SM/07/287
Correction 1

January 25, 2008

To: Members of the Executive Board

From: The Secretary

Subject: **Uruguay—Selected Issues**

The attached corrections to SM/07/287 (8/8/07) have been provided by the staff:

Mischaracterization of the Views of the Authorities

Page 20, para. 9, line 3: for "the multiplicity of objectives and the lack of transparency on the relative importance of each of these objectives under the existing framework"
read "the appearance of multiple objectives and lack of transparency on the relative importance of each of these objectives under the existing framework"

Factual Errors Not Affecting the Presentation of Staff's Analysis or Views

Page 11, para. 14, line 31: for "combined with intervention in the foreign exchange market to resist nominal appreciation,"
read "combined with intervention in the foreign exchange market partly to resist nominal appreciation,"

Page 25, para. 20, lines 16–17: for "Since 2006, there has been a moderate but persistent deterioration in credibility,"
read "This measure of credibility suggests that since 2006 there has been a moderate but persistent deterioration in credibility,"

Page 50, para. 30, line 5: for "Thus, a challenge for the authorities is to foster healthy competition while preserving the soundness of the financial system."
read "Thus, a challenge for the authorities is to further foster healthy competition while preserving the soundness of the financial system."

Page 57, Table 1, row 1, column "2006": for "12.6" read "1.3"
   Table 2, stub "Risk-free rate": for "50%" read "5%"

Page 59, Figure 6: replaced to include missing years in the horizontal axis.

Page 72, para. 18, lines 16–17: for "However, default probabilities remain significant, thus underscoring the need to further reduce vulnerabilities in the banking system"
read "However, default probabilities under a 2002 crisis-like stress scenario remain significant, thus underscoring the need to further reduce vulnerabilities in the banking system."
   graph "Uruguay Banking Sector": replaced to add shading.

Questions may be referred to Mr. Piñón (ext. 37400), Mr. López-Mejía (ext. 34334), and Mr. Romeu (ext. 39675) in WHD.

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Att: (7)

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14.   ***There is some evidence that announced inflation targets have gained credibility***. Inference is limited given that the paper works with data starting January 2004, using the mid-point of the 12-month-ahead inflation target range. The coefficient on the inflation target is significant, and on lagged inflation insignificant. Recursive (OLS) estimates show that the coefficient has been approaching one during 2006 (Figure 6). These results suggest that forecasters are forward-looking and increasingly anchoring expectations around the central bank targets.[1] The notion of a recent increase in central bank's credibility is consistent with the evolution of the dispersion of inflation forecasts. In particular, the coefficient of variation for survey expectations show no clear trend until early 2006 and a decline since then (Figure 7). However, this result needs to be taken with caution. As discussed in the next chapter (López-Mejía, Rebucci, and Saizar (2007), announced targets for inflation and indicative ceilings for M1, combined with intervention in the foreign exchange market partly to resist nominal appreciation, have created ambiguity about the objectives and instruments of monetary policy, thus undermining monetary policy credibility.

Figure 6. Recursive Estimates of Coefficient on Inflation Target
(Recursive OLS estimate)

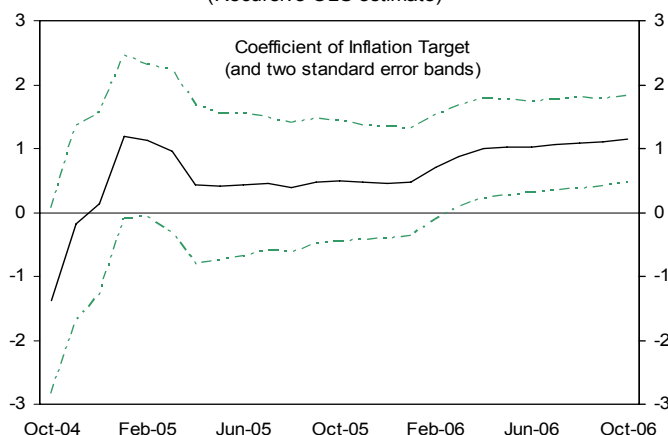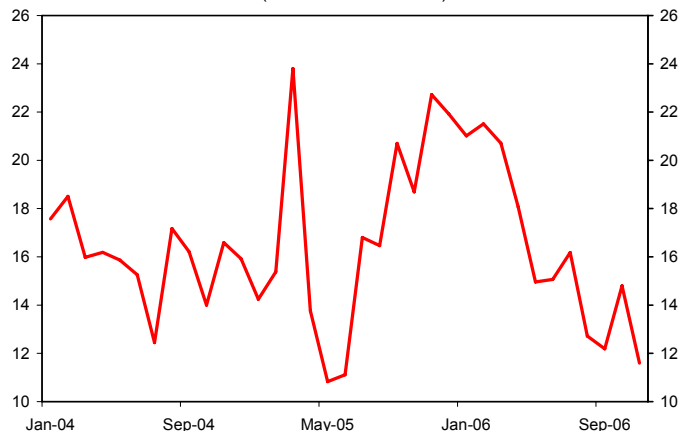Coefficient of Inflation Target
(and two standard error bands)

Figure 7. The Dispersion of Inflation Forecasts
(coefficient of variation)

15.   ***Estimations taking into account possible nonstationarity reinforce the results***. A Johansen cointegration test finds a stable relationship between expected inflation, lagged inflation, primary balance, real effective exchange rate, and real wage gap; a vector error correction model suggests that the 12-months ahead inflation forecasts are determined by lagged inflation, primary balance and the marginal costs proxies. The estimated coefficients have the same signs and only slightly higher magnitudes than the GMM estimates.

