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Uruguay: Selected Issues Paper

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URUGUAY

Selected Issues

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Approved by Western Hemisphere Department

January 12, 2011

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I. URUGUAY—ASSESSING THE STRUCTURAL FISCAL STANCE[1]

A. Introduction

1. **While there is consensus that countries should aim at implementing neutral to countercyclical fiscal policy, it is common to see budgets that amplify economic cycles.** Such procyclical policies can be seen during downturns—when governments, in particular in emerging market countries, often cut spending or raise taxes to deal with financing constraints—as well as during upswings—when the sense of bonanza can make it hard for policymakers to resist pressures to spend temporary revenues. The absence of precise information regarding the fiscal stance stripped from cyclical and one-off effects contributes to the risk of procyclicality and can even jeopardize long-term sustainability.

2. **The global crisis and subsequent rebound in emergent economies has brought a heightened awareness of the importance of assessing fiscal policy against the economic cycle by estimating cyclically adjusted balance (CAB).** By separating cyclical factors from discretionary actions, the CAB conveys useful information on whether or not fiscal policy is turning expansionary or contractionary given the stage of the business cycle. Hence, policymakers can have a more accurate indicator of the impact of discretionary fiscal policies on aggregate demand.

3. **Experience suggests that countries with fiscal frameworks more firmly based on the tracking of structural balances were better positioned to deploy countercyclical measures during the recent crisis.**[2] These countries tended to save revenue windfalls during years of booming economic activity, thus building important buffers that could later be used to deal the effects of the crisis to smooth output fluctuations.

4. **Uruguay has made efforts to further enhance the fiscal toolkit to assess the appropriateness of its economic policies.** The 2005–09 draft budget included a fiscal rule[3] aimed at aligning real spending growth with potential growth. Recent efforts include anchoring the 2010–14 budget in a reduction of public debt to around 40 percent of GDP by 2015 and the creation of an Energy Stabilization Fund to mitigate weather related

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[1] Prepared by Manuel Rosales Torres. I thank the very useful comments received from the staff of the Ministry of Economy and Finance and the Banco Central del Uruguay.

[2] For a more comprehensive overview on the ability of countries to implement countercyclical fiscal policies in Latin America, see IMF, 2009.

[3] The draft budget included a ceiling on the annual growth of real primary spending equivalent to 3.0 percent; the proposal by the Ministry of Economy and Finance, however, was not adopted by Parliament.

uncertainties in the electricity state owned company, UTE. The government has also announced plans to produce and publish estimates of the structural fiscal stance.

5. **Focusing on structural or cyclically-adjusted fiscal indicators can help reconcile the government's medium-term debt reduction objective with short-term stabilization objectives**. This will make the debt objective more robust and contribute to sustain growth with less volatility that in the past. Furthermore, there are other potential benefits from this fiscal approach. For instance, publishing cyclically-adjusted balances can raise public understanding of fiscal policy constraints—e.g., what are permanent and what are transitory revenues. This in turn can make it easier for policymakers to save revenue windfalls during good years and provide impulse to the economy during bad years.

6. **This paper estimates Cyclically Adjusted Balances for Uruguay and discusses methodological and practical implementation issues.** Section B introduces the methodology and discusses some particular issues relating to Uruguay. Section C applies the methodology to Uruguay. Section D concludes with some general recommendations amid the positive economic outlook for Uruguay.

7. **There are at least three important caveats about the precision of cyclically adjusted balance estimates for Uruguay.** First, the work on CABs in Uruguay is still at an early stage. Even countries with extensive experience of using CABs revise the estimates as both input data and the framework are improved. For instance, in Chile, the government recently created a high-level commission to recommend reforms that could enhance its decade-old fiscal rule to make it more effective (Box 1).[4] Second, Uruguay's economy has undergone a substantial transformation since the financial crisis in 2002. And there have been important reforms to the fiscal framework, including a tax reform in 2007. These changes make it more challenging to derive precise estimates of the cyclical revenue components. Third, there are several Uruguay specific items that need to be taken into account to get an accurate estimate of both structural revenues and expenditures; this paper discusses some of them, but further work is required. These caveats suggest caution in interpreting the results and that a broad set of indicators should be used.

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[4] The treatment of transitory tax changes has been a particular issue under discussion.

B. Methodology—Estimating the Cyclically Adjusted Balance (CAB)[5, 6]

Main Concepts

8. **The CAB is a measure of a country's underlying fiscal position when cyclical components are removed from headline fiscal indicators.** Cyclical components, or automatic stabilizers, are those that respond to the economic cycle. By excluding these components, the CAB measures the size of discretionary fiscal policy measures. Changes in the CAB indicate whether fiscal policy is neutral or becoming expansionary or contractionary. Hence, this measure helps assess whether fiscal policy is having a balancing or amplifying effect on fluctuations in economic activity (under the assumption that fiscal multipliers are positive).

9. **The cyclically adjusted balance, measured in terms of the primary balance, is calculated by decomposing the headline fiscal balance, as in equation (1).**

$$OB = CB + CAB - IP = PB - IP \tag{1}$$

Where OB is the overall fiscal balance; CB is the cyclical primary balance (or the part of the overall balance that reflects the effects of automatic stabilizers associated to the business cycle). The CAB is the cyclical adjusted primary balance, or the part of the overall balance that reflects the authorities' discretionary policies. PB is the primary balance and IP is the interest bill.

10. **The change in the CAB measures the fiscal impulse, or the "discretionary" actions taken by policy makers.** A positive fiscal impulse indicates that fiscal policy is procyclical when actual output growth is higher than potential output growth (or the output gap is increasing).

Estimating the Cyclically Adjusted Balance

11. **The estimation of the CAB requires an estimate of cyclically-adjusted revenues and expenditures** (that is, those purged of mechanic effects driven by the cycle). A standard approach is to calculate them using a measure of the cycle and its effects on their aggregates. For this, two sets of estimates are needed.

- First, an estimation of potential output—or the level of GDP if prices were fully flexible—and the output gap (the difference between potential and actual output) in order to assess the economic cycle.

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[5] See Fedelino et al., 2009.

[6] See Van der Noord, 2000.

- Second, an estimation of the sensitivity (i.e., the elasticity) of revenues and expenditures to changes in GDP is needed to derive the cyclical components and the long-run level of revenues and expenditures.

Potential Output

12. **Potential output—and consequently, the output gap—is typically estimated using different techniques, including filters, econometric models, and a production function.** This paper applies several univariate filters and a univariate linear trend for Uruguay. Specifically, it uses the Hodrick-Prescott (HP), Baxter and King (BK), and Christiano-Fitzgerald (CF) filters. It also uses the Piece-Wise Linear Detrending (PWLD) method, which fits a linear trend through the log of actual GDP. One finding of this paper is that the differences in the estimates of trend output for the various methods applied are quite small. The production function, which is a more sophisticated technique was not applied in this paper. A recent study by Magud and Medina (2010) on Chile used a wide range of methods, including filters, and the production function to estimate potential output, and found that the results did not differ much regardless of the applied method.[7] That said, further analysis to estimate the potential output for Uruguay should consider applying the production function as well as a standard vector auto-regression, or the Fund's Global Projection Model.

13. **The output gap between actual output and potential GDP is measured as in equation (2):**

$$GAP \equiv \frac{Y_t - Y^*}{Y^*} \tag{2}$$

Where, GAP is the output gap; Y_t is actual GDP and Y^* is potential GDP.

14. **The well-known problem of end-of-period bias of the filters in estimating trend growth can be reduced by including the growth forecasts for 2010–15.** One caveat when applying filters is that the estimate of potential growth may be affected by the end of period data. Hence, potential output could be overestimated during a period of high economic activity and underestimated during a recession. To reduce this imprecision the estimates for Uruguay include the projections for the five coming years. Staff projects that the economy will grow by 8¼ percent in 2010, 5 percent in 2011 and four percent thereafter.

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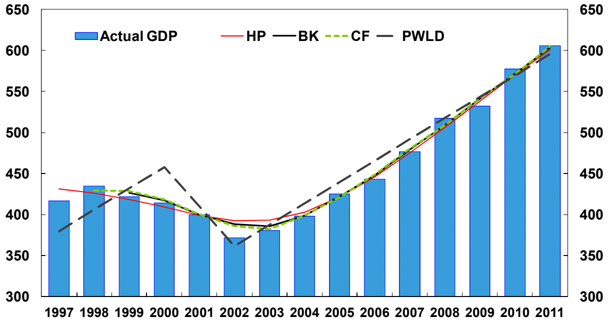
[7] See IMF, 2010b.

15. **The results for the four methods are very similar though the PWLD estimates are a bit more volatile.** All four methods yield similar average potential output growth for 1985–2009. According to the HP and BK filters, potential growth averaged 3.1 percent over the sample period while the CF's filter yielded potential growth at an average of 3.2 percent. Despite it shows a little bit more volatility, the PWLD generated a very similar level of potential output with trend growth averaging 3.3 percent.[8] This paper uses the HP filter in deriving the CAB but checks the robustness of the results with the other three methods.

Figure 1. Real GDP and Trends

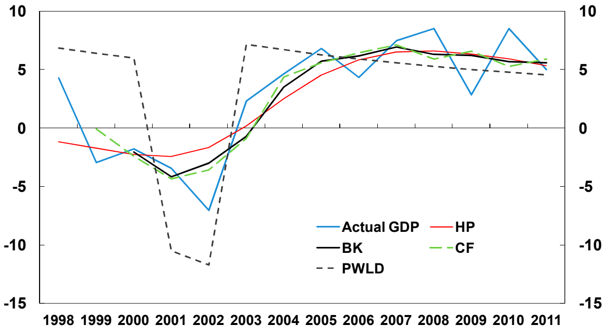
(In billions of Uruguayan Pesos)



Source: IMF staff estimates.

Figure 2. Real GDP and Trends

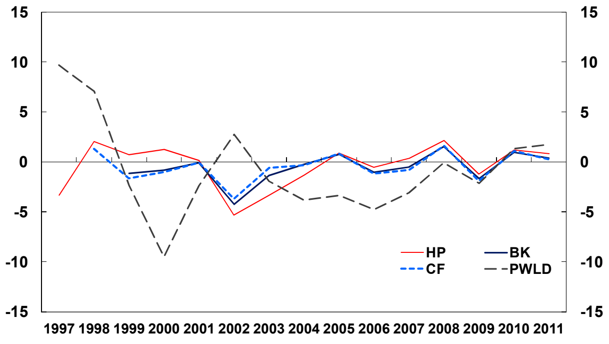
(Year-on-year percent change)



Source: IMF staff estimates.

Figure 3. Output Gaps

(As percent of potential GDP)



Source: IMF staff estimates.

16. **There is one important caveat in potential output estimates for Uruguay.** The crisis in 2002 caused a sharp fall in output which has been followed by six years of very strong growth. The filters capture a large part of the 2002 drop in *actual* GDP as a fall in *potential* GDP followed by strong growth in potential GDP. (The PWLD, oddly, shows a bigger drop in potential than in actual GDP.) While it is likely that the recession and especially the banking crisis caused a fall in potential output, there is a lot of uncertainty about the magnitude. One statistical effect of the crisis and the rapid recovery is that potential growth is estimated at about 6.0 percent in 2010 when using the four methods (with the medium-term projections included to reduce the end-of-period bias for the filters). Few observers believe Uruguay's long-term potential growth rate to be that high. The staff and the government's medium-term budget assume long-term growth at four percent a year. Hence, for the current time period, the filters are likely to overestimate potential output and hence underestimate the positive output gap and possibly the fiscal impulse measure.

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[8] Estimates of potential output and trend growth could differ slightly given a larger sample period.

Elasticity of Revenue and Expenditure

17. **In line with standard practice, this paper assumes aggregate fiscal revenue elasticity equal to one.** This implies that revenues respond one to one with changes in GDP growth. Nonetheless, to test for the robustness of this assumption, a sensitivity analysis is included assuming aggregated revenues elasticity between 0.9 and 1.25. Given that there is no public information on tax collections associated with commodities, the paper assumes that all changes in revenues arise from changes in the domestic economy.[9] Estimates for disaggregated revenues show that elasticities for 2003–09 ranged between 0.6 and 1.9 while the aggregated elasticity is 1.2. However, the major tax reform in 2007 has affected the tax bases and the tax rates. For this reason, the standard assumption of unit elasticity is used.

