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URUGUAY

SELECTED ISSUES

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INTERNATIONAL MONETARY FUND

URUGUAY

SELECTED ISSUES

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Approved by
The Western Hemisphere Department

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CONTENTS

AGRICULTURAL LAND PRICES—A CHANNEL IN THE TRANSMISSION OF GLOBAL COMMODITY PRICE SHOCKS ON ECONOMIC ACTIVITY[1]

Between 2000 and 2010, agricultural land prices have increased fivefold in Uruguay. This paper examines the drivers and implications of the agricultural land price boom in the region. It finds that almost half of the increase in agricultural land prices between 2000 and 2010 can be explained by commodity price dynamics. At the same time, farmland prices are estimated to have played an important role in the transmission of commodity price shocks to economic activity, accounting for about 30 percent of the effect of commodity price shocks on GDP growth in the region.

A. Introduction

1. Exporters of food commodities in the Latin America region, including Uruguay, have experienced strong growth in agricultural land prices in recent years. Against the backdrop of a super cycle in commodity prices, the agribusiness sector has been an important driver of the vigorous growth observed in some Latin American countries. The strong demand for agricultural land has pushed land prices to record levels, with prices per hectare increasing fourfold on average for the region during the last decade. Among the countries in the region where data is available, Uruguay is where farmland prices have increased the most. Therefore, a better understanding of the underlying factors behind land price dynamics and the impact of land prices on the broader economy is useful for Uruguay.

2. The paper is organized as follows. Section B describes some stylized facts on commodity and farmland prices, and production. Section C describes the data and the econometric methodology. Section D presents the results, and Section E concludes.

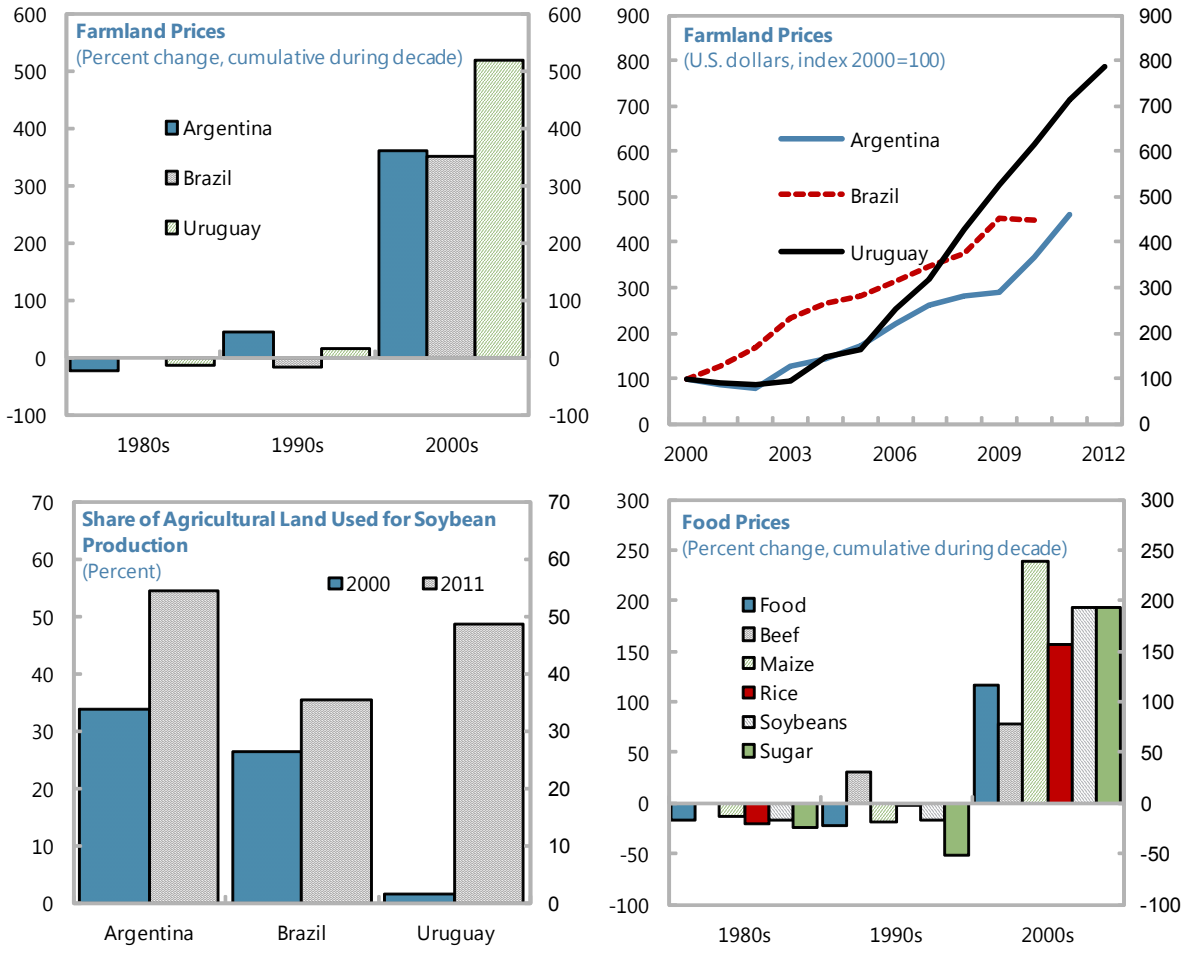
B. Some Stylized Facts

3. Land prices increased almost fourfold on average for the region between 2000 and 2010 (Figure 1). The observed increase in land prices during the last decade has been stronger than any ten year period in the last 30 years; it has also been stronger than in other comparators, e.g. in the United States, where farm land prices roughly doubled over the same period. The boom in land prices materialized against a backdrop of a strong rise in global food prices,

[1] Prepared by Juan F. Yépez.

including for soybeans—an increasingly important export commodity for Uruguay and the region—and an increase in the share of the agricultural land used for soybean production.[2]

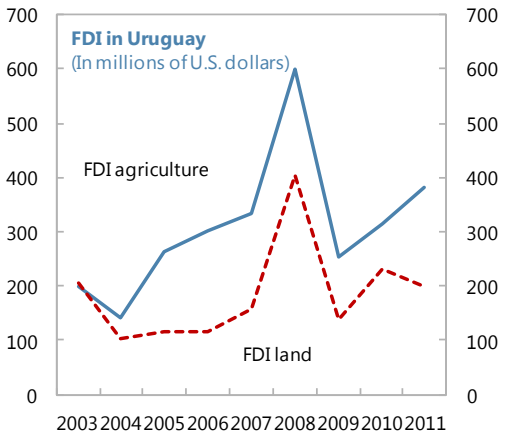
Figure 1. Farmland and Commodity Price Developments



Sources: Ministries of Agriculture for Argentina and Uruguay, Getulio Vargas Foundation for Brazil, FAO and IFS.

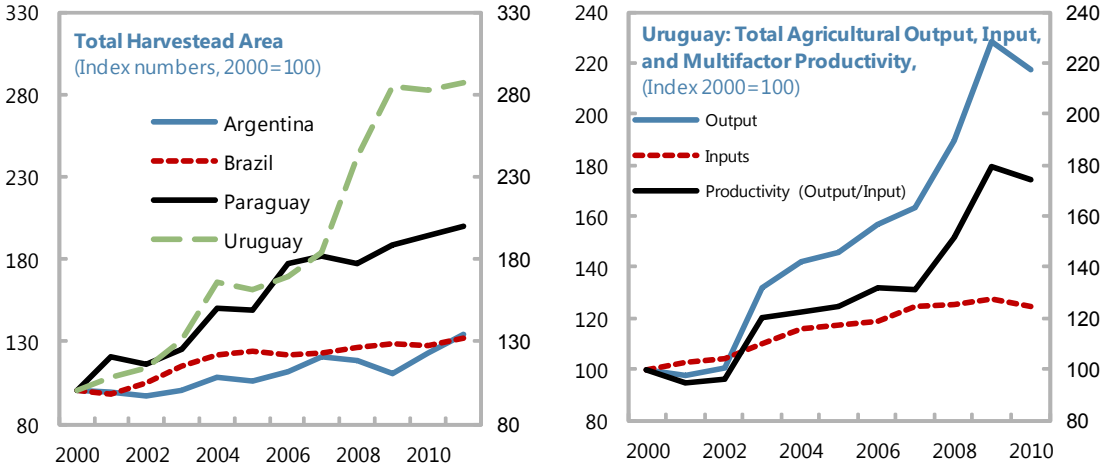
[2] In Uruguay, pulp has also become an important agricultural staple. Paper production has increased eightfold in the last 8 years, and the sector will expand even further when the Montes del Plata pulp mill becomes operational in 2014.

4. Agriculture-related FDI is likely to have played an important role in explaining the observed land price dynamics. In the case of Uruguay, expectations of high investment returns due to rising agricultural commodity prices, accompanied by a stable macroeconomic environment and a favorable investment climate, have supported a substantial inflow of FDI. The agricultural sector was one of the main recipients of FDI during the last decade. Land has been a primary destination of FDI into the agricultural sector, accounting on average for almost sixty percent of agriculture-related FDI.



Source: BCU.

5. Increased foreign participation in the agricultural sector has introduced more sophisticated production technologies, increasing the productivity of the sector. Based on the ratio of total agricultural output (crops) to inputs as a proxy for aggregate agricultural productivity, agricultural productivity in Uruguay has increased by around 80 percent in the last decade (compared to 21 percent in the 1990's).[3] At the same time, there has been a marked increase in the amount of land used for crop production, which has brought down crop specific productivity measures. In the case of Uruguay, the amount of harvested land has increased threefold in the last decade, with a significant reallocation of farmland to the agricultural sector.



Sources: FAO and Bervejillo, Alston, and Tumber (2011).

[3] Partial productivity of main staples (i.e. soybeans, barley, and maze) has not shown the same increasing trend. This is partly reflected by the brisk expansion of land used for crop production to land previously used for livestock production, which is of lower nutrient quality (therefore less productive). This reallocation brings down average productivity for crops, as measured by their yield (kilograms per hectare).

6. The estimated wealth of Uruguayan farms has risen dramatically as a result of soaring agricultural prices. In 2000, total farmland surface was 16.3 million hectares. Assuming a price per hectare of around US$531 (based on MGAP's agricultural statistics), total farmland value in 2000 amounted to about US$8.7 billion. In 2011, the value of farmland value reached US$52 billion (16.2 million hectares with price per hectare of around US$3,196), representing an eightfold increase in estimated wealth (from 28 percent of GDP in 2000 to 112 percent of GDP in 2011).

