Paraguay

2011 ARTICLE IV CONSULTATION

August 2011

Selected Issues

This Selected issues Paper for Paraguay was prepared by a staff team of the International Monetary Fund as background documentation for the periodic consultation with the member country. It is based on the information available at the time it was completed on July 15, 2011. The views expressed in this document are those of the staff team and do not necessarily reflect the views of the government of Paraguay or the Executive Board of the IMF.

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INTERNATIONAL MONETARY FUND

PARAGUAY

Selected Issues

Prepared by Santiago Acosta-Ormaechea and Teresa Dabán Sánchez (WHD)

Approved by the Western Hemisphere Department

July 15, 2011

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I. PARAGUAY—POTENTIAL OUTPUT GROWTH AND SPILLOVERS FROM AGRICULTURE[1]

A. Introduction

1.   **Paraguay's economy has recently experienced particularly large output swings, opening again the question of what its potential growth rate is**. Notably, in only two years, the economy went from a half-a-century record-low GDP contraction of 3¾ percent in 2009—after the severe and widespread drought of that year and the adverse international environment due to the global crisis—to a record-high GDP growth of 15 percent in the subsequent year, led by the unprecedented boom in the agricultural sector during 2010.

2.   **This paper assesses Paraguay's potential growth and its associated output gap, and estimates the spillovers from agriculture to the rest of the economy**. In assessing potential growth, the paper uses a number of econometric and statistical techniques, focusing on both the long-run trends of the economy and more recent developments. Owing to the large relevance of the agricultural sector in Paraguay, the paper also estimates the potential spillovers from the agricultural sector to the rest of the economy.

3.   **Three main results follow from the paper**. First, it is shown that after the 2002 crisis the economy seems to have entered into a higher GDP growth path. Although Paraguay's economy is still very volatile, estimations suggest that a GDP growth rate of 4½ to 5 percent per year might be achievable over the medium term, up from the historical 4 percent estimated in previous studies.[2] To attain this, however, the economy will require larger investment ratios. Economic policies will be crucial to raising the investment ratio, including by maintaining a climate conducive to higher private investment and addressing well-known bottlenecks to higher long-run growth in Paraguay, such as the quality of infrastructure. Second, estimations show that Paraguay had a positive output gap in 2010. Additionally, a more disaggregated analysis indicates that the economic boom (and the output gap) of 2010 was driven by a broad-based economic expansion and not only by the historically large agricultural sector boom. Finally, estimations show that the spillovers from agriculture are limited, with construction being the sector that is more influenced by the swings of the Paraguayan agricultural sector.

4.   **The rest of the paper is organized as follows**. Section B discusses Paraguay's long-run output trends, including a growth accounting exercise to evaluate the determinants of growth. Section C focuses instead on the most recent developments, to evaluate the current potential growth of Paraguay and its associated output gap. Section D deals with a quantitative estimation of the spillovers from the agricultural sector to the rest of the economy, while Section E closes the paper presenting a number of concluding remarks.

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[1] Prepared by Santiago Acosta-Ormaechea.

[2] See, for example, Brauman (2009).

B. Long-Run Growth and Total Factor Productivity (TFP) Estimates

5.   **Paraguay's GDP growth has historically been very volatile.** However, significant differences in the average growth rate arise depending on the specific period under consideration. During the *belle époque* of rapid growth, between 1963 and 1981, the economy grew on average 7.1 percent per year. This vigorous rate plummeted in the following 20 years to a modest 2 percent annual growth. From 2003 until 2010 the economy took off again, reaching an average growth rate of 4.9 percent. Interestingly, although Paraguay experienced important economic swings in the past 50 years, sharp and persistent output contractions have been relatively rare. In fact, the largest GDP fall in half a century occurred in 2009—3¾ percent—after the widespread drought that affected the agricultural sector and the adverse international environment due to the global crisis. Yet the downturn immediately reverted with the all-time record harvest of 2010, which substantially contributed to the 15 percent record-high GDP growth of that year.

Figure 1. Actual and Potential GDP Growth
(In percent)

Source: IMF staff calculations.
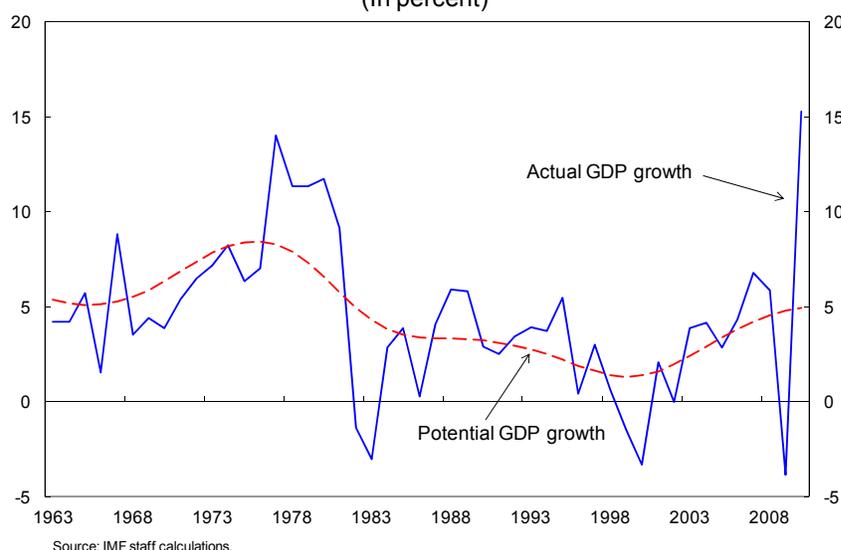
6.   **The upswings of the Paraguayan economy have also led to important changes in its potential growth assessment over half a century.** According to a growth accounting exercise explained later in detail, Paraguay's potential growth hovered around 6.7 percent per year between 1963 and 1981. This level later decreased to 2.7 percent between 1982 and 2002, in line with the large downturn in actual growth. As the economy's actual GDP growth rate increased significantly from that point onwards, potential growth rose accordingly, reaching about 4.9 percent by end-2010.

7.   **The assessment of Paraguay's long-run potential output growth builds on a standard growth accounting exercise.** Specifically, the following Cobb-Douglas production function is estimated:

$$(1) \qquad\qquad Y_t = A_t K_t^{\alpha} L_t^{1-\alpha}$$

where Y_t is total output, A_t is a technology parameter or TFP, K_t and L_t denote the capital stock and labor inputs, respectively, and α is the share of capital income in total output. In this setting, the capital stock evolves according to the following law of motion:

$$(2) \qquad\qquad K_{t+1} = I_t + (1-\delta)K_t$$

where I_t is total investment and δ is the depreciation rate of the capital stock. This methodology requires the estimation of Paraguay's capital stock, as explained below.

8.   **Although Paraguay's capital stock has generally trended upwards over the last 50 years, the capital-to-output ratio has decreased after a peak reached in the early 2000s.** To estimate the capital stock an initial condition is required, which is obtained from the following steady state relation,

$$(3) \qquad\qquad K_{ss} = I_{ss} / (\delta + g)$$

where g is the long-run growth rate of the capital stock. The capital stock of the year 1962, K_{1962}, is set as the initial condition for the model. Specifically, this is obtained from Eq. (3) using investment figures for the year 1962, I_{1962}, and setting $\delta=0.08$—a capital depreciation rate of 8 percent per year—and g=0.04—the average GDP growth rate over the last 60 years, equal to 4.06 percent.[3] Over the long run (in the steady state), the growth rate of the capital stock and GDP should coincide. The capital stock later evolves according to Eq. (2). Results of the estimation are summarized in Figure 2.[4]

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[3] The depreciation rate for the capital stock is taken from Fernández Valdovinos and Monge Naranjo (2004).

[4] The capital-to-output ratio in Paraguay still remains well below the level of industrialized countries. For instance, in the case of the U.S., the average of this ratio for the period 1962 to 2008 reached 2.9 whereas in Paraguay it reached 1.8.

Figure 2. Capital Stock Estimations

Source: IMF staff calculations.
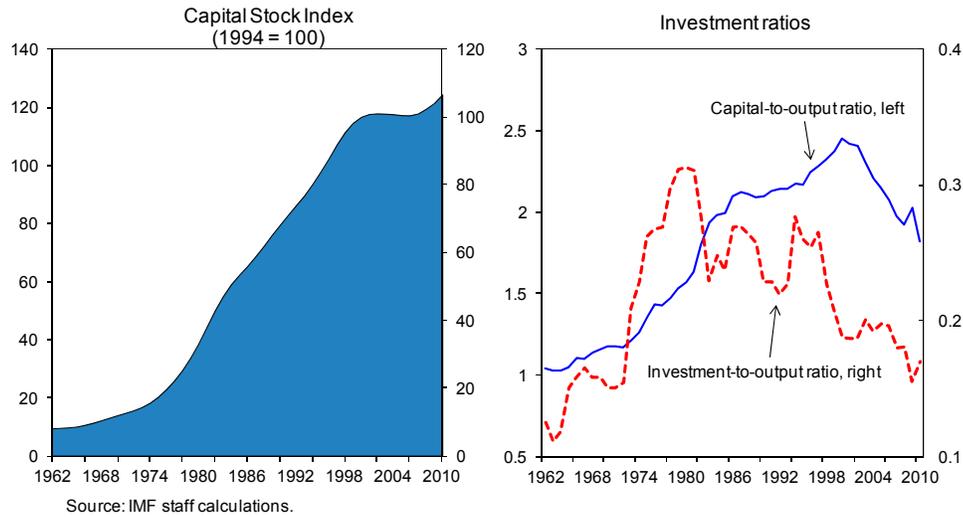
9.   **Estimations also suggest that Paraguay's TFP has fluctuated significantly more than output, trending downward or remaining flat after the early 1980s' peak**. TFP estimations are obtained from Eq. (1), once capital and labor inputs are accounted for, and the parameter α is calibrated. The latter is set to 0.35 in this exercise.[5][6]

10.   **The model is also used to evaluate the dynamics of Paraguay's per worker GDP growth, as it helps assess more thoroughly the long-run performance of the economy**. Expressing Eq. (1) in per worker terms and applying logs gives,

(4) $y_t = a_t + \alpha k_t$

where y_t is output per worker, k_t is capital per worker and a_t is TFP, all in logs. Differentiating Eq. (4) with respect to t provides a decomposition of per worker GDP growth between the contributions due to TFP growth (or productivity gains) and those due to capital per worker growth.

11.   **Paraguay's per worker GDP growth performance has been less than stellar from a long-run perspective, notably after the 1980s.** This fact can be explained by the combination of moderate productivity gains in the economy and a relatively stagnant capital

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[5] The chosen value for α is in line with previous growth accounting exercises. For instance, Brauman (2009) estimates from Paraguay's national accounts an average capital income share on output of about 35 percent considering data from the late 1990s and early 2000s. He then sets α=0.35 in his analysis, as it is also done here.

[6] Results are robust to different parameterizations of the depreciation rate δ and the capital income share α. In addition to the calibration used here of δ=0.08 and α=0.35, other estimations have been considered taking instead δ=0.1 (from Brauman, 2009) and α=0.44 (from a number of unpublished estimations of the Central Bank of Paraguay), without showing major differences in results.

per worker growth rate. During the 1970s, the rapid per worker GDP growth was sustained by the significant increases in the capital per worker ratio and, to some extent, TFP gains. However, the stagnant or decreasing investment ratio that prevailed after the 1970s reduced the overall contribution of capital to explaining GDP growth. Indeed, during certain particular years the main engine for growth was related to increases in TFP. This occurred for instance during the late 1980s and early 2000s, yet in general productivity gains in Paraguay have been modest and intermittent, and thus they have not been the main source of economic growth in the last 30 years. Lately, in 2010, per worker GDP growth has surprised on the upside—about 13.1 percent—which the model particularly assigns to significant TFP gains. However, this probably reflects the effect of extremely favorable weather conditions on agricultural sector growth in that year and might thus be short-lived.