18. **There are at least three complicating issues in estimating revenue elasticities in Uruguay.** First, the government often resorts to measures to contain price increases of certain sensitive consumer items, and these measures affect fiscal revenues (e.g., delays in adjusting fuel prices affect the net income of the state fuel company, ANCAP). These discretionary measures distort the estimates of cyclically adjusted revenues. Second, changes in tax exemptions, (e.g., for investment promotion), also affect the estimate of the elasticity of revenues, as they raise potential output but do not increase structural revenues accordingly. Third, certain revenues are affected by changes in the exchange rate and this too can distort estimates of elasticities to GDP growth. Future work should seek to capture these effects better.[10]

19. **For expenditure, a reasonable assumption for Uruguay is that all spending has an elasticity equal to zero, except for the unemployment benefits.** This means that spending does not automatically react to the business cycle and hence that all changes in spending are structural changes. On the other hand, Uruguay's unemployment benefits, as is the case in developed countries, change with economic activity. For such spending, assuming elasticity equal to one seems reasonable. There are other aspects on the spending side that affect the structural balance, e.g., the indexation of pensions, and more work is needed to integrate these aspects into the estimates.[11]

20. **This paper focuses on the cyclically adjusted primary balance, so interest payments are excluded from the analysis.** Focusing on the primary balance allows a better

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[9] In the future, as the impact of soy prices and other commodity exports gain significance in Uruguay, it will be important to disentangle the cyclical effects from those revenues generated by purely domestic sources from those stemming from the external conditions (which are likely not fully aligned with the domestic cycle).

[10] Relevant work in this area has been done by Romaniello (2010).

[11] To improve the accuracy in estimating structural revenues and expenditures, future works should focus on the national accounts methodology developed by OECD.

assessment of year on year discretionary changes in fiscal policy instead of focusing on past decisions by policy makers.

Coverage of the Fiscal Sector

21. **The CAB is typically estimated for the consolidated public sector or a more narrow coverage of the public sector, e.g., the general government.** In Uruguay, fiscal policy focuses on the consolidated public sector. This is sensible given the important role of state-owned enterprises in Uruguay and the fact that they do matter for aggregate demand and debt sustainability. Furthermore, many government decisions are implemented by state-owned enterprises. Hence, the focus on the consolidated fiscal accounts is in line with best practice.

22. **At the same time, including all state-owned enterprise operations can blur CAB estimates, especially when they are prone to be subject to shocks unrelated to the cycle.** For instance, the financial position of public company in charge of importing and distributing fuel oil in Uruguay (ANCAP) can change significantly because oil imports are lumpy, but with no effect on aggregate demand. Similarly, the operations of the state-owned electricity company (UTE) are affected by variations in rainfall. Droughts forces UTE to rely more on costly oil to produce electricity (i.e., the drought in 2008 and 2009 cost UTE approximately 1.4 percent of GDP on an annual basis). In a sense, given the objective to smooth electricity tariffs, UTE's financial position depends on "rain-cycles" rather than GDP cycles. There are probably many other operations or developments in state-owned enterprises that neither depend on the GDP cycle or should be seen as discretionary fiscal policy or that do not affect demand. For these reasons, in many countries, the CAB is estimated for the general government.

23. **This paper estimates CABs for both the consolidated public sector and the general government**. The general government is defined as the consolidated operations of the central government plus the Social Security Bank (BPS). At the same time, even though public enterprises' operations in Uruguay are important, the general government represents around 90 percent of the public sector activity and most discretionary policies are undertaken at the general government level. This supports the case to estimate CABs for both the general government and the consolidated public sector to measure the fiscal stance.

Idiosyncratic Factors

24. **Idiosyncratic factors relate to corrections for one-off items.**[12] One-off items are large, non-recurrent budgetary factors, e.g., one-off expenditures or revenues such as a tax

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[12] For a comprehensive discussion of one-off adjustments, see OECD's "Accounting for one-off operations when assessing underlying fiscal positions." Working Paper No. 642, 2008.

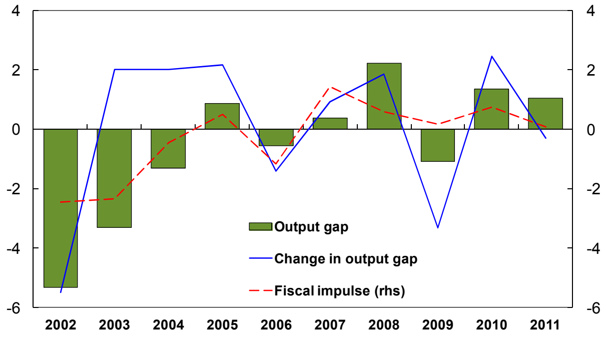
forgiveness programs, which temporarily affect the fiscal position but have limited impact on economic activity or have big impact on GDP but little effect on the fiscal position. For Uruguay, one example of such a one-off item relates to the tax exemption granted to a new pulp mill factory in 2008. The construction of the pulp mill factory increased GDP but had no effect on the government's tax revenue intake.[13] The paper tries to control, for this effect by adjusting the tax to GDP ratio more in line with its structural level. For the consolidated public sector, the paper seeks to control for the effects of the droughts on UTE's financial performance by adjusting its operating surplus to a level closer to its structural position.

C. Estimating the CAB for Uruguay: Results

The Consolidated Public Sector

25. **The estimates of the CAB for the consolidated public sector suggest that Uruguay has been implementing somewhat procyclical policies during the majority of the last ten years**. This finding is similar to that of other studies.[14] This was especially the case prior to the Uruguay's own financial crisis in 2002 and before the 2009 global economic recession (Figure 4). In contrast, other countries in the region, especially those which have introduced some type of de facto or de jure fiscal rules, e.g., Chile, Peru, and other countries, pursued more countercyclical policies (Box 1 and Western Hemisphere Department's October 2009 Regional Economic Outlook). In Uruguay, relatively neutral to countercyclical policies were deployed in 2009 contributing to lessen the negative impact of the global crisis. In 2010, as the output gap closed more rapidly than envisaged (as growth surprised on the upside in 2009 and 2010), fiscal policy became somewhat procyclical. Again, these results (their magnitude, not so much their sign) should be treated with caution given the issues surrounding the estimates of potential output and structural revenues and expenditures discussed earlier.

Figure 4. Fiscal Impulse, Output Gap, and Change in Output Gap
(Public Sector, in percent of GDP)



Source: IMF staff estimates.

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[13] The contribution to growth from the construction of the pulp mill factory was about 2.5 percent in 2008.

[14] See Daude et al, 2010.

Table 1. Uruguay: Consolidated Public Sector Operations
(In percent of GDP)

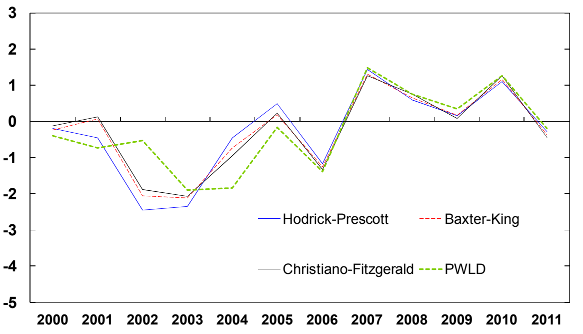
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Headline Fiscal Indicators												
Revenues	28.4	30.0	29.3	30.4	30.0	30.8	31.0	30.7	28.9	30.4	30.7	30.8
Of which: public enterprise surplus	1.8	2.6	2.2	3.5	2.7	2.1	1.4	2.4	0.8	1.3	2.2	2.3
Non interest expenditures	29.7	31.1	29.5	27.6	26.3	26.9	27.5	27.3	27.6	29.3	28.8	28.8
Real primary spending growth (in percent)	**-6.5**	**0.2**	**-14.5**	**-7.5**	**3.4**	**4.1**	**7.0**	**9.6**	**9.2**	**9.6**	**6.4**	**5.5**
Primary balance	**-1.2**	**-1.1**	**-0.3**	**2.7**	**3.7**	**3.8**	**3.5**	**3.4**	**1.3**	**1.1**	**1.8**	**2.0**
Overall balance	**-3.3**	**-3.4**	**-3.7**	**-2.6**	**-1.8**	**-0.5**	**-0.5**	**0.0**	**-1.5**	**-1.7**	**-1.2**	**-1.1**
Cyclical Primary Balance (automatic stabilizers's contribution)	**0.4**	**0.1**	**-1.6**	**-0.9**	**-0.4**	**0.2**	**-1.3**	**0.1**	**-1.4**	**-1.5**	**0.0**	**0.2**
Cyclically Adjusted Fiscal Indicators												
Cyclically adjusted revenues	28.4	30.0	29.3	30.4	30.1	30.8	32.1	30.7	31.0	31.6	31.0	30.8
Of which: public enterprise surplus	2.0	1.8	2.6	2.2	3.5	2.8	2.1	2.5	2.4	2.4	2.5	2.5
Cyclically adjusted expenditures	32.7	32.2	33.5	31.2	31.9	31.4	31.6	31.4	30.8	31.1	31.7	32.2
Structural primary balance	**-1.6**	**-1.1**	**1.3**	**3.6**	**4.1**	**3.6**	**4.8**	**3.3**	**2.8**	**2.6**	**1.9**	**1.8**
Structural overall balance	**-3.7**	**-3.5**	**-1.9**	**-1.5**	**-1.3**	**-0.8**	**0.7**	**-0.1**	**-0.2**	**-0.2**	**-1.2**	**-1.3**
Fiscal impulse with elasticity equal to 1, 1/	**0.2**	**-0.5**	**-2.4**	**-2.3**	**-0.5**	**0.5**	**-1.2**	**1.4**	**0.6**	**0.2**	**0.7**	**0.1**
Elasticity = 0.9	-0.2	-0.4	-2.3	-2.4	-0.5	0.4	-1.1	1.4	0.6	0.2	1.0	-0.3
Elasticity = 1.25	-0.2	-0.5	-2.9	-2.2	-0.3	0.7	-1.3	1.5	0.6	0.0	1.3	-0.3
Memorandum items:												
Output gap (in percent)	**1.2**	**0.2**	**-5.3**	**-3.3**	**-1.3**	**0.9**	**-0.6**	**0.4**	**2.2**	**-1.1**	**1.4**	**1.0**
Real economic growth (percent)	-1.8	-3.5	-7.1	2.3	4.6	6.8	4.3	7.5	8.5	2.9	8.3	5.0
Real potential economic growth (percent)	-2.3	-2.4	-1.7	0.2	2.5	4.5	5.8	6.5	6.6	6.3	5.9	5.3

Source: National authorities and IMF staff estimates.
1/ Defined as the change in the primary structural balance (positive means expansionary policies).

26.

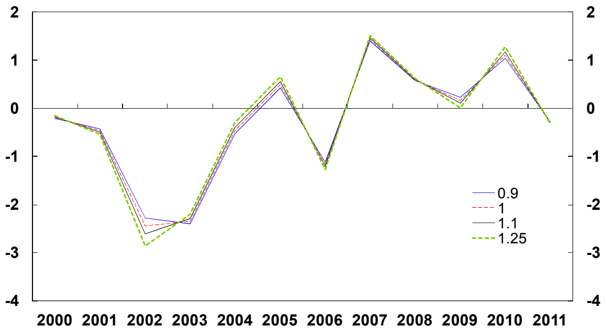
27. **The fiscal impulse measure is not strongly sensitive to the method used to measure potential output.** (Figure 5). Except fot the piece-wise linear detrending in the first part of the sample period, the fiscal impulse measure is very robust regardles of the univariated method used.

Figure 5. Fiscal impulse under selected trend filters
(In percent of potential output, unit elasticity)



Source: IMF staff estimates.

Figure 6. Fiscal impulse under selected elasticities
(in percent of potential output, HP filter)



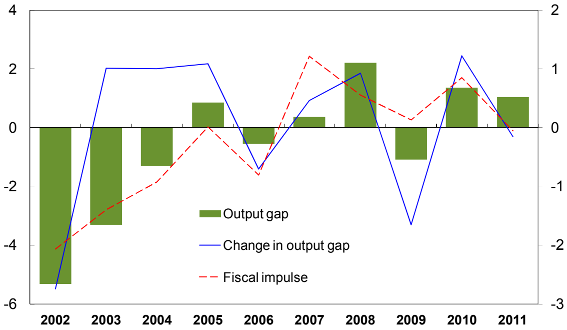
Source: IMF staff estimates.

28. **Furthermore, the overall results are not strongly sensitive to the elasticities used (Figure 6).** In the case of revenues, assuming unit elasticity generates a fiscal impulse of 0.5 percent of potential GDP in 2010. An elasticity of 1.25 gives an impulse of 0.7 percent of potential GDP, and an elasticity of 0.9 gives an impulse of 0.4 percent of trend output. In the case of expenditures, given the small size of the unemployment program, the effect of automatic stabilizers is also small irrespective of the elasticity used. Changes in structural spending reflect discretionary policies which have raised current spending on a permanent basis over the last two years.

The General Government

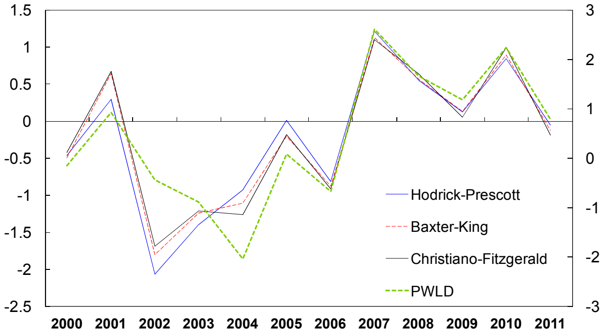
29. **The results are similar when focusing on the general government.** A somewhat more procyclical fiscal policy stance is observed at the general government level in the run up to the 2009 economic crisis. (Figure 7 and Table 2). As in the case of the consolidated public sector, sensitivity tests suggest the results are robust. The results are not very sensitive to the method used to estimate potential output (Figure 8). Nor are the results affected greatly by the elasticity applied (Figure 9).

