Brazil in the 21st Century:

How to Escape the High Real Interest Trap?

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Abstract

The hope that lower real interest rates and higher growth would follow the floatation of the currency was in large measure frustrated. Two international liquidity crises, caused by the reversal of capital flows, hit in 2001 and 2002. These crises were associated with higher interest rates, lower economic activity and higher inflation. Therefore, the name exchange-rate stagflation seems to characterize the essence of the phenomenon. A stylized model, due to Caballero and Krishnamurthy [2002], was used to explain the events. The main characteristic of the model is that domestic investment depends on the aggregate international liquidity of the economy, which is a limiting factor. During a liquidity crisis, the amount of liquidity is reduced, and the economy falls in recession. Neither the fiscal authority nor the monetary authority can reflate the economy by increasing government expenditures or the money supply. The bulk of the difficulties Brazil is currently facing derives from the uncertainty associated with the course of the future economic policy to be followed by the new administration, and to the sustainability of the public debt. To avert a painful default, real interest rates must fall and sustained growth must resume. To increase the chances of success, several policy measures are suggested:

- To increase the exportability of the economy;
- To increase the fiscal effort, in order to help dispel the doubts over the sustainability of the public debt;
- To increase the credibility of the monetary authority, by conferring instrument independence to the Brazilian Central Bank; and
- To resume the debt management efforts to lengthen the debt profile while reducing the indexation to the exchange rate and to the Selic short term rate, by making larger user of inflation-linked bonds.

When and if the current international liquidity crisis is overcome, the above measures will help Brazil to lower the real interest rates and achieve sustained growth.

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1. Introduction

With the Real Plan of July 1994, Brazil has eventually tamed inflation. Since then, more than eight years have elapsed, but the real interest rates in Brazil still rank among the higher in the world. This has a deleterious impact on public finances, and also jeopardizes the Brazilian economy's growth prospects. The banking spread is also extremely high, making credit extremely expensive. Not surprisingly, outstanding credit provided by the financial sector remains below 30% of GDP. Finance through equity is also small. The total capitalization of the Brazilian market is less than 70 USD billion. The public sector remains the main attractor of private savings. The gross bonded domestic debt of the public sector has jumped from 11.5% to 46.3% of GDP in this eight-year period.

For the financial sector to properly act as a support for sustained growth, several challenges loom ahead. Among those, this paper will deal with the fundamental question of how to lower the basic interest rate (Selic). This is a *sine qua non* condition both for the economy to resume sustained growth and for the public sector debt not to become unsustainable.[2]

Section 2 lays out the main stylized facts for Brazil during the floating exchange rate period since January 1999. It also presents a decomposition (analysis) of the domestic interest rates identifying the main components of the high real interest rate. These components, in turn, will be interpreted in light of the schematic model of Section 3 to derive policy recommendations.

Section 3 describes the IS-LM version of the model proposed by Caballero and Krishnamurthy for emerging markets [2002]. We use this simple adaptation of the traditional Mundell-Fleming model to explain the events and policy reactions that marked the recent experience since the real was floated in January 1999.

Section 4 derives policy conclusions aimed at reducing the real interest rate in the next years. Finally, Section 5 presents the conclusions.

[2] In a recent article, where the 2002 Brazilian crisis is generated in a multiple equilibrium model by a fear of a regime change after the presidential elections, Razin and Sadka [2002] conclude that "… whether Brazil can return to robust growth seems to crucially depend on whether lower interest rates could be restored."

2. 1999-2002: The floating exchange rate experience

In this Section, we analyze the behavior of the interest rates and of the exchange rate during the floating rate period of the Real Plan, which corresponded to the second term of President Fernando Henrique Cardoso. Table 1 displays the main macroeconomic indicators of that period.

TABLE 1: The Floating Period of the Real Plan				
	1999	2000	2001	2002*
GDP Growth	0.81%	4.36%	1,51%	1.20%
Inflation (CPI)	8.94%	5.97%	7.67%	8.76%
Exchange Rate Depreciation	52.96%	6.45%	20.36%	48.03%
Nominal Interest Rate (Selic)	24.80%	17.39%	17.24%	18.01%
Real Interest Rate	14.56%	10.77%	8.89%	11.25%
Fiscal Surplus (%GDP)				
Primary	3.28%	3.55%	3.75%	3.88%
Nominal	-5.83%	-3.64%	-3.54%	-3.50%
Current Account				
USD Billion	-25.33	-24.22	-23.21	-11.10
%GDP	-4.77%	-4.08%	-4.61%	2,69%
* Expected as of November 8, 2002.(source Market Readout)				
http://www4.bcb.gov.br/gci/Readout/R20021108.pdf				

The second term of President Cardoso started with the change in the exchange rate regime. The BRL was floated in January 1999, and later in second quarter, the inflation-targeting regime was introduced. Also in marked contrast with the 1995-98 period, the primary fiscal balance has posted a marked improvement. Growth, however, has been faltering, and the current account balance, despite the earlier depreciations, only this year has improved in dollar terms.

The very high real interest rate, the low growth and the risky debt structure, highly indexed to the exchange rate and to the short term interest rate, as well as the recognitions of hidden liabilities, made the net public debt to GDP ratio to increase dramatically: from 30.4% in 1994 to 41.7% in 1998 and 58.3% in 2002.[3] The sustainability of the public debt depends not only on the capacity of keeping high primary fiscal surpluses, but also of lowering the real interest rate and of resuming growth.[4]

In order to better understand the joint behavior of exchange and interest rates, we perform a decomposition of Brazilian domestic interest rates according to the covered interest parity condition. This condition states that an investor should be indifferent between investing in domestic bonds, receiving the domestic interest rate i_t, or investing in foreign bonds, receiving the international interest rate i_t^*, and insuring against exchange rate

[3] See Garcia [2002] for a decomposition exercise of the debt growth.
[4] For debt simulations under different scenarios, see Goldfajn [2002].

fluctuations. This insurance is usually undertaken through forward or futures markets, and its cost is the depreciation rate computed by dividing the forward rate by the spot rate, also known as forward premium, fp_t. The forward premium encompasses not only the expected depreciation $E_t(\ln(S_T/S_0))$, but also a risk premium, usually called currency risk, CUR_t. Therefore, if the covered interest parity held, the domestic rate would equal the international interest rate plus the forward premium, i.e., equation (1) would hold:

$$i_t = i_t^* + fp_t = i_t^* + E_t(\ln(S_T / S_0)) + CUR_t \qquad (1)$$

The analysis for Brazil uncovers a substantial positive residual once both the international interest rate and the forward premium are subtracted. This covered-interest-parity differential ($CIPD_t$) is a measure of the country risk.[5] Therefore, equation (1) must be adapted to fit the Brazilian data.

$$i_t = i_t^* + fp_t + CIPD_t = i_t^* + E_t(\ln(S_T / S_0)) + CUR_t + CIPD_t \qquad (2)$$

Alternatively, sovereign bonds traded in international markets could be used to infer the country risk. One of the most widely used measure of country risk is the C-Bond spread, obtained from deducting the yield on US treasuries of the same duration from the yield offered by the C-Bond in international secondary markets. We call this measure the country risk, COR_t, since it is a measure derived from secondary international markets, which are not directly affected by domestic monetary policies measures. The comparison of the two measures of country risk, $CIPD_t$ and COR_t, has important consequences for the joint behavior of the exchange rate and the interest rate as we will argue below.

Chart 1 displays the interest rate decomposition described by equation 2 from the time when President Cardoso took office in January 1995. The one-year nominal interest rate is the upper dark line, and should be read in the LHS scale. The one-year rate is usually higher than the basic rate (Selic) displayed in Table 1 because the yield curve has usually sloped upwards during the period studied. Only for brief periods this interest rate has been below the 20% threshold, even during the floating period (since January 1999).

The one-year interest rate is decomposed in three series, according to equation 2. The lower dark blue area is the one-year interest rate on US Treasuries, i_t*. On top of the international interest rate, the red area is the forward premium, fp_t. Finally, the residual is the covered-interest-parity differential, $CIPD_t$.