Uruguay: Farmland Size and Value

	1980	1990	2000	2011
Farmland area (million hectares)	16.0	15.8	16.3	16.2
Price per hectare (U.S. dollars) 1/	535.0	460.0	531.0	3,196.0
Farmland value (U.S. dollars, billion) 1/	8.6	7.3	8.7	51.8
Number of farms	68,362	54,816	57,115	44,890
Average farm value (U.S. dollars) 1/	125,216	132,589	151,542	1,153,379

Sources: MGAP/DIEA, Censos Agropecuarios (1980, 1990, 2000, and 2011).
1/ Calculated using the 2011 constant exchange rate.

C. Food Prices as a Driver of Agricultural Land Prices

7. The drivers of land price dynamics are identified using a structural VAR (SVAR) model. This method allows obtaining dynamic responses of farmland prices to commodity prices shocks as well as quantifying the relative importance land prices as a propagation mechanism and amplifier of macroeconomic fluctuations. The relationship between the variables in this model is assumed to be governed by a system of "structural" equations. Ignoring the constant term, the system can be written as:

$$A_0 y_t = A_1 y_{t-1} + \ldots + A_p y_{t-p} + \varepsilon_t$$

where ε_t is a (k×1) vector of structural shocks that are assumed to be uncorrelated with one another; A_0 is a (k×k) impact matrix that contains the contemporaneous relations among variables, and y_t is a (k×1) vector of variables. The reduced form of the structural model can be written as:

$$y_t = B_1 y_{t-1} + \ldots + B_p y_{t-p} + e_t$$

where $B_p = A_0^{-1} A_p$ and $e_t = A_0^{-1} \varepsilon_t$ for p =1,...,4.

The model can be estimated by ordinary least squares, imposing restrictions on A_0 to identify the coefficients in the structural form. Identification is achieved through a Choleski decomposition of the variance-covariance matrix Σ_e of reduced-form errors, given by e_t.

8. The VAR includes a global index of non-fuel commodity prices, agricultural land prices (in dollars per hectare), lending rates, and real GDP. The VAR is estimated in log-fist-differences with the exception of lending rates, which are estimated in levels. The VAR is first estimated in panel format for Argentina, Brazil, and Uruguay through 1995–2011. Results from country specific VAR estimations are also reported.

9. The recursive nature of the empirical model makes the results sensitive to the ordering of the variables in the system. The selected Choleski ordering is characterized by the idea that the more exogenous variables of the model precede the endogenous ones. Hence, global variables (commodity prices) are included first and domestic variables (land prices, lending rates, and real GDP) are last. This implies that land prices do not respond instantly to changes in lending rates or economic activity, but the latter may be affected by contemporaneous changes in commodity prices.[4]

10. Counterfactual scenarios are constructed to quantify the impact of land prices on the economy as a whole and to test whether they act as amplifiers of global commodity price shocks. Counterfactual impulse response functions (IRFs) to a shock are constructed by holding the impulse responses of land prices fixed at zero at all forecast horizons. This hypothetical impulse response is then compared with the actual response, with the difference capturing the contribution of land prices in propagating commodity price shocks.[5]

D. Empirical Results

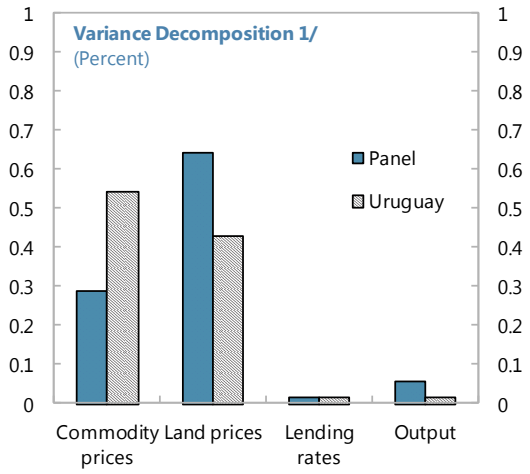
11. Our findings suggest that commodity prices had an important effect on agricultural land prices. In a panel consisting of Argentina, Brazil, and Uruguay (Figure 2), a positive one and a half standard deviation shock to the growth rate of commodity prices (equivalent to a 6 percent q/q increase on impact) increases the growth rate of land prices by almost 7 percentage points eight quarters after the impact (cumulative). Furthermore, the shock to commodity prices eases credit conditions by reducing lending rates, although not significantly. Output responds significantly one quarter after the shock, and has a cumulative growth rate of around 2 percent eight quarters after impact.

12. In Uruguay, a positive one-and-a-half standard deviation shock to the growth rate of commodity prices increases the growth rate of land prices by almost 6 percentage points eight quarters after impact (Figure 3). In contrast to the panel results, the response of lending rates (credit conditions) to the shock to commodity prices is statistically significant. The response of output is slightly smaller than the panel estimation, but it remains economically and statistically significant.

[4] The results are qualitatively robust to different orderings.

[5] The counterfactual scenarios are equivalent to estimate the full SVAR dynamics, but with the coefficient corresponding to land prices in the GDP equation set to zero.

13. Variance decompositions provide additional evidence of the importance of commodity price dynamics in explaining the observed volatility in agricultural land prices. In the panel estimation, commodity prices explain almost thirty percent of the total variation in agricultural land prices during a one year window. When only Uruguayan data is used for the estimation, commodity prices explain around half of the total variation in land prices.



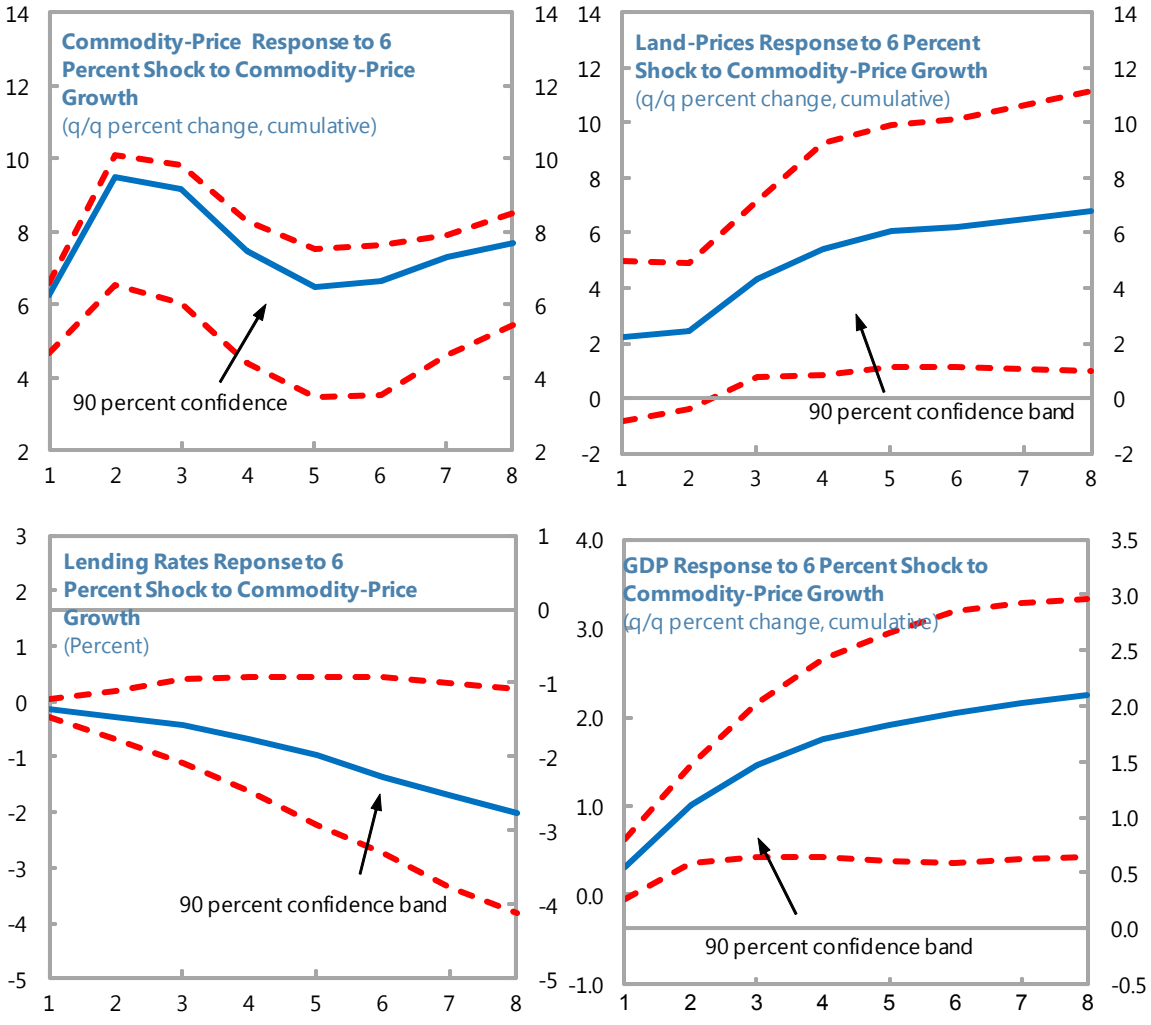
Source: Fund staff calculations.
1/ Average share of the variance of land prices explained by the variation in selected variables (1 year window).

14. Were land prices an important channel through which food commodity prices influenced the aggregate economy? To quantify the impact of land prices on the economy as a whole and to test whether they act as amplifiers of global commodity price shocks, counterfactual scenarios are constructed (Figure 4). By comparing the impulse responses with and without land prices, we observe that land prices do in fact amplify shocks to commodity prices and contribute to a further loosening in lending rates. In the case of Uruguay, land prices account around 30 percent of the increase in the growth rate of GDP eight quarters after impact (compared with 40 percent in the panel estimation).