Figure 7. Fiscal Impulse, Output Gap, and Change in Output Gap
(Central government, in percent of GDP)



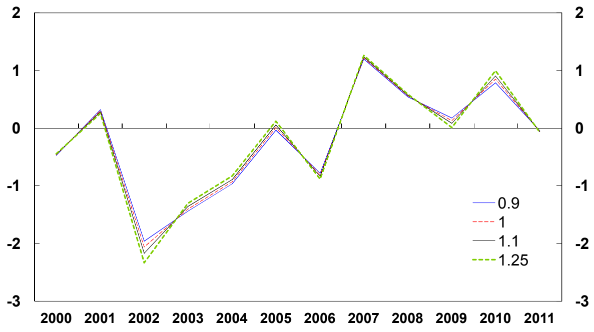
Source: IMF staff estimates.

Figure 8. Fiscal Impulse Under Selected Trend Filters
(General government, in percent of potential output, unit elasticity)



Source: IMF staff estimates.

Figure 9. Fiscal Impulse Under Selected Elasticities
(General government, in percent of potential output, HP filter)



Source: IMF staff estimates.

Table 2. Uruguay: General Government
(In percent of GDP)

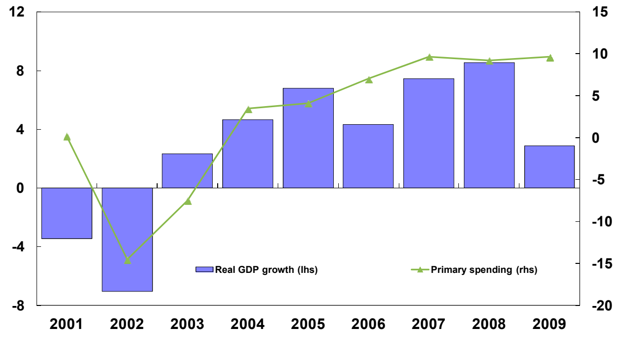
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Headline Fiscal Indicators												
Revenues	24.3	24.5	24.4	24.4	25.3	25.9	26.7	25.6	25.3	26.4	25.8	25.9
Non interest expenditures	25.6	26.3	25.2	23.4	23.0	23.2	23.4	23.4	23.6	25.2	24.9	25.1
Primary balance	-1.3	-1.8	-0.8	1.0	2.3	2.7	3.3	2.2	1.7	1.2	0.9	0.9
Overall balance	-3.1	-4.0	-4.5	-4.2	-2.4	-1.5	-0.9	-1.5	-1.1	-1.6	-1.5	-1.4
Cyclical Primary Balance (automatic stabilizers's contribution)	**0.2**	**0.0**	**-1.1**	**-0.6**	**-0.2**	**0.2**	**-0.1**	**0.1**	**0.2**	**-0.3**	**0.3**	**0.2**
Structural Fiscal Indicators (Cyclically Adjusted)												
Cyclically adjusted revenues	24.4	24.5	24.1	24.2	25.2	26.0	26.6	25.6	25.7	26.4	25.8	25.9
Cyclically adjusted expenditures	28.2	27.7	28.6	27.4	27.7	27.4	27.7	27.4	27.2	27.0	27.7	27.6
Structural primary balance	**-1.5**	**-1.8**	**0.2**	**1.6**	**2.6**	**2.5**	**3.4**	**2.1**	**1.6**	**1.5**	**0.6**	**0.7**
Structural overall balance	**-3.4**	**-4.0**	**-3.2**	**-3.4**	**-2.1**	**-1.7**	**-0.8**	**-1.6**	**-1.3**	**-1.2**	**-1.8**	**-1.6**
Fiscal impulse with elasticity equal to 1, 1/	**-0.5**	**0.3**	**-2.1**	**-1.4**	**-0.9**	**0.0**	**-0.8**	**1.2**	**0.6**	**0.1**	**0.8**	**-0.1**
Scenarios for Central Government												
Excluding Botnia	-0.5	0.3	-2.1	-1.4	-0.9	0.0	-0.8	1.2	0.9	-0.2	0.8	-0.1
Elasticity = 1.25	-0.4	0.3	-2.3	-1.3	-0.8	0.1	-0.9	1.3	0.6	0.0	1.0	-0.1
Elasticity = 0.9	-0.5	0.3	-2.0	-1.4	-1.0	0.0	-0.8	1.2	0.5	0.2	0.8	0.0

Sources: National authorities and IMF staff estimates.
1/ Defined as the change in the primary structural balance (positive means expansionary policies).

Complementary Indicators

30. **Given the caveats noted earlier, it is sensible to look at complementary indicators as well to monitoring and guide policy decisions.** One often used “rule-of-thumb” is to compare real growth in primary spending with potential GDP growth. Real primary spending has been growing at about 9½ percent a year over the past three years, well above potential GDP growth, and thus helping fuel the economy during the upturn (Figure 10). This continued into 2010, even as the output gap closed. In the first semester of 2010, real primary spending increased 11.4 percent (y/y), compared with long-run potential GDP growth of about 4 percent.

Figure 10. Economic and Real Primary Spending
(Real growth rates)



Sources: Banco Central del Uruguay, Ministry of Finance and IMF staff estimates.

D. Conclusions

31. **Measures of cyclically-adjusted fiscal balance can help assess and guide fiscal policy.** Focusing on CABs rather than nominal deficit targets can strengthen fiscal policy design. And publishing CABs can enhance public understanding of fiscal policy and trade-offs. During booming times, CABs help by avoiding masking transitory revenues with structural ones. During bad times, CABs help by providing an estimate of automatic stabilizers.

32. **For Uruguay, estimating CABs is still very much work in progress.** Further work will be needed on potential output, revenue and expenditure elasticities, one-off factors, and state-owned enterprises activities. Therefore, caution is needed in interpreting the results and a broad set of complementary indicators should be used.

Box 1. Cyclically Adjusted Balance or Structural Balance for Policy Decision Making: Country Experience

Targeting the cyclically adjusted balance or structural balance rather than the headline balance (standard balance) can help policy makers to increase credibility, reduce pro- cyclicality, and fiscal sustainability by reducing public debt. As some selected country experience has demonstrated, countries with some institutionalized fiscal rule framework have benefitted by saving revenues during the upside of the economic cycle and deploying important fiscal stimulus programs during downturns, especially during the recent global economic recession.

Chile introduced a fiscal rule framework in 2001. The rule is based on the structural balance and is in a revision process by an expert committee with the objective to make it a second generation rule which will further enhance transparency, coverage, the computation of the structural balance and its uses. Since its inception, the design and implementation of fiscal policy based on the structural balance has greatly contributed to signal a prudent and responsible fiscal stance. The main benefits of Chile's fiscal rule include: a) reducing procyclicality, b) reducing financing needs, c) improving the availability of stable resources to finance social programs. During last year's crisis, Chile was able to draw about US $9 billion from the Economic Stabilization Fund providing a large fiscal stimulus program. In summary, Chile's macroeconomic and social achievements lie in its structural balance approach.

Colombia originally introduced a fiscal rule framework in 1997. The current Organic Law on Fiscal Transparency and Responsibility approved in 2003, which combines a balanced budget rule with expenditure targets as well as debt sustainability objectives, has contributed to reduce public debt from 50 percent of GDP at end-2002 to 32 percent of GDP at end-2008. A draft law was recently sent to Congress to enhance the current framework. The law envisages a gradual fiscal consolidation, requiring the central government to reduce its structural deficit to1.5 percent of GDP from the 3.5 percent of GDP in 2009; furthermore, it requires that future fiscal surpluses be saved into a stabilization fund.

Mexico approved a Budget and Fiscal Responsibility Law in 2006. The Law introduced a balanced-budget fiscal rule. The new macroeconomic framework has been successful in enhancing credibility and reducing public debt. Spending, however, has shown some level of cyclicality as it reflects oil and output fluctuations. Such performance has been affected by the fact that the rule targets the nominal fiscal balance which is affected by oil revenue volatility. Partial efforts to adopt a formula to reflect long term oil prices and save some of the windfalls are being made; yet, a structural balance rule has not being fully incorporated to save revenue buoyancy during good times and act countercyclical in bad times.

Peru enacted its "Ley de Responsabilidad y Transparencia Fiscal" in 1999. The main objective of the law was to promote fiscal discipline in a transparent, credible and sustainable way. The law was enhanced in 2003 by adding the objective of reducing public debt. Despite some rigidities in public spending, Peru's fiscal rule has helped to consolidate fiscal accounts and fiscal discipline. Years of accumulating surpluses allowed for countercyclical fiscal policy during the recent global recession, with a substantial fiscal stimulus of 2.5 percent of GDP allowing the economy to grow around 1 percent in real terms.

Peru and Mexico's rule have escape clauses which allowed them to adjust prior to the recent crisis. In the case of Peru, the escape clause was waived for the fiscal stimulus program.

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II. TRANSMISSION OF POLICY RATES IN URUGUAY: A CROSS-COUNTRY PERSPECTIVE[1]

A. Introduction

1. **A large number of countries rely on the policy rate as their main monetary policy instrument.** This is the case in countries that have adopted an inflation targeting (IT) regime. Under this regime, the monetary authority sets a reference interest rate—i.e., the policy rate—to achieve a pre-announced inflation target. Although the ultimate goal is generally stated in terms of inflation, monetary policy decisions are transmitted first through various interrelated channels and variables, and only with a delay to inflation.

2. **The paper studies the transmission of monetary policy in Uruguay after the adoption of the policy rate as its main monetary policy instrument in late 2007.** That is when Uruguay began transitioning towards an IT regime. The paper uses a vector autoregressive (VAR) model to estimate the strength of the transmission channels of monetary policy, and evaluates the extent to which policy rate changes affect inflation and economic activity.[2] To put Uruguay in perspective, the paper also undertakes a cross-country comparison considering the cases of Chile, Peru, and New Zealand, which are three small open economies with well-established IT regimes. Peru is of particular relevance for Uruguay, since like Uruguay it has a high degree of banking dollarization.

3. **The paper suggests that in Uruguay the policy rate has a more significant effect on inflationary pressures than in output.** A similar result is obtained in the case of Peru. Due to the relatively large exchange rate pass through of these two countries, the exchange rate channel plays an important role in the transmission of monetary policy. Results also suggest that the credibility of the inflation target in Uruguay has increased recently, though it is still below the level of the other three countries. In addition, the implicit monetary policy reaction function of Uruguay appears to be only mildly responsive to changes in inflation and the stance of economic activity, a finding that mirrors the yet limited number of policy rate modifications that have taken place in the country. Evidence also indicates that a higher degree of local-currency lending to the private sector may reinforce the effectiveness of policy rate changes in controlling inflation and aggregate demand.

4. **The paper is organized as follows.** Sections B and C discuss the recent economic developments and the credibility of the inflation target in the four economies under study. Section D discusses the strength of the policy rate pass through in these countries. Section E presents the empirical analysis of the transmission of monetary policy decisions using a VAR model, while Section F deals with the role of financial-system variables in the monetary

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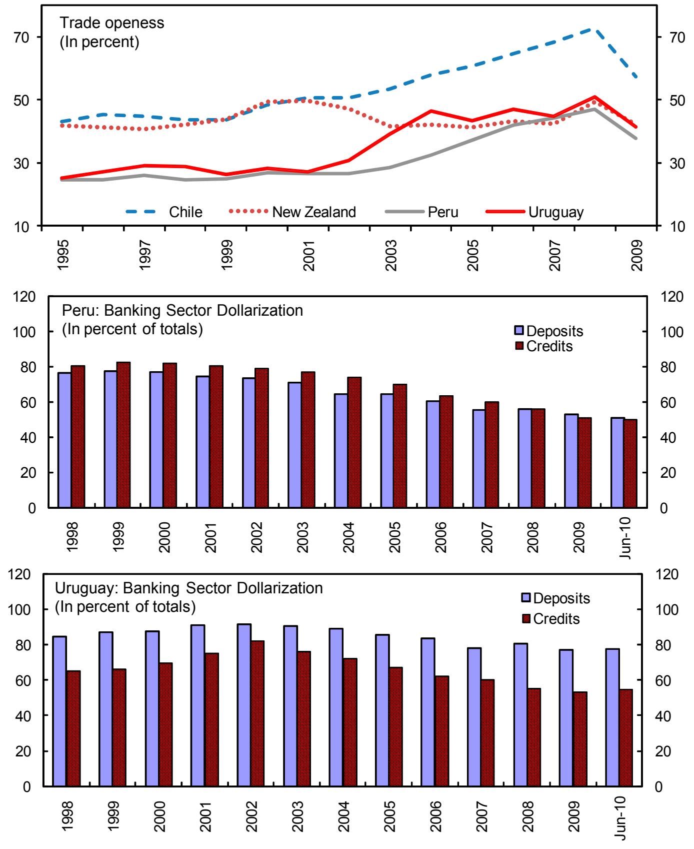
[1] Prepared by Santiago Acosta-Ormaechea. I thank the very useful comments received from the staff of the Banco Central del Uruguay, and the Chile, Peru and New Zealand country-desk economists.

policy transmission. Finally, Section G suggests a number of policy recommendations to strengthen the transmission of monetary policy in Uruguay.