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[1] See Cerisola and Gelos (forthcoming) and Minella (2003) for similar results on the relevance of inflation targets for the case of Brazil.

Rationality

16.   *Are expectations rational?* To explore this issue, the paper first examines unbiasedness, regressing actual inflation on both an intercept and expected inflation:

(3) $\Pi_t = c + \beta \Pi_t^e + \varepsilon_t$

If expectations are unbiased, c should be zero and β one. This is the joint hypothesis tested in the paper (Table 3).

Table 3. Tests of Unbiasedness of Inflation Forecasts

Coefficients	Consensus forecasts	Central bank of Uruguay
α	-0.031	-0.004
β	1.35	1.46
Adjusted R2	0.89	0.382948
Coefficient (p-values)	Consensus forecasts	Central bank of Uruguay
$\alpha = 0$	0.0001	0.0520
$\beta = 1$	0.0001	0.0816
$\alpha = 0$ and $\beta = 1$	0.0003	0.1265
Sample period	1998:01-2006:09	2004:01-2006:09

17.   *The central bank of Uruguay inflation forecasts appear unbiased for 1-month ahead, but biased for 12-month ahead*. However, the tests should be interpreted with caution given the potential nonstationarity of the series. Generally, the estimated coefficient of an I(1) variable is not normally distributed, invalidating the usual tests. In any case, however, the paper would reject unbiasedness for the 12-month ahead inflation expectations.[2, 3]

18.   *Allowing for the possibility of nonstationarity, the results confirm that expectations do not use all available information*. Johansen (1991, 1995) tests find a cointegration relation between actual and expected inflation (Appendix Table A1). The speed at which expectations are revised over time in light of new information is estimated through a bivariate VEC model with inflation and expected inflation (Appendix Table A2). If the parameter on the expectation error in this regression is significant, then consumers revise their expectations and adjust them toward the fully rational outcome. The estimated coefficients are negative and significant for both the 12-months ahead and 1-month ahead forecasts, implying low persistence in deviation between actual and expected inflation. However, regressions of the forecast errors on different variables indicate that 12-month-

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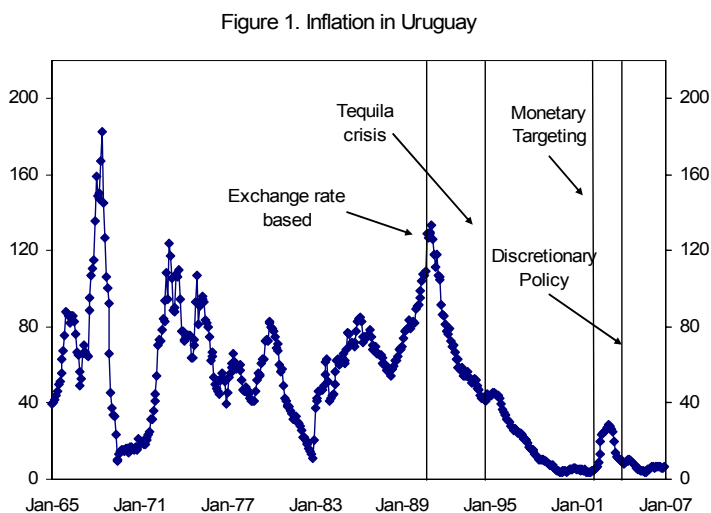[2] See similar results for other Latin American countries in Carvalho and Bugarin (2006).

[3] The results are not an artifact from the approximation for the 12-month forecasts as unbiasedness is also rejected for much shorter subperiods.

B. Background

4.   ***This section describes the evolution of the monetary policy framework and the constraints to the channels of transmission of monetary policy in Uruguay***. It underlines the importance of increasing the clarity of objectives and the transparency of operations under the existing framework to increase credibility.

The evolution of the monetary policy framework

5.   ***Uruguay's long history of monetary instability came to an end with a successful exchange-rate-based stabilization during the 1990s***. Starting in late 1990, the authorities allowed the peso to move within a crawling band that was depreciated at a declining rate, but in excess of domestic inflation to help strengthen external competitiveness. This policy helped anchor inflationary expectations and brought inflation down to 4 percent in 1999 from over 100 percent in 1990 (Figure 1).
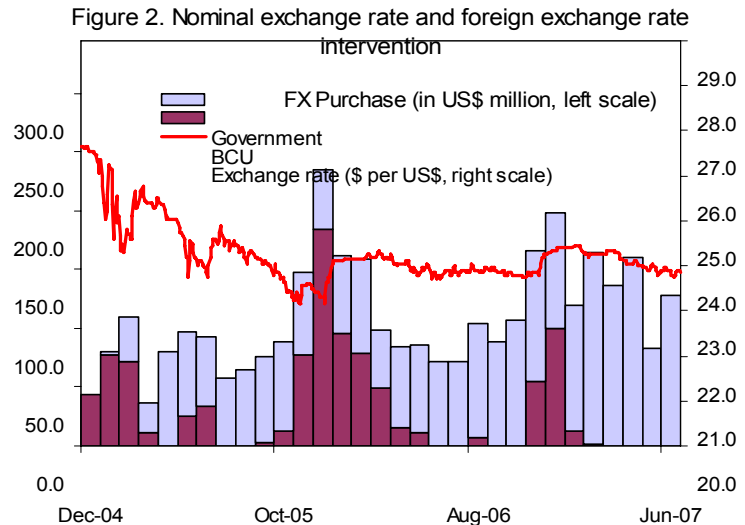
Figure 1. Inflation in Uruguay