E. Concluding Remarks

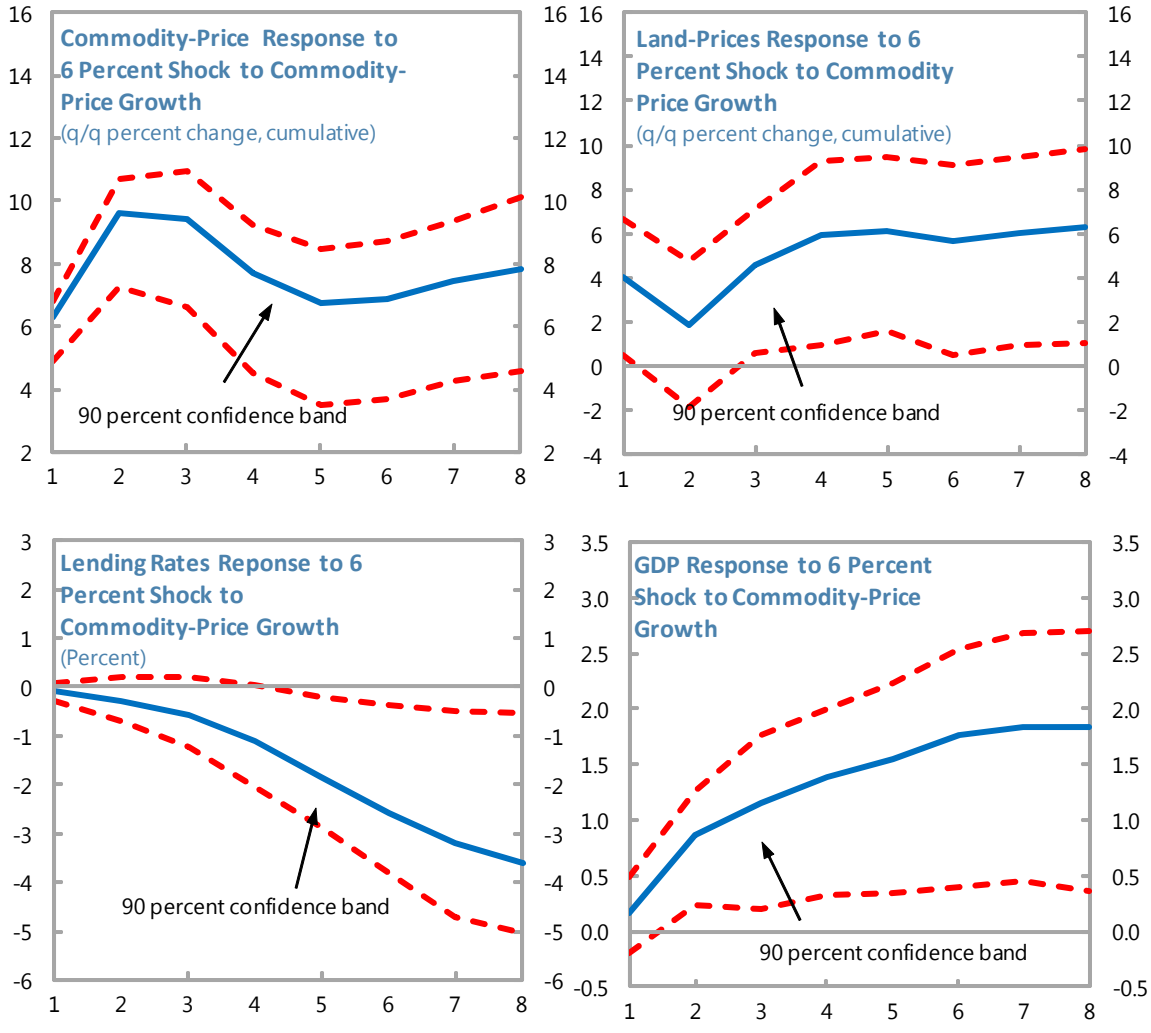
15. The marked increase in farmland prices in the past decade could be explained to an important extent by commodity price dynamics, and land prices, in turn, have played a key role in propagating the commodity price shocks on output. Higher overall productivity in the agriculture sector, supported by strong FDI inflows, is also likely to have been a key driver of the rise in agricultural land prices.

Figure 2. Impulse Responses to Commodity-Price Shocks
(Panel consisting of Argentina, Brazil, and Uruguay)



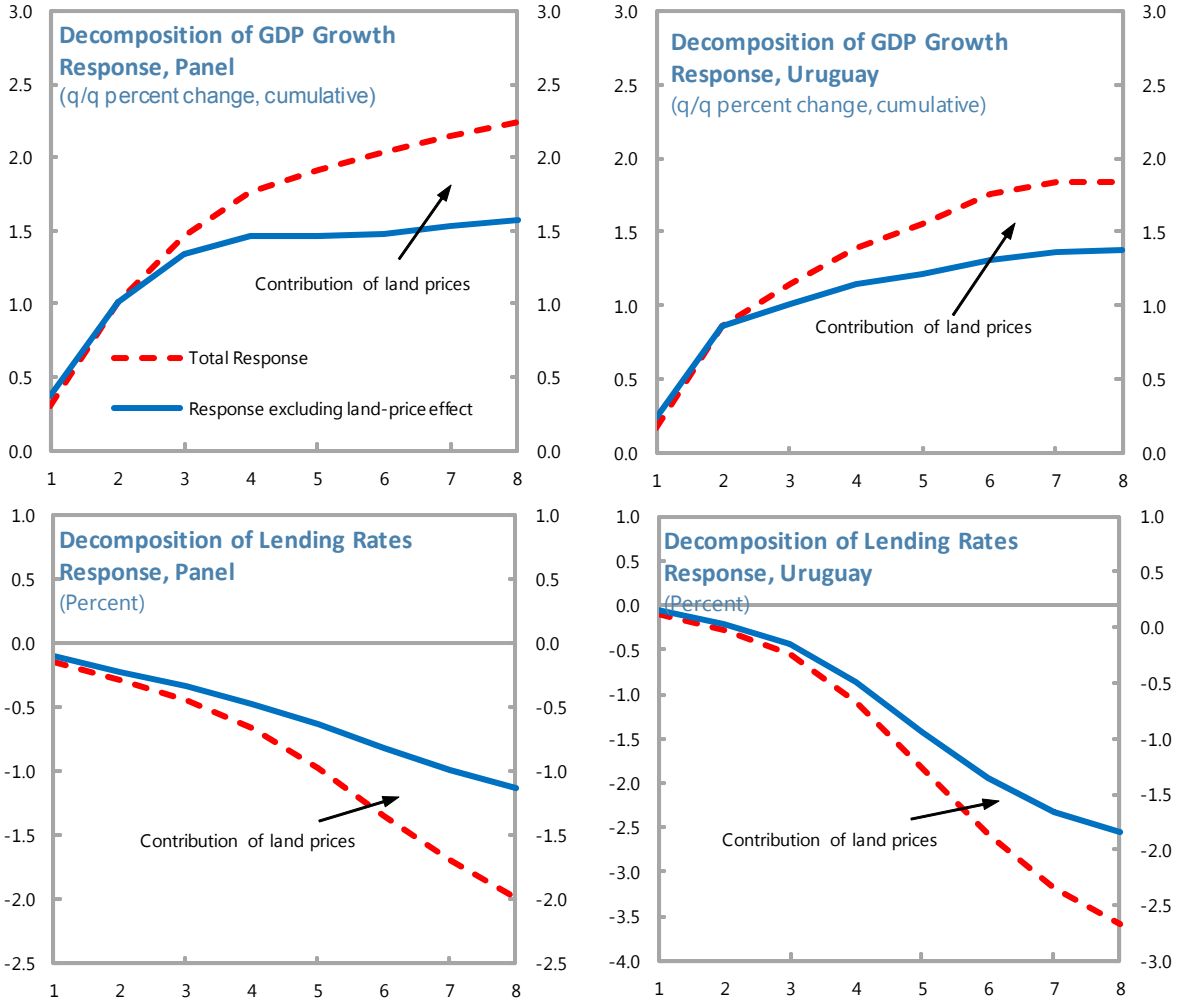
Source: Fund staff estimates.

Figure 3. Impulse Responses to Commodity-Price Shocks
(Uruguay)



Source: Fund staff estimates.

Figure 4. Decomposition of Response to Commodity-Price Shock



Source: Fund staff estimates.

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COMPETITIVENESS TRENDS IN URUGUAY[1]

This Selected Issues Paper examines the performance of Uruguay's exports and external balances over the past decade, and applies IMF's standard external sector assessment tools to Uruguay. Our results indicate that export performance has been strong over the last decade, driven by gains in trade competitiveness. That said, the current account deficit has widened in 2012, while remaining more than financed by FDI. Uruguay's current real effective exchange rate is found to be on the strong side of fundamentals (0–10 percent).

A. Introduction

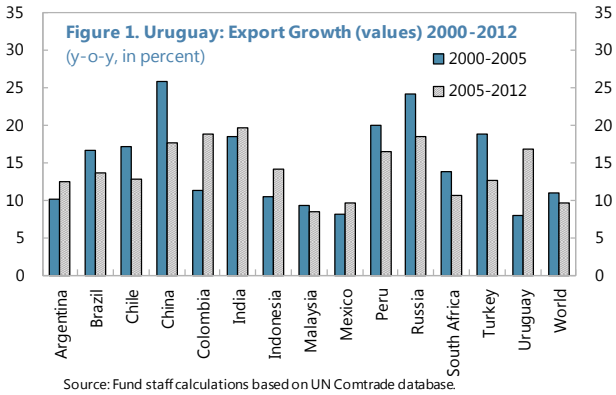
1. This Selected Issues paper examines the performance of Uruguay's exports, external balances and relative price movements over the past decade and applies the IMF's standard external sector assessment tools to Uruguay. Our results indicate that Uruguay has made important strides in export performance, including expanding markets shares, over the past decade driven by 'trade competitiveness' gains. The current account deficit (CAD) has remained well contained and more than fully financed by FDI over the past decade, notwithstanding external shocks. At the same time, the real exchange rate has appreciated strongly in recent years. Standard IMF equilibrium real exchange rate valuation models suggest that the Uruguayan peso is slightly stronger than its equilibrium level (0–10 percent).

2. The paper is organized as follows. Section B contains a summary on the evolution of Uruguay's exports over the past decade using various metrics, including the constant market share measure. An analysis of the current account dynamics is presented in section C. In section D relative price dynamics over the past decade are presented. In section E the IMF's CGER and EBA methods are used to assess whether the real exchange rate and current account are aligned with fundamentals. The paper concludes in section F.