To better contrast the behavior of the covered-interest-parity differential with the C-Bond spread, it is displayed again as the light blue line (RHS scale). It may then be easily compared to the country-risk measure provided by the C-Bond spread, the green line

[5] The differential (or deviation) of the covered interest rates parity[5] is the best measure of the lack of perfect capital mobility ...*because it captures all barriers to integration of financial markets across national boundaries: transactions costs, information costs, capital controls, tax laws that discriminate by country of residence, default risk, and risk of future capital controls* [Frankel, 1991].

(RHS scale). Although the two lines are country-risk measures, they should differ by several reasons, as analyzed in Garcia and Valpassos [2000], e.g.:

1. The maturity and duration of the bonds involved are different; the C-Bond's being much longer than one year during the period studied. This effect is smaller the closer to the end of the period.
2. The tax treatment may be very different and it varies according to the investor. [6]
3. Capital controls (on capital inflows) affecting the domestic bonds were in place during the first half of the sample.[7]
4. The credit risk (default risk) may be perceived to vary across debt types (domestic vs. foreign). I.e., investors may believe that there is an order of default, and domestic debt may be junior or senior in relation to foreign debt.
5. In the event of an exchange rate crisis, restrictions on capital outflows may be imposed. If this were done without defaulting on the debt, it would only affect foreign investors who purchased domestic debt, while those that acquired foreign debt would not be harmed.

Despite all the reasons above outlined, the two Brazilian country-risk measures cannot drift too much apart without triggering financial strategies that revert the spread between the two to "normal". In other words, if a negative shock, as the current increase in risk aversion of international investors, increased the C-Bond spread, domestic interest rates would also have to rise. Otherwise, capital would flee the country, causing losses of foreign reserves (under the old crawling-peg regime), or exchange rate depreciation (under the current flexible exchange rate regime). In the first half of the sample, the crawling-peg period, the covered-interest-parity differential has systematically surpassed the C-Bond spread. Only during crises, when the C-Bond spread jumped upwards, has it been above the covered-interest-parity differential.

Salgado, Garcia and Medeiros [2001] explain this behavior through a non-linear central bank reaction function. According to our argument, the Brazilian central bank faced two different constraints. In "good times", foreign capital was plentiful, and the central bank reaction function did not take into consideration the pressure from the exchange rate (since it was a crawling peg, the pressure would materialize in a loss of foreign reserves to preserve the peg). During those periods, the Brazilian central bank would act as a developed country central bank, concerned only with the inflation expectation and with the output gap. During crises, however, the loss of reserves necessary to preserve the peg would trigger another channel (call it exchange rate channel) that would make interest rates to jump upwards. Typically, as shown in Chart 1, the C-Bond spread is the first to jump, and the covered-interest-parity differential moves later, as domestic interest rates are raised to avoid further foreign reserves losses. Therefore, the increase in the difference between the C-Bond spread and the covered-interest-parity differential has served as a very good coincidental, and sometimes leading, indicator of crises.

After a turbulent initial period that followed the floatation of the Real (BRL) in January 1999, the ordering that prevailed in the previous crawling peg regime was inverted: the

[6] See Oliveira [1997].
[7] See Garcia and Barcinski [1998].

C-Bond spread became systematically larger than the covered-interest-parity differential. A possible reason for that was the large increase in foreign direct investment (FDI), and the much lower inflow of short-term-arbitrage-funds to invest in Brazilian domestic debt. What is suggested is that the difference between the C-Bond spread and the covered-interest-parity differential—given all the taxes, legal restrictions and perceived risks involved—was enough to prevent capital flight, but not enough to attract foreign funds as in the previous period.[8]

Chart 2 displays the interest rate decomposition data in a different format, more akin to the model of Section 3. It covers the period from January-2000 to April-2002. The year of 2000 was the only good year of the flexible regime. During 2000, the basic interest rate (Selic)—the dark green line (LHS scale)—fell throughout, and the exchange rate—the yellow area in the background (RHS scale)—remained well behaved. The slope of the yield curve is measured by the difference between the one-year interest rate—the black line (LHS scale)—and the Selic rate. The yield curve was not very steep, and even became inverted during brief periods, signaling the expectation of further fall in interest rates.

In Chart 2, the one-year interest rate is decomposed in two parts: the forward premium—the red line (LHS scale)—, corresponding to the depreciation one-year ahead; and the domestic USD rate—the blue line (LHS scale)—, corresponding to the yield one gets by investing in a domestic bond indexed to the USD. I.e., one can either get a nominal rate in BRL, or buy a bond that pays the actual (ex post) depreciation plus the USD domestic rate.

The C-Bond yield is also included as the brown line (LHS scale). Finally, the difference between the C-Bond spread and the covered-interest-parity differential, the two measures of country risk, is portrayed as the purple line (LHS scale). During 2000, the forward premium and the USD domestic rate were both falling, evenly splitting the BRL domestic rate.[9] The C-Bond yield remained stable. The hope by the end of 2000 was that sustained growth was just around the corner, and, accordingly, the Brazilian equivalent of the FOMC,[10] the COPOM,[11] cut the Selic target in early January 2001 to the lowest rate since the start of the Real plan, 15.25%.

[8] It is likely that the exchange rate volatility introduced by the new regime much increased the risks involved in the financial strategy known as carry trade. This strategy consists of borrowing in low-yielding currency, exchanging the proceeds into a high-yielding currency and reverting the trade at the end. The gain is the difference in interest rates. If the low-yielding currency depreciates vis-à-vis the high-yielding currency, there is an additional capital gain. However, if the high-yielding currency depreciates, then the interest rate differential may be wiped out.

[9] Probably, this is just a coincidence.

[10] Federal Open Market Committee.

[11] Monetary Policy Committee.

Unfortunately, a composition of domestic and international events[12] did not let this happen. After March 2001, it became clear that the good times were gone. The country risk, as measured by the C-Bond spread, started trending upwards. The domestic interest rates also reacted. The Selic was increased several times, and the yield curve steeped remarkably. Despite the large increase in the one-year interest rate, the increase was entirely due to the increase in the forward premium. The USD domestic rate actually fell during 2001, increasing the difference between the two country risk measures. Until September 2001, the exchange rate depreciated continually. The immense liquidity that was injected by the Fed after September 11 allowed the situation to improve until the first quarter of 2002. The C-Bond yield fell to its previous level, while the exchange rate appreciated and interest rates fell, and the yield curve flattened.

However, not everything had reverted to the configuration that prevailed one year before. The forward premium remained at a much higher level, signaling that the calm inspired by the exchange rate appreciation was not trusted to last for long. The difference between the two measures of country risk was as large as it had ever been, also signaling that potential financial strategies involving capital outflows could be profitable.

With the benefit of hindsight, we now know that another negative combination of domestic and international events created a confidence crisis that made the country risk explode after April 2002. Chart 3 displays what happened during the second crisis bout.

As during the 2001 crisis, the one-year interest rate rose along with the increase in the country risk. Nevertheless, the COPOM decided to keep the downward movement in the Selic rate, justifying such move with the recession and a low pass-through from exchange rate depreciation to inflation. The Selic target was raised by 300 bps, from 18% to 21%, only on October 14 2002. The decomposition of the increase in the one-year interest rate this time, however, reveals a completely opposite picture from the 2001 crisis. In 2002, the one-year interest rise was entirely due to the increase in the domestic USD rate, which was lagging behind the C-Bond yield, while the forward premium decreased substantially, even becoming negative, a clear indication that markets expected appreciation of the BRL.[13] Of course, for the expected appreciation to materialize, an enormous depreciation happened. From April to October, the exchange rate depreciated almost 70%. The real exchange rate attained the most depreciated level it has ever reached in the last three decades, period that included several depreciation episodes and international financial crises.