Figure 3. TFP Estimations

Source: IMF staff calculations.
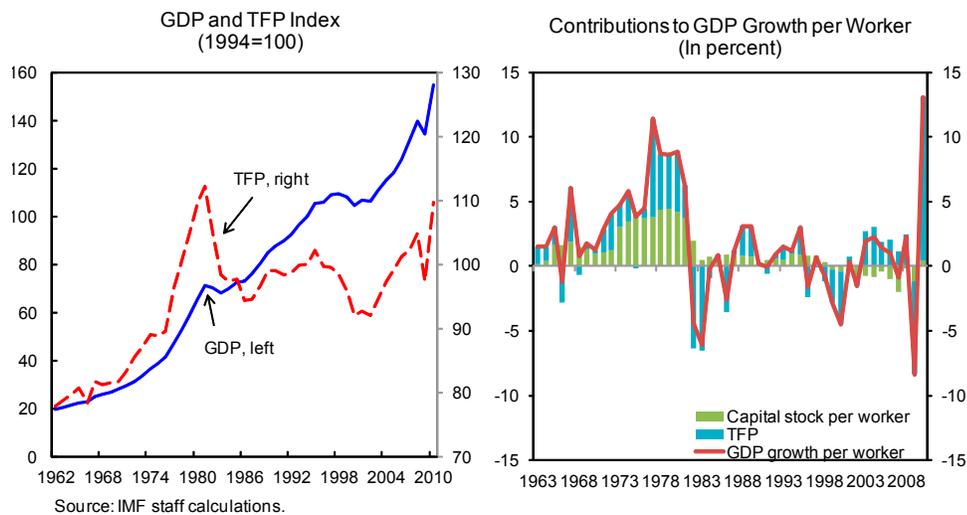
C. Potential Growth and the Output Gap: Recent Developments

12.   **A structural break affected the Paraguayan economy by end-2002, leading to significant differences in the assessment of its potential growth**. According to standard statistical techniques, Paraguay's potential growth rose on average from about 0.6 percent in the period 1994–2002 to an average of about 4½ percent in the period 2003–2010 (Table 1 and Figure 4).

13.   **Potential growth in the non-agricultural sector also increased after 2002, following a path broadly similar to that of total output.** Specifically, potential growth in the non-agricultural sector rose from about 0 percent to about 4.1 percent on average between 1994–2002 and 2003–2010. These findings suggest that the increase in Paraguay's potential growth during 2003–2010 has been driven by a widespread expansion of the different sectors of the economy and not only by the very dynamic agricultural sector.

Table 1. Potential Growth Estimations
(In percent)

	Aggregate GDP 1/2/			Non-agricultural GDP 1/2/		
	(1)	(2)	(3)	(1)	(2)	(3)
Hodrick and Prescott	2.5	0.8	4.3	2.1	0.2	4.0
Baxter and King	2.6	0.4	4.5	2.1	-0.2	4.2
Christiano and Fitzgerald	2.6	0.6	4.3	2.1	0.0	4.0
Average	**2.6**	**0.6**	**4.4**	**2.1**	**0.0**	**4.1**

Source: IMF staff calculations.

1/ (1): 1994Q1 to 2010Q4 period; (2): 1994Q1 to 2002Q4 period; and (3): 2003Q1 to 2010Q4 period.

2/ To reduce the end-of-sample bias problem eight additional quarters are added to the 1994Q1-2010Q4 sample for these estimations using IMF staff projections.

Figure 4. Actual and Potential Output
(Billions of 1994 Guaraníes)
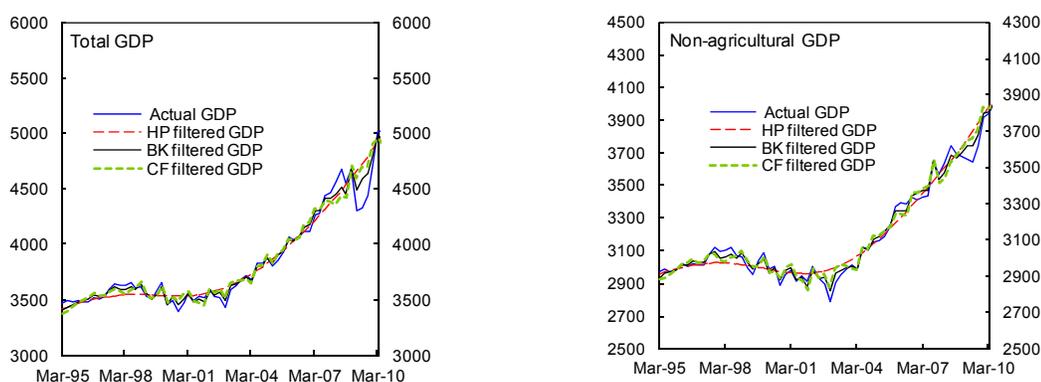
Source: IMF staff calculations.

14.   **Statistical techniques are also used to estimate Paraguay's output gap in recent years**. The statistical techniques used to evaluate Paraguay's potential growth may also be applied to estimate its output gap. As summarized below, the methodologies permit to evaluate easily the output gap for the economy as a whole, and that specific to the non-agricultural sector.[7] It is important to estimate the latter separately given the relatively large share (around one-fifth) of the agricultural sector in Paraguay and the inherent difficulties of estimating an output gap for agriculture. In this respect, and given the limited spillovers from agriculture to the rest of the economy (see section D), the output gap of the non-agricultural sector is arguably a more meaningful indicator of demand pressures—or their absence—in Paraguay.

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[7] The use of different statistical filters to calculate potential output and its associated output gap is widely considered in the literature. Magud and Medina (2011), for instance, calculate these unobservable variables following an approach similar to that considered here.

- **Total GDP:** The severe drought in combination with the global crisis led to a substantially negative output gap in 2009—estimations ranged from -6.7 percent according to the Hodrick-Prescott (HP) filter to about -6 percent according to the Christiano and Fitzgerald (CF) filter (Table 2). With the 2010 economic boom, the output gap moved into positive territory again, with estimates ranging from 1.6 percent (HP filter) to 2.4 percent (CF filter). Notwithstanding the strong economic boom in 2010, the output gap in that year remained below that estimated for 2008, a year in which the economy also experienced an important boom.

- **Non-agricultural GDP:** The output gap for the non-agricultural sector followed a path similar to that of the economy as a whole, yet the size of the gap has been lower. According to the results of the estimation, the output gap excluding agriculture was on average about 0.8 percent in 2008, decreasing to around -2.5 percent in 2009. After the widespread economic boom of 2010, the output gap is estimated to have turned positive in the second quarter of the year and was slightly positive for the year as a whole.

Table 2. Output Gap Estimations
(In percent)

	Aggregate GDP 1/2/			Non-agricultural GDP 1/2/		
	HP	BK	CF	HP	BK	CF
2008Q1	3.14	2.66	4.75	0.71	1.63	2.53
2008Q2	4.28	3.54	5.52	2.61	1.70	2.97
2008Q3	0.42	2.44	3.00	-0.05	0.63	0.27
2008Q4	1.64	-0.21	-0.70	-1.74	-0.69	-1.26
2008	**2.37**	**2.11**	**3.14**	**0.38**	**0.82**	**1.13**
2009Q1	-7.56	-4.13	-6.24	-3.24	-2.20	-2.81
2009Q2	-8.33	-5.67	-7.79	-5.03	-2.67	-3.93
2009Q3	-7.14	-4.09	-5.31	-3.57	-1.67	-2.57
2009Q4	-3.73	-2.25	-4.77	-0.39	-0.77	-1.60
2009	**-6.69**	**-4.03**	**-6.03**	**-3.06**	**-1.83**	**-2.73**
2010Q1	1.88	0.91	1.18	-1.03	-0.26	-0.80
2010Q2	0.67	1.72	2.51	-0.38	0.22	0.70
2010Q3	-0.64	1.40	2.41	0.15	0.40	1.00
2010Q4	4.64	1.65	3.55	1.95	1.45	2.45
2010	**1.64**	**1.42**	**2.41**	**0.17**	**0.45**	**0.84**

Source: IMF staff calculations.
1/ HP: Hodrick and Prescott methodology; BK: Baxter and King methodology; and CF: Christiano and Fitzgerald methodology.
2/ To reduce the end-of-period bias problem eight additional quarters are added to the 1994Q1-2010Q4 sample for these estimations using the IMF staff projections

Figure 5. Output Gap Estimations
(In percent)
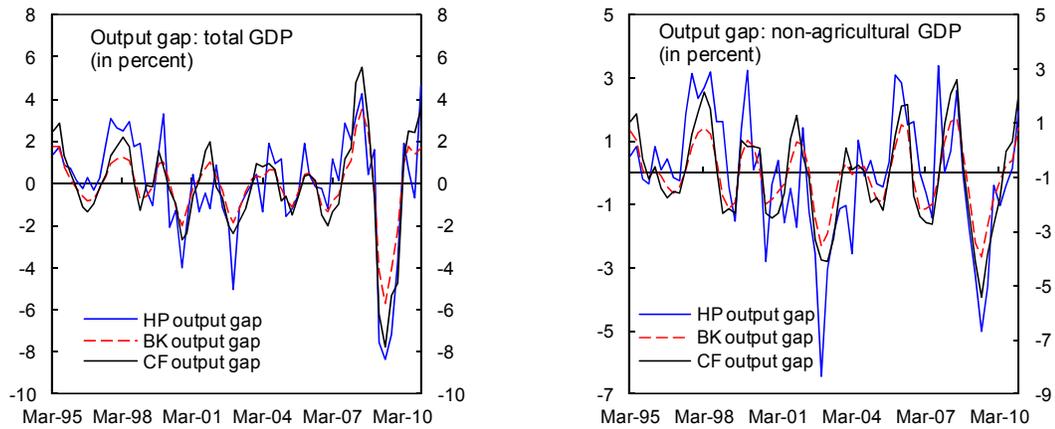
Source: IMF staff calculations.

D. Are the Spillovers from the Agricultural Sector Relevant in Paraguay?

15.   **To analyze empirically the spillovers from the agricultural sector to the rest of the economy, the following vector autoregressive (VAR) model is estimated**:

$$(5) \qquad Y_t = A(L)Y_{t-1} + B(L)X_t + U_t$$

where $A(L)$ and $B(L)$ are a n x n and a n x k polynomial matrices in the lag operator L, respectively, Y_t is a n x 1 vector of endogenous variables, X_t is a k x 1 vector of exogenous variables, and U_t is a n x 1 vector of estimated residuals. The VAR model is further specified as follows:

$$(6) \qquad Y_t = \left[Agriculture_t \quad Industry_t \quad Construction_t \quad Services_t \right]$$

and

$$(7) \qquad X_t = \left[Dummy_t \right]$$

16.   **In this specification the vector of endogenous variables Y_t includes the output of Paraguay disaggregated by sectors.** Specifically, Y_t includes agricultural output (Agriculture$_t$) as the most exogenous variable, followed by industrial output (Industry$_t$), construction output (Construction$_t$) and services output (Services$_t$).[8] According to this ordering, a shock to the agricultural sector at period t affects contemporaneously all the variables of the model, whereas an innovation to the services sector at time t affects the

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[8] Strictly speaking, due to data availability Industry also includes Mining, yet the latter is a very minor activity in Paraguay—about 0.1 percent of 2010 GDP.

remaining variables of the model only with a lag. The Dummy$_t$ variable in vector X$_t$ is included to control for the drought that affected the economy during 2009.