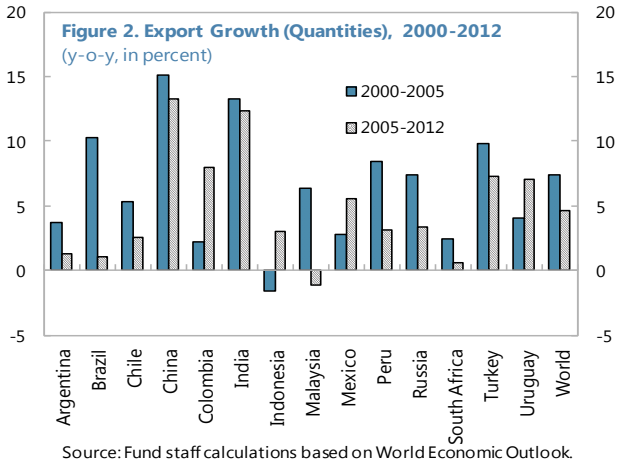
B. Key Trends in Export Performance in the Last Decade

3. During 2000 to 2012, Uruguayan exports grew robustly, both in value and volume terms. In values, exports grew on average by about 16.8 percent per year during 2005–12, higher than world export growth (9.8 percent) and were within striking range of China's and India's export growth (Figure 1). Export growth measured by volume was also robust during the 2005–2012 period (Figure 2).

[1] Prepared by Garth P. Nicholls, with inputs from Natalia Melgar. The author thanks the seminar participants at the Central Bank of Uruguay for their helpful feedback.



Source: Fund staff calculations based on UN Comtrade database.



Source: Fund staff calculations based on World Economic Outlook.

4. As a result, Uruguay has increased its share of world goods exports to 0.06 percent in 2012 from about 0.036 percent in 2000 (Table 1). However, measured from 2003, Uruguay has doubled its market share of global goods exports. Importantly, during 2000 to 2012 Uruguay increased its global goods market share faster than that of its key regional trading partners — Brazil and Argentina.

Table 1. Uruguay: Shares of World Exports
(Percent)

	Share of World Exports		Percent Growth	
	2000	2012	2000-12	2003-12
Argentina	0.41	0.46	10.88	16.24
Brazil	0.93	1.35	45.09	38.23
Chile	0.30	0.44	45.93	53.03
China	3.90	11.48	194.25	96.80
Colombia	0.21	0.34	64.70	98.46
India	0.67	1.66	148.26	103.71
Indonesia	0.97	1.06	9.30	30.85
Malaysia	1.54	1.27	-17.12	-8.81
Mexico	2.60	2.07	-20.61	-5.77
Peru	0.11	0.22	101.03	83.48
Russia	1.61	2.94	82.33	68.07
South Africa	0.48	0.49	3.86	2.29
Turkey	0.43	0.85	96.29	35.74
Uruguay	0.04	0.06	67.02	105.26

Sources: Fund staff calculations based on Direction of Trade Statistics and UN Comtrade databases.

5. Most of the growth in exports since 2005, at a disaggregated level, occurred in existing markets and products (Table 2). About 55.0 percent of export growth between 2005 and 2012 came from net growth of existing products (intensive margins). On the other hand, product diversification in established markets accounted for 34.8 percent of the growth in exports. Meanwhile, only about 6.9 percent of export growth was explained by the introduction of new products in new markets.

Table 2. Uruguay: Export Growth Decomposition, 2002-2012
(Contribution to total export growth, in percent)

Description	2002-05	2005-2012
Intensive Margins	**39.3**	**55**
Increase of existing products in established markets	72.9	99.7
Decrease in existing products in established markets	-23.8	-22.3
Extinction of exports of products in established markets	-9.9	-22.4
Extensive Margins	**60.8**	**45**
Introduction of new products in new markets	0.5	0.1
Introduction of new products in established markets	13.1	3.2
Introduction of existing products in new markets	10.3	6.9
Product diversification in established markets	36.8	34.8

Source: Fund staff calculations based on the World Integrated Trade Solution database.

6. World trade growth, market distribution, and commodity composition do not appear to have been key drivers of the change in exports — suggesting that improved pure 'trade competitiveness gains' played a key role (Table 3). The constant market share (CMS) approach assumes that the demand for exports in a given market from competing sources is a function of relative prices and therefore assumes that export share remain unchanged over time unless the relative price varies. It decomposes aggregate export growth into growth attributed to general increase in world exports, growth attributed to specializing in specific products, growth attributed to exporting to specific markets (which together represent growth that would result if the country had maintained constant market shares), and a residual representing the gain in export value from increasing market shares.[2] Thus, gains in competitiveness reflect an increase in market share by gaining an advantage relative to competitors in world markets. The CMS decomposition of Uruguay's exports indicates that its exports have increased faster than world exports, and that 63 percent of this gain is related to increased competitiveness.

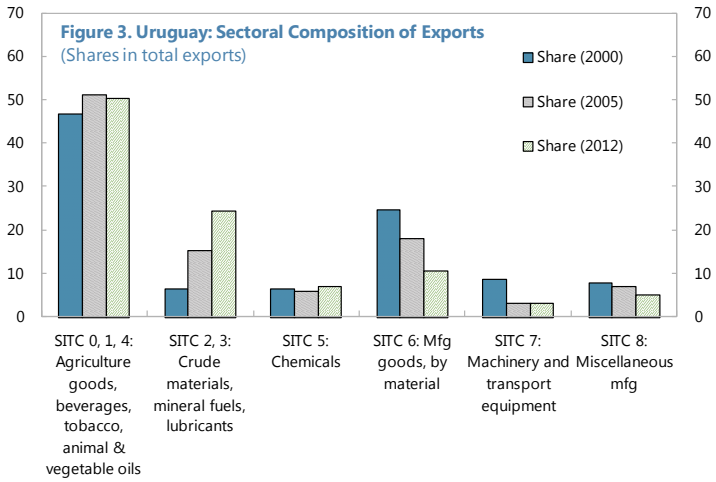
[2] See Appendix I for a description of the CMS approach to measuring trade competitiveness.

Table 3. Uruguay: Constant Market Share Analysis of Export Changes
(in billions of U.S. dollars; unless otherwise indicated)

	1990-2000	2000-2005	2005-2012
Change in Exports	0.6	1.1	5.3
Uruguay exports t	2.3	3.4	8.7
Uruguay exports t-1	1.7	2.3	3.4
Due to:			
World Trade Effect	1.6	1.4	0.3
Commodity Composition Effect	1.8	0.3	0.1
Market Distribution Effect	(3.0)	-1.2	1.5
Residual (Competitiveness)	0.2	0.5	3.4

Source: Fund staff estimates based on UN Comtrade database.

7. At an aggregate level, Uruguay's export growth in this decade was accompanied by a slight shift in the composition of exports to primary goods. Figure 3 decomposes total merchandise exports by standard international trade classification (SITC) at three points in time: 2000, 2005, and 2012. The increase in the relative importance of agricultural products (SITC 0, 4, especially beef and rice), and crude materials (SITC 2,3, especially soybeans), coincided with a shift away from manufacturing goods by material (SITC 6), machinery and transport equipment (SITC7) and miscellaneous manufacturing goods (SITC 8).[3] There were also shifts within some SITC groups, including the decline in textile and the rise of wood and paper (Table 4).



Source: Fund staff estimates based on UN Comtrade database.

[3] The key commodities beef, rice, soybeans, wheat, milk products, fish, citrus, and malt comprise about 30.6 percent of total export earnings on average during 2000–2012. In 2012, these commodities represented about 48 percent of total goods exported.

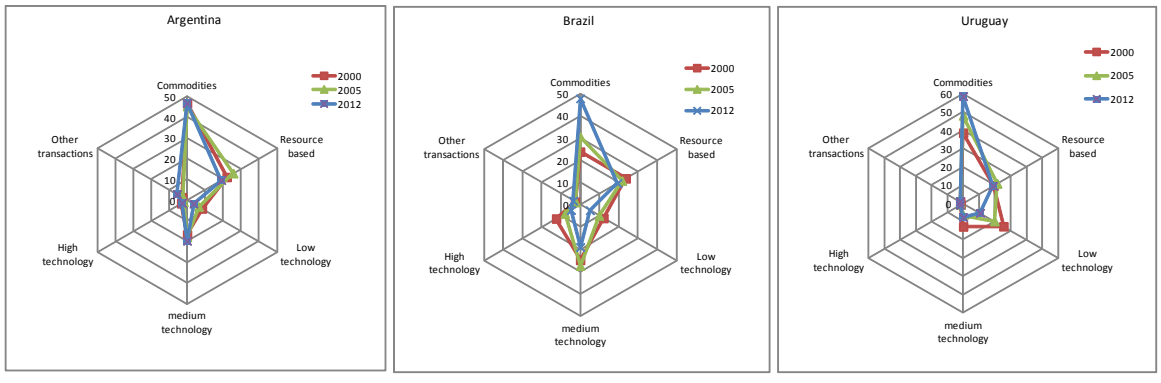
Table 4. Uruguay: Key Exports
(In percent of total export, unless otherwise stated)

	2001-2005	2005-2012
Beef	16.6	19.7
Soybeans	1.7	7.8
Milk and Milk products	6.4	7.5
Wood and Paper	5.7	7.4
Rice	7.3	6.4
Textiles	10.1	5.5
Tanned hides and related products	11.4	5.4
Fish	4.0	2.9
Malt	2.9	2.6
Citrus	2.0	1.3
Wheat and Wheat products	0.2	3.1
Tobacco/Cigars and related products	1.5	0.6
Other exports	30.2	29.8
Memo items:		
Total Goods Exports to GDP	17.6	21.4
Total Services Exports to GDP	6.6	7.2

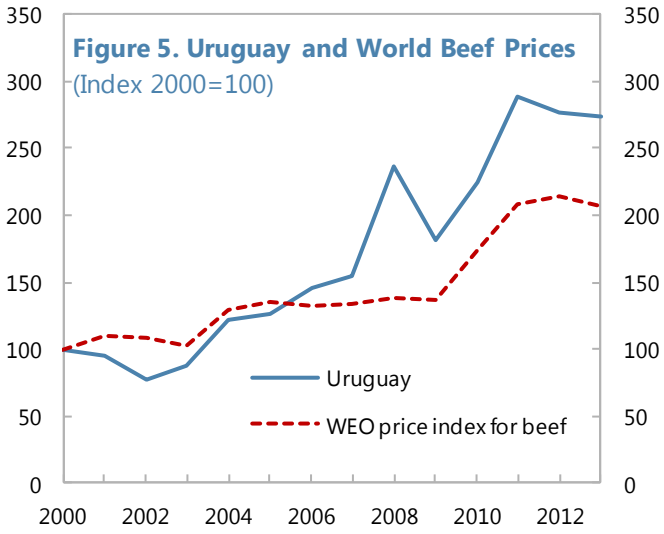
Source: Fund staff estimates based on Uruguay XXI data.