The decomposition of the forward premium in the expected depreciation and the currency risk sheds more light in the joint behavior of interest and exchange rates. However, the separation of the two components is not a clear-cut procedure. First, the expected inflation is itself a theoretical construct, since market players may disagree in their

[12] On the domestic side there were the energy crisis and the political disarray inside the government coalition. On the international side, it became clear that the US economy entered a recession and the Argentina crisis worsened considerably, bringing contagion to Brazil.

[13] This "expected" appreciation could be a sheer market outcome or a result of future measures that restricted capital outflows.

expectations. Even if we agree upon the existence of an expected inflation variable, the empirical literature points out to the existence of a severe bias in survey data (see Chinn and Frankel [1994]). Alternatively, econometric methods may be used to disentangle the two components (see Garcia and Olivares [2001]).

Notwithstanding the previous caveats, a survey[14] compiled by the Brazilian central bank is used to decompose the forward premium in the expected depreciation and the currency risk. The results are presented in Chart 4. The forward premium is the red line (LHS scale); the expected depreciation, the dark green line (LHS scale); and the currency risk, the light blue line (LHS scale). On the RHS scale is the exchange rate, as the yellow are in the background.

Chart 4 shows that during the 2001 depreciation episode, the forward premium increase was due to the increase in the currency risk, while expected depreciation became negative.[15] The same movements happened during the 2002 crisis, except that the expected depreciation became much more negative, while the currency risk still increased vis-à-vis the calm interim between the two exchange rate depreciation episodes. Chart 4 shows that the currency risk premium has almost always been positive,[16] even in periods of large expected appreciation of the BRL.

As Chart 3 shows, during the 2002 depreciation episode, the USD domestic rate became larger than the domestic interest rate. Consequently, the forward premium became negative. Since there is an arbitrage between the domestic rate in BRL and the domestic rate in USD plus exchange rate indexation, the negative forward premium caused the yield curve in instruments indexed to the exchange rate to stay above the yield curve for BRL instruments. This effect is higher the shorter the instrument, since rates are annualized. For example, if the 1 month forward premium is –5%, an investor who purchased an USD indexed instrument would have to get at least a 5% a month, or 60% per year, just to break-even.

Chart 5 displays the yield curves for BRL and USD-indexed domestic instruments on October 22 2002. For maturities equal or less than one-year, the USD domestic yield curve is higher than the BRL domestic yield curve. This is a very unusual situation that signals the extreme scarcity of foreign liquidity in Brazilian domestic markets.

In summary, the stylized facts are the following:

1. In both large depreciation episodes, 2001 and 2002, the country risk measure given by the C-Bond spread increased, although the increase was much more

[14] http://www4.bcb.gov.br/gci/Readout/R20021018.pdf.
[15] If agents believed that the exchange rate is a martingale (or a random walk), thereby issuing forecasts equal to the current values, and if these forecasts were measured with a lag, we would get expected appreciation when the currency is depreciating, and expected depreciation when the currency is appreciating.
[16] Except for a brief period around the end of March 2000, when the exchange rate reached a trough.

pronounced in the latter episode than in the former. This latter episode is associated with large exchange rate outflows from Brazil.

2. In the 2001 episode, the country-risk measure given by the covered-interest-parity differential and the domestic USD interest rate decreased, while they increased significantly during the 2002 episode. Conversely, the forward premium increased substantially in 2001, and became negative in 2002.
3. The negative forward premium gave rise to an inverted yield curve of USD domestic rates that surpassed the BRL yield curve for maturities up to one-year.
4. The 2002 depreciation created an expectation of nominal appreciation of the BRL, a very unusual situation. Nevertheless, the currency risk remained positive in both depreciation episodes.

An alternative way to put the above facts is the following: the extreme scarcity of foreign liquidity in the 2002 crisis increased substantially the return in USD domestic instruments. Because of no arbitrage, either the domestic interest rate would have to increase much more than it did, or an expected appreciation of the BRL would have to be generated. For this to happen—and given that the long term equilibrium real exchange rate should have also depreciated because of the worse prospects of capital inflows—, the BRL/USD exchange rate had to overshoot. The model in the next Section will help to interpret some of the facts, and to derive policy recommendations.

3. A version of the CK model for segmented financial markets

The fundamental characteristic for a model to adequately represent the recent events described in the previous Section is the imperfect integration (segmentation) between the Brazilian domestic market and international financial markets. Here we resort to the simplest version of the dual liquidity models developed by Caballero and Krishnamurthy [2002], henceforward, CK.[17] This static simple model is akin to the traditional Mundell-Fleming IS-LM-BP model[18] with a restriction on the amount of foreign liquidity that can be used as collateral for foreign capital inflows.

To simplify, CK assume that all private investment and public outlays must be foreign-financed, i.e.:

$$I + G = CF \qquad (3),$$

where I is domestic investment, G is government outlays, and CF is net capital inflows.[19] Given this simplifying assumption, an external crisis is a situation where there is not enough capital flows to implement the desired levels of investment and public outlays. I.e., the economy is restricted by the availability of foreign capital inflows. CK assume that the economy has a stock of international liquidity (assets that can be posted as collateral in international markets), IL. Loans backed by international liquidity are made at the international rate i^*. Inequality (4)—always valid—holds as equality in a crisis:

$$I + G \leq IL \qquad (4).$$

The domestic financial market is used to redistribute international liquidity among domestic agents, since the domestic owners of international liquidity are not necessarily those with investment projects. Domestic agents may borrow from other domestic agents according to their domestic liquidity, DL, which is a decreasing function of the domestic interest rate, i^p.[20] When a firm borrows international liquidity from a domestic agent, it pays a domestic rate indexed to the currency depreciation, call it, the domestic dollar rate, i^d.

Investment is a decreasing function of both rates, i^p and i^d. Since i^d is the firm's cost of capital, the higher the i^d, the lower the investment. When the central bank tightens monetary policy, i.e., increases i^p, the present value of future cash flows falls, reducing DL, the collateral firms can offer, thereby reducing investment, *ceteris paribus*.[21]

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[17] See also Caballero and Krishnamurthy [2001a, 2001b, 2001c, and 2001d].
[18] See Williamson [1986] and Blanchard and Fischer [1989].
[19] In fact, all that is needed is that domestic absorption be larger than national output, generating a need for external savings (current account deficits).
[20] In Caballero and Krishnamurthy [2002], the superscript p stands for peso. We opted not to substitute the real rate for the peso rate to avoid the possible confusion between the name of the Brazilian currency and the adjective real.
[21] We could simply assume that higher domestic interest rates would lower domestic absorption. However, since CK assumed that investment is fully financed from abroad, this domestic credit channel is needed.

$$I\left(i^d, i^p\right); \frac{\partial I}{\partial i^d} < 0, \frac{\partial I}{\partial i^p} < 0 \qquad (5).$$

CK's model of emerging markets' crises is better understood with the help of Figure 1, where i^d and G are taken as given for the moment. The horizontal axis is $I+G$, which in this simplified framework determines the domestic absorption. According to inequality (4), $I+G$ is limited by the amount of international liquidity, represented in Figure 1 by the reversed-L shaped supply curve. A crisis is a reduction of the amount of IL, which forces firms to reduce aggregate investment.

$$I\left(i^d, \bar{i}^p\right) + G = IL \qquad (6).$$

As shown in Figure 1, the reduction in IL forces the dollar rate, i^d up, above the international rate, i_0*. This does not represent an arbitrage opportunity for foreign investors because the amount of internationally accepted collateral is limited. Foreign loans have to be fully collateralized with international liquidity. The lower panel in Figure 1 represents the usual modeling of crises, where an external shock increases the risk premium, increasing i^d. While the same amount of aggregate investment could be produced with both models for the appropriate rescaling of the parameters, the key difference is that the supply of capital flows in the upper panel is completely inelastic, as opposed to the lower panel, where the supply of capital flows is completely elastic at the higher rate. This inability of higher dollar rates to increase the capital inflows will generate a completely new set of results that conforms to most stylized facts of the Brazilian experience, as it will be shown. Certainly, no supply is completely inelastic. However, anecdotal evidence support the conjecture that the extremely large country risk premium (above 2000 bps) recently verified in Brazil, was a result of quantitative restrictions.[22]

A *domestic* investor with an unit of international liquidity may either lend this unit to another domestic agent, receiving the domestic dollar rate, i^d, or convert this unit in domestic currency and invest it at the domestic interest rate, i^d. The *domestic* interest parity condition that corresponds to the non-arbitrage condition of a *domestic* investor that possesses one unit of international liquidity is given by equation (7), where $\hat{e}$ is the expected appreciation of the domestic currency.

