t) \mathbf{r}_{Lula}(t) \mathbf{d}_F \\ &= (1 - P_t) \mathbf{r}_{Lula}(t) \frac{b^2}{\mathbf{a}_L + b^2} (1 + \mathbf{d}_t^e) \end{aligned}$$

assuming that $\mathbf{r}_M = 0$.

This implies that the expected default rate is

$$\mathbf{d}_t^e = \frac{(1 - P_t) \mathbf{r}_{Lula}(t) \frac{b^2}{\mathbf{a}_L + b^2}}{1 - (1 - P_t) \mathbf{r}_{Lula}(t) \frac{b^2}{\mathbf{a}_L + b^2}} \quad (\text{A5})$$

Since both $(1 - P_t)$ and $\mathbf{r}_{Lula}(t)$ are decreasing over time, \mathbf{d}_t^e declines monotonically. This gradual downward adjustment in sovereign spreads is more realistic than the simple step-change used in the text, and it corresponds broadly to the time-profile of Brazilian spreads depicted in Figure 3.