8. The share of commodities in Uruguay's exports has increased over time (Figure 4). This result is common with Uruguay's two important regional trading partners – Brazil and Argentina (based on the Lall (2000) classification scheme). In some of these commodities, however, Uruguay now commands a quality premium, suggesting higher value added. An example is beef exports; quality enhancements have focused on the inputs to the production and logistics in the distribution of beef, such as the introduction of technology to permit traceability of beef exports to production unit. Since 2007, Uruguay's price premium over the world beef prices has averaged about US$107 per ton of beef (Figure 5).

Figure 4. Brazil, Argentina and Uruguay: Export Technological Content, 1990-2012
(in percent of total exports)



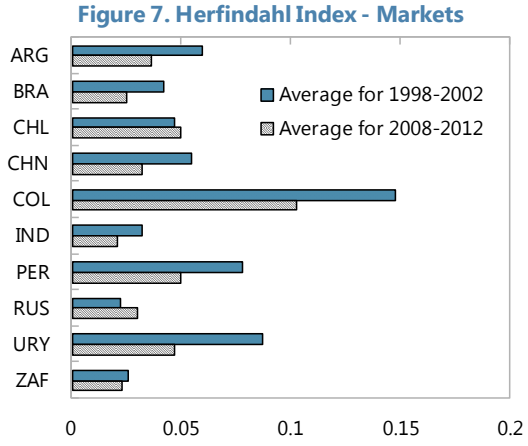
Source: Fund staff calculations based on data from World Integrated Trade Solution.



Sources: Uruguay XXI and World Economic Outlook.

9. At the same time, Uruguay has also diversified, somewhat, its export markets and trading partners. In particular, while Brazil remained the key trading partner during 2000–12, the relative importance of the United States and Argentina has declined, and China, Venezuela, and Russia have become more important destinations for Uruguayan exports (Figures 6 and 7). However, the new markets and trading partners are still small relative to total exports; seven countries still absorbed over half of Uruguay's exports in 2012.

Source: Fund staff calculations based on the Direction of Trade Statistics database.



Source: Fund staff calculations based on the World Integrated Trade Solution database.

C. External Sector Dynamics

10. Despite several shocks, the current account deficit during 2004 to 2011 averaged only 1.8 percent of GDP compared with about 2 percent for 1993 to 2001 (Table 5). The non-oil trade balance had an average surplus of about 3.3 percent of GDP during the period, notwithstanding strong FDI financed capital imports. The oil trade deficit, however, averaged about 5.2 percent of GDP, driven by drought episodes as well as higher oil prices. As a result, the overall trade account was in deficit over the decade to the tune of about 2 percent of GDP. The income account deficit averaged about 3.2 percent of GDP, reflecting interest payments on public sector debt and increased dividend payments on growing FDI. Finally, the services and current transfers account had a surplus of about 3 percent of GDP over the entire period.

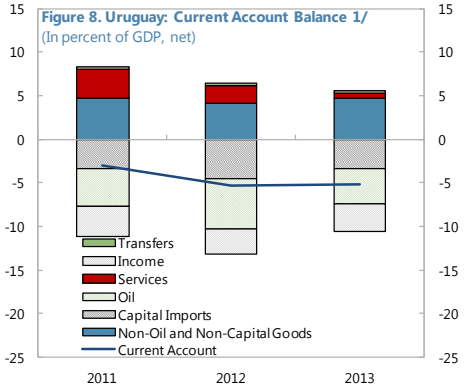
Table 5. Uruguay: Current Account Balance
(In percent of GDP, net)

	Avg. 2004-2011
Current Account	-1.8
Non-Oil Goods	3.3
Oil	-5.2
Services	2.7
Income	-3.2
Transfers	0.6

Source: Fund staff calculations based on Banco Central del Uruguay data.

11. In 2012, the current account deficit widened to 5.4 percent of GDP from about 3 percent in 2011. The drivers of this widening included higher oil imports (40 percent increase in volumes) due to drought conditions and a rise in capital imports boosted by the construction of the Montes del Plata pulp mill (Figure 8). Net service earnings also declined, led by lower net tourism revenues, reflecting lower revenues from Argentine visitors and increased overseas spending by Uruguayans. At the same time, industrial exports weakened in the second half of 2012, reflecting weak demand from Argentina, Brazil, and Europe.

Figure 8. Uruguay: Current Account Balance 1/
(In percent of GDP, net)



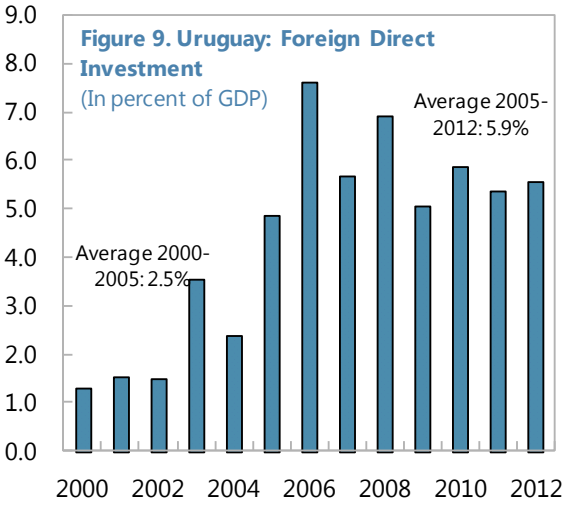
Source: Fund staff estimates based on Banco Central del Uruguay data.
1/ Data for 2013 represents the 4-quarter rolling balance through 2013Q2.

12. Since the second quarter of 2013, imports and exports of goods have been normalizing, reducing the current account deficit, albeit, slightly. Oil imports have dropped by about 40 percent in the first 7 months of 2013 compared with the same period in 2012—largely reversing the sharp increase in 2012. Goods exports have been lifted by strong commodity exports—e.g., soybean exports have risen by about 34 percent in the first 8 months of 2013. The net services balance, however, has continued to weaken, mostly owing to still weak tourism revenues and increased spending abroad by Uruguayans, likely to recover only gradually in line with the outlook for demand from Argentina.

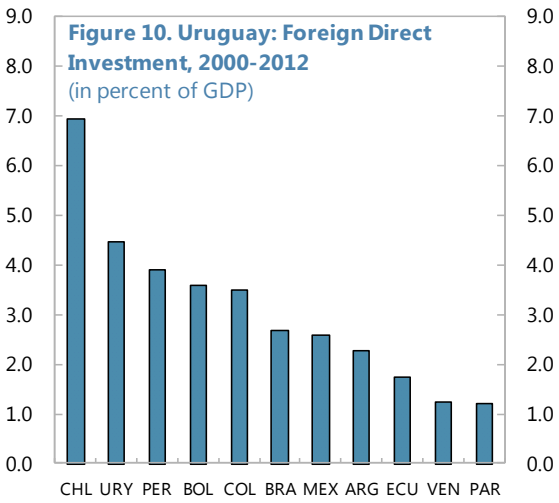
13. Over the medium term, the current account deficit is projected to narrow to about 3.5 percent of GDP by 2018 under the baseline scenario. In particular, the oil import bill should decline as the energy mix is diversified to renewable energy and oil prices decrease with new global supply capacity coming on stream. In addition, goods exports are poised to rise (by

about 1.5 percent of GDP) and imports will decline from their 2012 levels owing to the completion of the Montes del Plata pulp mill. The net tourism balance is set to recover gradually in line with the outlook for external demand, but downside risks remain. [4]

14. Since 2004, current account deficits were more than financed by increasing amounts of FDI (Figure 9). During 2005 to 2012, FDI into Uruguay as a share of GDP was second only to Chile in Latin America (Figure 10). Since 2002, FDI has flowed to agriculture, utilities and other services, in contrast to financial, hotel and restaurants, construction and manufacturing sectors as obtained prior to 2002 (see the 2012 Selected Issues Paper *FDI in Uruguay: Recent Trends and Developments*, IMF Country Report No. 13/109).



Sources: BCU and Fund staff calculations.

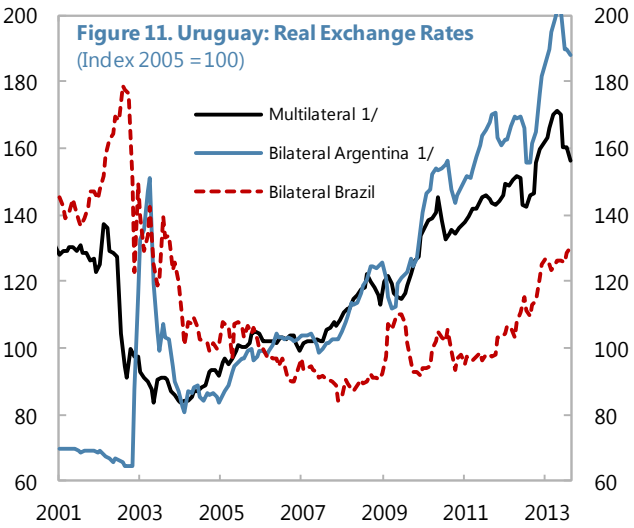


Source: World Economic Outlook.

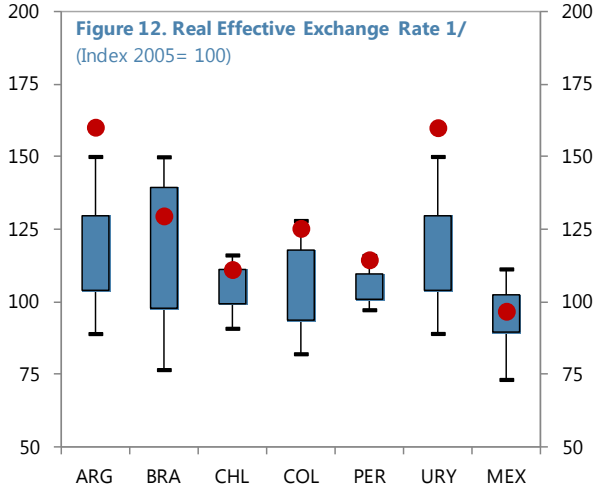
[4] Once production commences at the Montes del Plata Pulp Mill, export revenues are expected to go up by about US$730 million per year.