17.   **The VAR model includes the main sectors of Paraguay, which represent around 90 percent of 2010 GDP.** In terms of the relevance of each particular sector, agriculture roughly represents 22 percent of 2010 GDP, industry about 13 percent, construction about 4 percent, and services about 51 percent (Figure 6).[9]

Figure 6: Main Sectors of the Paraguayan Economy
(In percent of total output)

Source: IMF staff calculations.
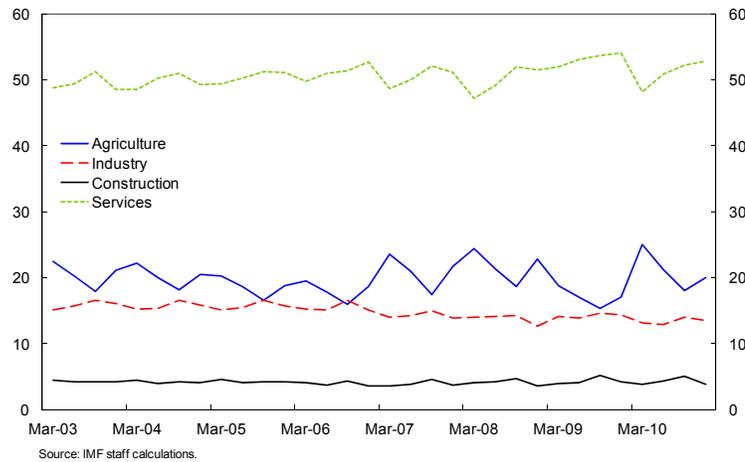
18.   **The VAR model is estimated considering quarterly data for the period 2003Q1–2010Q4.** Therefore, this data set covers only the period that follows the structural break of the Paraguayan economy that took place by end-2002. All variables in Y$_t$ are measured at constant prices, are seasonally adjusted and expressed in logs. Using standard techniques, 2 lags are chosen for the estimation of the VAR model.

19.   **VAR results suggest little spillovers from the agricultural sector to the rest of the economy, with the construction sector responding more significantly to changes in agricultural output.** Specifically, Figure 7 depicts the impulse-response functions to a 10 percent increase in the output of the agricultural sector. In the case of construction, its output rises on impact about 2 percent, yet the effect vanishes about 4 quarters after the shock. Although there is a somewhat mild increase in the output of the services sector, the effect is not very significant. Interestingly, industrial output does not seem to be affected by the increase in the output of the agricultural sector. In general, these results might reflect the

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[9] The other relevant sectors not included in the model are livestock (about 8 percent of 2010 GDP) and electricity (about 2 percent of 2010 GDP).

fact that agriculture in Paraguay relies heavily on imports of intermediate and capital goods, it is a land- and capital-intensive sector, and pays relatively little taxes.[10]

Figure 7. Impulse-Response Functions to a 10 Percent Increase in Agricultural Output
(In percent)
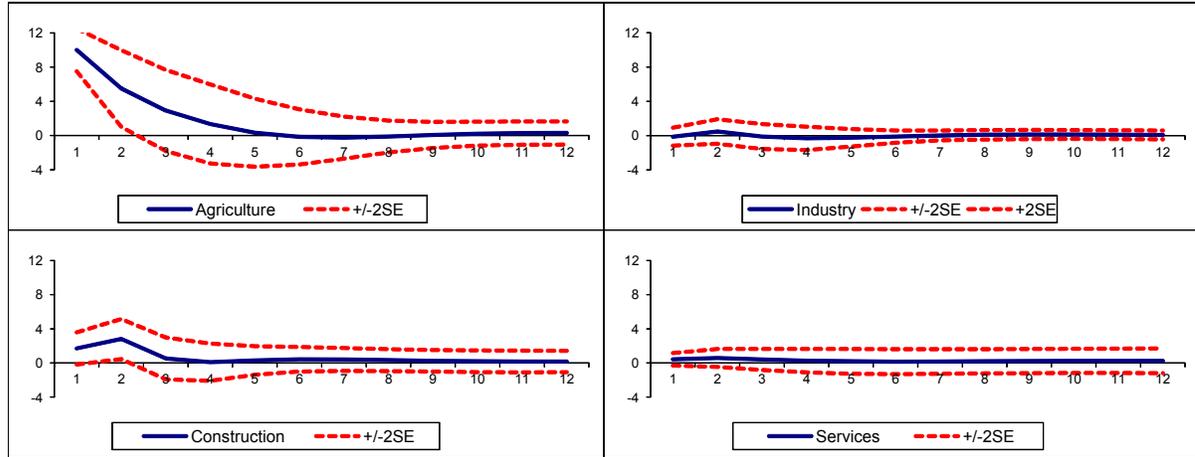
20.   **A forecast error variance decomposition analysis confirms the limited spillover effect from the agricultural sector to the rest of the economy.** At most, an agricultural sector specific shock contributes to explaining about 22.5 percent of the output volatility in the construction sector—the sector with the largest spillover from agriculture—around 4 quarters after the shock. For the other two sectors the contribution of agricultural shocks in explaining their sectoral volatility is rather scant, with a slightly larger relevance in the services sector (Table 3).

Table 3. Forecast Error Variace Decomposition Due to an Agricultural Sector Shock
(In percent)

Quarters	Industry	Construction	Services
1	0.1	9.8	4.2
4	2.3	22.5	5.6
8	2.6	20.0	3.6
12	2.7	17.5	3.0
24	2.5	12.5	2.4

Source: IMF staff calculations.

21.   **To contrast results with those provided by the VAR model, a set of simple OLS regressions are also considered in the analysis.** The estimated univariate OLS model is represented by the following equation:

(8) $$Y_{j,t} = c(1) + c(2)Y_{j,t-1} + c(3)A_t + c(4)A_{t-1} + c(5)Dummy_t + \varepsilon_{j,t}$$

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[10] The stronger link with the construction could be related to the tendency of agricultural booms to generate property booms in countries where agriculture is important as a source of income.

where $Y_{j,t}$ is output in either industry, construction or services as indicated by the sub-index j, A_t is agricultural sector output and $Dummy_t$, as in the VAR specification, is a dummy variable that corrects for the effects of the 2009 drought. Also as in the VAR model, the estimations consider quarterly data for the period 2003Q1 to 2010Q4, with all sectoral output data expressed in logs and seasonally adjusted. In this specification, the short-run impact of agriculture on the other sectors is given by $c(3)$, whereas the long-run impact is accordingly given by $\dfrac{c(3)+c(4)}{1-c(2)}$.

22.   **OLS regressions for each sector support the findings of the VAR model: the largest short-run spillover effect of agriculture is on the construction sector, and the effects on industry and services are limited.** Estimations also show that over the long run a rise in agricultural output produces a significant and positive effect on construction and services, yet the effect on industry remains particularly small (Table 4).

Table 4. OLS Estimation of Spillover Effects From the Agricultural Sector

	c(1)	c(2)	c(3)	c(4)	c(5)	Short-run effect	Long-run effect	R-squared
Industry	1.72	0.70	0.00	0.02	0.03	0.00	0.09	0.75
t-Statistic	2.39	5.09	0.02	0.46	2.33			
Construction	1.64	0.18	0.23	0.13	0.13	0.23	0.44	0.85
t-Statistic	3.51	1.83	2.38	1.37	5.01			
Services	0.25	0.93	0.05	0.00	0.02	0.05	0.61	0.97
t-Statistic	0.68	12.22	1.10	-0.07	1.18			

Source: IMF staff calculations.

23.   **Estimations also show little change in the spillovers from the agricultural sector over time, but suggest an increase in the spillover to the construction sector around 2002.** Using the VAR stated previously, a set of rolling VARs is estimated using different subsamples. Each estimated VAR comprises a 32-window period, starting in 1994Q1. The impulse response functions to a one standard deviation agricultural sector shock are then computed, and the associated one quarter response of each sector is stored. Each subsequent subsample adds one quarter to the previous one, with the latest subsample starting in 2003Q1 (going through 2010Q4) being equal to that used in the previous VAR estimations. Figure 8 plots the one-quarter responses of the different sectors considering the rolling VAR estimations. It follows from the figure that only the construction sector output had a significant and positive increase in the spillover from agriculture starting around 2002, roughly coinciding with the boom in the production of soybeans in Paraguay.

Figure 8. Rolling VARs
(In percent)

Source: IMF staff estimations.
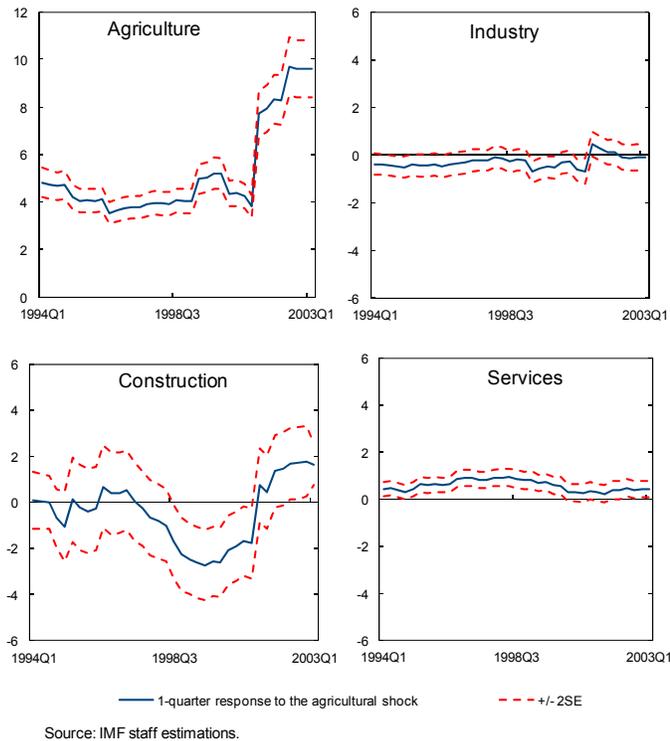
E. Concluding Remarks

24.   **The analysis of the paper suggests that Paraguay's potential growth increased substantially in the years that followed the 2002 crisis, reaching about 5 percent in 2010.** To sustain this growth level over the medium term, however, the economy will require larger investment levels. Economic policies will play a critical role in raising investment, notably by making sure that macroeconomic stability and a favorable climate for private investment are maintained, while well-known bottlenecks to long-run growth in the country (e.g., infrastructure quality) are effectively addressed.

25.   **Estimations also suggest that the output gap turned positive in mid-2010**. Containing, and eventually eliminating, the overheating pressures associated with a positive output gap is also an important challenge for the authorities to sustain a stable macroeconomic environment. Finally, although the agricultural sector represents about one fifth of Paraguay's GDP, the paper suggests that the spillovers from this sector to the rest of the economy are limited. While strengthening the linkages of agriculture with the other sectors of the economy is a big challenge, economic policy measures that raise the tax contribution of the agricultural sector in an efficient manner could help in this regard. This would also contribute to the ultimate goal of providing the basis for Paraguay to grow at its potential level over the medium run by providing the state with additional resources to improve infrastructure and raise human capital.

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II. BANK EXCESS RESERVES IN PARAGUAY—DETERMINANTS AND IMPLICATIONS[1]

A. Introduction

1.   **Paraguay's banks hold a high volume of cash-based reserves above and beyond the level required by legislation.[2]** This paper suggests that banks' excess reserves respond to a mixture of *precautionary* and *involuntary* factors. Banks hold excess reserves to protect themselves from several contingencies derived from the prevalent high level of volatility in the economy, institutional weaknesses and market failures. In addition, banks hold a large volume of *involuntary* excess reserves as a result of several shocks beyond their control.

2.   **Large excess reserves have important implications for monetary policy and the financial sector.** In particular, they limit the central bank's capacity to affect banks' cost of funding, weakening the monetary transmission channel. At the same time, high levels of involuntary excess reserves could increase financial stability risks. The paper suggests several measures to reduce excess reserves, including strengthening the monetary policy framework, fostering money markets, and overhauling the payments system.

3.   **The structure of the paper is as follows.** Section II describes Paraguay's bank reserve requirements and documents the currently existing high level of bank excess reserves from a regional perspective. Section III reviews the various factors that have led to the current high level of bank excess reserves in Paraguay. Section IV uses an econometric model to estimate the relative importance of precautionary and involuntary factors in the build-up of bank excess reserves during 1995-2010. Section V discusses some important implications of excess reserves in Paraguay. Section VI summarizes and presents some policy recommendations.

B. Paraguay's Reserve Requirements from a Regional Perspective

4.   **Paraguay's *statutory* reserve requirements are broadly in line with Latin American countries' standards.** They are different according to the currency in which the deposits are denominated and their maturity (see Appendix I for a regional comparison). The statutory ratios are higher for sight deposits than for time deposits and for foreign currency-denominated deposits than for deposits denominated in local currency. The average statutory ratios in Paraguay are at present 18 percent for deposits in guaranies and 25 percent for foreign currency deposits. As Figure 1 shows, Paraguay's *statutory* ratios are in line with regional averages, except for ratios on sight deposits denominated in foreign currency, in which Paraguay pairs with those countries with the highest ratios such as Peru and Guatemala. As regards their goal, reserve requirements in Paraguay are mainly devised as

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[2] Bank excess reserves are a feature shared by several developing countries, including Paraguay (Agenor and Aynaoui, 2010 and Gray, 2011).

complementary tools for monetary policy,[3] and have been changed only sparingly over the last decades. Most recent modifications include the reduction in October 2008 and February 2009, by an average of 3 percentage points, in response to the global financial crisis and the recent increase,[4] in March 2011, by 3 percentage points for reserve requirements in guaranies and 4 percentage points for foreign currency-denominated deposits to contain monetary expansion.