6.   ***A revealed preference for single digit inflation has emerged since the late 1990s***. During the last eight years, average annual inflation has fluctuated within 3½ and 9⅓ percent. An exception was 2002, when end-year inflation reached 26 percent following the financial crisis―still a moderate increase compared to the inflation experienced in previous decades.[2]

7.   ***The monetary framework that was adopted in the midst of the 2002 financial crisis has evolved gradually***. Initially, the exchange rate was allowed to float in June 2002 and base money targets were selected to anchor the system staring in early 2003. In 2004, a band for base money (rather than a point) became the monetary target and, at the end of each quarter, the central bank began to announce a target for the annual headline consumer price inflation, twelve months in advance. In late-2005, the authorities moved away from the free float and

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[2] The crisis was triggered by deposit withdrawals from cash-strapped Argentine residents that soon developed into a more generalized run on the banks (IMF, 2003).

adopted M1 as the intermediate target, keeping the base money range as the operational target; since then, significant foreign exchange purchases, partly undertaken by the government to meet its foreign currency needs, have succeeded in maintaining the nominal exchange rate broadly stable (Figure 2). In 2006, the central bank stopped announcing base money targets and extended the inflation target band to 18 months (still with the possibility of revising it at the end of each quarter) (De Brun and Licandro (2005), Aboal, Lanzilotta, and Perera (2006)).

Figure 2. Nominal exchange rate and foreign exchange rate intervention

8.   *Under these circumstances, the existing monetary framework appears to have multiple objectives*. In particular, by mid-2007, the authorities were simultaneously targeting (and announcing) M1, the inflation rate, and had an apparent exchange rate target. This ambiguity may also reflect the fact that the mandate of the central bank is not exclusively to maintain low inflation. According to the law, other objectives of the central bank are to maintain an adequate level of international reserves and the stability of the financial system. In addition, although an exchange rate objective is not specified in the central bank's formal mandate, the exchange rate has in practice been a policy objective due to concerns related to competitiveness and the balance sheet effects associated with dollarization.

9.   *Under the existing monetary regime, consistency among the main objectives of monetary policy is essential*. While duri
ng the 1990s the exchange rate ~~was a clear and~~ _____
transparent nominal anchor, the multiplicity of appearance of multiple objectives and the lack of transparency on the relative importance of each of these objectives under the existing framework leaves the system without a clear anchor and undermines its credibility. For instance, if the exchange rate is perceived as a policy objective per se, the authorities' inflation target may be ignored by the public when forming their expectations about inflation. Thus, there is strong need to be transparent regarding the role of the exchange rate to help strengthen the effectiveness of monetary policy (Mishkin and Savastano, 2000). In this context, limiting foreign exchange intervention by the state bank would minimize market perceptions of exchange rate "floors" and need to be coordinated with the central bank (Aboal, Lorenzo and Loya, 2003).

The transmission mechanisms of monetary policy and its implications

10.   *The channels through which monetary policy is transmitted to prices and output face several constraints in Uruguay*. If the exchange rate plays a key role in the price setting

deviation of expectations from the inflation target associated with high uncertainty may result in the same credibility level than a relatively smaller deviation with lower uncertainty.

20.   ***According to this measure, credibility has fluctuated widely since the late 1990s and has lately fallen***. Broadly in line with previous findings (Masoller, 1997), monetary policy credibility appears to have been very "close to perfect" during the last years of the exchange-rate-based stabilization period,
reflecting a small undershooting of expected inflation compared to the target and little uncertainty about those deviations.[6] Credibility started to deteriorate just before the crisis, but it took three years before reverting to the pre-crisis levels. This latter improvement was partly due to a second wave of uncertainty, possibly associated with the changes in the monetary procedures and framework in 2005 (Figure 7). <u>This measure of credibility suggests that S</u>since 2006, there has been a moderate but persistent deterioration in credibility, with small deviations of expected inflation from the target associated with progressively less uncertainty about those deviations.
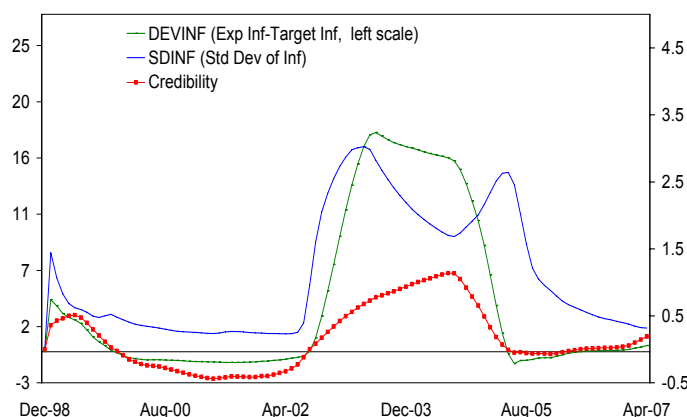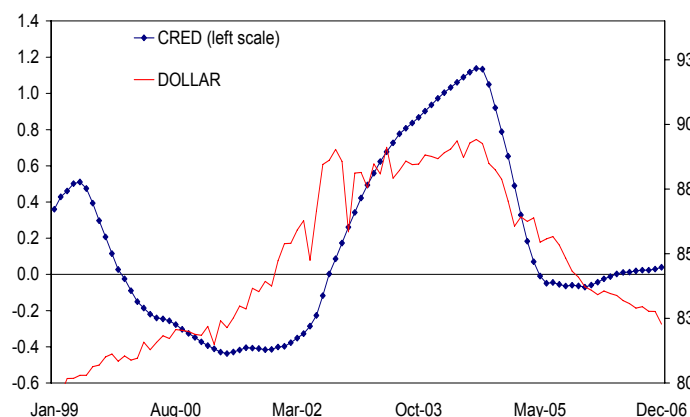
Figure 7. A Measure of Credibility