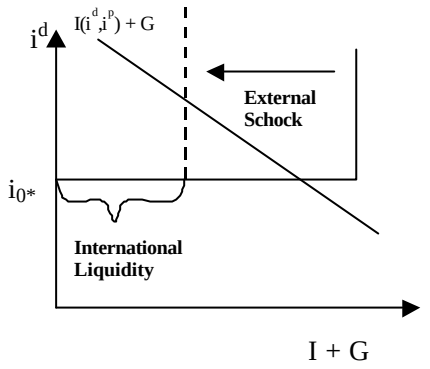
$$i^d = i^p + \hat{e} \qquad (7)$$

If the domestic dollar rate rises, either the monetary authority has to tighten monetary policy by raising i^p, or an expected appreciation must be generated.[23] The latter is accomplished through the depreciation of the spot exchange rate (overshooting). The

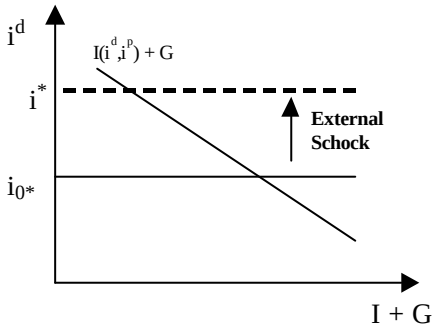
[22] A few large international banks that used to do the carry trade in Brazil simply stopped doing such "arbitrage" strategies after April 2002.

[23] Since this simple static model does not consider uncertainty, the expected appreciation must equal the actual one.

depreciation causes the dollar value of all domestic assets to fall, i.e., even though the future cash flows may remain the same, prices in dollar of, say, domestic stocks fall just because the economy lacks international liquidity.



(a) Dual-Liquidity Model



(b) Standard Model

Figure 1: External Crises

CK model the monetary side with a simplified LM curve, equation (8). Figure (2) illustrates the equilibrium in both the goods and the money markets. The standard model is represented by the IS' curve, while the CK model curve is IS, where the vertical segment follows from the limited *IL*.

$$L\left(\bar{i}^{p}, I+G\right)=M \qquad (8)$$

Figures (1) and (2), together with equation (7) determine the equilibrium of the investment plus government outlays level, the domestic interest rate, the domestic dollar rate and the exchange rate.

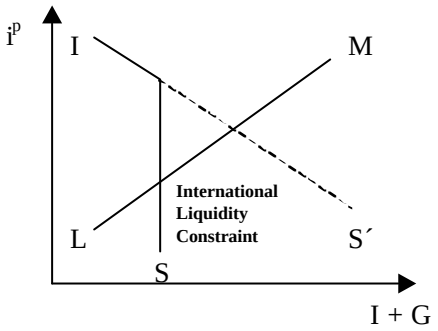


Figure 2: Equilibrium

This simple model is sufficient to exemplify some of the new results arising from assuming the segmentation of the domestic and the international financial markets. For example, in the standard model, an expansionary monetary policy, by moving the LM to the right and reducing the domestic interest rate, i^p, raises firms' net worth, relaxing their domestic financial constraint, thereby increasing investment. In the CK model, that does not happen, because the aggregate level of investment depends, by assumption, only on *IL* during crises. If, during a crisis, the monetary authority tries to reflate by increasing money supply, it will create the aggregate effect of having all firms (now with higher net worths) bidding higher for the fixed international liquidity, in order to invest more. It will only shift up the $I(i^d, i^p)$ schedule in Figure 1a, thereby raising i^d, and further depreciating the exchange rate through the domestic interest parity condition, equation (7).

The broken curve in Figure (3) shows the impact of monetary policy on the exchange rate in the CK model. The steeper segment corresponds to the non-crisis regime, where, according to the domestic interest parity condition, a decrease in the domestic interest rate causes the exchange rate to depreciate, while the domestic dollar rate remains fixed. However, when the amount of international liquidity becomes binding, further decreases in the domestic interest rate cause the domestic dollar rate to increase, requiring additional depreciation of the domestic currency.

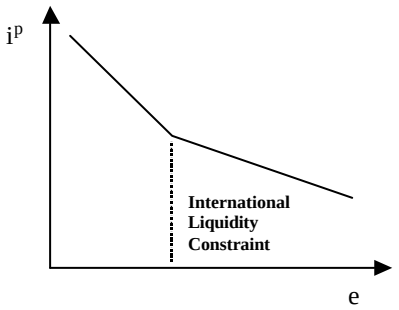


Figure 3: Interest and Exchange Rate

Regarding fiscal policy, the CK model also delivers contrasting results to those of the standard Mundell-Fleming model. The CK model introduces a new crowding-out effect, since investment and government outlays are competitors for the restricted international liquidity during crises. An increase in government outlays increases the domestic dollar rate, causing exchange rate *depreciation*. The contrast becomes even stronger under a fixed exchange rate regime with perfect capital mobility. In that case, the usual Mundell-Fleming model would predict that an increase in government outlays would create an incipient increase of the domestic interest rate, thereby attracting capital inflows that would appreciate the currency. To prevent the appreciation, the central bank would expand money, driving down the domestic interest rate to the previous international level. This causes the output to expand without the traditional crowding out effect. In the CK model, however, the increase in government outlays creates an incipient *depreciation*, because of the increase in the domestic dollar rate, while nothing happens to output. To keep the peg, the central bank has to increase the domestic interest rate (decrease the money supply).

Finally, more sophisticated versions of the model allow CK to study of the welfare effects of ex-ante policy options. The idea is that private agents face a trade-off while contemplating the alternatives use of a unit of international liquidity. It may be invested at the domestic dollar rate or used to import investment goods. A free-rider externality keeps the domestic dollar rate below the social value of an extra unit of international liquidity, thereby creating over borrowing in good times that reduces the amount of international liquidity during crises. Three different ways are suggested to correct this market failure: the central bank may keep extra foreign reserves, it may tax the capital inflows, or it may commit to expand monetary policy during crises. Such commitment of lowering the domestic interest rate during the crisis would increase the domestic dollar rate towards its social optimal level. As the authors point out, however, such policy is time inconsistent.

As it will be discussed in the next Section, these results are important to understand the rationale of the Brazilian central bank's actions under an inflation-targeting regime, as well as most of the movements in asset prices.

4. How to reduce the real interest rate?

The simple model depicted in the previous Section shows that the high real interest rates are not a result of "irrational" monetary policy, as some have claimed.[24] If the Brazilian Central Bank tried to reflate the economy out of the recession in the middle of the current international liquidity crisis, all it would obtain is further exchange rate depreciation, causing more inflation and no growth. If the basic (Selic) interest rate were to fall substantially, it would prompt larger capital outflows and further currency depreciation, which would fuel inflation. In the short run, the current account would adjust mainly through the fall in imports, since exports take time to increase. Investment would not pick up, since macroeconomic uncertainty would increase. Consumption could increase, but that alone would not lead to sustained growth. In summary, in this exchange-rate-led stagflation, the Brazilian economy would have more inflation without being able to resume growth.

This powerful channel through the exchange rate has, so far, been of little or no relevance in the developed economies. For example, the fear of massive capital outflows[25] has never entered in the realm of the practical considerations that geared the FED's decisions of lowering interest rates to reflate the economy. This, however, is a luxury that emerging markets central banks cannot afford. Reflating a recessionary economy in times of high-risk aversion is a procedure that is not to be found in emerging markets monetary policy manuals. The CK model captures the essence of the difference between an economy integrated in the international financial markets and the ones where international liquidity is binding.