D. Relative Price Dynamics

15. The exchange rate appreciated steadily in real terms over the last decade (Figure 11). During the 2002–03 crisis, the Uruguayan peso depreciated by about 31 percent in real terms (and 109 percent against the U.S. dollar in nominal terms). The Uruguayan peso rose in real terms by about 70 percent from 2003 through end-2011. The appreciation accelerated in 2012,



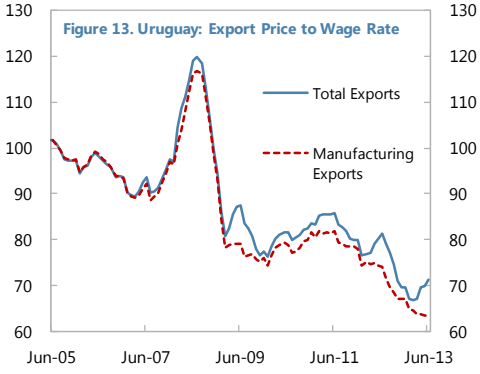
Source: Fund staff calculations.
1/ The real exchange rate against Argentina is calculated using the unofficial CPI for Argentina and the average of the unofficial and official exchange rates for the Argentine peso.



Source: Fund staff calculations.
1/ Shows 95th and 5th percentile for the period from January 1993 to July 2013. Gray box covers range between 25th and 75th percentile of REER. Dots are latest observation (Jul-13).

as portfolio capital inflows surged while FDI held steady at a high level. The capital inflows strengthened the Uruguayan peso against the U.S. dollar at a time when Argentina and Brazil depreciated against the U.S. dollar. As a result, the appreciation of the real exchange rate was particularly sharp against the Brazilian real and the Argentine peso (about 26 percent and 19 percent respectively between end-2011 and May 2013). Moreover, even though some of the appreciation of 2012 has been reversed since May 2013, the Uruguayan peso is above its average (Figure 12). This observation on its own may suggest an overvaluation of the Uruguayan peso. However, as we shall discuss below much of the appreciation since 2002 is related to movements in fundamentals.

16. At the same time, wages have risen faster than export prices (Figure 13). Since 2005 wages have risen by about 12 percent per year, while export prices increased by about 4 percent. In the last two years, wages rose by about 13 percent per year in Uruguay, while export prices increased by about 9 percent per year. This development has contributed to a fall in export sector profitability, especially for the manufacturing sector.



Sources: Haver and Fund staff calculations.

E. Real Exchange Rate Assessment

17. Against this background, we examine the valuation of the Uruguayan peso relative to its equilibrium level. This section uses the IMF's standard IMF approaches—that is, the CGER methodologies (Lee, et al, 2008) and the EBA (2011) current account approach—for assessing the current account and the real exchange rate. The range of results indicates that the Uruguayan peso is slightly above its equilibrium level, in the range of zero to ten percent (Table 6). The results of each of these approaches are discussed in turn.

Table 6. Uruguay: Current Account and Exchange Rate Assessments

	Current Account Balance 1/		REER: Percent Deviation from Equilibrium 2/	
	Norm	Projection		
I. Macroeconomic Balance (MB) approach	-4.2	-3.4	-1.3	1/
II. External Sustainability (ES) approach	-1.3	-3.4	3.3	1/
III. Equilibrium Real Exchange Rate (ERER) approach 3/	...	...	8.8	
IV. EBA (2012) 4/	-2.8	-4.9	3.2	1/
Memo:				
Big Mac Index 5/			9.3	

Source: Fund Staff calculations.

1/ The exchange rate gap is derived as the difference between the CAD norm and the CAD forecast divided by the assumed elasticity of the current account with respect to the real exchange rate (-0.640).

2/ Positive values indicate that the real exchange rate is stronger than the level implied by the model.

3/ Considers the REER as of June 2013.

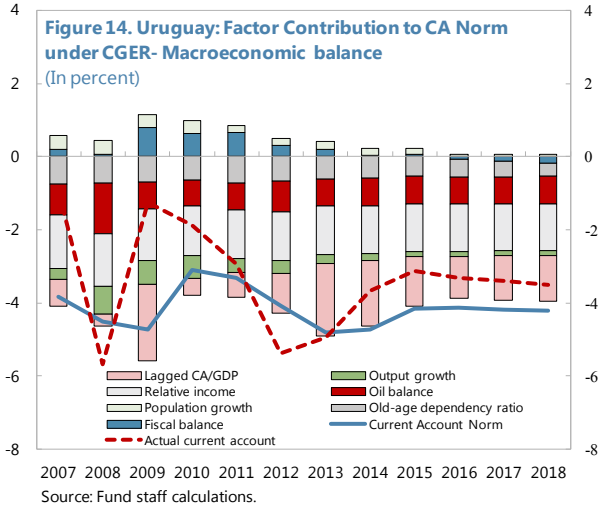
4/ Considers the average REER as of 2013Q2.

5/ June 2013.

Macroeconomic Balance Approach

18. The Macroeconomic Balance (MB) Approach suggests that the Uruguayan peso is broadly aligned with its equilibrium level (Table 6). This result is based on the difference between the underlying medium-term CAD forecast (3.4 percent of GDP) and a predicted CAD norm (4 percent of GDP). The underlying CAD is the CAD projected for 2018. The MB current account norm is derived using the coefficients of a model estimated for a large panel of countries, applied to Uruguayan data. The model suggests that from the macroeconomic balance perspective, relative income, the lagged current account, old age dependency are the key factors in Uruguay's current account norm (Figure 14). The size of the exchange rate gap was derived by dividing the

Figure 14. Uruguay: Factor Contribution to CA Norm under CGER- Macroeconomic balance
(In percent)



Source: Fund staff calculations.

difference between the underlying CAD and the calibrated CAD norm with the assumed elasticity of the CAD to changes in the exchange rate (-0.64).

The External Balance Assessment Approach

19. The External Balance Assessment (EBA) approach suggests that the Uruguayan peso is 3.3 percent above its equilibrium level. The EBA approach, in contrast to the MB Approach, focuses on the current CAD and seeks to strip out the influence of cyclical factors and also to estimate the impact of policy gaps—gaps between desired and actual policies—on the current account. In the EBA method, five policy areas are contemplated: fiscal policy, social protection, capital controls, reserves accumulation, financial and monetary policies. [5]

Table 7. Uruguay: EBA Estimate of the Current Account Gap
(In percent of GDP)

	2012
A. Actual current account (CA)	-5.4
B. Cyclical contributions	-0.5
C. Cyclically-adjusted CA (A-B)	-4.9
D. Cyclically-adjusted CA norm implied by fundamentals and desired policies (P*)	-2.8
E. Total Gap (including residual) (C-D)	-2.1
Contributions of identified policy gaps	0.6
Unexplained residual	-2.7

Source: Fund staff estimates.

Table 8. Uruguay: EBA Policy Gap Contributions
(In percent of GDP)

	Total	Domestic
Fiscal balance	0.7	-0.3
Health expenditure	0.1	0.2
Change in reserves	0.0	0.0
Credit	0.1	0.0
Capital controls	-0.2	0.0
Total contributions of identified policy gaps	0.6	-0.1

Source: Fund staff estimates based on IMF (2013).

20. The CAD norm compatible with fundamentals and desired policies is estimated to be about 2.8 percent of GDP in 2012 (Table 7). This is within the 95 percentile of the current account norms for countries in the EBA sample. The CAD for 2012 of 5.4 percent of GDP corresponds to a cyclically adjusted CAD of 4.9 percent of GDP, implying a total CAD gap of 2.1 percent of GDP (Table 7). Using the assumed elasticity (-0.64) the real exchange rate is found to be about 3.3 percent above its model-predicted value.

21. The gap of -2.1 percent of GDP between the actual cyclically-adjusted current account and the current account norm can be explained by the policy gaps and the regression residual. The total policy gaps as a whole were positive, 0.6 percent of GDP (Table 8). That is, Uruguay's policy settings relative to the rest of the world were contributing to a lower deficit—while domestic policies, in particular fiscal policy—were more expansionary than their

[5] The EBA method calculates norms for the current account and the real exchange rate. In the case of Uruguay, EBA estimates have been done only for the current account as data deficiencies prevent the application of the real exchange rate method.

desired level, the overall policy stance in aggregate was less expansionary than that of the rest of the world, implying a positive contribution from the policy gaps. The regression residual was, however, going in the other direction offsetting the effect of the total policy gap. For Uruguay, the negative regression residual (2.7 percent of GDP) in 2012 likely captures the effect of idiosyncratic factors; above trend oil imports due to the drought and the slump in net tourism revenues, largely owing to low demand from Argentina related to currency restrictions.

External Sustainability Approach

22. The external sustainability (ES) approach suggests that the real equilibrium exchange rate of the Uruguayan peso is about 3.3 percent above its equilibrium value. The ES approach involves estimating the adjustment in the REER needed to stabilize Uruguay's NFA to GDP ratio at its 2012 level. The estimation consists of three steps. The first step determines the current account that stabilizes the NFA position at 2012 level:

$$CA^s = \frac{g_t + \pi_t}{1 + g_t + \pi_t} b^s$$

Where $CA^s$is the NFA stabilizing current account/GDP; g is real GDP growth rate (3.9 percent in 2018); π is the U.S. GDP inflation rate (2.2 percent in 2018); and b^s is the target NFA/GDP (23 percent of GDP). The estimated CAD that stabilizes NFA at 2012 level is 1.3 percent of GDP (Table 9). The second step is to compare this NFA stabilizing current balance (ES norm) with the level of Uruguay's underlying CAD (UCAD, 3.4 percent of GDP).[6]

$$\frac{UCAD - CA^s}{elasticity} = Exchange\ rate\ valuation$$

The third step is to assess the exchange rate gap associated with the gap between the underlying current account balance and the NFA stabilizing current account using the assumed elasticity of the current account with respect to the real exchange rate (Table 9).

[6] The underlying CAD is the CAD projected for the medium term (i.e. for 2018, 3.4 percent of GDP).

Table 9. Uruguay: External Stability Approach

External Stability approach (baseline calibration)	NFA/GDP 1/	IIP 2/
Benchmark NFA level (NFA/GDP) 2012 Projection	-23.0	-15.2
U.S. Inflation in 2018	2.2	2.2
Real GDP growth in 2018	3.9	3.9
Current account, stabilizing NFA at benchmark level (CA/GDP)	-1.3	-0.9
Underlying Current Account (2018)	-3.4	-3.4
CA-REER Elasticity	-0.6	-0.6
Exchange rate misalignment	3.3	4.0

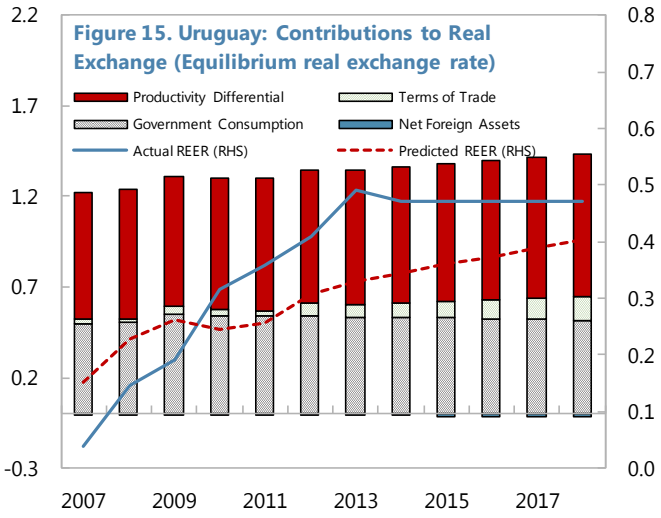
Source: Fund staff calculations.