DEVINF (Exp Inf-Target Inf, left scale)
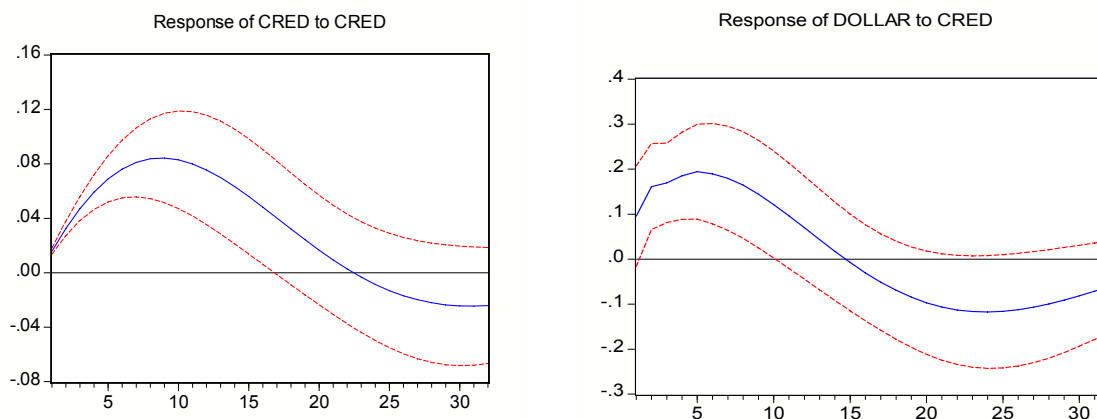SDINF (Std Dev of Inf)
Credibility

21.   ***Financial dollarization and credibility are closely associated***. This holds for the pre and post-crisis periods, with a sample correlation of

Figure 8. Financial Dollarization and Credibility

CRED (left scale)
DOLLAR

around 0.8, and is confirmed by a more formal analysis (Figure 8). A simple VAR analysis shows that lower credibility increases dollarization persistently (Figure 9).[7] Thus, enhancing the credibility of monetary policy could help reduce financial dollarization, which, in turn, would make monetary policy more effective. However, consistent with evidence from other

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[6] This evidence is robust to two alternative measures of credibility: the difference between consensus forecast inflation and the inflation targets under the IMF programs, and the difference between expected depreciation (as implied by the interest rate differential between dollar and peso bank deposits) and actual depreciation under of the upper band of the crawl.

[7] For identification purposes, the VAR assumes that dollarization does not affect credibility within a month. The VAR includes the measure of credibility above and the share of dollar deposits in total deposits by residents, together with three lags of each variable, a constant and a linear trend, and Argentine and Uruguayan country spreads. Data are monthly and the sample period is from January 1999 to December 2006.

countries (Borensztein et. al 2004), credibility is likely to take a long time to deliver its benefits and for dollarization to decline. For instance, between February 2004 and May 2005 credibility improved from 1 to zero, but deposit dollarization changed only by 4 percentage points (to 90 percent of total deposits).

Figure 9. Impulse response functions

E. Conclusions

22.   ***The exchange rate pass-through to domestic prices has declined over the last decade although it has become unstable since late-2005***. This implies that the exchange rate is now a less effective nominal anchor and, therefore, the role of an appreciation in offsetting inflationary pressures, while still important, has diminished. It also means that the exchange rate can generate expenditure-switching effects, thus helping isolate the economy from shocks. Accordingly, the exchange rate should be allowed to float more freely in response to normal shocks. However, high dollarization is still a constraint to a floating exchange rate as exchange rate fluctuations generate balance sheet effects that can destabilize the real economy and the financial sector. In this context, intervening in the foreign exchange market in response to financial shocks is justifiable. Clarity on they rational for intervening and transparency of intervention procedures may help increase the effectiveness of such interventions and facilitate floating more freely in response to other shocks.

23.   ***Improving monetary policy credibility would help reduce dollarization, a key constraint to monetary policy in Uruguay***. Enhancing credibility would strengthen the expectation channel of monetary policy and, by reducing dollarization, would increase the effectiveness of other transmission channels and make monetary policy more credible for stabilizing the economy. This, in turn, could lead the private sector to require less hedging against the risk of instability, thus reducing the vulnerability of the economy to crisis and increasing long-term growth prospects.

24.   ***There is scope to secure credibility gains in Uruguay***. In particular, the credibility of its monetary framework can be improved by: (i) strengthening *de facto* the operational independence of the central bank through its recapitalization and a clear commitment to

Table 6. Results from Revenue Estimations

	(1) lnir	(2) lnrev	(3) lnir	(4) lnrev
Ln (wages)	0.269	0.265	0.269	0.267
	(2.17)*	(2.00)*	(2.15)*	(2.00)*
Ln (cost of funds)	0.252	0.233	0.250	0.232
	(3.48)**	(3.41)**	(3.45)**	(3.39)**
Lnw (cost of capital)	0.260	0.230	0.259	0.224
	(3.58)***	(3.21)**	(3.04)**	(2.57)**
Ln (wages) x after	-0.038	-0.038	-0.039	-0.039
	(0.85)	(0.96)	(0.84)	(0.96)
Ln (cost of capital) x after	-0.193	-0.186	-0.193	-0.188
	(3.07)**	(3.20)**	(3.04)**	(3.15)**
Ln (cost of funds) x after	-0.023	-0.021	-0.023	-0.022
	(0.43)	(0.48)	(0.43)	(0.48)
Loans/Total assets	1.404	1.318	1.434	1.344
	(3.91)***	(3.94)***	(3.98)***	(4.00)***
Ln (total assets)	0.977	1.065	0.972	1.062
	(8.67)***	(9.79)***	(8.67)***	(9.76)***
No. of Obs.	88	88	84	84
R-squared	0.98	0.98	0.97	0.97
***H* 2003-04**	**0.78**	**0.73**	**0.78**	**0.72**
Change in *H*	**-0.25***	**-0.25***	**-0.25**	**-0.25***
***H* 2005-05**	**0.53**	**0.48**	**0.52**	**0.47**

After=Dummy for period since 2005. Include bank fixed effects. Standard errors are adjusted for clustering by date.
* Denotes significant at the 10 percent confidence level; ** significant at 5 percent; *** significant at 1 percent.