The risk factors that account for the high real interest rate have to be addressed to obtain its sustained reduction. The stylized facts outlined in Section 2 show that, even in a context of segmented financial markets, there is a connection between the domestic interest rates and the secondary market yields of the foreign debt, as predicted by the covered interest parity condition with country risk (equation 2). Therefore, the reduction in the domestic real rate has happen in a context of a reversal of the extremely high secondary market yields of the Brazilian foreign debt.

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[24] A few Brazilian economists have written that the interest rate is so high because the market knows less than the Central Bank and reads between the lines of the Central Bank's actions to infer the amount of default risk. The Central Bank, according to the argument, has the power of choosing: if it signals high default risk through a high interest rate, that is what the market will believe. If, however, it signals low default risk through a low interest rate, the market will charge a low default risk premium. I do not think that asymmetric information is at the heart of the problem of the very high interest rate in Brazil, and therefore do not agree with this reasoning. In their assessment of this point, Favero and Giavazzi [2002] say that "… the experience of other countries which have successfully made the transition to a "good" equilibrium suggests that one should not rely on such a transition happening automatically: Brazil may have to raise its primary surplus further, at least for some time, before the transition to a good equilibrium will allow the government to relax fiscal policy. A temporary increase in the primary surplus should be seen as an investment: the returns will justify the temporary sacrifice with a vengeance."

[25] The IMF's [2002] most recent *Global Financial Stability Report* raises doubts on whether or not "… the United States will continue to attract and distribute substantial shares of international capital."

A large body of literature has been dedicated to uncover the explanatory factors of country risk spreads.[26] The characteristics of the domestic economy as well as the conditions of the international financial markets usually explain the bulk of the spreads. My own previous work in trying to explain the time-series behavior of the Brazilian country-risk indicates that the expectations for the future path of the fiscal and current account balances, as well as the conditions of the domestic and international financial markets are able to account for large part of the variance.[27]

There is not much that domestic policies can do to improve the current state of extreme risk aversion in international markets. However, the behavior of the Brazilian country-risk has been much worse than the average emerging markets bond index, measured by the JP Morgan family of EMBI indices, indicating that domestic actions may potentially play a large role in reducing the country-risk spread.

The recent "explosion" of the country-risk spread, surpassing the 2000 bps threshold, was in large measure associated with the electoral uncertainty. This uncertainty is bound to vanish, as the new president, Lula da Silva, unveils the economic policies his administration will follow, as well as the names of the economic team components. If the new administration sticks to the terms of the IMF agreement, both in deeds and words, the country-risk spread is bound to fall, as the prices prevailing before the elections were discounting the possibility that the austere fiscal and monetary policies could be overthrown. Such result is consistent with the multiple equilibrium model developed by Razin and Sadka [2002], where "… an external correction of the country's credit rating can be self-validated in the sense that it could reduce the country's prime rate, restore investment and shrink the fiscal deficit." If, however, lax fiscal and monetary policies are followed, the country-risk spread will not fall and no reduction in real interest rate can occur in the current setup.[28]

But the challenges ahead for the new president are more profound than merely trying to mimic its predecessor's second term in office. Notwithstanding the uncertainty generated by the presidential elections, the high country-risk spread during the good year of 2000, when the elections were a much smaller concern, and the behavior of the interest rate risk components analyzed in Section 2 reveal that much more has to be achieved in order to reduce the real interest rate and resume sustained growth.

In their study of the causes of the high interest rates in Brazil, Favero and Giavazzi [2002] conclude that "… future expected monetary policy plays a very small role in explaining fluctuations of interest rates at longer maturities. (…) Such term premia are strongly correlated with Brady bond spreads, which are not (at least directly) affected by devaluation expectations. We conclude that macroeconomic fundamentals and debt dynamics are the main determinants of the term spread of Brazilian rates."

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[26] See, for example, Bekaert et al. [1996], Duffie et al. [2001], and Cruces et al. [2002].

[27] See Garcia and Didier [2002].

[28] Lower (even negative) real interest rates may result from financial repression (McKinnon [1973]) if exchange rate controls are introduced. However, such scenario will not be analyzed, as it would not bring the ultimate objective of sustained economic growth.

Chart 6 makes clear that not only the C-Bond spread is highly positively correlated with the one-year-term premium (the difference between the one-year interest rate and the Selic rate),[29] but also that both are also highly positively correlated the exchange rate.[30] What Favero and Giavazzi [2002] seem to miss by excluding the exchange rate from their simulation model of future Selic rates is the exchange rate channel of domestic inflation that feeds in the central bank reaction function.

The hypothesis is the following: the increase in the country risk premium reflects the reduction of international liquidity, as the shift of the vertical part of L-shaped curve in Figure 1-a. By the domestic interest parity condition, equation (7), the rise in the domestic dollar rate, in the absence of a monetary policy tightening, causes the exchange rate to depreciate. Large depreciations seem to be associated with a shift in the higher moments of the perceived distribution of expected inflation rates.[31] From the shift of the expected inflation distribution to the future Selic rate distribution, two opposite views may intervene, both leading to a higher term premium. One may believe that the central bank will stick to the inflation-targeting frame work. In that scenario, it will have to increase the Selic rate in the future, leading to both higher nominal and real interest rates, to reverse the rise in inflation expectation. Conversely, if one believes that the necessarily tight monetary policy will not be pursued, then actual inflation will rise and higher nominal (but not real) interest rates will ensue. Therefore, both scenarios lead to higher future nominal rates, possibly explaining the shift in the term premium. Incidentally, if this hypothesis is true, the loss of credibility of the monetary authority may probably lead to an even higher term premium, depending on distribution of future inflation rates.

One key difference between the two depreciation episodes is that in 2001 the depreciation was associated with a slight fall of the USD domestic rate, while in 2002 the (larger) depreciation was associated with a large increase in the USD domestic rate. The different behavior is probably associated with the role of domestic-USD-indexed instruments as hedging instruments for *domestic* agents, which is not modeled in the CK model. The perfect foresight version of uncovered interest parity used in the CK model—equation (7)—does not have all the elements of the covered interest parity with country risk—equation (2).

The hypothesis is that agents incorporate the workings of the CK model in their behavior. They know that times of international liquidity crises are associated with low output and large depreciations, and they cannot diversify away this risk. Therefore, exchange rate depreciation constitutes a systemic risk for domestic agents. When an international liquidity crisis is expected to hit, the price of the insurance against the systemic bad shock

[29] The simple correlation coefficient is 0.78.
[30] The simple correlation coefficients are 0.84 (exchange rate and C-bond spread) and 0.79 (exchange rate and one-year-term premium).
[31] Although the pass-through coefficient has been low since 1999 in Brazil, it is believed to have a non-linear behavior, and large cumulative depreciations may impact heavily in inflation. The most recent high inflation figures seem to corroborate that non-linear behavior.

increases, i.e., the USD domestic dollar rate tends to fall.[32] This effect, absent of the CK model, tends to offset the increase of the USD domestic rate stemming from the smaller supply of international liquidity given the domestic investment schedule. In 2001, the former effect slightly dominated. However, in 2002, the international liquidity shortage was much higher,[33] and the prevailing effect was the one modeled by the CK model. Looking at equation (2) and Chart 3 we can see that for the price of the exchange rate depreciation hedge to fall, i.e., for the USD domestic rate to increase, the exchange rate overshot creating a negative forward premium.