Figure 1. Statutory Reserve Requirements in Latin American Countries
(In percent) 1/
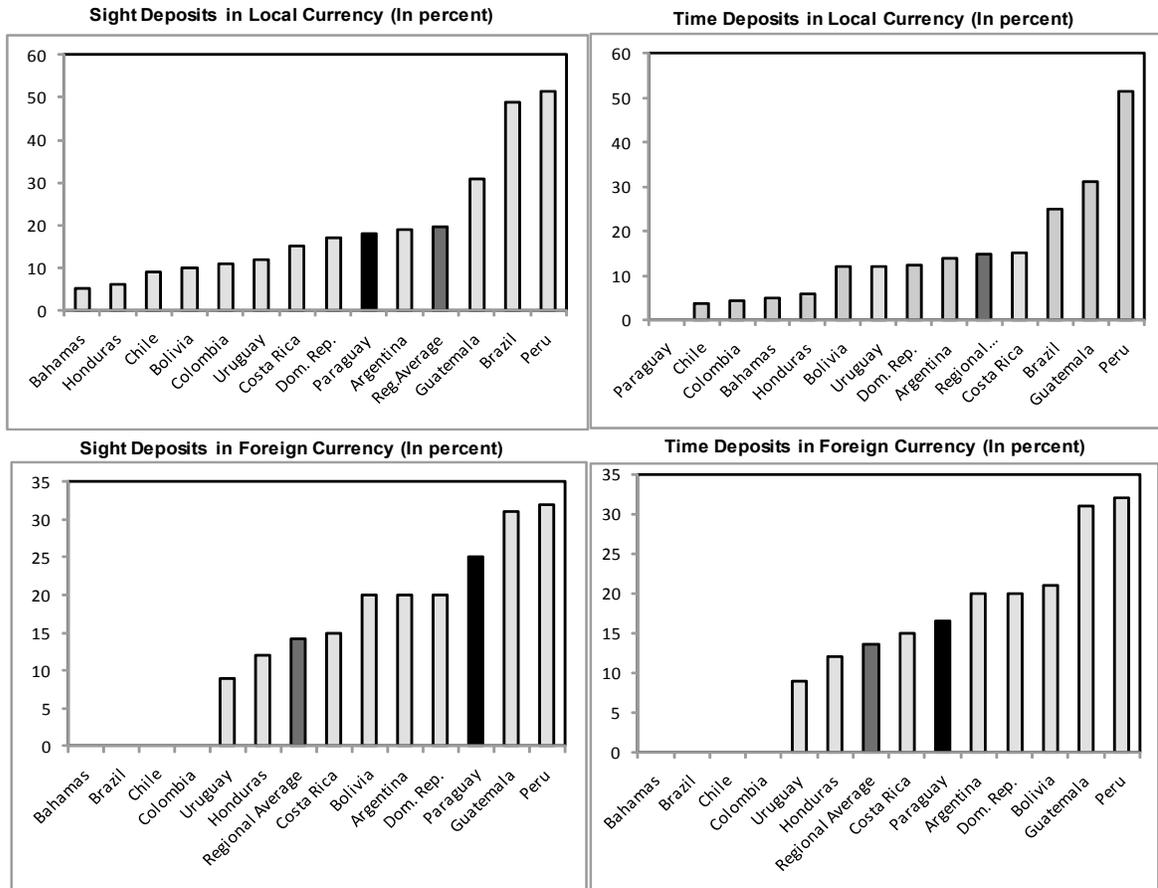
Source: Information System for Instruments of Monetary Policy, Monetary and Capital Market Department, and International Monetary Fund.
1/ For each type of currency and maturity, ratios are calculated as the simple average of the ratios applicable within each category. Peru and Brazil's average ratios include the marginal and additional requirements.

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[3] Banks are allowed to use their legal reserves only after experiencing a 20 percent reduction in their deposits.

[4] In October 2008, the reduction focused on the ratios for sight deposits which fell by 2 percentage points in the case of deposits in guaranies and 5.5 percentage points for foreign currency deposits. In February 2009, the reduction focused on the requirements ratios for time deposits, which fell by 7 percentage points. The increase adopted in early 2011 rolled back the reductions in the ratios adopted in 2008.

5.   **As regards compliance and enforcement, Paraguay's reserve requirements are also broadly in line with neighboring countries' rules, with a few important exceptions.** As in other Latin American countries, legal reserves in Paraguay have to be maintained in the currency in which the deposits are denominated, and are partially remunerated, above pre-established thresholds: if legal reserves in guaranies are above 7 percent of total deposits, the residual balance is remunerated at the average deposit rate; for foreign currency, if legal reserves are above 10 percent of total deposits, the residual balance is remunerated at the one-month LIBOR. However, in clear contrast with other Latin American countries, in Paraguay reserve requirement compliance on an average basis is not allowed. The total amount of legal reserves is computed at the beginning of the month by multiplying the average monthly deposits of the previous month by the reserve requirement ratios. Banks need to hold constant that amount of legal reserves during the following month (the holding period). This implies that banks cannot use their legal reserves for their daily operations nor as collateral in their operations with the Central Bank of Paraguay (CBP). In addition, in contrast with regional practices, reserve requirements have to be observed exclusively in the form of banks' deposits at the CBP. Cash maintained by banks in their vault and their holdings of government securities are not eligible assets to comply with legal reserve requirements. Another important difference with neighboring countries is the penalty for reserve deficiency, which in Paraguay is subject to the discretion of the CBP, instead of being defined in terms of a reference rate and the average deficiency (see Appendix I for a regional comparison).

6.   **Paraguay's *effective* reserve requirement ratios are higher than in neighboring countries, especially for deposits in local currency.** The effective reserve requirements are defined as the total amount of required reserves actually maintained by the banking system divided by the total amount of actual deposits and other liabilities subject to reserve requirements. The effective reserve requirement ratios could deviate from the *statutory* ratios depending on the composition of deposits. Figure 2 shows how the average effective reserve requirement ratio for deposits in local currency in Paraguay is higher than in neighboring countries, with Chile presenting the lowest level. As regards foreign currency deposits, Paraguay's effective reserve requirements are in line with the ratios in neighboring countries, and in particular Peru and Bolivia. These results reflect that countries with high average statutory reserve requirements, such as Peru, have in fact a moderate effective reserve requirement ratio, because the highest statutory ratios apply only to marginal or additional deposits. Figure 2 also shows the substantial increases in the statutory reserve requirements for deposits in foreign currency implemented by Peru and Bolivia in recent years.

7.   **The most striking feature of Paraguay's bank reserves is the high level of reserves that banks maintain above the level required by legislation (Figure 3).** Banks maintain their excess reserves in the form of cash-based and non-remunerated deposits at their current accounts at the CBP (around two-third of the total) or as vault cash, and mostly in local currency. Because holding cash-based reserves above the legal requirements are not remunerated, in most countries excess reserves are usually nil or small (e.g., Chile, Brazil

and Peru, as shown in Figure 3).[5] In Paraguay, however bank excess reserves are substantially higher, averaging 12 percent of total deposits in recent years. Other dollarized economies, such as Bolivia, also present high levels of bank cash-based excess reserves, at 16 percent of total deposits in recent years.

Figure 2. Effective Reserve Requirements in Paraguay and Latin American Countries 1/
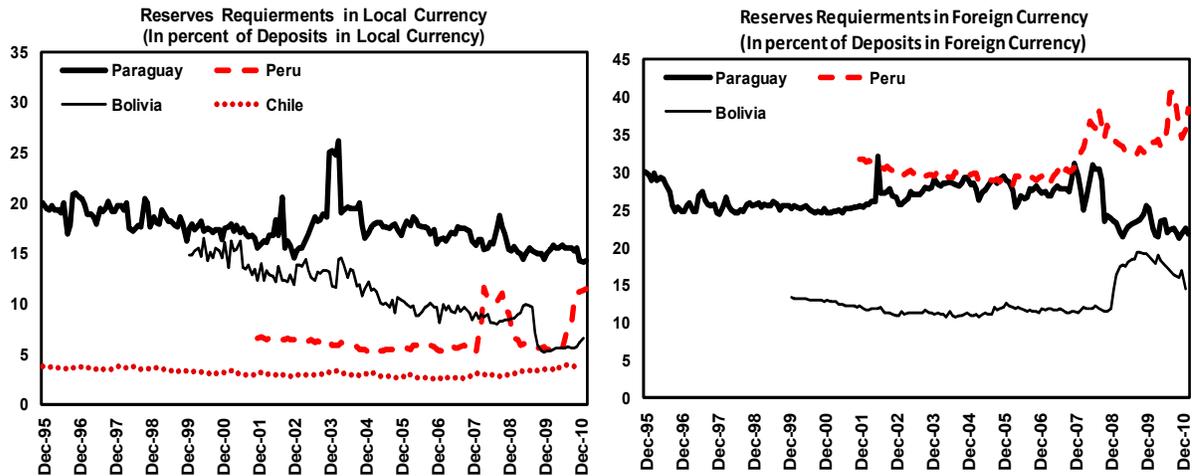
Source: Central Bank of Paraguay, Central Bank of Chile, and Central Bank of Peru.

1/ Effective reserve requirements are calculated as the total legal reserve requirements maintained by the banking system divided by the total amount of deposits and other liabilities subject to reserve requirements.

8.   **Another striking feature of Paraguay's bank excess reserves is that they have been high for a very long period of time, which started in 2002 (Figure 3).** While in Bolivia, excess reserves seem to be a phenomenon of recent years, probably linked to uncertainties related to the recent global financial crisis, in Paraguay, bank excess reserves have been at a high level since 2002. In particular, since 1995 it is possible to distinguish two distinct periods: (i) 1995-2002, during which excess reserves only amounted to an average of 3 percent of total deposits; and (ii) 2002-2011, when banks' excess reserves jumped to an average of 12 percent of total deposits. This paper deals both with the factors behind the sharp increase in bank excess reserves in Paraguay in 2002 and the reasons why bank excess reserves still continue at such high levels in present times.

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[5] This does not implies that banks in those countries do not hold liquidity buffers above and beyond the reserve requirements. They do, but in form of non-cash and remunerated liquid assets, such as government securities.