E. Conclusions

27.   *This paper assessed the role of and prospects for bank-lending in Uruguay from a cyclical and structural perspectives*. Specifically, the paper tested the existence of bank-lending-channel transmission mechanisms in response to domestic and external shocks for local and foreign currency credit. It also looked at the competitive structure of the domestic banking system.

28.   *The results indicate that bank-lending in local currency reacts to changes in domestic policies*. This suggests that monetary policy will become more effective over time, but also more challenging. With a growing share of peso-denominated debt, the bank-lending channel will be becoming more important. This means that monetary policy shocks will be amplified, which in turn implies that its fine-tuning will become more relevant.

29.   *The results also show that domestic credit in foreign currency is partly driven by foreign shocks*. Moreover, the less liquid banks are, the more foreign and domestic shocks

are amplified. With the ongoing resumption in lending, banks' liquidity will naturally decline from their current high levels. This will further amplify the effect of shocks in the future, implying the need for more vigilance in macroeconomic policies.

30.   ***From a structural perspective, the study indicates that measures to promote a more competitive environment are likely to enhance sustained growth over the medium term***. In particular, it finds that the degree of competition in the Uruguayan banking system is relatively low by international standards. Looking ahead, this may limit financial deepening and, thereby, economic growth. Thus, a challenge for the authorities is to <u>further</u> foster healthy competition while preserving the soundness of the financial system.

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De Bandt, O. and E.P. Davis, 2000, "Competition, Contestability and Market Structure in European Banking Sectors on the Eve of EMU," *Journal of Banking and Finance*, Vol. 24, No. 6, pp. 1045–66 (22).

Table 1. Variable Parameters
(In percent)

	1999	2000	2001	2002	2003	2004	2005	2006
Public sector short-term foreign currency debt/GDP (λ_G)	8.1	9.4	10.2	22.2	9.7	11.3	11.1	1.3
Private sector short-term foreign currency debt/GDP (λ_P)	12.5	13.7	16.5	18.2	12.7	2.7	1.6	1.5
Total foreign currency deposits/GDP (λ_D)	56.3	63.3	78.0	63.7	69.4	59.4	48.5	45.7
Non-residents' foreign currency deposits/ Total foreign currency deposits (S_{NR})	39.6	41.6	45.6	32.8	24.4	20.9	20.6	19.8
Residents' foreign currency deposits/ Total foreign currency deposits (S_R)	60.4	58.4	54.4	67.2	75.6	79.1	79.4	80.2
Banks' liquid foreign assets as a share of foreign currency deposits—corrected (α^C)	16.2	17.3	13.9	21.4	28.9	41.0	42.8	37.3

11. ***Many of the parameters are calibrated following standard conventions***. The risk aversion parameter is set at 2, a number typically used in the business cycle literature. The risk free short-term dollar interest rate (the return of reserves) is set to 5 percent, about the average U.S. 3-month T-bill rates in the last 10 years. The term premium is assumed to be 1.5 percent, close to the average difference between the yield on 10-year U.S. treasury bonds and the

Table 2. Fixed Parameters

Coverage of non-residents' deposits (C_{NR})	100%
Coverage of residents' deposits (C_R)	30%
Accumulated output loss (γ)	14%
Probability of sudden stop (π)	7.5%
Term premium (δ)	1.5%
Risk-free rate (r)	5%
Risk aversion (σ)	2
Real exchange rate depreciation (Δq)	30%
Long-run GDP growth rate (g)	3%

federal fund rate in the last 20 years. The growth of potential output in Uruguay is calibrated at 3 percent. The real exchange rate depreciation following a crisis is calibrated at 30 percent, slightly less than the 33 percent depreciation that took place between March and September of 2002.

12. ***Coverage of foreign currency deposits by official reserves and banks' liquid foreign assets was set at 100 percent for nonresidents and 30 percent for residents***. The full coverage for nonresidents deposits, which broadly matches the current practice by banks in Uruguay, would insulate the domestic economy from sudden withdrawals by nonresidents, that can be large as evidenced by the 2002 crisis. Since residents' deposits are less volatile than nonresidents,' a smaller coverage of 30 percent seems appropriate.