In both cases, however, the depreciation has been large and harmed domestic output and inflation. This mechanism is the Achilles' heel of the Brazilian economy. Without properly addressing it, sustained growth will probably be elusive. The economy is too sensitive to negative shocks to the provision of foreign capital. With the enormous depreciation that happened so far, recent figures show that the trade balance and the current account balance have been improving. The cost is being paid in the higher inflation indices and the lower growth. The structure of the economy must be improved to allow a better trade-off for the monetary authority. It goes without saying that improving credibility, by conferring instrument independence to the central bank, would also help. However, it would probably not be enough. It is necessary to reduce what has been called external vulnerability. As argued before, this is extremely relevant to enable the Central Bank to set interest rates compatible with economic investment and sustained growth.

In a recent piece, Edmar Bacha [2002], refers to three, possibly complementary, ways of making the emerging market economies less prone to exchange rate crises. The "global option" would be the institution of an international lender of last resort. However, this option would not be politically viable in the near future. The "regional option" would be "… the establishment of a free trade area in the Americas, accompanied by full dollarization." Given the reluctance of the US in letting international concerns intervene with its monetary policy, this option would likewise be of little immediate use. Finally, there would be measures at the national level, mainly "… to deepen and further long-term domestic financial markets, thus making the investment process less dependent on foreign finance." This would require the need to improve a long-term finance market, and to increase the "exportability" of the economy.

This last point can again be illustrated with the CK model. If the amount of international liquidity of the economy is made to depend positively in the exchange rate, i.e., depreciations increase net future cash flows in foreign currencies by improving the trade balance, then international liquidity crisis will not be as severe. The strength of this effect depends on the alluded "exportability" of the economy, which is very low in Brazil.

[32] An USD-linked domestic bond provides hedge against the exchange rate depreciation. The higher demand for exchange rate depreciation hedge builds up the bond's price, thereby lowering its yield, the USD domestic rate.
[33] Even trade credit lines are reported to have been slashed.

Therefore, to increase the tradable sector in the economy is fundamental to allow better trade-offs to the central bank, which translates in lower average interest rates.

Unfortunately, this point is commonly misunderstood. For example, all the contenders in the 2002 presidential election, including the new president, had in their economic programs "import substitution" as the main policy to deal with the external vulnerability. Although import substitution and export promotion may both lead to lower current-account deficits, the emphasis on import substitution is completely misled. After all, the goal is have a (much) higher portion of the output that is "exportable", i.e., which meet both the quality standards and is competitively produced (without subsidies). Import substitution promotion schemes have led in the past to low quality and high prices, while requiring large subsidies. If such policy slippage materializes, it will further jeopardize the growth prospects.

Finally, much has been recently debated about the sustainability of the Brazilian public debt. Although we will not address this issue in this paper,[34] it is clear that the increase in the perceived credit risk was responsible for the bulk of the "explosion" of the country-risk. When and if the current crisis finishes, special attention must be attached to lowering the fragility of the current debt structure, mostly short-term and indexed to the Selic interest rate or to the exchange rate. The use of inflation-linked bonds, as the Chilean economy has been successfully using for decades, seems to be the least costly way to lengthen the debt maturity, thereby reducing risk and the interest rate.

[34] See Garcia [2002] and Goldfajn [2002].

5. Conclusion

Even after adopting the flexible exchange rate regime, Brazil suffered two major depreciation episodes in 2001 and 2002. These episodes were caused by the reversal of capital flows, and were associated with higher interest rates, lower economic activity and higher inflation. Therefore, the name exchange-rate stagflation seems to characterize the essence of the phenomenon.

In order to explain the exchange rate stagflation a stylized model, due to Caballero and Krishnamurthy [2002], was used. The main characteristic of the model is that domestic investment depends on the aggregate international liquidity of the economy, which is a limiting factor. During a liquidity crisis, the amount of liquidity is reduced, and the economy falls in recession. Neither the fiscal authority nor the monetary authority can reflate the economy by increasing government expenditures or the money supply. Either action results in higher domestic dollar rate and do not affect the output. These stylized facts seem to conform to the Brazilian recent experience, as well as of several other emerging markets.

The bulk of the difficulties Brazil is currently facing derives from the uncertainty associated with the course of the future economic policy to be followed by the new administration, and to the sustainability of the public debt. To avert a painful default, real interest rates must fall and sustained growth must resume. To increase the chances of success, several policy measures are suggested:

- To increase the exportability of the economy. This implies both larger exports and larger imports. It is not akin to import substitution.
- To increase the fiscal effort, in order to help dispel the doubts over the sustainability of the public debt. If the goal is achieved, the initial fiscal effort will support higher growth, lower interest expenditures and higher fiscal revenues.
- To increase the credibility of the monetary authority, by conferring instrument independence to the Brazilian Central Bank to use monetary policy to achieve the inflation target set outside the Central Bank in the best possible way.
- To resume the debt management efforts to lengthen the debt profile while reducing the indexation to the exchange rate and to the Selic short term rate. This will require larger use of inflation-linked bonds.

When and if the current international liquidity crisis is overcome, the above measures will help Brazil to lower the real interest rates and achieve sustained growth.

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Chart 1
Interest Rate Decomposition