B. Recent Macroeconomic Developments

5. **Chile, New Zealand, Peru and Uruguay are all small open economies that currently operate IT regimes.** The four countries have relatively similar degrees of trade openness and all of them are important commodity exporters. One key difference among them is the degree of banking-sector dollarization. Whereas in Chile and New Zealand almost all credit and deposits are denominated in local currency, in Peru and Uruguay the share of foreign-currency denominated credits and deposits is large, though on a downward trend.

Figure 1. Selected Macroeconomic Indicators



Sources: countries' authorities and IMF staff calculations.

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[2] A lot of research on monetary policy transmission in both advanced and emerging countries uses VAR models (see Kim and Roubini, 2000; Peersman and Smets, 2001; and Leiderman et al, 2006). Although these models have the virtue of reducing to a minimum the restrictions needed to identify policy shocks, researchers are currently moving towards the use of dynamic stochastic general equilibrium models (DSGE). These models tend to provide a better fit to the data than VAR models.

6. **There are important differences across these four countries in the performance of key fundamentals.** In Uruguay and Peru, the variability of the nominal exchange rate against the U.S. dollar (NER) and the real effective exchange rate (REER) has been relatively low. This might reflect a 'fear of floating' behavior, owing to their significant bank dollarization. Also, Uruguay has experienced a considerably higher volatility in industrial production (IP) relative to all other countries.[3] In contrast, the volatility of CPI inflation in Uruguay is low and has recently decreased, contrary to the other economies in which it has shown an upward trend. Expected inflation has followed a similar pattern: in all countries but Uruguay, its volatility has increased. Finally, the volatility of international reserves has moved upward in all countries but New Zealand, suggesting more active foreign exchange interventions in the three Latin-American countries in recent years.

Table 1. Volatility of selected variables 1/

	REER		NER		IP		CPI inflation		Expected inflation (12-months ahead)		Foreign Reserves to GDP	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Chile	6.4	7.8	5.0	18.3	1.0	3.6	1.4	4.4	0.3	1.1	7.1	34.6
New Zealand	8.0	13.0	10.1	24.4	1.1	2.0	0.6	1.0	0.2	0.6	20.2	12.9
Peru	2.3	3.1	3.4	7.9	1.8	5.0	1.6	3.7	0.3	0.6	15.5	34.0
Uruguay	5.9	7.6	6.8	15.5	5.3	8.7	1.5	0.8	0.5	0.5	15.8	23.5

Source: countries' authorities and IMF staff calculations.

1/ Standard deviations of y/y changes. For inflation-related variables, statistics are computed considering actual values of the variables.

(1): January 2005 to December 2007.

(2): January 2008 to June 2010.

7. **Although Uruguay's CPI inflation has been relatively more stable, it has also been higher than in the other three countries, particularly in 2010.** A similar pattern arises when considering core inflation (not shown). Furthermore, actual and expected inflation have remained systematically in the upper band (or above) the target range in Uruguay, whereas in all the other cases both variables have hovered around their respective mid-point target ranges. Figure 2 shows that the policy rate has closely tracked inflation in all four cases, pointing to an active role of monetary policy in curbing inflationary pressures. As expected, inflation expectations have moved in tandem with actual inflation, but showing a lower degree of volatility.

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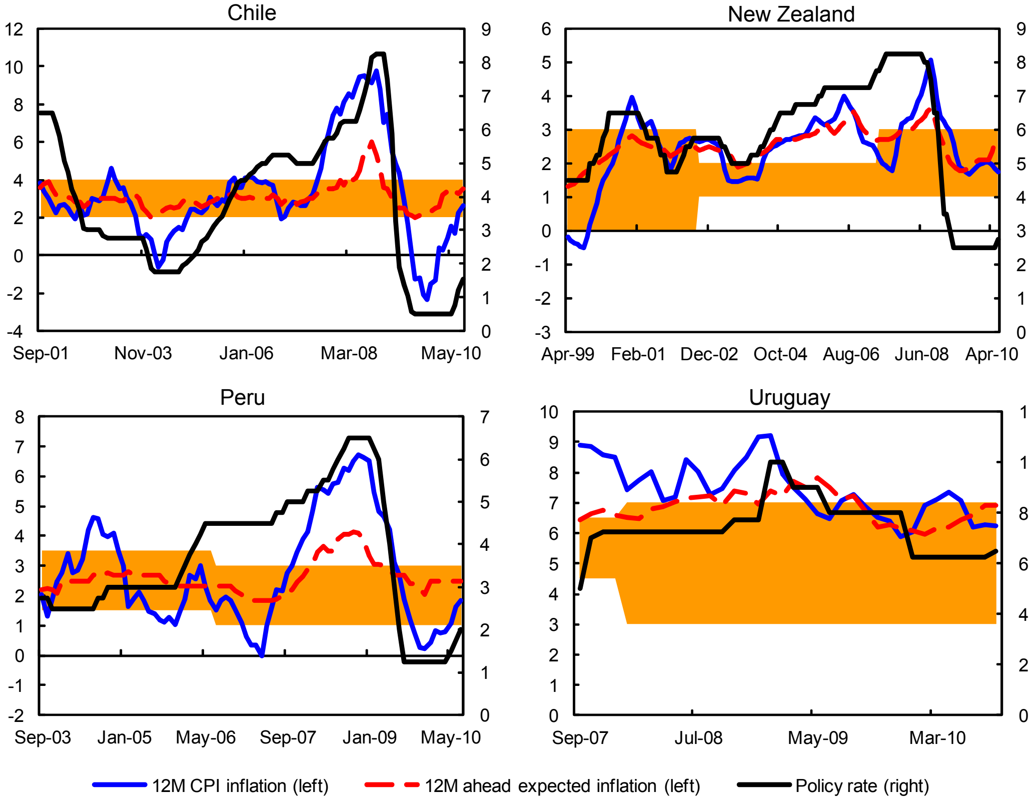
[3] The Staff Report also discusses the higher output volatility of Uruguay vis-à-vis a number of peer countries. IP data consider for Chile the IMACEC index of economic activity, for New Zealand an expenditure-based real GDP index, for Peru a real GDP index and for Uruguay the industrial production index without distilleries.

Figure 2. Actual Inflation, Expected Inflation, Target Bands and Policy Rates



Sources: Contries' authorities and IMF staff calculations.

8. **There are significant differences in terms of the evolution of the policy rate in Uruguay relative to the other countries (Table 2).**[4] The sample is divided in two periods: the first period starts with the introduction of the policy rate as the main monetary policy instrument for Peru in September 2003, going through August 2007; the second period starts with its introduction in Uruguay, in September 2007, going through the latest available observation (August 2010). Since Uruguay has had the highest average inflation level, the policy rate has accordingly taken the highest value after its implementation. Uruguay also had the fewest number of policy rate modifications, though the median change of the policy rate was the largest. These results differ substantially from those of Peru, where the IT regime is also somewhat more recent. Overall, evidence suggests a less frequent use of the policy rate in Uruguay yet with relatively larger changes whenever it was modified.

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[4] Policy rates are taken from the website of each central bank, and reflect a target set and announced by the central bank on the overnight interbank interest rate of each country.

Table 2. Inflation and Policy Rate
(In percent, unless otherwise specified)

	CPI inflation	Policy rate		Policy rate changes 1/			
	Avg	Avg level	Std deviation	No of times	Minimum	Maximum	Median
			2003M9-2007M8				
Chile	2.5	3.7	1.4	29	6	58	15
New Zealand	2.7	6.7	0.9	13	25	25	25
Peru	2.1	3.5	0.8	10	25	25	25
Uruguay	7.3	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
			2007M9-2010M8				
Chile	4.4	3.8	3.1	21	8	261	33
New Zealand	2.8	4.9	2.6	9	25	150	50
Peru	3.6	4.0	2.1	18	25	100	25
Uruguay	7.4	7.5	1.1	8	25	225	100

Source: countries' authorities and IMF staff calculations.

1/ Minimum, maximum, and median are based on the absolute value of the policy changes, in basis points.

C. Credibility of the Inflation Target

9. **The strength of the transmission of monetary policy decisions depends to a large extent on agents' inflation expectations.** When inflation expectations are well-anchored in an IT regime, expected inflation is largely determined by the pre-announced inflation target of the central bank.

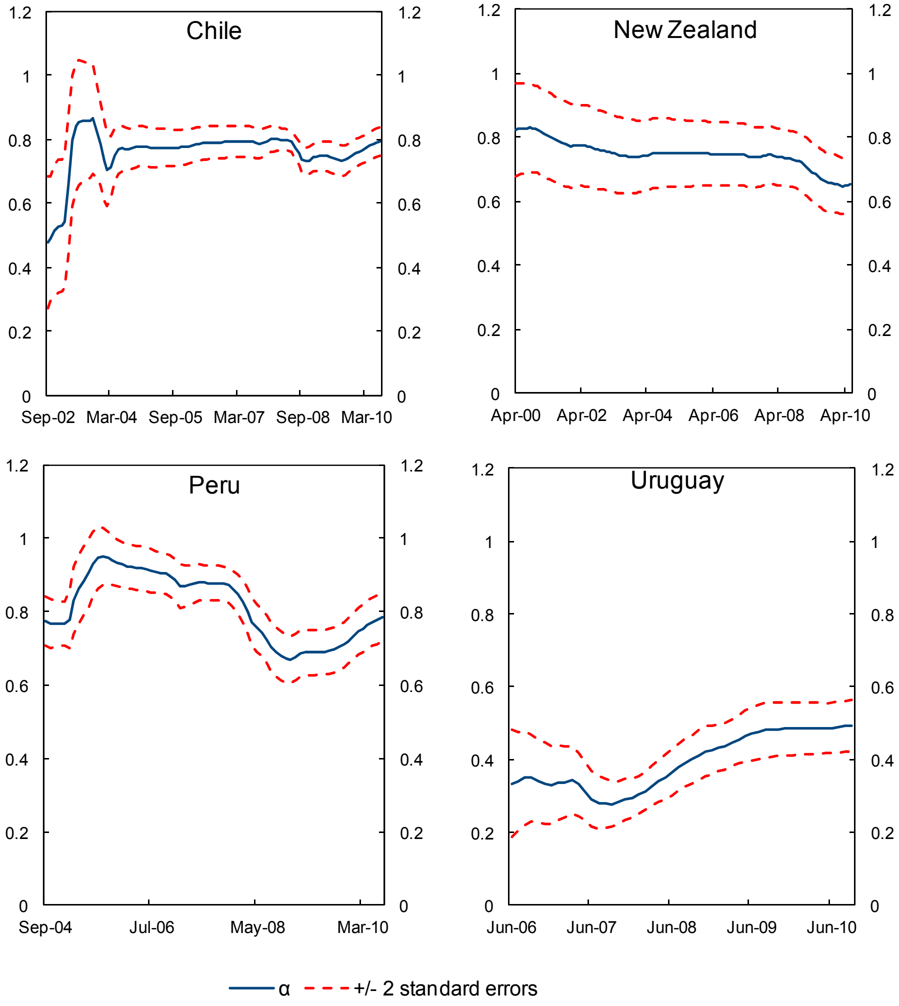
10. **To evaluate how well anchored inflation expectations are in these countries, the following OLS recursive regressions are estimated:**

$$\pi^{e}_{i,t} = \alpha_i \pi^{T}_{i,t} + (1-\alpha_i)\pi_{i,t-1} + \varepsilon_{it}$$

where for any country *i*, $\pi^{e}_{i,t}$ is the 12-month ahead expected inflation at period *t*, $\pi^{T}_{i,t}$ is the 12-month ahead inflation target set at period *t*, $\pi_{i,t-1}$ is the lagged y-o-y realized inflation and ε_{it} is a white noise component. The coefficient α_i is the weight agents attach to the inflation target: a high value for α_i means that inflation expectations are well anchored, and that the IT regime is credible.

11. **Recursive estimations show that the degree of credibility in the inflation target significantly varies across countries and time.** The evidence also suggests that after the introduction of the policy rate as the main monetary policy instrument in Uruguay, in September 2007, the credibility of the inflation target increased significantly (Figure 3). The credibility level still remains well below that of other countries, however, thus suggesting that agents in Uruguay still form expectations largely based on past inflation.