13. ***The output loss due to a crisis was calibrated at 7 percent of GDP per year during 2 years***. The accumulated output loss of the Uruguayan economy as a result of the 2002 crisis was about 18.5 percent, and output took roughly two years to recover to its pre-crisis levels. Given the improved external conditions, compared with 2002 (when the devaluation in Brazil
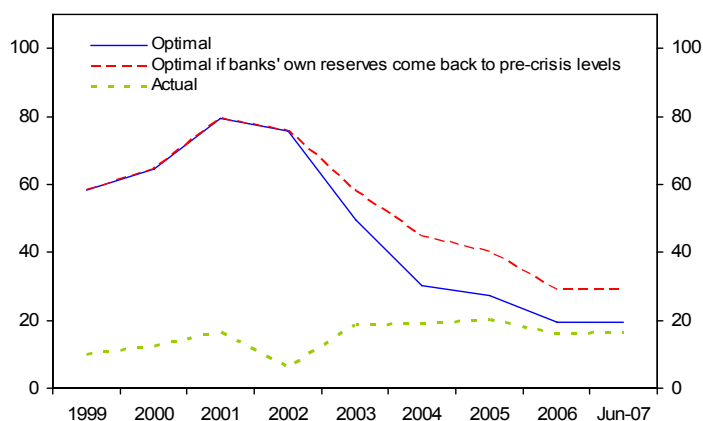
was followed by a severe crisis in Argentina), we assumed a smaller output loss (14 percent). This is also close to estimates found in the literature on currency crisis and sudden stops for a typical emerging market country.[8]

14.   ***The probability of a crisis was calibrated at 7.5 percent a year, or an average of one crisis every 15 years.*** JR's estimation, based on a cross-country Probit model, yields a probability of 10 percent for a typical emerging market country. Nonetheless, Uruguay track record of one major crisis every 20 years (1982 and 2002) implies an observed crises frequency of 5 percent. Given the potential specification problems of the Probit estimation and the difficulty of inferring the probability from Uruguay's few crisis episodes, the calibration is set to the intermediate probability of 7.5 percent.

15.   ***As vulnerabilities have diminished since 2002, so has the estimated optimal level of reserves***. Because short-term foreign currency indebtedness and deposit dollarization have been decreasing since 2002 and given the exceptionally high banks' liquidity levels, the need for central bank reserves for prudential purposes has diminished (Figure 5). Prior to the crisis, the estimated optimal level of reserves reached almost 80 percent of

Figure 5. Optimal versus actual level of reserves in Uruguay
(in percent of GDP)

GDP in 2001 (or US$14.7 billion), highlighting the large vulnerabilities of the economy at the time. In June 2007, with less vulnerabilities, the optimal level of central bank reserves was estimated to be less than 20 percent of GDP (or around US$3.8 billion). That is about 1.7 percent of GDP (or US$300 million) above current levels.[9]
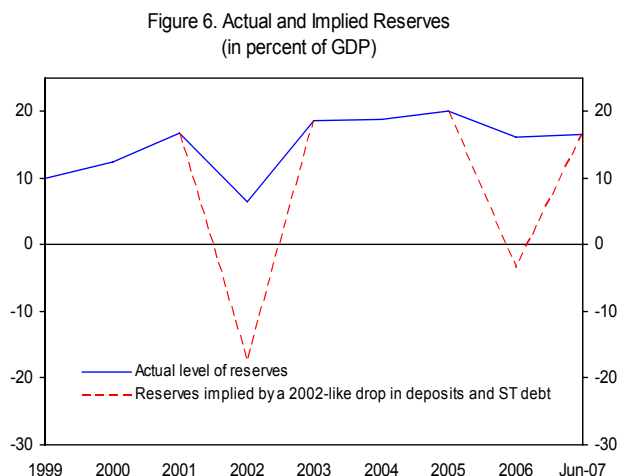
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[8] Hutchison and Noy (2006) find that the cumulative output loss of a sudden stop (defined as a simultaneous occurrence of a currency/balance-of-payments crisis with a reversal in capital inflows) is around 13–15 percent of GDP.

[9] The definition of the actual level of reserves excludes an account of the government in the central bank that has liquid foreign assets. While the value of assets in this account can be very large, it is also very volatile (in end-2005 it had US$328 million, then in end-2006 the account had zero assets, and in June 2007 it had US$1.2 billion) and is not included in official reserve figures since it is typically held by the government momentarily and used for debt management purposes, not as precautionary reserves.

16.   ***Simulations indicate that reserves are close to adequate levels and would be nearly sufficient to deal with a 2002 like crisis***.[10] This is a consequence of increased reserves and, more importantly, reduced vulnerabilities. Figure 6 simulates the results of a 2002-like crisis, i.e. drops in nonresidents' and residents' deposits, and short term debt of 63 percent, 36 percent, and 26 percent respectively. While such drops generated a severe reserve gap in 2002 in the absence of external support, a similar scenario in 2006 yields a much smaller gap.

Figure 6. Actual and Implied Reserves
(in percent of GDP)