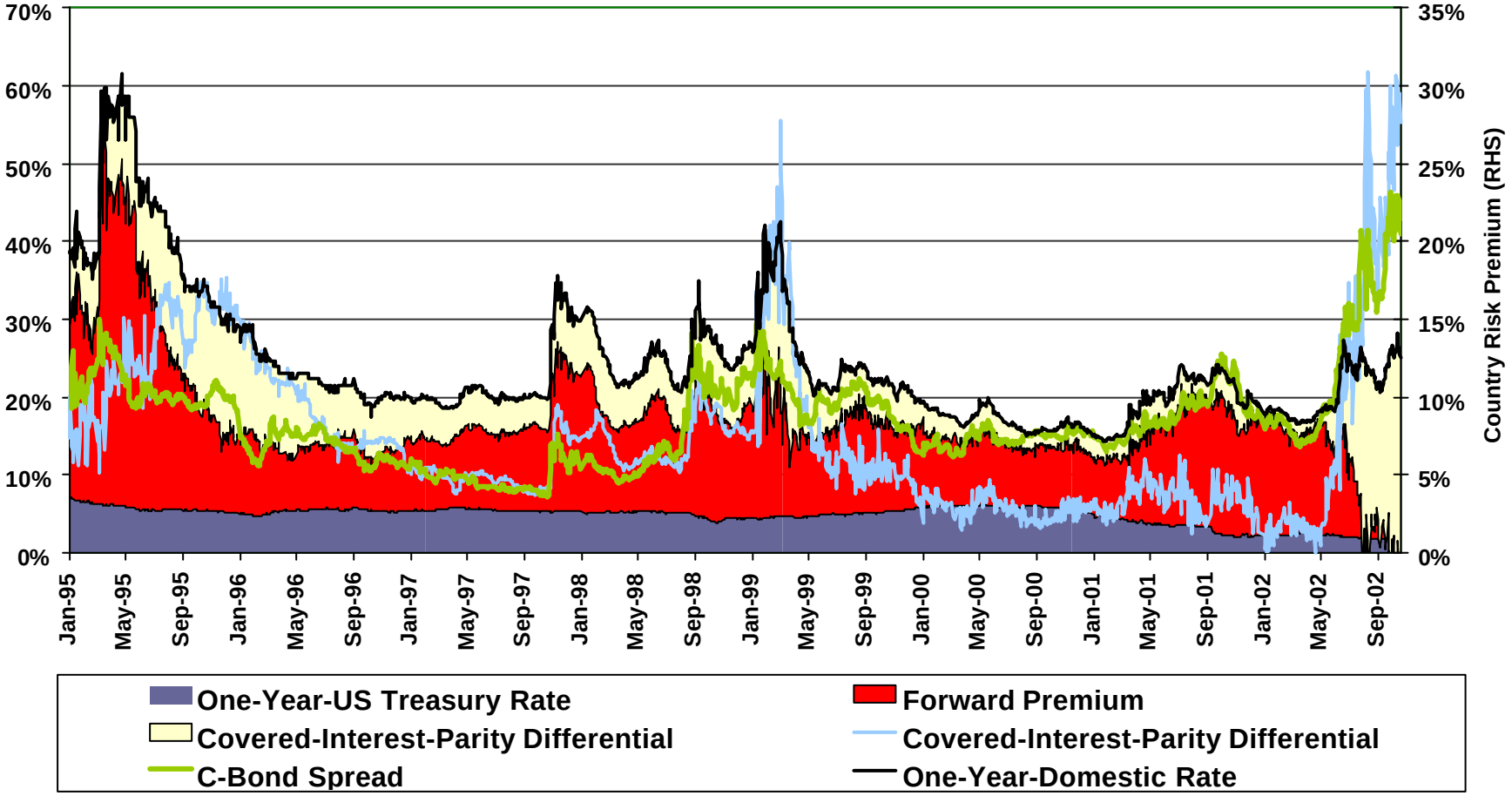

Chart 2
Interest and Exchange Rates: The First Crisis Bout

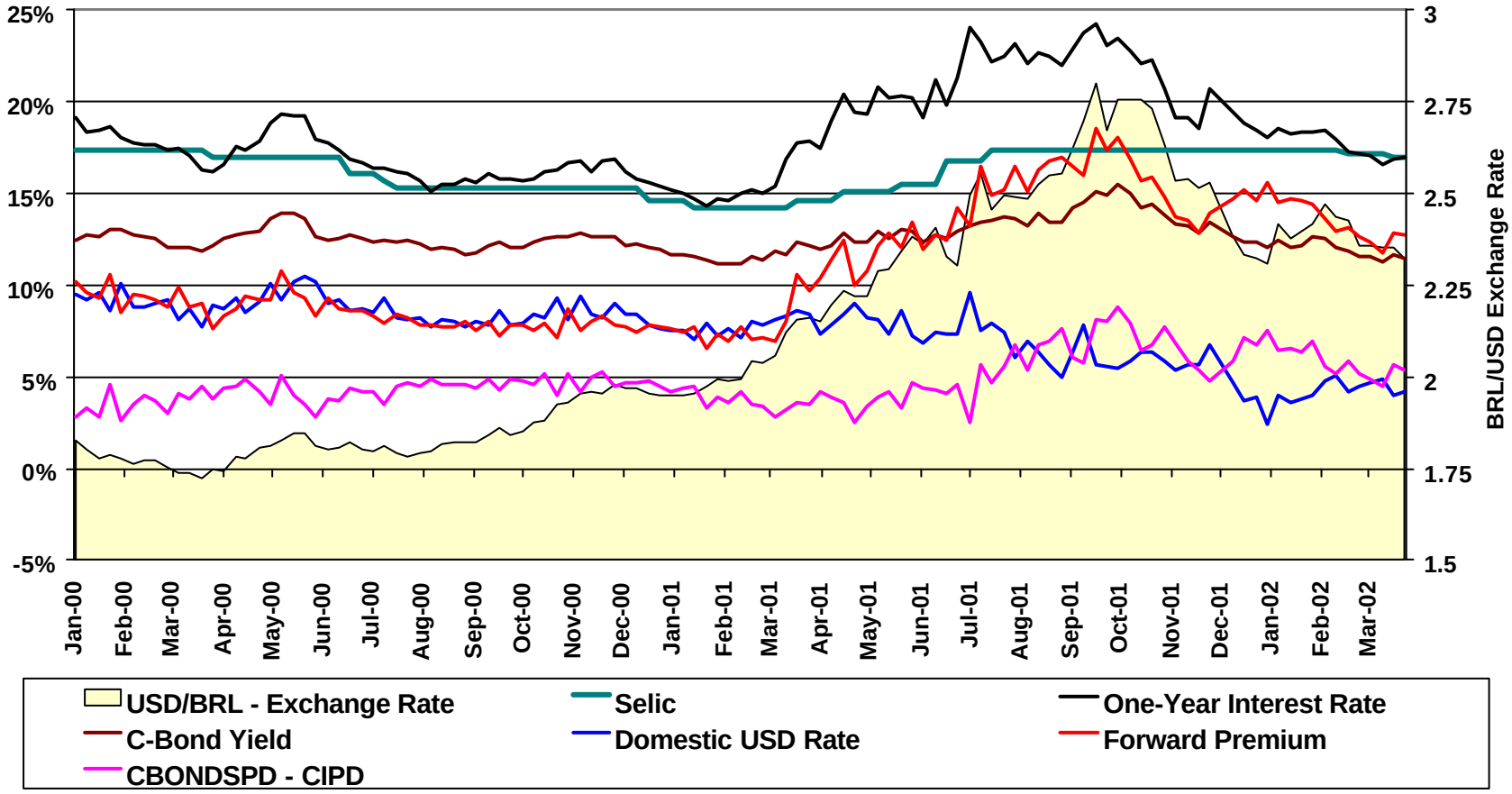

Chart 3
Interest and Exchange Rates: The Current Crisis

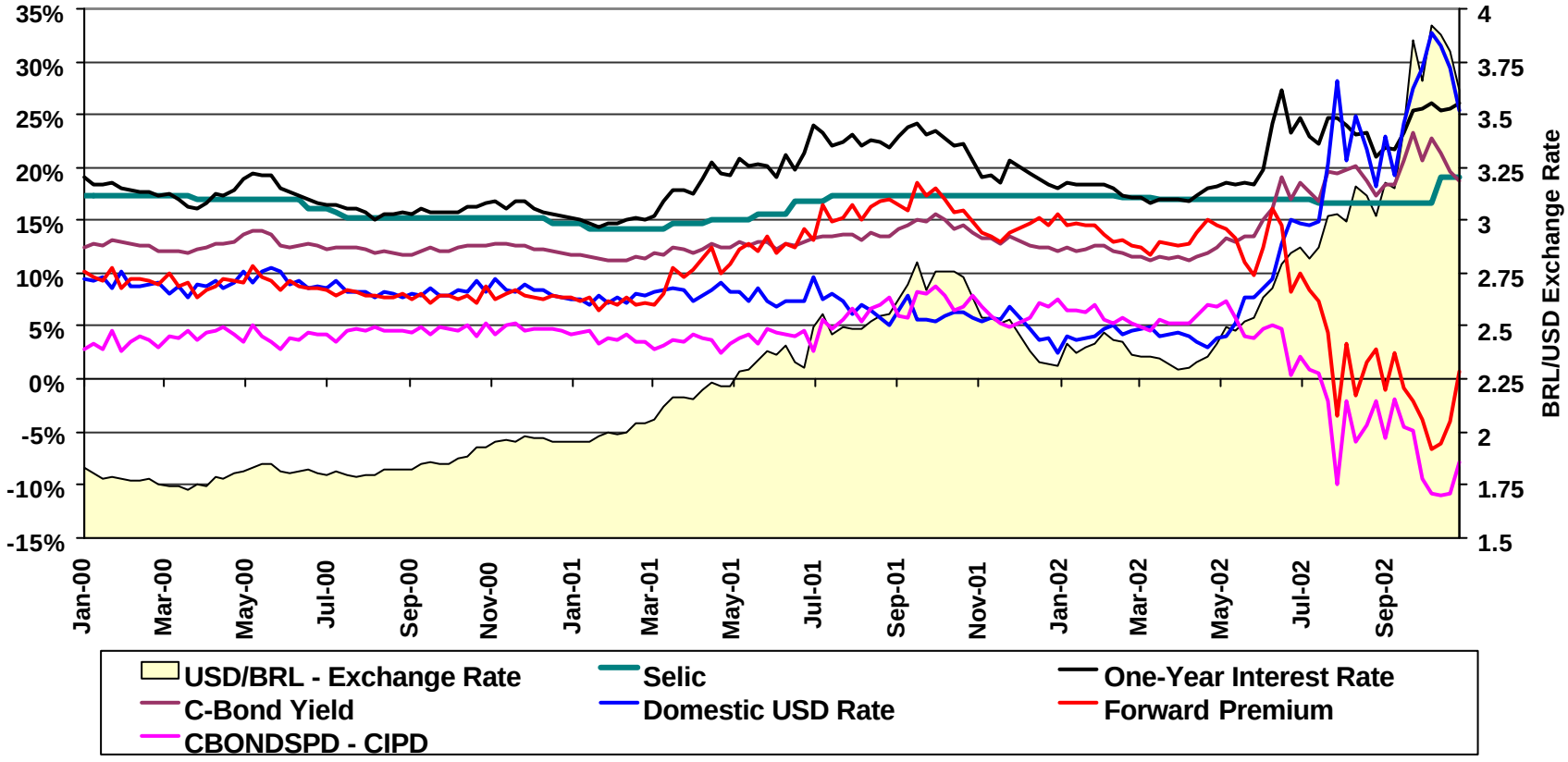

Chart 4