Figure 3. Credibility Coefficients
(OLS recursive regressions)

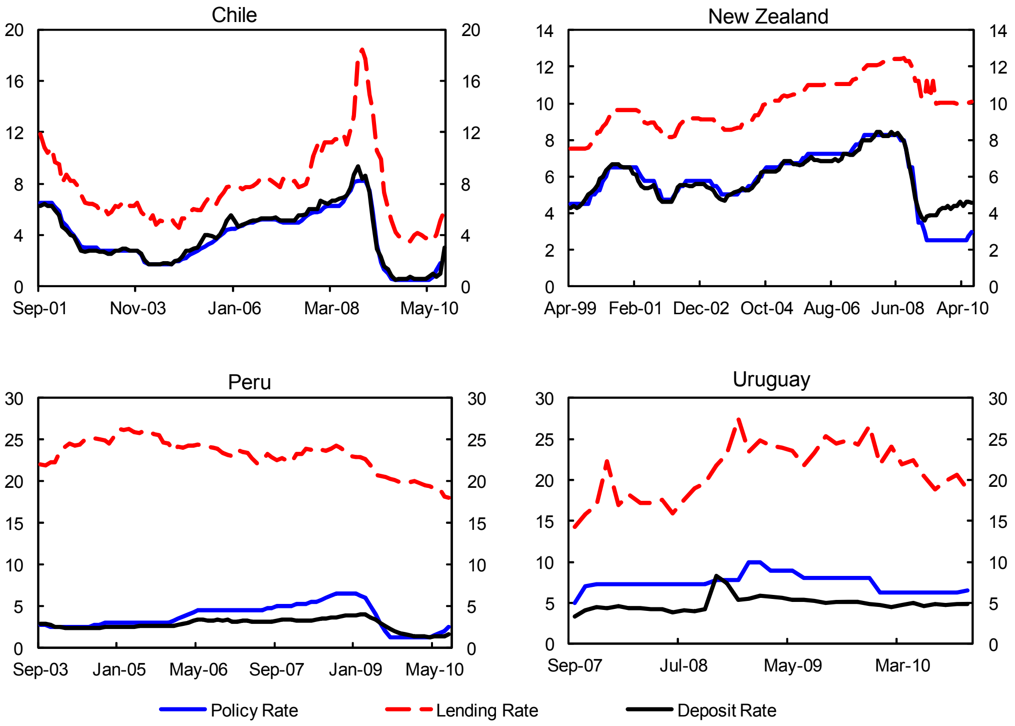


Source: IMF staff estimations.

D. The Policy Rate Pass Through

12. **Monetary policy decisions in IT regimes are initially transmitted to the rest of the economy through the effect of the policy rate on the money market rate.** Changes in the latter are, in turn, transmitted to deposit and lending rates, thus affecting the consumption and saving decisions of individuals and firms, and hence aggregate demand and inflation. Simultaneously, monetary policy decisions may affect the overall availability of credit as well as different asset prices that react to short-run interest rates, thus enhancing the initial transmission through the so-called credit and asset price channels. Moreover, as domestic and foreign interest rates differ for comparable assets, arbitrage between them gives rise to nominal exchange rate fluctuations, which in turn affect inflation and economic activity through the so-called exchange rate channel.

Figure 4. Local-Currency Deposit and Lending Rates, and Policy Rate


Chile

New Zealand

Peru

Uruguay

Source: Contries' authorities.

13. **As expected, in all four countries there is a positive co-movement between the policy rate and both the lending and deposit rates.** However, in Peru and Uruguay the co-movement is significantly weaker than in Chile and New Zealand. This weaker relationship likely reflects differences in the structure, depth, and the degree of dollarization of their financial systems.

14. **To assess the relation between these interest rates and the strength of the policy rate pass through, the following OLS regression is estimated:**

$$y_{it} = c_i + \alpha_i y_{it-1} + \beta_i x_{it} + \gamma_i x_{it-1} + \varepsilon_{it}$$

where for any country i and period t, y_{it} is either the deposit or the lending rate, c_i is a constant, x_{it} is the policy rate and ε_{it} is a white noise component. The short-run effect of the policy rate is thus given by β_i whereas the long-run effect is given by the coefficient $\frac{\beta_i + \gamma_i}{1 - \alpha_i}$. Tables 3 and 4 show the results.

Table 3. Pass-Through from the Policy to the Deposit Rate

	c	*α*	*β*	*γ*	Short-run Effect	Long-run Effect	R-squared	Sample
Chile	0.10	0.53	0.98	-0.50	0.98	1.00	0.92	2001M1–2010M9
t-Statistic	0.77	6.89	7.94	-3.61				
New Zealand	0.18	0.95	0.56	-0.53	0.56	0.47	0.98	1999M4–2010M9
t-Statistic	2.25	28.39	9.96	-9.40				
Peru	0.04	0.89	0.29	-0.22	0.29	0.62	0.99	2003M9–2010M8
t-Statistic	0.77	22.68	8.11	-4.80				
Uruguay	0.97	0.52	0.26	-0.07	0.26	0.40	0.44	2007M9–2010M9
t-Statistic	1.12	3.50	1.28	-0.35				

Source: IMF staff estimations.

Table 4. Pass-Through from the Policy to the Lending Rate

	c	*α*	*β*	*γ*	Short-run Effect	Long-run Effect	R-squared	Sample
Chile	0.36	0.80	0.77	-0.47	0.77	1.54	0.94	2001M1–2010M9
t-Statistic	1.77	19.00	4.87	-2.60				
New Zealand	0.23	0.96	0.22	-0.18	0.22	0.79	0.97	1999M4–2010M9
t-Statistic	1.44	51.96	2.67	-2.22				
Peru	-0.20	1.01	0.35	-0.37	0.35	2.00	0.96	2003M9–2010M8
t-Statistic	-0.35	38.45	2.03	-2.17				
Uruguay	2.41	0.65	0.36	0.32	0.36	1.95	0.67	2007M9–2010M9
t-Statistic	0.93	5.47	0.62	0.56				

Source: IMF staff estimations.

15. **The estimations suggest a significant pass through from the policy rate to both lending and deposit rates.** For Chile and New Zealand, the short-run effect of the policy rate is larger for the deposit rate. In contrast, for Peru and Uruguay, the short-run effect is strongest on the lending rate, though the significance of the estimated coefficients tends to be weak.[5]

E. Empirical Analysis of the Transmission of Monetary Policy Decisions

16. **To analyze empirically the impact of changes in the policy rate on inflation and economic activity, the following vector autoregressive (VAR) model is estimated**:

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

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. X_t is included to control for exogenous disturbances that may affect the dynamics of the model that could lead to counter-intuitive results.[6] The benchmark model takes the following form:

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[5] These results should be treated with some cautious since the sample period of the estimation in the case of Uruguay is short. However, the results obtained here are broadly consistent with other studies that show a low pass through from the policy rate to active and passive interest rates.

$$Y_t = \begin{bmatrix} R_t & IP_t & \pi_t & reer_t \end{bmatrix}$$

where R_t is the policy rate, IP_t is the y-o-y change of an index of economic activity; π_t is a measure of annual core inflation; and $reer_t$ is the y-o-y change in the Real Effective Exchange Rate.[7]

17. The vector of exogenous variables is in turn given by

$$X_t = \begin{bmatrix} FF_t & WCPI_t & IP_t^{us} \end{bmatrix}$$

where FF_t is the U.S. Federal Funds rate; $WCPI_t$ is the y-o-y change of the world commodity price index, and IP_t^{us} is the U.S. industrial production index gap in logs.[8]

18. **The model uses a standard identification framework**. Structural shocks are identified using a Cholesky decomposition, with the variables ordered as in vector Y_t.[9] This implies, for instance, that R_t is contemporaneously affected only by its own shock, whereas $reer_t$ (or $neer_t$, when later specified), being the most endogenous variable of the model, is affected on impact by all structural innovations.

19. **The estimations are based on monthly data, with the sample period tailored to each country.** In the case of Chile, the sample starts with the introduction of the inflation targeting regime in September 1999, going through July 2010. For New Zealand, it goes from April 1999, when the so-called cash rate was set as the main policy instrument, until June 2010.[10] For Peru, the sample starts in September 2003, the month in which the full-fledged IT regime was implemented, going through July 2010. Finally, for Uruguay, the

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[6] Sims (1992) shows the importance of introducing the oil price index to avoid the *price puzzle*—a positive response of prices to a monetary contraction—in the case of the U.S.

[7] Different measures of annual core inflation were used in the estimations. Those presented here are computed as the difference between CPI inflation and tradable goods inflation, to isolate to the largest possible extent the effect of commodity prices on CPI inflation.

[8] Using an index for export and import prices for each country instead of the world commodity price index to avoid the price puzzle produces only marginal differences in results.

[9] For robustness, estimations are compared with those obtained from a structural VAR model using an identification structure similar to that proposed in Kim and Roubini (2000), without showing major differences in results.

[10] In the case of New Zealand, information is mostly available on quarterly basis. Quarterly data have been converted to monthly basis by taking a linear trend between each pair of consecutive quarters. At the time of running the estimations, quarterly data was available through 2010Q2.

sample starts in September 2007, with the introduction of the policy rate, and it goes until September 2010. The model is estimated with two lags, except for Uruguay, where only one lag was considered due to the short sample period.

20. **The strength of the transmission of the policy rate change varies greatly across countries.** The impulse-response (IR) functions to a 100 basis point increase in the policy rate—a contractionary monetary policy shock—are presented below. In New Zealand, there is a significant and persistent contraction in the growth rate of economic activity and inflation. In Chile, the negative impact on economic activity takes about four months to materialize, yet it is persistent. The effect on inflation in Chile is more immediate but it is also less persistent.

21. **The two dollarized economies appear to have distinct results**. The estimations for Peru and Uruguay indicate that the policy rate hike leads to a short-run reduction in inflation, and an increase in economic activity (Peru) or an insignificant effect on it (Uruguay). The transmission from monetary policy decisions to inflation does not seem to operate through credit and aggregate demand in these countries, but rather through the exchange rate channel, (as discussed below). In addition, the absence of a contraction in economic activity after the rise in the policy rate may be related to the existence of balance-sheet effects. That is, the associated exchange rate appreciation that follows the interest rate increase may lead to an improvement in the balance-sheets of those agents indebted in the foreign currency, generating an indirect positive effect on aggregate demand that may outweight the contractionary effect initially given by the traditional interest rate channel.[11]

22. **The estimation also shows differences in how the policy rate reacts endogenously to shocks.** The reaction of the policy rate in Uruguay is associated with a lower degree of persistence relative to the other three countries. This result supports the conclusion that monetary policy has reacted relatively less frequently to changes in economic activity and inflation in Uruguay, implying that the policy rate still provides a rather weak signal of the monetary policy stance in the country.[12]

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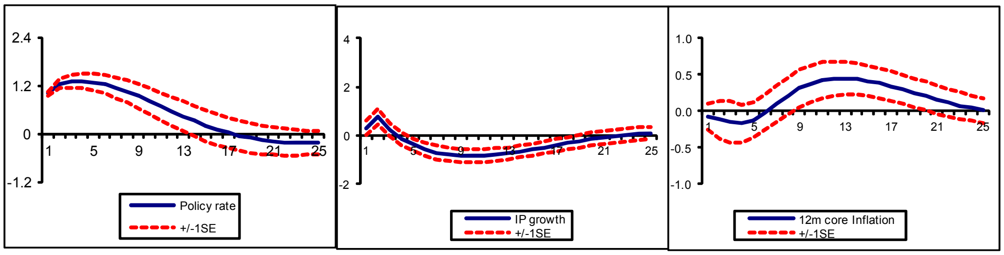
[11] Rossini and Vega (2006) point out that the presence of balance sheet effects may explain why economic activity seems to expand after an increase in the policy rate when considering Peruvian data.

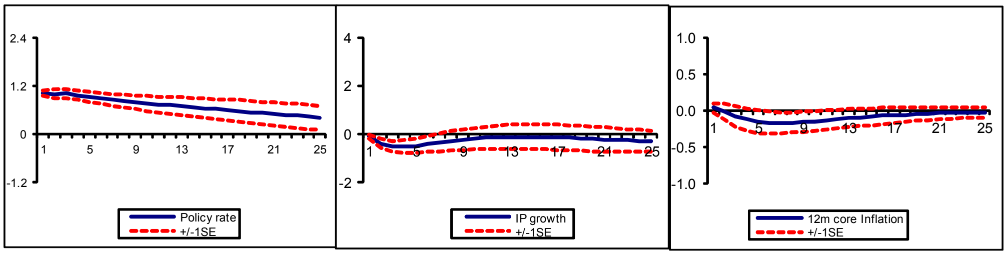
[12] A formal estimation of the policy reaction function often requires the use of quarterly data to obtain a good fit of the model. Owing to the very short sample period of Uruguay, a proper estimation of the reaction function is left as a topic for further research.