Figure 3. Ratio of Excess Reserves to Deposits in Paraguay and Selected Latin American Countries

Paraguay: Total Bank Legal Reserves and Excess Reserves
(In percent of Total Deposits)

Paraguay: Breakdown of Banks' Excess Reserves
(In percent of Total Deposits)

Bolivia: Banks' Cash-based Excess Reserves
(In percent of Total Deposits)

Peru: Banks' Cash-based Excess Reserves
(In percent of Total Deposits)

Chile: Banks' Cash-based Excess Reserve
(In percent of Total Deposits in Pesos)

Brazil: Banks' Cash-based Excess Reserve
(In percent of Total Deposits in Reais)
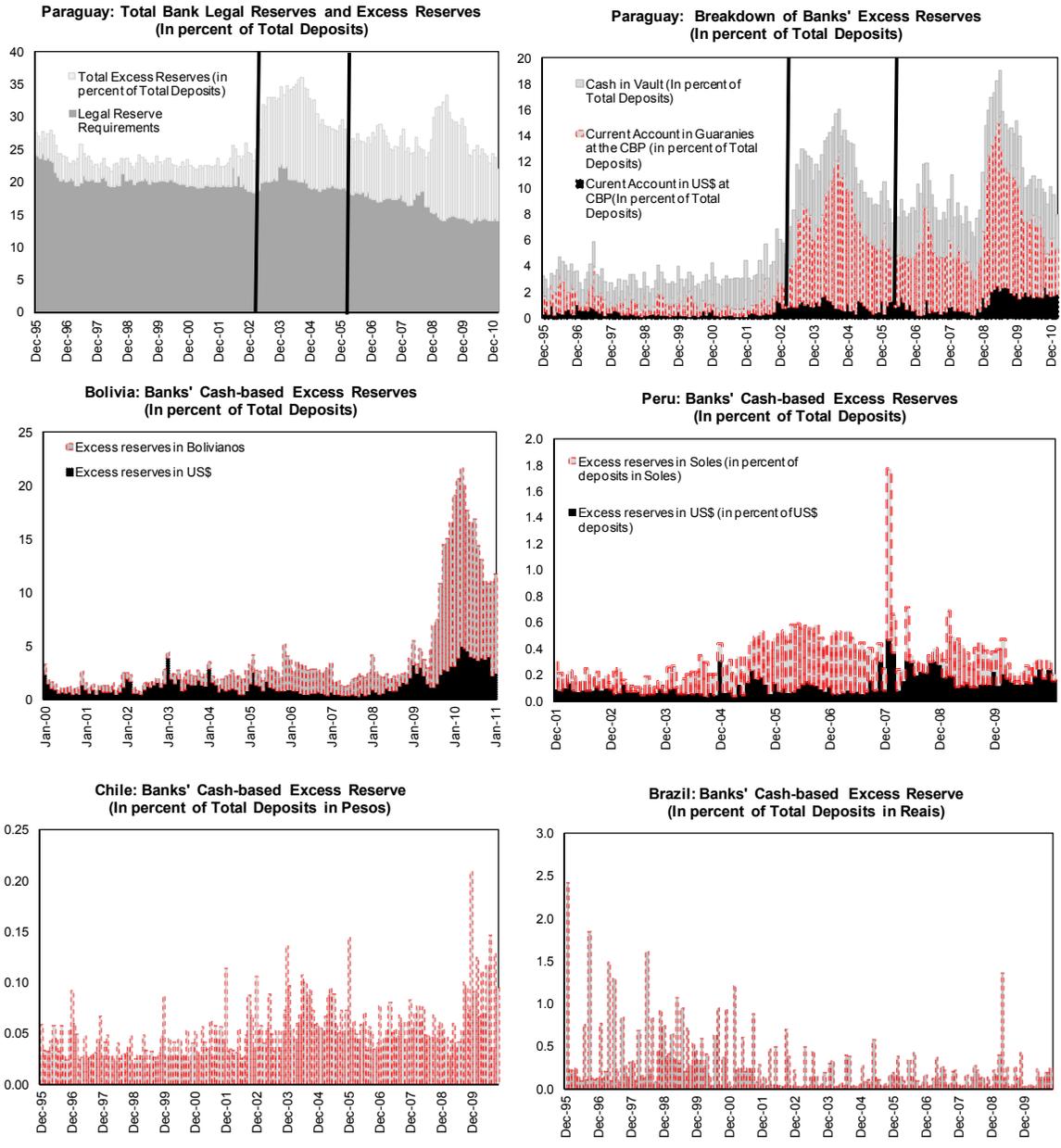
Source: Central Bank of Paraguay, Central Bank of Chile, and Central Bank of Peru.

C. Precautionary and Involuntary Factors Behind Paraguay's High level of Bank Excess Reserves

9.   **From an analytical point of view, the factors behind bank excess reserves could be divided into precautionary and involuntary factors.**[6] Banks are expected to hold large precautionary excess reserves in the presence of high volatility and large counterparty risks. For instance, when inflation is very volatile and information costs on borrowers are high, banks usually present a high degree of risk aversion about the value of the collaterals pledged by borrowers. As a result, banks may charge a higher risk premium, restraint their credit supply, and increase their precautionary excess reserves. Banks may also need to accumulate large non-remunerated and cash-based excess reserves to cover themselves from sizeable structural risks such as the lack of adequate mechanisms to spread liquidity shocks over time or a highly volatile deposit base, among others. Regarding involuntary factors, a sudden fall in credit, (e.g. derived from a sharp contraction in aggregate demand or a banking crisis), an unexpected increase in private deposits (e.g. arising from a spike in capital inflows), and a sudden increase in government deposits at the banking system, could also translate into a higher-than-desired build-up of involuntary reserves, especially if these developments are not accompanied by relevant corrective actions by the central bank.

Precautionary Factors and Bank Excess Reserves in Paraguay

10.   **Paraguay's banks need to hold large precautionary excess reserves to counter high macroeconomic volatility.** Paraguay is a small and very open economy, which primarily exports commodities. The country's economic activity and inflation are highly vulnerable to weather cycles and swings in commodity prices. Paraguay has also strong economic ties with two large neighbors, and is subject to large spillovers from their economies. Against this backdrop, Paraguay has a history of relatively large fluctuations in economic activity and inflation (measured in Figure 4 by the 3-year moving standard deviation of price and economic activity indexes). The financial sector is closely linked to this potential volatility, as credit to the agribusiness sector and commerce accounts for almost 65 percent of banks' loan portfolio. Figure 4 suggests that Paraguay's banks have tended to increase their excess reserves in periods of high inflation volatility and large contractions in economic activity. In an environment with little options to hold liquidity buffers, given the scarcity of alternative financial assets, banks are compelled to hold excess reserves in cash-denominated, non-remunerated reserves.

11.   **Large precautionary excess reserves may also be the result of high volatility of key monetary aggregates, partly a legacy of past banking crises.** Paraguay's banking system suffered several severe banking crises during 1995-2003, either caused by purely domestic reasons (e.g., prevalent weak prudential regulations and supervision during the 1990s)[7] or

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[6] See Agenor and Aynaoui (2010), Gray (2011) and Saxegaard (2006).

[7] Bank failures were caused by several factors, including poor supervision and regulation, excessive risk taking, lending to related enterprises and, in some cases, outright fraud (see IMF Staff Country Reports No. 90/10 and No 01/88). Altogether, 13 banks and 35 financial companies were closed or liquidated during the period. See Mlachila (2009), *Recurrent Financial Crisis: Causes, Costs, and Consequences*.

regional factors (e.g., the contagion of the Brazilian and the Argentinean crises). As a consequence of the crisis, confidence in the banking system weakened and banks' risk aversion increased. In this context, key monetary aggregates, such as currency in circulation, credit to the private sector, and deposits, tend to present high level of volatility and to be sensitive to episodes of uncertainty and heightened risk. As Figure 5 shows, the volatility of bank deposits and credit to the private sector increased substantially after the 2002 and 2008 crises and seems to be highly correlated to bank excess reserves.

Figure 4. Paraguay: Bank Excess Reserves and Macroeconomic Volatility
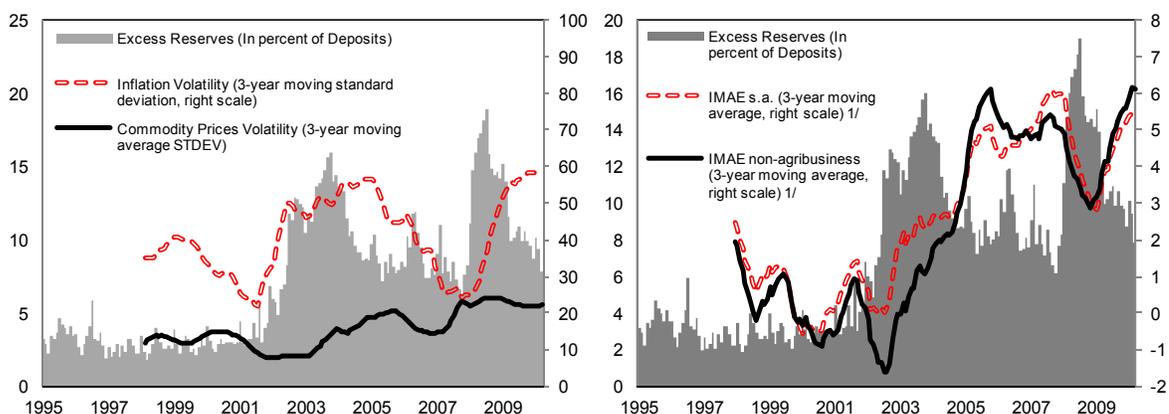
Source: Central Bank of Paraguay and IMF's staff estimates.
1/ IMAE stands for *Indice de Actividad Economica* (Economic Activity Index).
2/ Commodity prices measures according to the IMF World Commodity Price Index.

12.   **Another important precautionary factor could be the high prevalence of sight deposits in Paraguay.** This appears to be another legacy of the banking crises and the ensuing weakening of confidence in the banking system. In Paraguay sight deposits account for 70 percent of total bank deposits, significantly above the level observed in neighboring countries, where sight deposits account for 20-40 percent of total deposits (see Figure 6). In addition, in Paraguay most of bank deposits are large (larger than US$94,500 or 350 times Paraguay's minimum wage).[8] Under these circumstances, banks need to hold significant liquidity buffers to protect themselves against unexpected withdrawals. These buffers, given Paraguay's underdeveloped financial markets, take the form of cash-based reserves. As Figure 5 shows, the build-up of bank excess reserves that took place in Paraguay after 2002 occurred simultaneously with an increase in the sight-to-time deposit ratio.

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[8] Deposit insurance in Paraguay benefits deposits for amounts equivalent to 75 times the minimum wage or lower. See Appendix III for the detail breakdown of banking deposits in Paraguay by size, currency and holders.

Figure 5. Paraguay: Bank Excess Reserves and Volatility of Monetary Aggregates
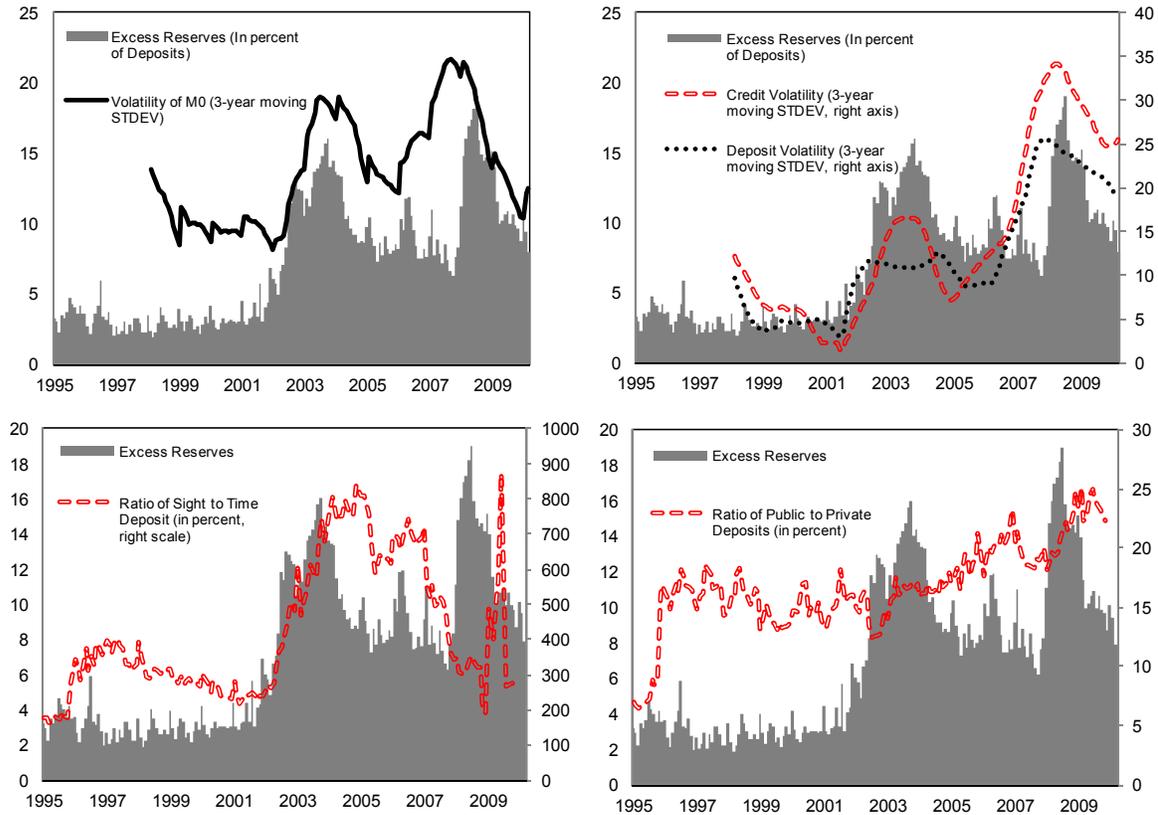
Source: Central Bank of Paraguay and IMF's staff estimates.