1/ End 2012 NFA/GDP was constructed by adding the CADs to the net foreign assets from Lane and Milessi-Ferretti (2007), External Wealth of Nations, Mark II database - updated to 2010.

2/ International Investment Position.

Reduced-Form Equilibrium Real Exchange Rate Approach

23. The CGER's reduced form Equilibrium Real Exchange Rate (ERER) Approach suggests that the Uruguayan peso is about 8.8 percent above its equilibrium value. The ERER is estimated based on a large panel of countries (Lee et. al (2008). The estimated coefficients are used to fit an equilibrium real effective exchange rate (REER) path for Uruguay. The equilibrium REER is then compared with the actual REER. The reduced form equilibrium approach suggests that the key factors driving the equilibrium real exchange rate in Uruguay were productivity differentials, government consumption and the terms of trade (Figure 15).



Source: Fund staff calculations.

F. Conclusion

24. Uruguay has made important strides in export performance over the past decade. Exports have grown robustly, markets have expanded, quality has improved, and Uruguay is receiving a price premium over world prices for some products such as beef. At the same time, exports have become more concentrated on commodities as Uruguay expanded exports in line with its comparative advantage. In line with this, the strong export performance characterized by increased global market share has been facilitated by pure 'trade competitiveness'.

25. The real effective exchange rate has appreciated strongly in the past decade. The appreciation since end-2011 has been particularly strong against Uruguay's key regional trading partners of Brazil and Argentina. At the same time wages have risen faster than export prices in Uruguay, putting strain on the export profitability of enterprises, particularly in the manufacturing sector.

26. The IMF's standard exchange rate assessment models suggest that the Uruguayan peso is slightly above its equilibrium level. In particular, the equilibrium exchange rate (ERER), external stability (ES) and external balance (EBA) approaches suggest that the Uruguayan peso is on the strong side of fundamentals, by 0–10 percent.

Appendix I. Constant Market Share Analysis

1. Constant market share analysis (CMS) is a method for assessing export competitiveness. This approach was first applied to international trade by Tyszynski (1951). The main elements of the CMS approach can be expressed by equation (A1). The analysis is done on a value basis as quantities are not consistently available.

$$X^i - X^0 = r\sum_i X_i^0 + \sum_i (r_i - r)X_t^0 + \sum_i \sum_j (r_{ij} - r_i)X_{ij}^0 + \sum_i \sum_j (X_{ij}^i - X_{ij}^0 - r_{ij} X_{ij}^0) \quad \text{(A.1)}$$

where $X^t = \sum_i \sum_j X_{ij}^t = \sum_i X_{ij}^t$, t=1,0

X_{ij}^t = the value of Uruguayan export of commodity i to market j at time t,
r = the rate of growth of world exports,
ri = the rate of growth of world exports of commodity i,
rij = the rate of growth of world exports of commodity i in market j.

2. Equation (A.1) shows that the change in Uruguay's export share can be decomposed into four effects:

- The global market growth effect (first term) gives the part of export growth that is due to the expansion of the overall world trade. This effect shows the potential growth of Uruguayan exports when its share in the world export market is kept constant.

- The commodity composition effect (second term) represents the weighted sum of exports of different commodities. The weights are the deviations of the growth rate of individual commodity exports from the growth rate of the aggregate world exports.

- The market distribution effect (third term) measures the change in exports due to market distribution. This effect would be positive if Uruguay exports had gone to countries where demand growth was faster than the global average.

- The competitiveness effect (fourth term) represents the residual after account has been taken of the other three effects—it is used as a measure of export competitiveness.

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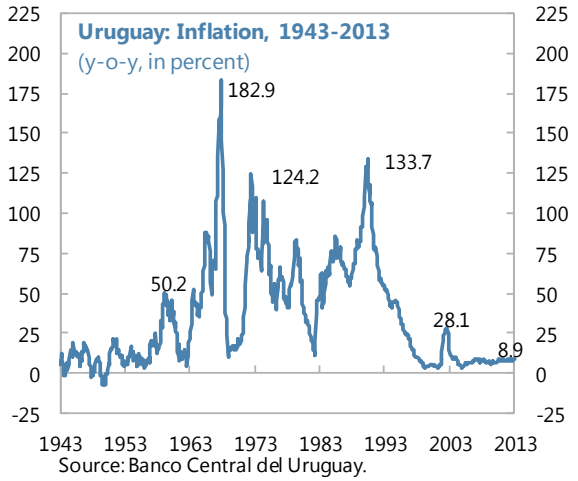
FISCAL POLICY AND INFLATION IN URUGUAY: EXPLORING THE NEXUS[1]

This chapter examines the empirical relationship between fiscal policy and inflation in Uruguay. The findings suggest that fiscal policy has a measurable influence on inflation. Thus, a tighter fiscal policy stance could contribute to the goal of bringing inflation toward the mid-point of the authorities' inflation target.

A. Motivation

1. While Uruguay has succeeded in reducing inflation to single digits after decades of high inflation, bringing it into the central bank's target range of 4–6 percent has proven to be a challenge. After experiencing double digit inflation between the 1960s and early 1990s, inflation was gradually reduced to single digits in the 1990s. Although inflation rose to almost 30 percent following the 2002–03 currency crisis, it was down to single digits again by 2004, and has remained in that range since then (7.4 percent on average between January 2004–August 2013), marking the longest period of single digit inflation in recorded history. However, inflation and its expectations have persistently exceeded the ceiling of the target band and have shown a moderate but persistent upward trend since 2010.

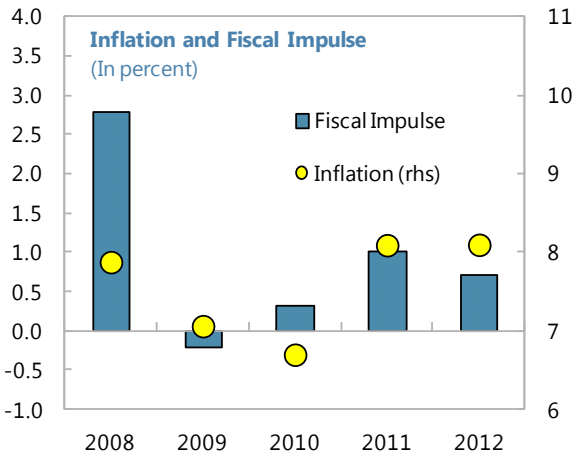


Source: Banco Central del Uruguay.

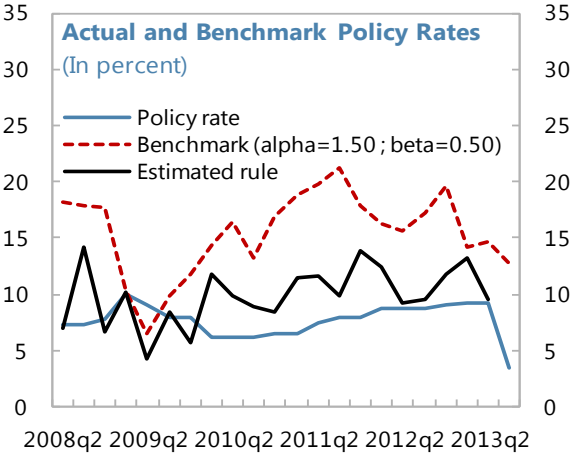
2. Some analysts have argued that fiscal policy has been a significant driver of inflation, but little empirical evidence has been brought to bear on the subject. Although Uruguay's overall public sector consistently ran a primary surplus between 2003 and 2011 (2.7 percent of GDP on average), and seen its gross debt sharply decline as a share of GDP (see Annex Figures 1 and 2), the primary balance declined significantly in 2008—the year of the global financial crisis—followed by another decline in 2012. Against this backdrop, inflation increased in 2011 (and a further acceleration was offset by lower administrative prices and agreements with supermarkets to cut/freeze prices in late 2012). At the same time, monetary policy was tightened in the second half of 2012, but according to staff estimates remained on the accommodative

[1] Prepared by Camilo E. Tovar. This Selected Paper has benefited from useful discussions with Oya Celasun, Ulric Erickson von Allmen, and Francisco Arizala. Francisco Arizala provided assistance in early stages of the project. The author thanks the seminar participants at the Central Bank of Uruguay for their comments and suggestions.

side, with the central bank facing a trade-off between lowering inflation and containing nominal appreciation pressures.



Sources: Ministerio de Economia y Finanzas and Instituto Nacional de Estadistica. Fund staff calculations.



Source: Fund staff estimates.
Note: See details in Selected issues Paper "Why are Inflation and Inflation Expectations above target in Uruguay?", IMF Country Report No. 13/109. Sample estimates until 2013q2.

3. This chapter examines the extent to which fiscal policy may have contributed to inflation dynamics in Uruguay. Section B discusses a simple framework for estimating the influence of fiscal policy on inflation. Section D discusses the results. Section E extends the methodology to consider the effect of *large* fiscal shocks on inflation, and Section E briefly discusses the impact of fiscal policy on inflation expectations. Section F concludes.