Figure 5. Impulse Response Functions to a 100 Basis Points Increase in the Policy Rate
(In Percent)

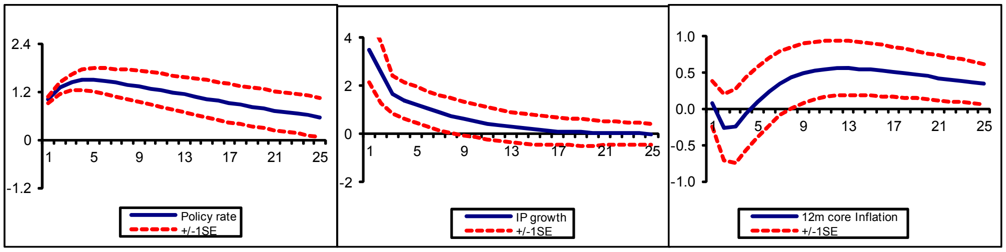
Chile



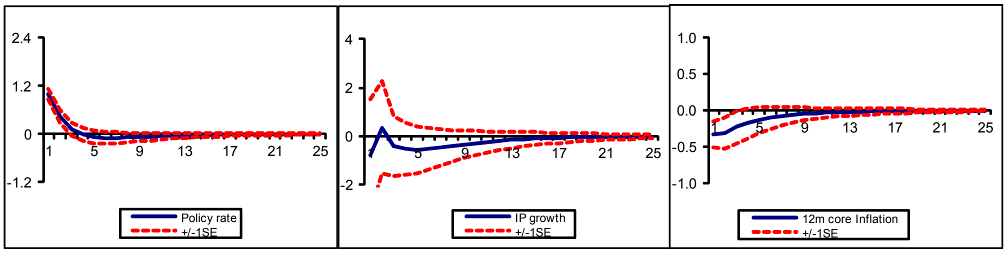
New Zealand



Peru



Uruguay



Source: IMF staff estimations.

23. **To explore the relevance of the exchange rate channel, a slightly revised version of the VAR model is estimated.** Specifically, the vector of endogenous variables now becomes

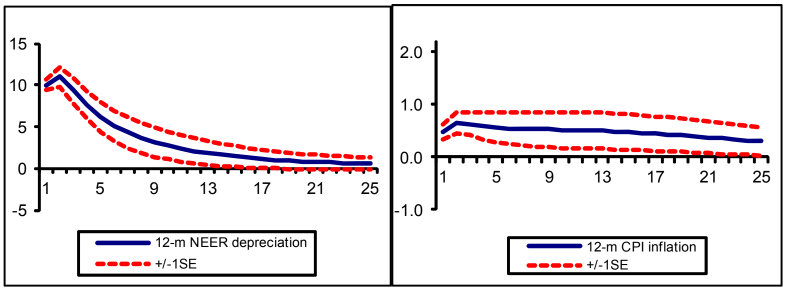
$$Y_t' = \left[neer_t \quad IP_t \quad \pi_t \quad R_t \right]$$

where π_t represents the annual CPI inflation rate whereas $neer_t$ indicates the y-o-y change in the NEER. The rest of the model remains as in the baseline specification.

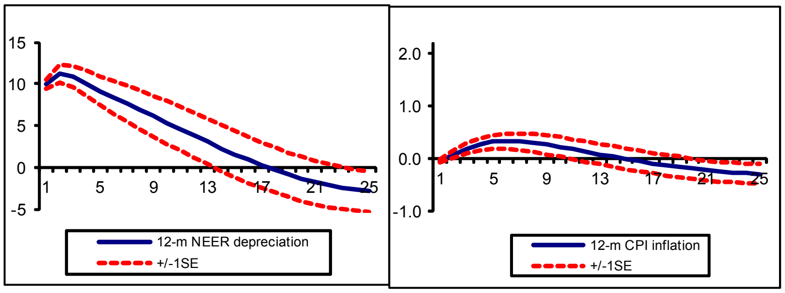
24. **To help understand the role of the exchange rate transmission channel, the IR functions below consider how a NEER depreciation affects CPI inflation.** Peru and Uruguay have the largest exchange rate pass through, likely reflecting the high dollarization and the relevance of the exchange rate channel in these countries. For Peru, a 10 percent depreciation of the NEER raises CPI inflation up to 1.5 percent five months after the shock. In Uruguay, CPI inflation increases 1.7 percent after three months.

Figure 6. Impulse Response Functions to a 10 Percent NEER Depreciation
(In percent)

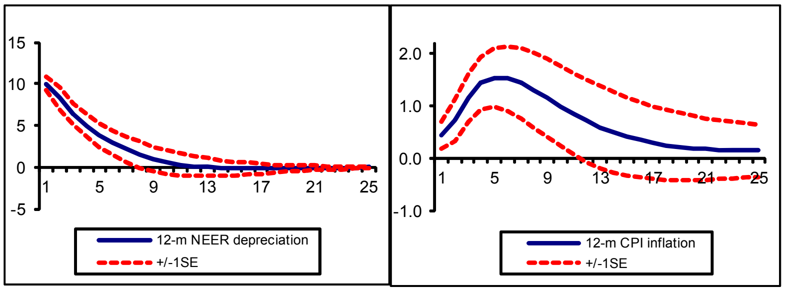
Chile



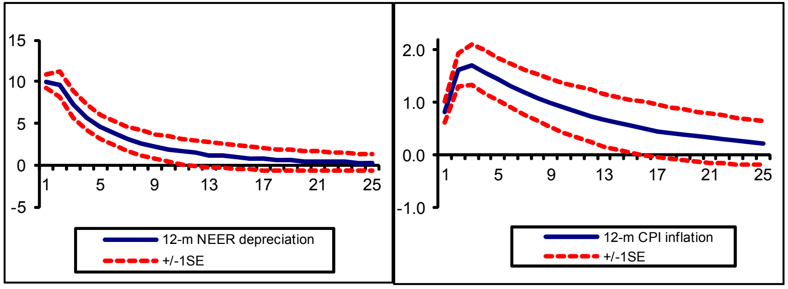
New Zealand



Peru



Uruguay



Source: IMF staff estimations.

F. The Role of Financial Factors in the Transmission of Monetary Policy

25. **Policy rate changes are transmitted through different channels, whose strength depend on various factors, notably those related to the financial system.** In a dollarized economy, the traditional interest rate channel tends to be weaker, as the monetary authority has a lower influence on the relevant interest rates that affect consumption and investment decisions. With lower financial depth, the credit channel may also be less pronounced, as a low ratio of local-currency credit to output may reduce the overall impact of monetary policy on the flow of credit and thus on aggregate demand.[13] Similarly, the low relevance of domestic capital markets may impinge on the tranmission from asset price changes to aggregate demand, also limitting the effects of policy rate changes.

26. **Although financial factors may affect the strenght of the transmission, other critical factors are at play.** These include the overall impact of monetary policy of course also depends on the credibility of the monetary regime, the extent of the exchange rate pass through, and the frequency and size of changes in the policy rate. Thus, a low level of financial depth does not mean that monetary policy cannot affect inflation. It means that the other transmission channels will be more important, and it reinforces the need for an active and credible monetary policy.

27. **Table 5 shows some key financial system parameters in the four countries.** Uruguay ranks low in terms of credit to the private sector over GDP, closely followed by Peru—again, the two countries where the transmission of monetary policy to aggregate demand is comparatively weaker. Particularly striking is the very small size of the stock market capitalization in Uruguay. Not surprisingly, Uruguay also has the largest share of international debt issues over GDP—followed by Peru—reflecting the yet limited scope for funding in local markets. This trend has recently started to revert, in line with the significant de-dollarization process experienced by these two economies.

Table 5. Financial system indicators

	Total Deposits 1/	Credit to Private Sector 1/	Stock Market Capitalization 2/	International Debt Issues 3/
		In percent of GDP 4/		
Chile	49.4	71.1	123.9	6.1
New Zealand	85.3	141.7	26.5	7.4
Peru	25.8	24.6	47.5	9.8
Uruguay	43.1	18.3	0.3	22.2

Source: countries' authorities, Federación Iberoamericana de Bolsas, New Zealand Exchange, BIS and IMF staff calculations.

1/ As of June 2010.

2/ As of July 2010.

3/ International debt securities of all issuers (amortizations outstanding) from BIS Securities Statistics (Table 12A) as of June 2010.

4/ 2010 GDP taken from WEO forecasts.

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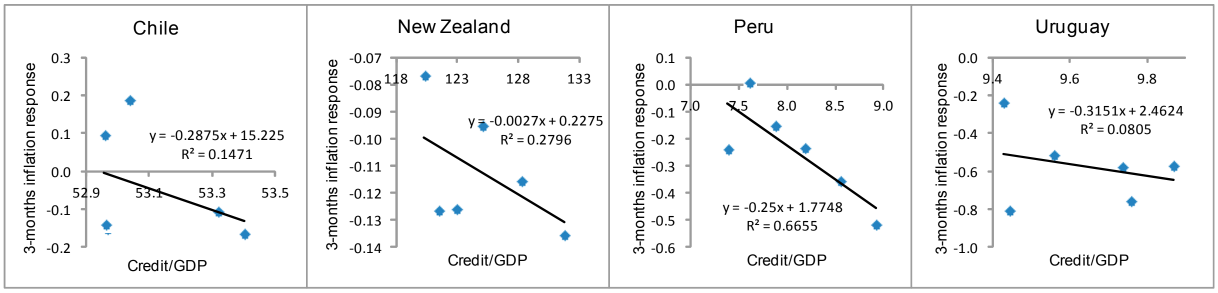
[13] The evidence on the relevance of financial depth in the transmission of monetary policy decisions is scarce and not conclusive. Saizar and Chalk (2008), for instance, find no clear-cut evidence on the positive relation between the credit-to-GDP ratio and the transmission of interest rate shocks in a group of developing countries.

28. **A set of VARs for each country is run to understand how the degree of local-currency credit may affect the transmission of changes in the policy rate.** [14] The paper then explores whether the three-month response of inflation to a 100 basis points increase in the policy rate has changed with the degree of financial deepening.[15]

29. **The evidence suggests that a higher level of local-currency credit to the private sector may help strengthen the effectiveness of monetary policy in controlling inflation.**[16] As shown in Figure 7, a greater ratio of private sector credit (in local currency) to GDP, gives rise to a more important (negative) response of the inflation rate after the increase in the policy rate. This trend is also present in the cases Peru and Uruguay, suggesting that the strenght of the transmission of monetary policy has increased somewhat with the ongoing de-dollarization process.

Figure 7. Response of inflation after 3 months to a 100 basis points increase in the policy rate
(In percent)



Source: IMF staff estimations.

G. Policy Recommendations

30. **Policy rate changes seem to have a significant transmission to interest rates and inflation in Uruguay since late 2007 in the expected direction.** The effect on economic activity is, however, less significant, suggesting that the exchange rate is still a relevant channel to control inflation in Uruguay. Other transmission channels that tend to operate mostly through either aggregate demand or expectations may not be that operative in the country yet. However, the ongoing de-dollarization process of Uruguay is likely to reduce the relevance of the exchange rate channel over time. This gives rise to the need for a further

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[14] Six subsamples are computed for each country, with each having the same end point as in the benchmark VAR model. The largest subsample for each country also coincides with that of the benchmark VAR model. For Chile and New Zealand, each subsample starts 12 months after the previous one. For Peru and Uruguay, this occurs 6 and 3 months after the previous one, respectively, due the fewer observations available in these cases.

[15] The three-month response of inflation was chosen to account for the delay between the period in which the policy rate is changed and its effect on inflation.

[16] Results should be taken with cautious due to their relatively low statistical significance, which is particularly driven by the low variability of the credit-to-GDP ratio in the different samples. Yet results show the expected signs, thus providing support to the main conclusions discussed in the text.

strengthening of the other channels of transmission to effectively control inflation over the medium term.

31. **A number of policy recommendations to strengthen the transmission of monetary policy in Uruguay follow from the paper.** It is important to further enhance the credibility of the inflation target in the country to foster the effectiveness of monetary policy decisions. To do this, authorities should aim for and deliver an inflation rate within the pre-announced target range, close to its mid-point level. Further strengthening the operational autonomy of the central bank will help fulfill this objective. A better communication strategy with the public and a more frequent and persistent use of the policy rate will also help in this endeavor. In addition, continuing with the ongoing de-dollarization process while fostering financial deepening is commendable, as evidence suggests that a larger fraction of local-currency credit and a deeper financial system may also help strengthen the transmission of monetary policy decisions.

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III. WHAT EXPLAINS THE LOW PROFITABILITY OF THE URUGUAYAN BANKING SYSTEM?[1]

A. Introduction

1. **While Uruguay achieved high economic growth in recent years and managed to avoid a recession during the global financial crisis, its banks have seen a noteworthy trend decline in profitability**. Between 2006 and 2009 real GDP growth and credit growth expressed in constant exchange rate terms averaged 6 and 20 percent per year, respectively, but banks' pre-tax return on assets (RoA) fell from 1.7 percent to 0.5 percent, with more than half of the banks recording losses at year-end 2009. Even in the best profit year of 2007, the RoA remained below the 2 percent mark. At first glance, this result appears surprising because banks have maintained solid credit spreads and recorded low non-performing loans. However, a number of factors have weighted on banks' bottom line, notably high levels of liquidity and low returns, strongly rising personnel costs, and unfavorable exchange rate developments.

2. **This paper identifies the drivers of the low profitability of Uruguayan banks.** Using ratio analyses and standard efficiency measurement techniques, it sets out to identify the worsening elements on both the income and cost side, and it derives changes in total factor productivity as well as in efficiency scores. This paper does not yet compare the efficiency of Uruguayan banks to those in other countries with a similar level of banking sector development; however, such a cross-country study for the region is proposed.