13.	**Existing shortcomings of the monetary policy framework may also encourage Paraguayan banks to hold large precautionary excess reserves.** The two main shortcomings are the lack of well-designed standing facilities—from which banks could borrow quickly in case of a liquidity shock, or where banks could place their excess liquidity—and the prohibition to comply with reserve requirements on an average basis. The latter implies that banks cannot use their legal reserves as a temporary liquidity buffer to absorb unexpected liquidity shocks. In countries without these shortcomings, banks decide on a daily basis their optimal holdings of excess reserves by weighting the opportunity costs of holding excess reserves against the cost of borrowing from the central bank. In Paraguay, there is no deposit facility at the CBP, and the existing discount facility, the FLIR, is perceived by banks as a lender of last resort scheme, whose use would send a negative signal to the markets (see Appendix II for a detailed description). Banks could also get extra liquidity by requesting an early redemption of their CBP bills (the *Instrumentos de Regulación Monetaria*, IRM), but this action also carries a negative stigma. This implies that banks cannot vary their legal reserve holdings from one day to another during the maintenance period according to their liquidity situation, and need to hold a large volume of unremunerated excess reserves.

14.   **Paraguay's weak financial infrastructure is another reason for banks to hold large excess reserves for precautionary purposes.** The main weaknesses arise from a deficient payments system and underdeveloped financial markets. The payments system is still based on the use of checks which are cleared manually at the existing CBP-sponsored clearing houses on a daily basis and settled on the following day over the banks' current accounts at the CBP. As regards financial markets, there are weaknesses in all segments. The primary segment of government securities remains underdeveloped, mainly reflecting the legal prohibition for the Treasury to issue securities with a maturity inferior to one year and limited issuance of other government securities in general. Trading, and in particular repo operations, are hampered by the lack of clarity about the repo legal framework and the absence of an automated trading and repository system. Repo operations are also hampered by the lack of clarity about the ownership of outstanding IRM (reportedly banks underreport their cessions of IRM to third parties) and the fragmented, non-standardized and paper-based Treasury issuances (in spite of Paraguay law allowing the dematerialization of bonds). In this context, secondary markets and inter-bank transactions remain limited. As regards non-bank short-term liquidity instruments, they also remain underdeveloped. Most firms still prefer using bank loans or highly-expensive bank overdrafts over issuing their own short-term securities, and prefer to hold their cash surplus with banks rather than investing it in short-term securities.

Figure 6. Sight Deposits in Paraguay and Selected Latin American Countries 1/

Ratio of Sight Deposits in Local Currency
(In percent of total deposits in local currency)

Ratio of Sight Deposits in Foreign Currency
(In percent of total deposits in foreign currency)
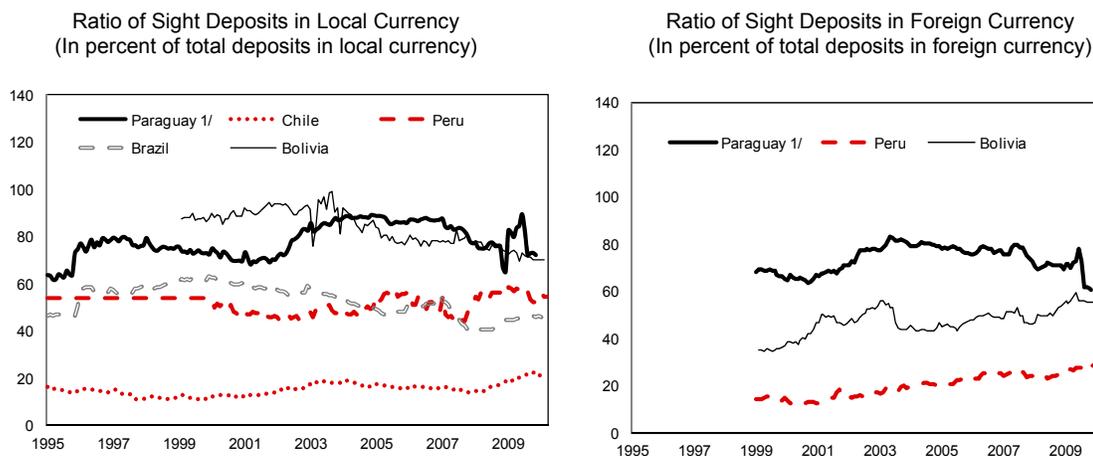
1/ For all countries sight deposits include "depositos a la vista" and "depósitos a ahorro o a ahorro a la vista". Series for Paraguay refer to the private sector.
Source: Central Banks of Bolivia, Brazil, Chile, Paraguay and Peru.

15.   **Paraguay's bank excess reserves for precautionary factors may have also been facilitated by prevalent low opportunity costs.** Banks would tend to hold a larger amount of excess reserves if, for example, the return on CBP short-term bills (the policy rate) is too low. As Figure 7 shows, bank excess reserves have increased especially in periods during which the real policy rate has been low, notably after 2003. As regards reserve requirements, a reduction in reserve requirements, which are only partially remunerated, would tend to lower the overall cost of holding reserves and encourage banks to increase their volumes of precautionary excess reserves. As Figure 7 shows, the increase in bank excess reserves has been accompanied by a reduction in legal reserves requirements.

Figure 7. Paraguay: Bank Excess Reserves and Banks' Liquidity Costs
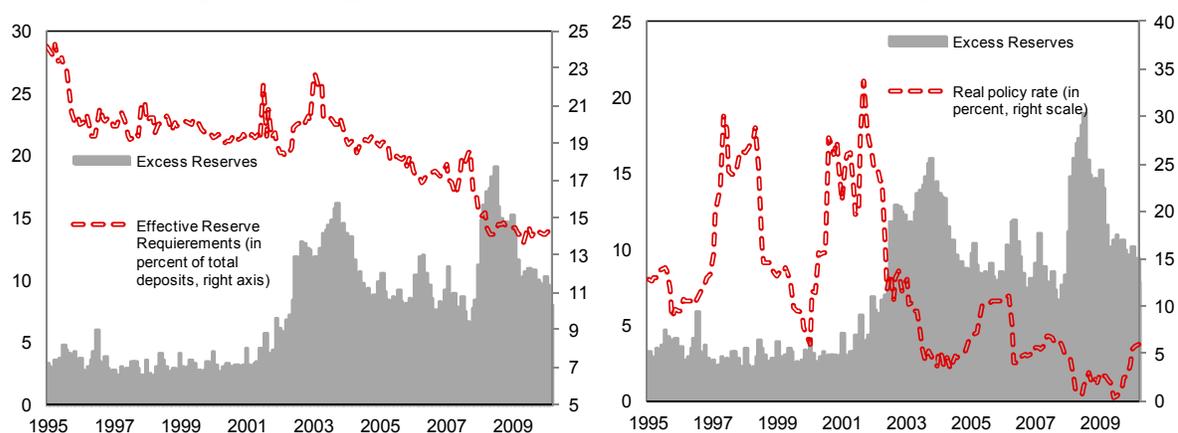
Source: Central Bank of Paraguay and IMF's staff estimates.

Involuntary Factors and Bank Excess Reserves in Paraguay

16.   **Bank excess reserves in Paraguay could also respond to involuntary factors derived from unexpected and abrupt swings in bank credit and deposits.** As Figure 8 shows, in the past and more recently, there have been several episodes of sudden reductions in loan demand and bank deposits, in some cases induced by the banking crises, which have translated into an accumulation of bank excess reserves. For instance, the significant increase in bank excess reserves that took place after the banking crises of 1995-2002 seems to have been the result of the sudden collapse in the credit and deposit-to-GDP ratios. During the first years of the recovery, bank deposits stabilized, while at the same time excess reserves increased further, probably reflecting banks' reluctance to extend credit to the private sector. By mid-2007, once confidence improved, banks reduced their excess reserves in favor of loans to the private sector and credit expanded. In 2009, the global financial crisis and the drought buffeted the economy, and credit and banking deposits weakened again, which translated again into an increase in bank excess reserves. During the strong recovery in 2010, the cycle repeats itself, with banks reducing their excess reserves in favor of an expansion of the credit to the private sector.

Figure 8. Paraguay: Bank Excess Reserves and Monetary Policy Actions
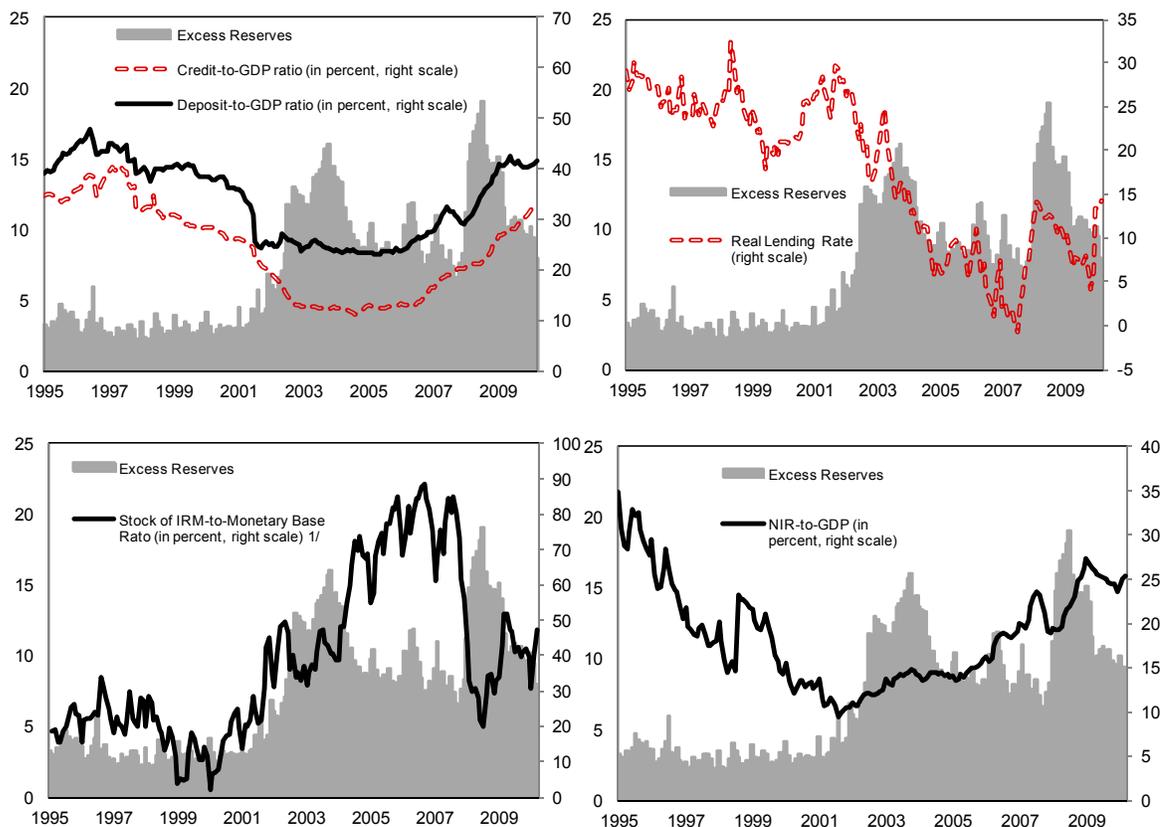
Sources: Central Bank of Paraguay and IMF's staff estimates.

17.   **Monetary policy actions could have also contributed to the building up of bank excess reserves.** During 1995-2005, the increase in bank excess reserves was accentuated by the CBP's actions to inject massive liquidity into the banking system to counter the effects of the banking crises, including by transferring public sector deposits to ailing banks. After 2005, the expansion in bank excess reserves resulted from the expansion in foreign exchange inflows, derived from high commodity prices and strong FDI inflows. The ensuing upward pressure on the nominal exchange rate often led to interventions by the CBP and the build-up of international reserves. In the absence of full sterilization, the monetary base, including bank excess reserves, expanded. More recently, excess reserves increased as a result of the monetary stimulus adopted in the context of the financial crisis and the delay in withdrawing it (e.g., by raising policy rates) during the recovery.