17.   ***However, further accumulation is still desirable***. In particular, the optimal level of central bank reserves is likely to increase in the next few years, as the ongoing credit recovery matures and banks' reduce their currently high holdings of liquid external assets. As an illustration of a relatively extreme scenario, Figure 5 shows that the optimal level of reserves as of June 2007 would increase to 28.9 percent of GDP (or about US$5.7 billion) if banks' coverage of deposits by own foreign liquid assets returned to pre-crisis levels.[11] This highlights the importance of proper banking regulation that addresses the vulnerabilities caused by dollar deposits, thereby limiting the need for central bank reserve accumulation.
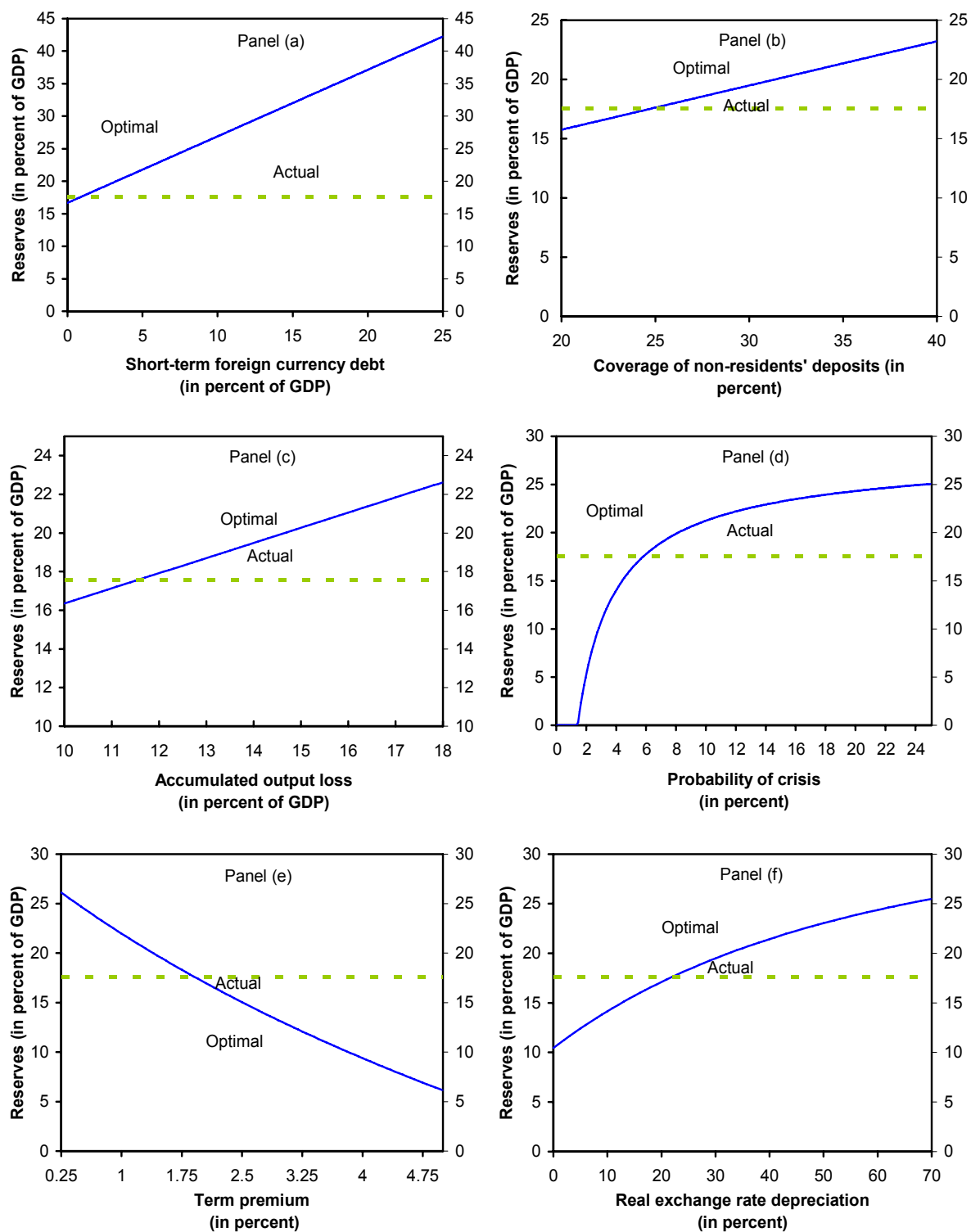
D. Sensitivity Analysis

18.   ***The optimal level of reserves is very sensitive to calibration choices***. Thus, undertaking a sensitivity analysis is important to gain broader perspective on the results under different conditions or parameter values. Figure 7 focuses on those parameters that, if changed, most affect the optimal level of reserves. The following facts emerge: (i) an increase in short-term foreign currency debt to 25 percent of GDP (a level close to 2001's), would result in an optimal level of reserves of over 40 percent of GDP; (ii) coverage of residents' deposits in the range 10–40 percent would imply reserve levels between 15–25 percent of GDP; (iii) an output loss of the magnitude observed in 2002 (about 18.5 percent of GDP) would imply an optimal level of reserves of over 22 percent of GDP; (iv) JR's calibration of a 10 percent probability of a crisis would yield an optimal level of reserves of 21 percent of GDP; (v) an increase in the term premium from 1.5 to 2.5 percent would raise the cost of holding reserves, and would lead to a sharp drop in the optimal level

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[10] See Appendix 2 for an explanation on how simulation results were obtained.

[11] The dashed line in Figure 5 assumes that the corrected ratio of banks' liquid assets to deposits is at pre-crisis level (the later is obtained by the 1999–2001 average of the ratio of banks' liquid assets to deposits).
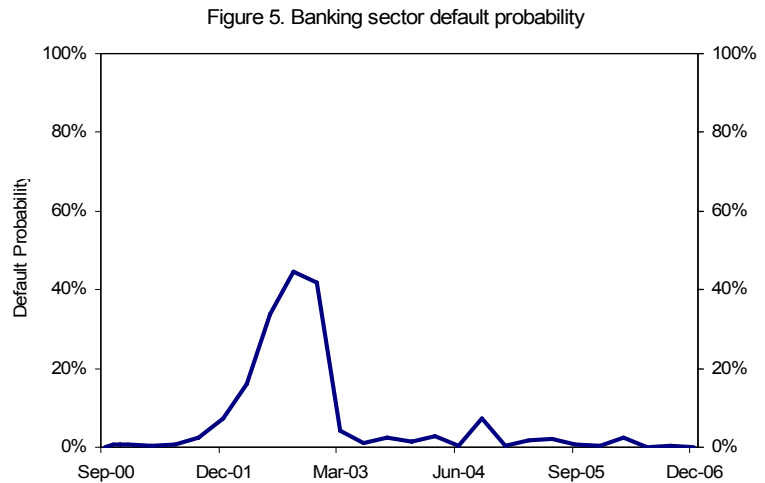
Figure 7. Sensitivity Analysis

probability of the banking sector estimated by applying, to the individual default probabilities, a weighted average (based on each banks' proportion of total assets).