3. **The results can be summarized as follows.** Among the production factors of intermediation—labor, fixed assets and financing—the pronounced rise in real wages has had the strongest impact on profitability. Other factors comprised low returns on the high stock of liquid assets, and to a lesser extent, the appreciation of the Uruguayan peso weighing on the value of the high share of dollar-denominated assets on banks' balance sheets.

B. Ratio Analysis

4. **Bank performance in Uruguay has been influenced by both cyclical and structural developments.** Between 2005 and 2009 the pre-tax return on average assets fell from 1.4 percent to 0.5 percent, having peaked at 1.9 percent in 2007. During this time the share of net earnings from lending and provision of services (net financial margin) in total assets dropped by 1½ percentage points, whereas the share of salary costs grew by half a

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[1] Prepared by Torsten Wezel (MCM). I thank the very useful comments received from the staff of the Banco Central del Uruguay.

percentage point (Table 1).[1] To date, the RoA is not on a path of recovery from its depressed 2009 level.

Table 1. Revenue and Expense Items

(In percent of average assets)

	Financial Margin	Loan Loss Provisioning	Exch. Rate Adjustment	Salary Costs	Operational Costs	Inflation Adjustment	Other Costs	Pre-Tax Profits
2005	7.4	-0.2	-0.6	-2.2	-1.8	0.1	-1.4	1.4
2006	6.8	-0.2	0.1	-2.3	-1.9	-0.4	-0.3	1.7
2007	7.4	-0.2	-0.5	-2.6	-2	0.0	-0.3	1.9
2008	6.6	-0.4	0.4	-2.5	-1.6	0.0	-0.8	1.6
2009	6.8	-0.1	-0.7	-2.7	-1.9	-0.8	-0.2	0.5
Disaggregation for 2009 by Banks with Positive and Negative RoA:								
RoA>0	6.9	0.0	-0.5	-2.3	-1.6	-0.8	-0.2	1.5
RoA<0	6.3	-0.3	-1.3	-3.8	-2.3	-0.9	-0.2	-2.5

Sources: Banco Central del Uruguay and author's calculations.

5. **There is widening gap between reasonably profitable and unprofitable banks.** In 2009, the standard deviation of banks' return on assets was one third higher than the 2005–07 average. Loss-making banks had on average a lower financial margin as well as higher labor and administrative costs than profitable banks (a few banks incurred the cost of severance packages). The unprofitable institutions also tended to be smaller, accounting for only one third of total assets, and more dollarized, which required a larger exchange rate adjustment.

6. **Overall, the impact of macroeconomic factors on profitability has increased lately.** The significant deterioration in the system's RoA in 2009 is mainly owed to required valuation adjustments for the effects of elevated inflation and the depreciation of the large share of U.S. dollar assets. Totaling 1½ percent of total assets, these additional expenses were charged to banks' income statement to preserve the real value of equity capital. The increase in valuation adjustments explains two thirds of the deterioration in the RoA from the peak year of 2007, with the reduced financial margin accounting for the balance.

7. **Among the cost components, the rising share of salaries stands out**. Bank employee compensation rose by 10 percentage points to just under 40 percent of the net financial margin (Figure 1). Given this trend, a number of banks decided to shed labor in 2009 but this was reportedly achieved only through severance packages of as much as four years worth of salaries. Payroll costs accounted for the largest single change in main cost elements apart from the valuation adjustments for inflation and exchange rate variations.

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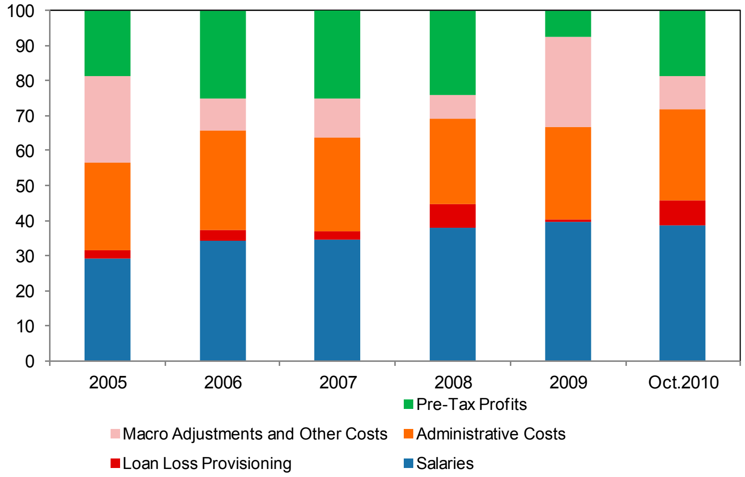
[1] All calculations exclude the restructured public mortgage bank *Banco Hipotecario del Uruguay*.

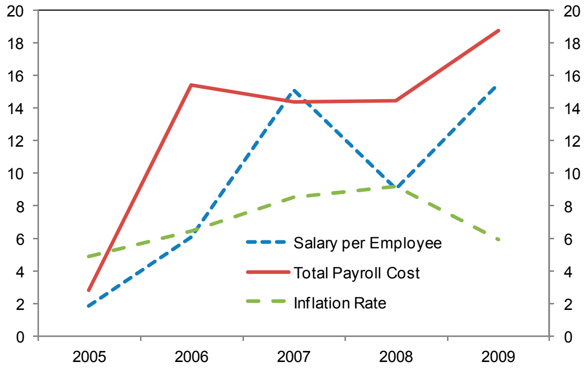
Figure 1. Income Statement Items as a Cumulative Share of the Net Financial Margin



Sources: Banco Central del Uruguay, and author's calculations.

8. **The increase in personnel cost was both in total payroll costs and salaries per employee.** Starting out from a near zero growth rate in 2005, nominal personnel costs thereafter grew by an average 16 percent for total payroll costs and 11 percent for salaries, which is well above the average inflation rate of 7½ percent (Figure 2) and in the absence of gains in labor productivity (see Section C). The fact that overall costs outpaced average salaries in all years but one implies that employees continued to be added to the workforce. Given the decline in earnings per employee this raises concerns about overstaffing.

Figure 2. Growth of Nominal Labor Costs



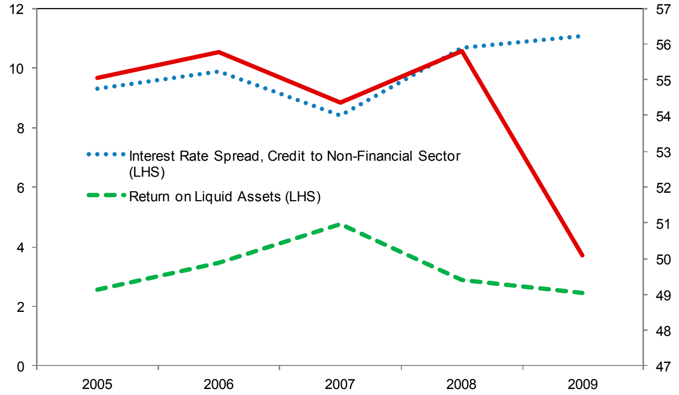
Sources: Banco Central del Uruguay, and author's calculations.

9. **Real wages and particularly social security contributions have risen considerably since 2007.** Salary increases and growth in non-wage labor costs on average exceeded the rise in consumer prices by 3.6 percent and 6.9 percent per year, respectively. In 2009, wages grew by 4½ percent and non-wage costs by 14 percent in real terms, the latter being primarily due to the higher contributions to the sector's private pension fund and in some cases to severance pay to redundant employees.

10. **On the revenue side, high holdings of liquid assets have long prevented a concurrent increase in earnings.**

The share of liquid assets[2] in total assets remained above 50 percent during 2005–09, but falling interest rates and temporarily elevated reserve requirements with low remuneration have depressed the returns on liquid assets in recent years (Figure 3). The persistently high level of liquidity is owed to inertia in the dollarization of deposits, presumably due to risk aversion coupled with long memory effects on the part of depositors. To avoid currency and maturity mismatches, banks are forced place these dollar deposits in liquid foreign currency instruments. Banks reacted to the decline in earnings from dollar-denominated assets and, more recently, to the reduction in reserve requirements by intermediating some of the freed-up peso liquidity and in the process widening the interest rate margin[3] by 2½ percentage points compared to end-2007.

Figure 3. Interest Rate Spread and Liquidity Ratio



Sources: Banco Central del Uruguay, and author's calculations.

In sum, rising salary expenses and low interest rates on the high share of liquid assets predominately account for the drop in the return on assets. These two factors alone explain three fourths of the decline in the RoA between 2006 and 2009, with the earnings drop accounting for half of that decline. While administrative costs and other expenses receded somewhat in terms of total assets, the inflation and exchange rate charges in 2009 also weighed heavily on bank profits. Had the inflation charge been imposed evenly during 2007–09, the RoA in 2009 would only have fallen to 1.05 percent rather than to 0.5 percent. Nevertheless, the decline in profitability appears unmistakably linked to both *cyclical* factors (low returns on liquid assets; elevated rates of inflation) and *structural* factors (persistently high share of liquid assets; trend increase in personnel expenses both overall and per employee).

C. Efficiency Analysis

11. **In the following, two standard procedures of efficiency estimation are applied to corroborate the results of the descriptive analysis**. As before, the drivers of bank profitability are explored. However, as the two methods cannot handle negative bank profits

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[2] Includes cash, deposits at the Central Bank (including required reserves), and deposits in other banks.

[3] The interest rate margin represents a weighted average of peso and dollar rates on loans and on deposits.

as have been recorded lately, instead gross earnings[4] are used as dependent variable in the estimations. Independent variables are labor (employee compensation), fixed assets (administrative costs), and financing (total interest expense); see the summary statistics in Table 2. To obtain developments in cost efficiency, these inputs were further broken down into volume (number of employees, number of branch offices, total value of deposits) and prices (salary per employee, administrative cost per branch office, implicit interest rate on deposits).

Table 2. Values of Output and Input Variables

(Average per-bank values, in millions uruguayan of pesos)

	Total 1/ Loans	Total 1/ 2/ Loans	Gross Earnings	Salary Cost	Administrative Cost	Interest Cost
2005	72,515	72,515	20,578	5,923	5,093	2,045
2006	84,061	81,915	19,774	6,843	5,659	2,388
2007	103,124	109,880	21,117	8,066	6,184	2,870
2008	132,174	129,419	24,093	9,276	5,987	2,638
2009	130,836	148,580	24,931	11,090	7,388	2,293

Sources: Banco Central del Uruguay and author's calculations.

1/ Loans to the non-financial sector.

2/ In constant peso-dollar exchange rate.

12. **Exchange rate variations have had a significant effect on balance sheet values expressed in local currency, notably the credit stock.** As mentioned, exchange rate movements have necessitated sizable valuation adjustments in the income statement. For example, credit growth expressed in peso terms appeared muted during 2005–07 and in 2009 when the local currency appreciated against the U.S. dollar and diminished the value of dollar-denominated loans expressed in pesos. When instead keeping the exchange rate constant in valuing dollar loans (see second numerical column in Table 2), total credit is shown to have grown on average 4 percentage points more between 2005 and 2009. While net interest income is also affected by exchange rate swings, this is less true for other items of the income statement, particularly salaries and administrative costs that are predominately incurred in local currency.

Data Envelopment Analysis and Changes in Total Factor Productivity

13. **First, a non-parametric approach to measuring bank efficiency, Data Envelopment Analysis (DEA), is applied.** DEA is a linear optimization procedure that uses information on each bank's input-output mix to construct an efficient production frontier for the banking system as a whole. The efficiency score of an individual bank is then computed as its "distance" from the efficient frontier, which means that it is a relative, not an absolute

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[4] Gross earnings ("resultado bruto") are defined as net revenue from financial intermediation (i.e. interest and non-interest revenue less respective expenses from lending and provision of services) less loan loss provisioning and exchange rate-induced changes in the valuation of assets and liabilities.

measure of efficiency (see Annex 1).[5] In other words, even the most efficient bank(s) may not be fully efficient if compared to banks in other jurisdictions. The efficiency score can be broken down into *technical efficiency* and *allocative (cost) efficiency*, which, respectively, denote the ability of a bank to obtain maximal output from a given set of inputs and the ability to use these inputs in optimal proportions in view of their respective prices. A third score, *scale efficiency*, measures the part of the technical efficiency score that is associated with a bank's ability to operate at its optimal firm size.

14. **The results of applying DEA to 2009 data illustrate a wide dispersion of efficiency scores across the 13 Uruguayan banks (Table 3).** The median score for technical efficiency is the lowest among the three efficiency measures, implying a great distance of more than half the banks to the fully efficient banks (five institutions), under the assumption of variable returns to scale, which permits large banks to have other economies than small banks. This efficiency gap is less pronounced for allocative efficiency and scale efficiency, which means that banks suffer less from a suboptimal input mix with respect to the relative prices of inputs and that most banks in fact operate at a near-optimal size.

Table 3. DEA Efficiency Results for 2009
(In percent)

	Technical Efficiency	Allocative Efficiency	Scale Efficiency
Highest	100.0	100.0	100.0
75th percentile	100.0	100.0	99.1
50th percentile (median)	**78.0**	**82.4**	**93.3**
25th percentile	64.1	69.7	87.0
Lowest	40.0	28.2	45.2

Source: Author's calculations.