D. Econometric Model of Bank Excess Reserves in Paraguay: Precautionary versus Involuntary Factors

18.   **Following Saxegaard (2006)'s approach, this sub-section identifies the precautionary and involuntary factors behind Paraguay's bank excess reserves.** To that end, we assume that banks adjust their ratio of actual excess reserves as a percent of total

deposits (ER) (including both banks' balance at the CBP and cash in their vaults) toward their desired value (ER*), following a partial adjustment process:

$$ER_t - ER_{t-1} = \lambda \, [\, ER_t^* - ER_{t-1}] + \xi_t \quad (1)$$

where ER* represents the desired level of reserves and ξ_t captures the involuntary build-up of excess reserves due to shocks beyond banks' control. We assume that both ER* and ξ_t depend on the vectors X_t^1 and X_t^2 that include variables that explain, respectively the precautionary reasons for holding excess reserves and the involuntary build-up of excess reserves. We assume that εt and μt are uncorreleated and well-behaved error terms.

$$ER^{*} = \alpha_1(L) \, X_t^1 + \mu_t \quad (2)$$

$$\xi_t = \alpha_2(L) \, X_t^2 + \varepsilon_t$$

19.   **Bank excess reserves are regressed against a vector of variables thought to explain their precautionary and involuntary build-up.** After combining (1) and (2), we obtain:

$$ER_t = (1-\lambda) \, ER_{t-1} + \lambda \, (\alpha_1(L) \, X_t^1) + \alpha_2(L) \, X_t^2 + \gamma_t \quad (3)$$

Our analysis excludes excess reserves on foreign currency, because in Paraguay excess reserves in foreign currency are usually small and foreign currency is not usually used for transactions purposes. We estimate the specification (3) using monthly seasonally adjusted data in logarithms for the period January 2008-February-2011. We proceed under the assumption that data, which mostly are ratios or rates, are stationary. Table 1 shows the variables we would use in our analysis and the expected sign. Because of the presence of several explanatory variables that are likely to be endogenous, we estimate the specification (3) using the instrumental variables (IV) estimator. Instruments include lagged values of output gap, credit-to-GDP ratio, the deposit-to-GDP ratio, the lending rate, the policy rate, the ratios of the stock of CBP bills and NIR to GDP.

Table 1. Explanatory Variables of Paraguay's Bank Excess Reserves

Motif	Variables	Data
Precautionary (X^1_t)	• GDP volatility (+) • Inflation volatility(+) • Volatility of monetary aggregates (+) • Short-term maturity of deposits (+) and prevalence of public sector deposits(-) • Banks' cost of holding excess liquidity (-)	• 3-year moving standard deviation of the monthly economic activity index for the whole economy (Vol_IMAE) • 3-year moving standard deviation of the 12-month inflation rate (Vol_Infla) and commodity price index (Vol_WCPI). • 3-year moving standard deviation of M0 (Vol_M0_GDP), Credit (Vol_Credit), and, Deposits (Vol_Depo_Priv and Vol_Depo_Pub). • Ratio of Sight to Time Deposits (Sight_Time_Depo) and of Public Sector to Private Deposits (Public_Priv_Depo) in the previous month. • Policy rate (IRM_rate, (-)) in the previous month and average effective reserve requirement (RR, (-)).
Involuntary (X^2_t)	• Contemporaneous increase/decrease in credit (-) • Demand for cash (-) • Contemporaneous increase/decrease in deposits (+) • Foreign exchange inflows (+) • Monetary policy actions to tighten/loose banking system liquidity	• Credit-to-GDP ratio (Credit-Priv-GDP and Credit_Pub_GDP) and Lending rates (Lr_lc) • Output gap (y-y*) • Deposit_to_GDP ratio (Depo_Priv_GDP and Depo_Pub_GDP). • World Commodity Price Index (WCPI). • Stock of LRM in percent of GDP (IRM_GDP, (-)) and Stock of Net International Reserves as a percent of GDP (NIR_GDP, (+))

Table 2. Determinants of Bank Excess Reserves in Paraguay

	(I) Precautionary Motifs	(II) Involuntary Motifs	(III) All Motifs	(IV) Preferred Specification
Constant	3.98	-0.80	2.65	3.43
	(0.04)	(0.14)	(0.33)	(0.00)
ER(-1)	0.54	0.52	0.16	0.28
	(0.01)	(0.00)	(0.31)	(0.00)
Vol_IMAE	-0.18	…	-0.02	…
	(0.13)	…	(0.86)	…
Vol_M0_GDP	-0.01	…	0.01	…
	(0.81)	…	(0.91)	…
Vol_Depo_Priv	0.03	…	-0.01	-0.01
	(0.09)	…	(0.31)	(0.03)
Vol_Depo_Pub	-0.01		0.01	0.01
	(0.02)	…	(0.11)	(0.00)
Vol_Credit	0.00	…	0.02	0.03
	(0.98)	…	(0.06)	(0.00)
Vol_Infla	-0.01	…	0.01	…
	(0.89)	…	(0.97)	…
Vol_WCPI	-0.17	…	0.03	…
	(0.01)	…	(0.74)	…
Sight_time_Depo (-1)	0.32	…	0.16	…
	(0.10)	…	(0.48)	…
Pub_Priv_Depo(-1)	-0.07	…	0.30	…
	(0.78)	…	(0.43)	…
IRM_rate (-1)	-0.01	…	0.00	…
	(0.28)	…	(0.74)	…
RR	-0.57	…	-0.73	-0.85
	(0.08)	…	(0.02)	(0.00)
(y-y*)	…	-4.64	-2.52	…
	…	(0.03)	(-0.92)	…
Depo_Priv_GDP	…	2.93	4.34	3.58
	…	(0.00)	(0.01)	(0.00)
Depo_Pub_GDP	…	0.26	-0.30	…
	…	(0.08)	(0.42)	…
Credit_Priv_GDP	…	-2.06	-3.05	-2.90
	…	(0.00)	(0.00)	(0.00)
Credit_Pub_GDP	…	-0.10	-0.12	-0.13
	…	(0.03)	(0.07)	(0.03)
Lr_lc	…	0.04	0.04	0.04
	…	(0.00)	(0.00)	(0.00)
WCPI	…	-0.23	-0.63	-0.47
	…	(-1.53)	(0.01)	(0.00)
IRM_GDP	…	-0.24	-0.36	-0.39
	…	(-3.73)	(0.00)	(0.00)
NIR_GDP	…	0.02	-0.28	…
	…	(0.15)	(0.18)	…
Number of Observations	151	151	151	151
Adjusted R Squared	0.83	0.89	0.90	0.92
Durbin Watson	1.77	1.71	1.73	1.51

Source: IMF staff's estimates

1/ p-values in parenthesis. Instruments include lagged values of (y-Y*), Credit_Priva_GDP, Depo_priva_GDP, Lr_lc, IRM_rate, IRM_GDP and NIR_GDP

20.   **As a first step, our analysis explores the relative relevance of precautionary and involuntary factors.** Table 2 presents the econometric results. As regards precautionary motifs, the estimations presented in column I suggest that the excess reserves in the previous month, ER_{t-1} is important to explain excess reserves, an indication of the existing inertia in banks' decision to adjust their volumes of excess reserves. Results also suggest, as expected, that banks maintain large precautionary excess reserves as long as the costs of those idle funds remain low. Therefore, a reduction in legal reserve requirements increases banks' holding of excess reserves. However, the policy rate observed in the previous month does not seen to be significant. In addition, excess reserves increase with the volatility of private deposits and the ratio of sight to time deposits. Other precautionary variables are also significant, but they do not present the expected sign. Regarding the results on involuntary factors (presented in column II of Table 2), as envisaged, an increase in the credit-to-GDP ratio (private and public) reduces banks' excess reserves, while an increase in the ratio of private deposit to GDP increases banks excess reserves. An increase in the lending rates leads to an increase in bank excess reserves, as it may trigger a reduction in the demand for loans in the private sector. However, changes in the stocks of IRM and NIR do not seem to impact banks' volume of involuntary reserves. World commodity prices are significant, but do not present the expected sign.

21.   **The combination of all precautionary and involuntary variables allows for the identification of the most robust factors explaining excess reserves.**[9] Column III of Table 2 presents the econometric results of including all explanatory variables in our estimation.

• As regards *precautionary factors*, results confirm that banks' increase their holdings of reserves according to the observed volatility of private and government deposits and the volatility of credit to the private sector. Surprisingly, the volatility of private deposits reduces banks' holdings of excess liquidity. This could be a result of the fact that the periods of rapid private deposit growth, usually in post-crisis periods, have also been characterized by high deposit volatility. Results confirm that an increase in legal reserves, by increasing the overall cost of holding reserves, reduce excess reserves. The policy rate again appears as not significant. The results also seem to conclude that variables such as inflation volatility, output gap, or commodity price volatility are not relevant or that their effects have been captured by other variables.

• Regarding *involuntary variables*, column III confirms the relevance of the deposit and credit ratio to GDP as well as the lending rate in explaining excess reserves. World commodity prices remain significant and with a negative sig. This could indicate that commodity prices are in fact affecting precautionary excess reserves, with banks holding less precautionary excess reserves in periods of commodity booms. Finally,

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[9] Results as regards involuntary variables are very robust to changes in the sample period, while results on precautionary variables are very sensitive to the time span used in the estimations. In particular, we tested the impact of considering a breaking point in 2003, to reflect the end of the years of crises. To do so we followed two approaches, by estimating the equations in Table 8 for the two periods 1995-2003 and 2004-10, and by introducing dummies variables.

column III confirms that increases in the ratio of IRM to GDP have helped reduced bank excess reserves, and therefore have been effective in moping excess liquidity.

- Column IV presents our *preferred specification*, which includes only those variables that are significant. The preferred specification shows that 56 percent of the variance of bank excess reserve within the period is explained by the variables we used to represent precautionary factors, while involuntary factors explain 35 percent of the variance of bank excess reserves.

E. Implication of High Bank Excess Reserves

22.   **Large levels of excess reserves can have important macroeconomic and financial sector implications.**

- *Interbank market and monetary policy effectiveness*. With high levels of excess reserves, there is little need for interbank transactions, which in Paraguay are very low and sporadic. In this context, even though rates in the interbank market follow the policy rates reasonably well, they have little bearing on banks' decisions on interest rates. This contributes to a weak monetary transmission channel and limits the effectiveness of monetary policy.

- *Financial stability.* Involuntary excess reserves could increase exchange rate volatility to the extent that banks may decide to convert their excess reserves into foreign currency under an abrupt change of market sentiment. Moreover, if excess reserves are sufficiently high, banks may be inclined to soften collateral requirements or more generally ease credit standards, in order to stimulate credit demand (Agenor and Aynaoui (2010)).

- *Financial intermediation*. When banks are flush with cash, they have little incentive to encourage deposits by offering higher rates of return in response to changes in their funding costs (Agenor and Aynaoui, 2010). Moreover, banks' need to hold a large buffer of liquidity could impose large inefficiency costs and impose a heavy burden on their margins.

F. Summary and Policy Recommendations

23.   **Reserve requirements in Paraguay are broadly in line with neighboring countries' practices, except for a few important features.** The statutory rates are in line with regional averages, except for the requirements on sight deposits denominated in foreign currency, in which Paraguay pairs with those countries with the highest ratios. They are mostly devised as complementary instruments for monetary policy, instead of as macro-prudential tools. As in most Latin American countries, they have to be maintained in the currency in which the deposits are denominated and are partially remunerated. However, they have to be held only exclusively as cash-based deposits at central bank (instead of as securities as it is allowed in other countries). In clear contrast with other Latin American countries, reserve requirement compliance on an average basis is not allowed in Paraguay,

and effective reserve requirements ratios are high by regional standards, especially for deposits in local currency.