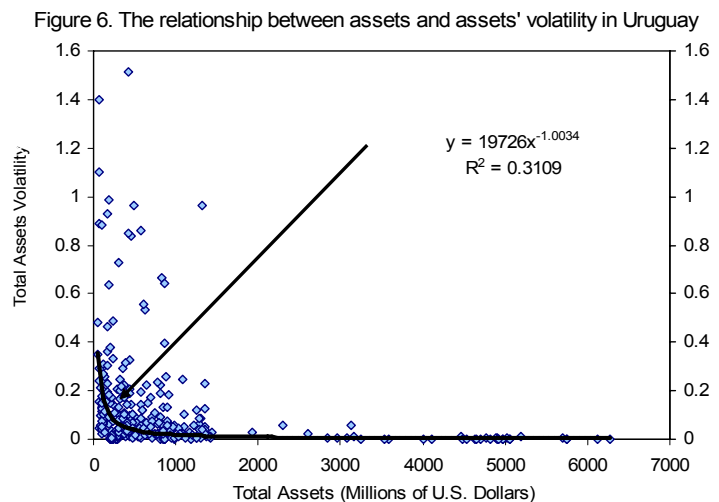16.   ***The estimated default probability (EDF) of the banking system using the modified Merton framework appears to be sensible***. The framework predicts a near-zero 1-year default probability (with volatility measured over total assets) prior to the 2002 crisis; this suggests that the 2002 shock was largely unanticipated (in line with the results found in Chapters II and III). However, beginning in March 2002, the estimated default probability

Figure 5. Banking sector default probability

starts to increase, reaching 45 percent in September 2002. Since then, the default probability has declined substantially, to near zero by end-2006 (Figure 5). This is consistent with a reduction in assets volatility and the substantial "clean-up' in banks portfolios associated with the restructuring process.

Using the modified Merton framework

17.   ***The modified Merton framework can be used to simulate the impact of potential shocks on the EDF***. This simulation provides a basis to assess the strength of the improved risk indicators beyond the traditional stress tests. In particular, given that volatility is a key parameter of the EDF, the near zero probability of default is to a large extent the result of the currently low volatility environment. Since standard stress tests only provide information on banks' assets and liabilities levels following shocks,

Figure 6. The relationship between assets and assets' volatility in Uruguay

$y = 19726x^{-1.0034}$
$R^2 = 0.3109$

this paper simulates assets' volatilities consistent with the after-shock level of assets. For this purpose, a historical relationship between total assets and their volatility is constructed for all banks to estimate the after-shock assets' volatilities (Figure 6).
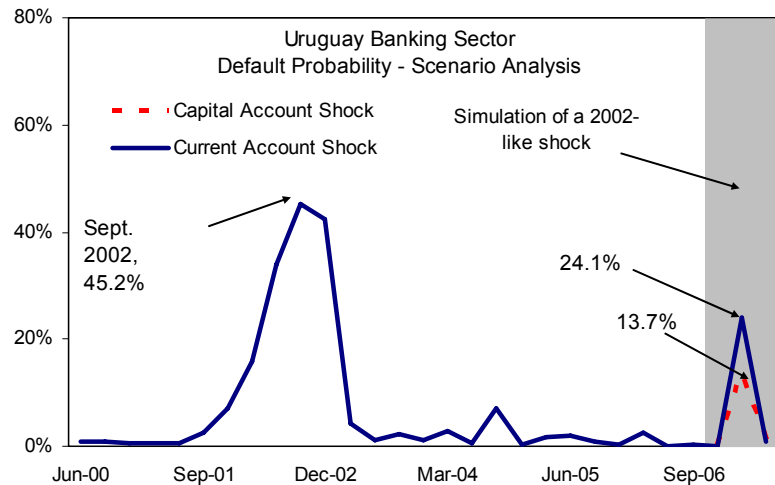
18.   *A simulation of a 2002 crisis-like scenario shows that banks have become more resilient to shocks, further confirming the thrust of the FSAP's stress tests results*.[7] Using the FSAP's severe capital and current account shocks, the default probabilities reach 24 percent and 14 percent respectively, far below the 45 percent default probability predicted by the model for the peak of the 2002 crisis. However, default probabilities under a 2002 crisis-like stress

The default probability for the banking sector has stabilized since 2002 and remains at lower levels even when facing significant shocks.

scenario remain significant, thus underscoring the need to further reduce vulnerabilities in the banking sector system (Figure 7).

E. Concluding Remarks

19.   ***The results of a modified Merton framework, applied to the case of the Uruguayan banking system, appear to be promising for countries without equity markets***. While the methodology is based on balance sheet information, and not on market valuations, the time series for the estimated asset volatilities and default probabilities seem quite sensible. Indeed, they track well the deterioration of the system during the 2002 crisis. The modified Merton framework also proves useful to simulate the effects on individual banks of possible changes in macroeconomic conditions—and, by incorporating volatility into the analysis, improves upon conventional stress tests that rely only on asset and liability levels.

20.   ***While still significant, the analysis suggests that vulnerabilities have continued to decline, further confirming the FSAP stress tests results***. The estimated default probability reaches only half the level measured at the peak of the 2002 crisis, even under a substantial shock to the capital account; and the impact of a shock to the current account is even smaller. The results also show, however, that important vulnerabilities remain. Thus, it will be essential to continue deepening financial sector reforms over the medium-term.

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[7] This is not surprising since the results from the stress tests are used to shock the modified Merton framework.