15. **Appropriately linking such DEA results for several past years permits to calculate changes in total factor productivity (TFP).** By constructing so-called Malmquist indices, the year-on-year change in overall bank efficiency can be calculated. Essentially, this output-oriented chain index measures the evolution of TFP of each entity, i.e. the distance between two production points or input-output mixes irrespective of the distance to other banks. In other words, it is the absolute change in efficiency that is computed, not a relative score denoting the distance to the most efficient banks as with DEA.

16. **The computed changes in total factor productivity (Table 4) confirm the findings of the ratio analysis.** Following considerable improvements in 2005–06, the average change in bank productivity turned out to be -6½ percent during 2007–09 (both in mean and median scores),[6] with less unfavorable cost developments in 2008 mitigating the setback.

Table 4. Changes in Total Factor Productivity of Uruguayan Banks
(In percent)

	Highest	Mean	Median	Lowest
2005	44.0	17.5	16.7	-44.7
2006	285.5	38.7	36.8	-25.9
2007	14.6	-22.0	-17.5	-28.2
2008	93.6	34.6	26.5	-14.6
2009	35.4	-10.8	-10.4	-32.5

Source: Author's calculations.

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[5] For a more detailed explanation of DEA see Coelli, Rao and Battese (1998). As a non-parametric approach DEA does not correct for measurement errors and other white noise.

[6] With 2006 as base year, the drop in productivity (median) is derived as follows: 100*0.825*1.265*0.896=93.5.

17. **As a consistency check, bank efficiency with respect to managing the credit portfolio was also assessed.** Here, as dependent variable was chosen bank credit to the non-financial sector, with dollar loans expressed in constant exchange rate terms. Under this alternative setup banks' TFP fell by only 1.3 percent during 2006–09, and it actually advanced in the past three years. This leads to the conclusion that internal processes have not been impaired as much as the earnings-based productivity measures suggest. Put differently, it is the lower return from these assets what accounts for the bulk of the decline in efficiency.

Stochastic Frontier Analysis

18. **Stochastic Frontier Analysis—the other main tool in efficiency measurement—estimates a specific production function and decomposes the error term into a pure random error and an inefficiency term.**[7] This approach proposes a solution to the noise measurement problem faced by DEA and other deterministic applications, which is caused by attributing all measurement errors to the efficiency estimates.[8] The following equation is estimated:

$$\ln(y_i) = x_i\beta + v_i - u_i ,$$

where x_i is a vector of input variables in logs and the error term consists of two elements: a traditional random error term, v_i, and an inefficiency term, u_i.[9] The technical efficiency of a bank, TE = $\exp(-u_i)$, while not directly measurable, can be derived using an estimator developed by Battese and Coelli (1988) that predicts the conditional expectation of u_i given the value of $(v_i - u_i)$. The importance or impact of the inefficiency term is measured by the contribution of its variance to overall variance, $\gamma = \sigma_u^2/(\sigma_v^2+\sigma_u^2)$, and conveniently expressed in percentage terms. As with DEA, the inefficiency term essentially describes the distance to the firm(s) with best practices on the efficient frontier.

19. **Three SFA models are estimated for a panel of 13 banks during 2003–09.** As before, the dependent variable is gross revenue, and the independent variables are payroll costs, administrative outlays and interest expenses. In Table 5, the results for model 1 show that the salary and interest variables are highly significant with the expected signs. Salary costs have by far the greatest weight in the regression.

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[7] For a detailed explanation of the methodology see Coelli (1996).

[8] While SFA accounts for measurement errors, it requires assumptions about the production function and is subject to issues of econometric misspecifications.

[9] While v_i picks up the impact of measurement errors and other noise factors on output values, y_i, and is therefore iid $N(0,\sigma_v^2)$, the additional error term, u_i, is a non-negative random variable that accounts for technical inefficiency in banks' production and is iid truncated at zero of the $N(\mu,\sigma_u^2)$ distribution.

Table 5. Stochastic Frontier Analysis—Regression Results 1/

	SFA Model 1	SFA Model 2	SFA Model 3
Salary Costs	1.312 ***	1.131 ***	1.084 ***
	(-0.004)	(-0.12)	(-0.153)
Administrative Costs	0.019 ***	0.119	0.162
	(-0.001)	(-0.086)	(-0.121)
Interest Costs	-0.221 ***	-0.154 ***	-0.143 **
	(-0.002)	(-0.052)	(-0.059)
Liquidity Ratio		-0.194 ***	-0.182 ***
		(-0.049)	(-0.03)
Exchange Rate Adjustment			0.053
			(-0.013) ***
Constant	-0.262 ***	-0.12	-0.159
	(-0.009)	(-0.139)	(-0.154)
Gamma	1	0.999	0.999
Number of Observations	88	88	88

Source: Author's calculations.

1/ Standard errors in parenthesis; ***, **, * denote significance at the 1%, 5% and 10% level, respectively.

20. **In addition, models 2 and 3 account for other bank-specific factors that in the previous sections were shown to have affected profitability.** The estimation technique permits to include other exogenous variables deemed to have an impact on bank efficiency. In line with the previous analysis, model 2 accounts for banks' share of liquid assets in total assets, and model 3 includes both this liquidity indicator and the ratio of the exchange rate-related valuation adjustment for assets and liabilities to total gross earnings. These additional explanatory variables turn out to be highly significant with the expected signs and alter the significance of the main variables only slightly (the administrative cost variable does become insignificant).

21. **The resulting efficiency scores confirm the findings so far.** Table 6 illustrates the drop in efficiency after the top year of 2006. In model 1 the average efficiency score declined by 20 percentage points between 2006 and 2009, reaching a mere 67.5 percent. The deterioration was particularly pronounced in 2009, when the average efficiency score plummeted 13 percentage points. This finding is in line with the results of the ratio analysis and with the calculated sharp decline in total factor productivity.

Table 6. Stochastic Frontier Analysis 1/

(Average efficency scores)

	SFA Model 1	SFA Model 2	SFA Model 3
2003	65.7	64.6	64.7
2004	76.7	76.9	77.5
2005	77.4	78.4	79.2
2006	87.5	88.6	89.2
2007	78.9	80.3	81.2
2008	80.4	83.6	84.9
2009	67.5	70.8	72.0

Source: Author's calculations.

1/ Aritmetic averages. Scores are not weighted for market share of individuals banks.

22. **The other exogenous variables—the liquidity ratio and the exchange rate adjustment—have a clear impact on efficiency outcomes.** The output obtained from Model 2 shows that controlling for the share of liquid assets increases the average efficiency score by more than 3 percentage points, or put differently, the actual scores are biased downward due to this additional factor. While in the earlier years there was no measurable difference in scores between the two models, starting in 2007 the gap began to widen from

1.4 to 3.3 percentage points, which is an indication of the negative effect of lower-yield excess liquidity on profitability. Adding the exchange rate adjustment variable in model 3 lifts the efficiency score by another 1.2 percentage points. Here again, the gap in scores between models 2 and 3 started widening slightly in 2007. The results corroborate that among the other drivers of efficiency, excess liquidity has had the strongest effect on the bottom line.

D. Conclusions

23. **There has been a trend decline in the efficiency of Uruguayan banks**. This paper finds that the observed decline in banks' average return on assets by 1½ percentage points during 2007–09 was associated with a drop in total factor productivity by 6½ percent and in technical efficiency by 20 percentage points.

24. **The paper has identified three principal reasons for low bank profitability.** Using ratio analysis and two standard efficiency estimation techniques, the paper shows low returns on the high share of liquid assets in banks' portfolios and rapidly rising personnel costs to account for most of the deterioration in bank earnings since 2005. A third reason for the drop in profits was the accounting loss associated with an adjustment for high inflation in 2009 that in fact corrects for the rise in prices during 2007–09. Valuation effects associated with the exchange rate variations were found to have considerable effects in all years, but on total they cancelled out. This said, whenever the Uruguayan peso appreciates against foreign currency there will be pressure on bank earnings because the still-high dollarization reduces the peso value of the assets and their returns while expenses are mostly paid in local currency and grow well above the rate of inflation.

Low-income banks may be more disposed to take on riskier clients in an attempt to boost profitability, especially in personal and credit card loans as well as in under-banked market segments like small and medium-size enterprises and home mortgage lending. Due to the rising salary costs there is already now a tendency to outsource mass consumer credit to lower-cost non-bank institutions, some of which are less regulated than banks. Although Uruguay has steadily modernized its regulatory and supervisory system limiting exposures and has provided for a large stock of countercyclical loan loss provisions (Adler et al. (2009), Wezel (2010b)), banks could still be affected by a cyclical downturn driving up loan delinquencies and thus curtailing net interest income in those riskier market segments.

25. **The potential remedies for improving bank profitability appear clear-cut.** First, bank salaries should not continue to rise well above inflation and productivity advances, if any. Investment in technology for automating processes in transaction banking combined with some further cuts in low-skilled labor would help contain labor cost while improving overall productivity. Second, the efforts to induce a significant decline in financial dollarization should be continued so that the necessary valuation adjustments for exchange

rate movements, particularly the depreciation of foreign currencies, decrease over time. Banks could more actively promote peso deposits and in the process increase their peso lending. Lastly, low returns on liquid assets, particularly in U.S. dollars, appear to be a cyclical issue but the excess liquidity itself is becoming structural in nature inasmuch as investment opportunities outside interbank lending and investments in government securities are limited. Some opportunities do exist in lending to small and medium-sized enterprises that have no excess to foreign financing and cannot tap the evolving corporate bond market. Notwithstanding some risks, credit to households, particularly mortgage lending, is another promising avenue as wealth creation continues in line with robust economic growth.

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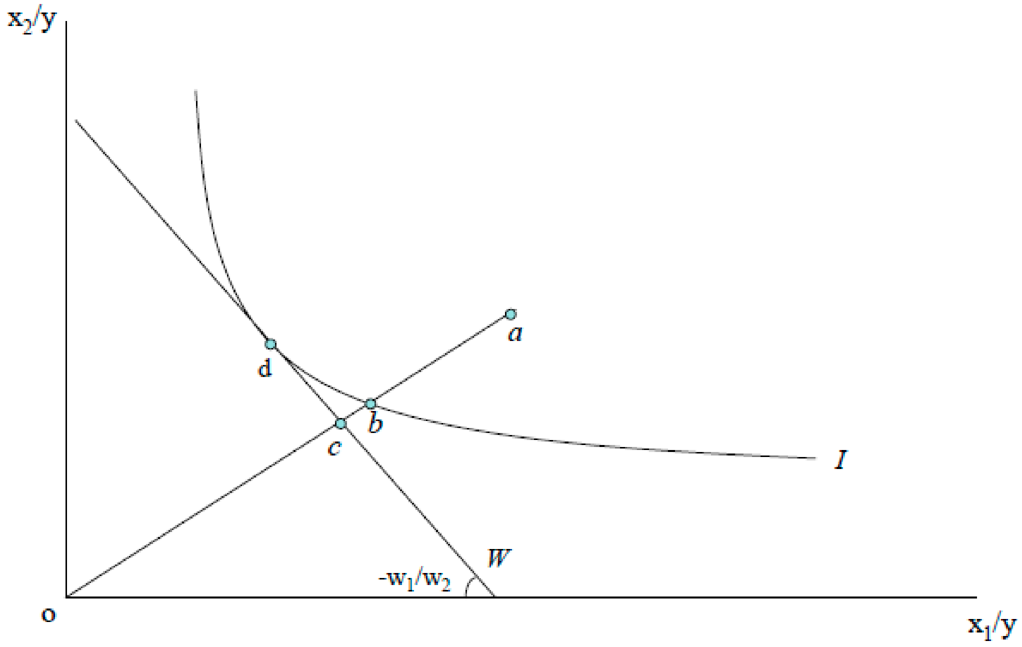
ANNEX 1. AN ILLUSTRATION OF DATA ENVELOPMENT ANALYSIS

The following chart illustrates the concept of technical and allocative efficiency used in Data Envelopment Analysis. A fully-efficient bank that uses two inputs (x_1, x_2) to produce one output (y) has a certain production possibility frontier denoted by the unit isoquant *I*. A bank that produces at point *a*, which is inferior to the optimal production, has a technical inefficiency that is measured by the distance *ab* or in relative terms, the ratio *ab*/*ao* which gives the percentage by which both inputs would have to be reduced by the bank to attain full technical efficiency. Conversely, the technical efficiency score is denoted by TE = 1- *ab*/*ao* = *bo*/*ao*. Therefore, the efficiency scores are normalized to between 0 and 1, expressing in percentage terms the degree of efficiency with respect to the leading bank(s) or "best practices."

Technical and Allocative Efficiency



Allocative efficiency (AE) is depicted by the distance between a point on the isoquant and the isocost line *W* whose slope is the ratio of the input prices, $-w_1/w_2$. The additional distance *bc* represents the reduction in production costs that would be obtained by changing the input mix in favor of using more of the relatively inexpensive factor x_2 and, thus, moving along the isoquant to attain the allocatively (and technically) efficient point *d*.