24. **The very high level of bank excess reserves in Paraguay reflects a mixture of precautionary and involuntary factors.** Several structural factors oblige banks to hold a large volume of cash-based, unremunerated excess reserves for precautionary purposes. Econometric results confirm that these factors include the large level of volatility of Paraguay's economy, and especially the volatility of the credit to the private sector and public sector deposits. Other important factors are the existing shortcomings in the monetary policy framework and several weaknesses in the financial sector infrastructure. This has been compounded by other involuntary factors, including sudden increases in the volume of private deposits, as well as sudden drops in credit or increases in the lending rates. Econometric results also show that the increase in the stock of IRM has been effective in reducing bank excess reserves, but at a slowest pace than required.

25. **Large bank excess reserves weaken the monetary transmission channel, cause inefficiency costs, and could pose risks to financial stability.** The large volume of bank excess reserves in Paraguay limits the effectiveness of monetary policy by weakening the interest rate channel. In addition, it increases the risk of exchange rate volatility if under an abrupt change in market sentiment banks decide to convert their excess reserves into foreign currency. Large excess reserves also represent large opportunity costs, which pushes up banks' spreads and might induce banks to soften credit standards in order to stimulate credit demand.

26. **To improve this situation, the authorities could consider taking actions on the following directions:**

- *Improve liquidity management and reduce banks' need to hold large liquidity cushions.* The CBP should aim at adopting, over time, a short-term liquidity management framework based on an overnight policy rate. It should also adopt a stable framework for long-term IRM, which should be issued at market-determined rates. To achieve this goal it will be crucial that the authorities implement the law on the recapitalization of the CBP through the transfer of interest-bearing guarani-denominated Treasury bonds. Over time, the CBP could use these bonds to conduct open market operations.[10] The CBP should also continue working to reduce the FLIR's stigma and consolidate its use as an overnight standing facility. In addition, the authorities should press ahead with the reform of the payment system to facilitate

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[10] The issuance of Treasury bonds for sterilization purposes is successfully used in many countries where the fiscal situation does not require the existence of a public sector securities market (e.g. Australia and Singapore), or where sterilization costs are covered by the Treasury (e.g. Uganda and Tanzania). See Chailloux and Hakura (2009) for further details.

the electronic mobilization of financial resources and promote the development of financial markets.[11]

- *Fostering the development of money markets*. The CBP should allow compliance with reserve requirements in guaranies on an average basis. This will allow banks to use required reserves as liquidity cushions and reduce the costs of maintaining high balances in their non-remunerated accounts at the CBP or in their vault. Under the new framework, banks would have an incentive to use the FLIR and the interbank market to comply with their average reserve requirements. In addition, the authorities should clarify and disseminate the legal framework governing repo operations and clarify the ownership status of the IRM in hands of third non-banking parties.

27.   **Reforms should be undertaken in a gradual and sequential way, and with a view to preserving financial and macroeconomic stability.** While aiming at a framework based on an overnight policy rate, the authorities should start by adopting a transitional liquidity management scheme based on short-term, 14-day IRMs, which would provide the policy rate and become the main absorption mechanism. In addition, the authorities should move to average reserve requirements, which would allow banks more flexibility to invest in longer term IRM and promote inter-bank transactions. As banks start managing their reserves in a more flexible way, the CBP will need to adjust its interventions to keep adequate control of system-wide liquidity. Given the current economic cycle, the CBP will need to offset the impact on liquidity from this change and make sure that it does not undermine ongoing efforts to lower credit growth and reduce inflation. More generally, and as a next step, the CBP would need to adopt a consistent framework to forecast and monitor liquidity. To address situations of surplus and deficit of short-term liquidity, the CBP would need to adopt overnight deposit/standing facilities with minimum/maximum rates established as the 14-days IRM rate plus a small spread. The current FLIR could be easily transformed into the overnight standing facility. At the same time, the authorities should adopt a stable and market-based framework for long-term IRM auctions, which will be geared toward balancing structural liquidity and conduct open market operations. As liquidity conditions become more balanced and the new regime for liquidity management consolidates, the BCP could move to the use of an overnight interest rate as its policy rate.

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[11] The design of a well-designed payments system is underway, which the authorities expect to implement in October 2011. At present, a Draft Law on Payments Systems is at Congress under discussion, and the authorities expect it be approval shortly.

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Appendix I: Legal Reserve Requirements in Selected Latin American Countries

Country	Local Currency	Foreign Currency	Marginal and Additional Rates	Remuneration	Eligible Liabilities	Compliance Assets	Averaging	Penalty	Purpose/ Last change
Paraguay	18 percent sight	25 percent sight deposits; and 16.5 percent time and saving deposits	No	Local currency: Interbank interest rate Foreign currency: one-month Libor	Deposits in local and foreign currency	Cash deposits at the central bank in the some currency than the deposits	No allowed	To be determined by the board of the central bank.	Monetary policy; reduced in 2009 to counter the crisis and increased back in 2011 to rein in credit growth.
Peru	Minimum 9 percent of deposits in local currency	Minimum 9 percent of deposits in foreign currency	Yes; 25 percent for deposit of residents in local currency, 120 percent for deposits of non-residents in foreign currency; 55 percent for deposits in foreign currency.	Only the additional requirements are remunerated at the overnight rate less 1 percentage point for reserve in local currency and 60 percent of the one-month Libor for reserves in foreign currency.	Deposits, bonds, mortgages securities, subordinated debt and external borrowing with maturity less than two years.	Cash in vault, deposits at the central bank in the some currency than the deposits	Yes, over a one-month maintenance period	1.5 times the lending rate in local and foreign currency over the average deficiency.	Monetary policy, macro-prudential tool.
Colombia	11 percent sight deposits; 4.5 percent time deposits	Not applicable	Discontinued	No remunerated	Deposits	Cash in vault and deposits at the central bank	Yes; two weeks maintenance period.	3.5 percent over the average deficiency	Monetary policy
Brazil	43 percent sight deposits 20 percent time and saving deposits (except if allocated to fund rural loans)	Not applicable	Yes; 12 percent on sight and time deposits and 10 percent on savings deposits	Only reserves corresponding to saving deposits and additional requirements, at 6.17 percent.	Deposits and interbank loans, excluding government deposits in public banks	Cash in vault, deposits in the central bank, federal government bonds and notes.	Yes, only for demand deposits for a two-week maintenance period.	Policy rate+ 14 percent over the average deficiency	Monetary policy, incentivize credit, macro-prudential tool
Dominican Republic	17 percent commercial	20 percent Foreign	No	Reserves in local currency are	Deposits	Deposits at the central	Yes	0.1 percent over the average	Monetary policy

	banks; 12.5 percent credit and saving associations; 10 percent other financial associations.	Currency Deposits		unremunerated. Foreign currency reserves are remunerated at the Fed Fund rat minus 2 percentage points.		bank in the some currency than the deposits		deficiency	
Chile	9 percent sight deposits, 3.6 percent time deposits, 0 percent saving deposits.	9 percent sight deposits, 3.6 percent time deposits, 0 percent saving deposits.	No	No remunerated	Deposits and external borrowing.	Cash in vault and deposits at the central bank	Yes for over a one-month maintenance period	2 times the 3-month interest rate over the average deficiency.	Monetary Policy
Bolivia	2 percent for cash, 10 percent for deposits below one-year maturity and 12 percent for two-year maturity deposits	2 percent for cash, 10 percent for deposits below one-year maturity and 12 percent for two-year maturity deposits	Additional 30 percent requirement for deposits in foreign currency	Reserves maintained as deposits at the central bank are no remunerated. If deposited in the "Liquid Asset Requirement Fund", the reserves are invested by the central bank of behalf of institutions and remunerated at the market interest rates.	Deposits and securities in local and foreign currency, except government deposits, short-term external credit lines, prepaid warranty deposits of credit letters.	Cash in vault, deposits at the central bank in the some currency than the deposits	Yes, for a 14 days maintenance period	2 percent over average deficiency or twice the lending rate. The penalty increase in 2 percentage points for any additional subsequent period of deficiency	Monetary Policy and incentivize credit (the total requirement could be reduce to 6 percent if the institution increase loans in local currency)
Costa Rica	15 percent	15 percent	No	No remunerated	Deposits and trusts	Deposits at the central bank (only those at the reserve account) in the some currency than the deposits	Yes, for a 15-day maintenance period	Interest rate of discount window over the reserve deficiency	Monetary policy
The Bahamas	5 percent	No applicable	No	No remunerated	Deposits, including non-residents' accounts.	Cash in vault, deposits at the central bank	Yes, over a one-month maintenance period	2 times the annual discount rate for every day of reserve deficiency	

Argentina	19 percent sight deposits, 0-14 percent time deposits depending on maturity	20 percent sight deposits, 0-20 percent time deposits depending on maturity	No	No remunerated	Deposits	Cash in vault and deposits at the central bank in the some currency than the deposits	Yes, over a one-month maintenance period	Two times the market deposits rate for both local and foreign currency deposits, and two times the 30-day LIBOR for US$ deposits if it is above market rate..	
Guatemala	31 percent of deposits	31 percent of deposits	No	0.6 percent	Deposits	Cash in vault and deposits at the central bank in the some currency than the deposits	No	n.a	Monetary policy
Honduras	6 percent of deposits	12 percent of deposits	No	Only compulsory investments are remunerated al ½ of the policy rate.	Deposits, expired term deposits, reduced capital contracts and savings stamps and others	Cash in vault, deposits at the central bank, and government bonds in the case of compulsory investment in local currency in the some currency than the deposits	Yes, over a two-week period	Penalties depend on the currency of denomination and the type of institution.	
Uruguay	12 percent on private deposits; and 100 percent on government deposits	9 percent on private deposits; and 100 percent on government deposits	No	2 percent for local currency, 0.025% for US$ currency, 0.20 percent for Euros, and zero percent for government deposits	Deposits and external loans	Cash in vault, but only for deposits in local currency, deposits in the some currency than the deposits	Yes, but only for reserves on local currency. No more than 4 days of reserve deficit are allowed per month.	On local currency 0.007 percent over the reserve deficiency with a minimum penalty of US$40.000. For foreign currency, 0.003 percent over the daily deficiency.	

Source: Information System for Instruments of Monetary Policy, Monetary and Capital Market Department, International Monetary Fund.

Appendix II: The CBP's Operational and Legal Framework

The CBP's operational framework includes tools in line with conventional practices.
The framework includes:

- *Reserve requirements*, that, for deposits in guaranies, stand at 18 percent for deposits up to 360 days and 0 percent for longer terms, and foreign currency-denominated deposits at 25 percent for deposits up to 360 days, 16.5 percent for time deposits, and 0 for deposits up to 540 days or above.

- *Instrumentos de Regulation Monetaria (IRM),* which are sold to commercial banks in competitive and non-competitive auctions, at different maturities (from 14, 35, 61, 91, and 180 days) and can be redeemed at the CBP at anytime. Since 2008 banks are not allowed to transfer their IRM to third private non-banking parties.[12] The "policy rate" is defined as the weighted average of the IRM issued for lower-maturity IRM.

- *A short-term collateralized liquidity facility,* called *Facilidad de Liquidez de Corto Plazo con Reporto de Instrumentos de Regulación Monetaria* (FLIR). The FLIR, which was established during the crisis in 2009, works as a discount window where banks can obtain liquidity for up to 60 days on repo operations collateralized with public sector securities, with a 5 percent haircut applied on market prices. The FLIR has two stages. The first one, during which banks can borrow liquidity for up to 30 consecutive days at the penalty interest rate determined by the CBP. After 30 days the FLIR can be renewed for up to an additional 30 consecutive days with a 1 percentage point penalty over the interest rate of the first stage. The current interest rate for the FLIR is 9 percent, which implies a 1 percentage point penalty from the CBP's 14-day rate of 8 percent.

- *Exchange rate interventions* which are conducted in a very ad hoc basis in the spot market.

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[12] In 2005 there were two types of IRM, the *Cartas de Compromiso* (kept at the BCP and only transferable among banks) and the *Letras de Regulacion Monetaria* (transferable with third non-banking parties). After 2008, the BCP only issues Cartas de Compromiso, which in a generic way are called Instrumentos de Regulacion Monetaria (IRM).