Forward Premium Decomposition: Expected Depreciation and Currency Risk

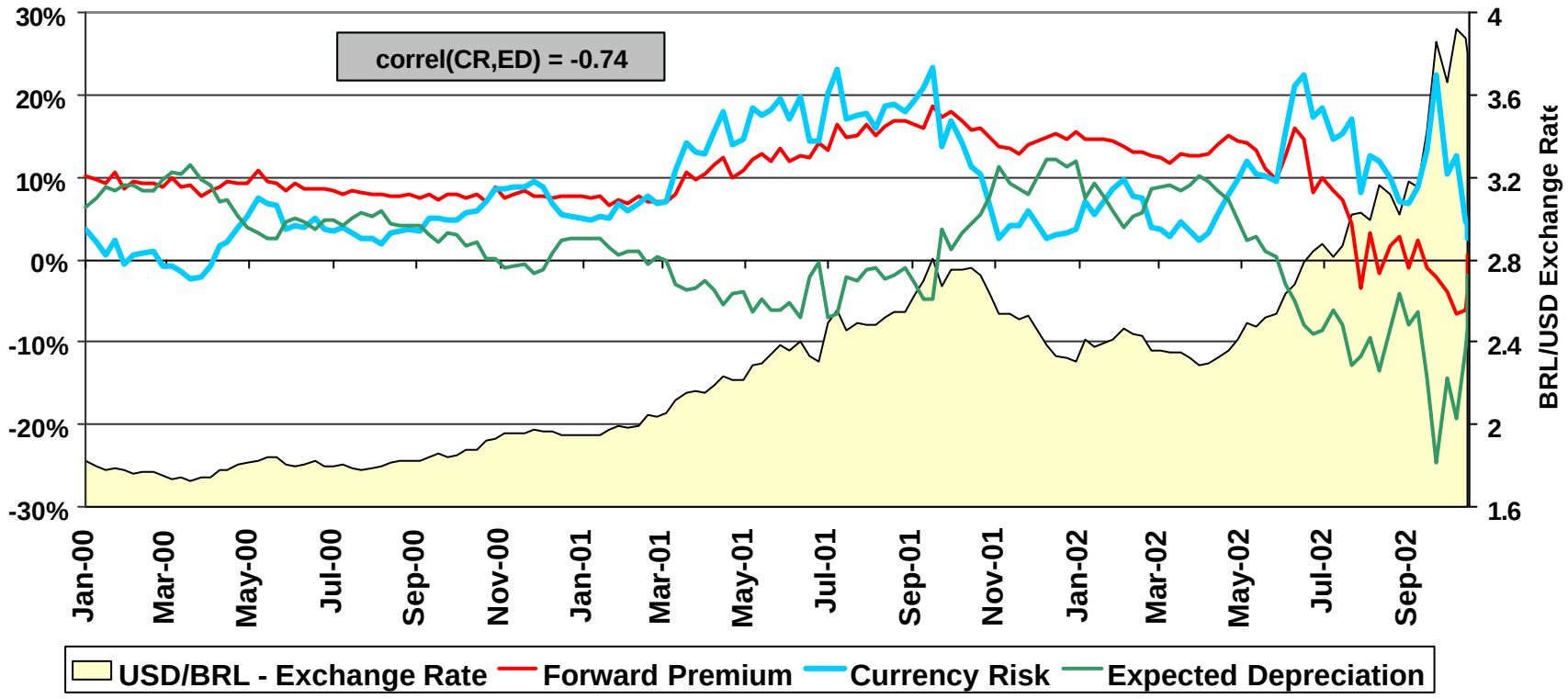

Chart 5
BRL and USD Domestic Yield Curves: 10/22/2002

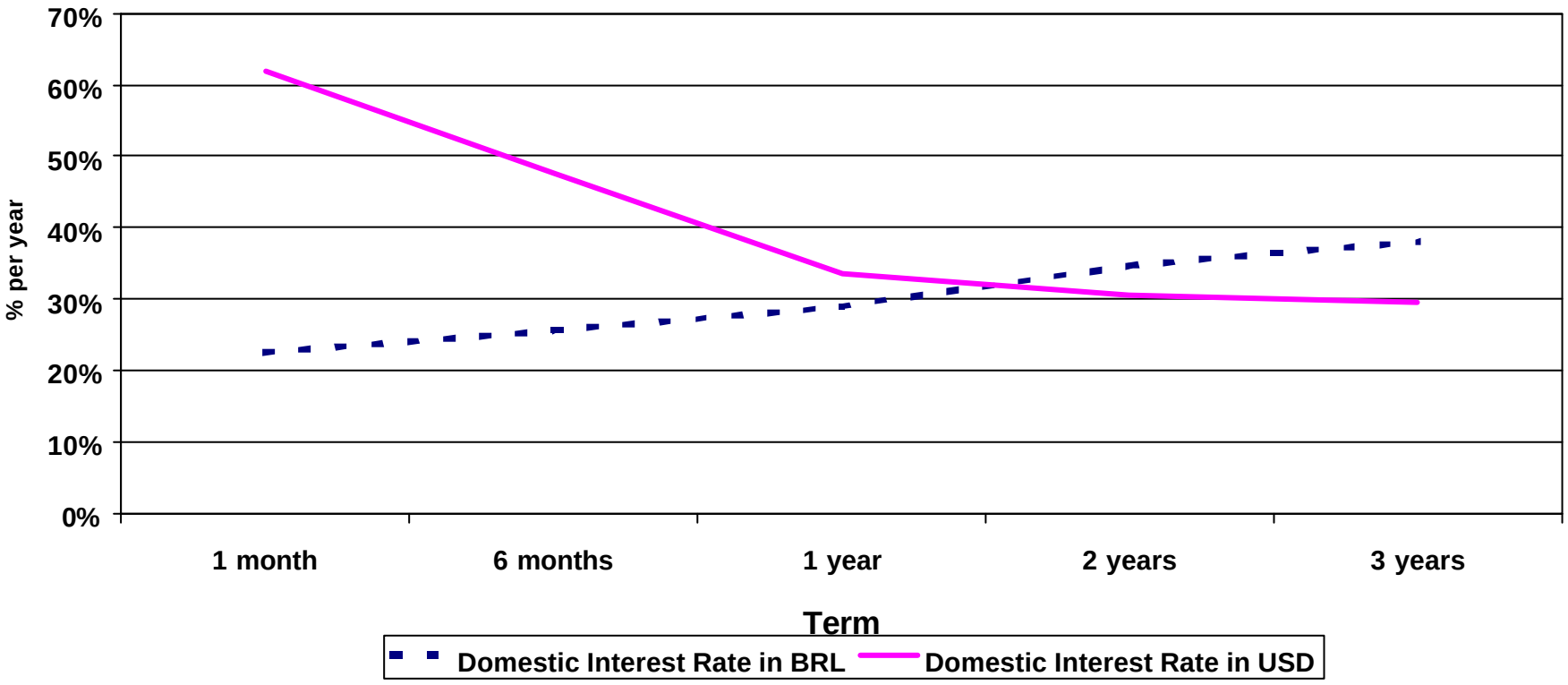

Chart 6
Exchange Rate and Country & Term Risk Premia