B. Uncovering the Effect of Fiscal Policy on Inflation

4. We estimate a Philips curve type of equation augmented by measures of fiscal policy. Most of the recent studies on Uruguay's inflation have estimated some variant of the Phillips curve without explicitly considering the role of fiscal policy (Tovar, 2013; Gelos and Rossi, 2008; IMF, 2007).[2] To uncover the effects of fiscal policy on inflation we first estimate a generalized Phillips curve of the following form (see Stock and Watson, 1999, or De Gregorio and others, 2007):

$$\pi_{t+k}^{k} = \alpha + \sum_{i=1}^{l} \beta_i \, \pi_{t-i}^{*k} + \sum_{j=0}^{m} \gamma_j EA_{t-j} + \varepsilon_t$$

[2] According to several cross-country studies (Gelos and Rossi, 2008; Celasun et. al., 2004) a one percentage point improvement in the primary balance-to-GDP ratio reduces expected inflation by 0.5 percentage point.

where π_{t+k}^{k} stands for the annualized quarter-over-quarter log difference of the consumer price index; π_{t}^{*k} for an underlying measure of inflation also measured as the quarter-over-quarter log difference of a relevant underlying consumer price index (i.e. core inflation); EA_{t-j} is a measure of demand and cost pressures. The analysis in this paper focuses on fiscal policy as a driver of aggregate demand and cost pressures (measured as the primary deficit of the central government scaled by GDP)[3]. This proxy has the benefit of being easily measurable (e.g. compared to the cyclically-adjusted balance which is subject to uncertainty associated with the size of the output gap) and being more directly under the control of the government in the short run than e.g. the primary balance of the overall public sector. Finally, β_i and γ_i are regression coefficients; α the regression constant; and, ε_t the regression error. In this specification, the contemporaneous impact of an increase in the primary balance of the central government on inflation is given by γ_0, while the impact over j periods is given by:

$$\frac{\gamma_j}{1-\sum_{i=1}^{j}\beta_i}.$$

5. We use quarterly data to quantify the impact of fiscal policy on inflation. The sample period is 1999Q1–2012Q4. However, since the 2002–03 crisis had a large effect on the economy, including inflation and fiscal variables, we mainly focus on estimates for the period 2004Q1–2012Q4. Data is obtained from national sources. Output and headline CPI measures are obtained from the National Statistical Office (INE), while the underlying core inflation measure is obtained from the Central Bank of Uruguay (BCU). Central government fiscal figures are obtained from the Finance Ministry (MEF). Finally, other variables such as the exchange rate and the interest rate are obtained from the BCU. A statistical summary of the variables employed is reported in Annex Table 1.

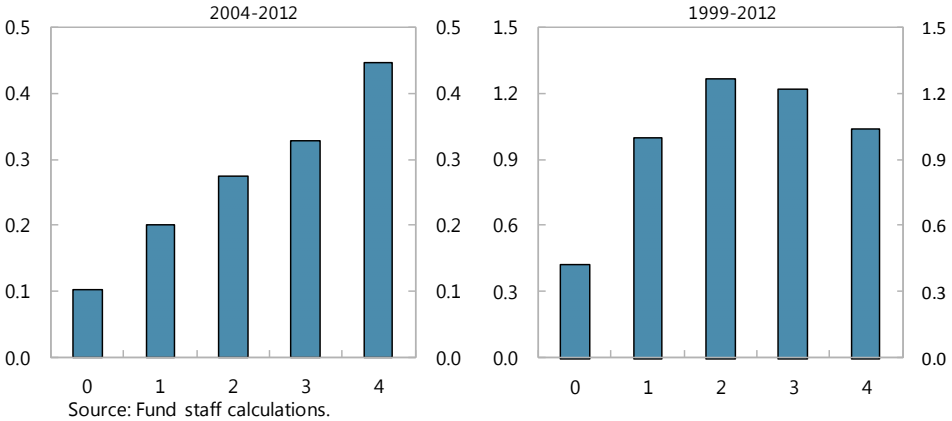
C. How Large is the Impact of Fiscal Policy on Inflation?

6. The estimates suggest the average cumulative effect of a 1 percentage point of GDP increase in the central government primary balance on inflation to be 0.45 percent after four quarters. This pass through implies that since 2009, the central government primary balance has contributed on average with 0.2 percentage points every quarter to annualized headline inflation.[4]

[3] The primary balance of the central government is chosen as a proxy for fiscal policy rather than a measure that includes the balance of state enterprises, since the latter may have a positive correlation with inflation by construction—a rise in utility tariffs, which are part of the consumer price index, tend to improve the balances of state owned enterprises. Moreover, state owned enterprise balances are subject to a number of volatile exogenous shocks (such as oil prices and weather events). The balances of the BCU and interest payments are not under the control of the central government and are therefore not included in the analysis.

[4] The average change in the primary central government deficit since 2009 was 0.4 percent of GDP, which multiplied by the estimated coefficient results in an estimated impact of 0.2 percent on average per year.

Pass-through of Fiscal Impulse to Headline Inflation
(Cumulative, in percent)

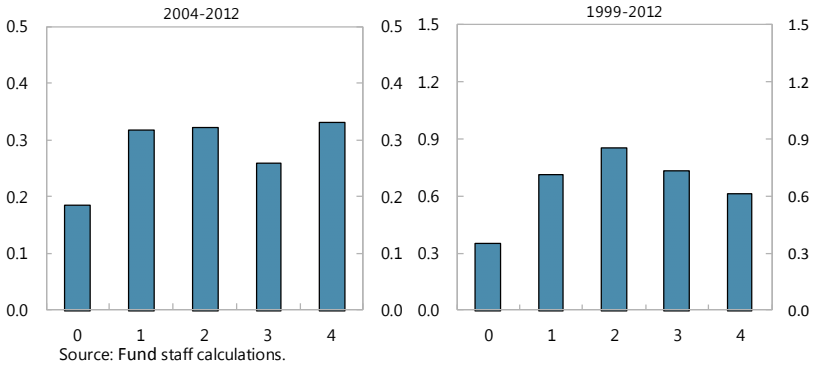


Source: Fund staff calculations.
Note: Horizontal axis reports the periods in quarters.

7. The impact of fiscal policy on inflation appears to have changed over time. If we take the full sample (i.e. the data starting in 1999) the impact of fiscal policy on inflation is estimated to be larger, with a 1 percentage point increase in the central government primary balance adding 1.3 percentage points to inflation, and peaks at two quarters.

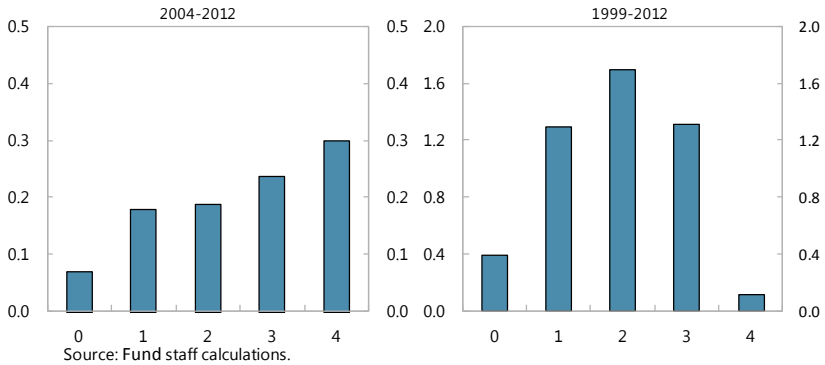
8. We check the robustness of our results along three lines. First, we examine the sensitivity of our results to this choice of lagged inflation by replacing core inflation with headline. Second, we add a quarterly output gap measure (constructed using a Hodrick-Prescott filter). Finally, we estimate the impact of fiscal policy after controlling for the output gap and the change in the nominal exchange rate. Results are reported in the figures below. The estimated pass through after four quarters is fairly stable, ranging between 0.30 and 0.41 for the 2004–2012 sample. However, the model appears to be less robust when using the full sample (i.e. 1999–2012). This confirms the importance of splitting the sample when drawing conclusions about the impact of fiscal policy on inflation.

Robustness Analysis— Replacing Core for Headline Inflation: Pass-through of Fiscal Impulse to Headline Inflation
(Cumulative, in percent)



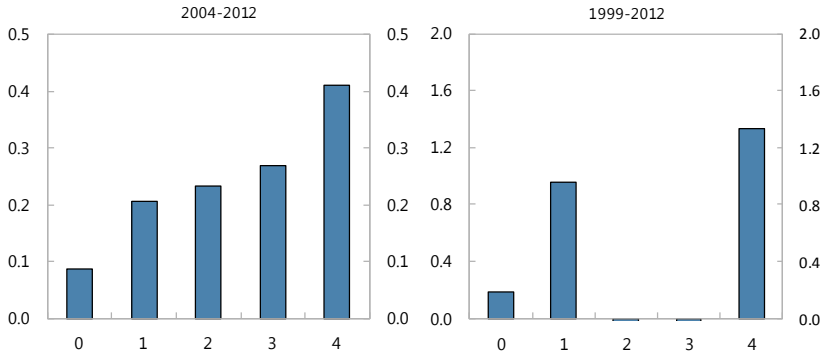
Source: Fund staff calculations.
Note: Horizontal axis reports the periods in quarters.

Robustness Analysis — Including the Output Gap: Pass-through of Fiscal Impulse to Headline Inflation
(Cumulative, in percent)



Source: Fund staff calculations.
Note: Horizontal axis reports the periods in quarters.

Robustness Analysis — Including the Output Gap and Exchange Rate: Pass-through of Fiscal Impulse to Headline Inflation
(Cumulative, in percent)



Source: Fund staff calculations.
Note: Horizontal axis reports the periods in quarters.

D. Does Inflation Respond to Large Spending Fiscal Shocks?

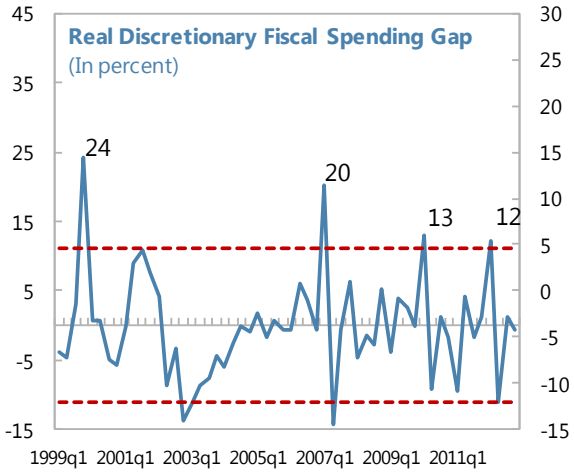
9. The previous analysis is complemented with an alternative one aimed at answering whether headline inflation responds to *large* fiscal spending shocks. Large *discretionary fiscal spending policy shocks* are identified as those episodes in which real central government discretionary fiscal spending (wage plus non-wage spending excluding transfers and pension payments) exceeds a threshold value relative to its underlying trend. Specifically, the threshold is set at 1.5 times the standard deviation of the real spending gap. The latter is estimated as the percent deviation of real spending from a Hodrick-Prescott filter trend.[5] The identified episodes are used to construct a dummy variable D_t , which is then employed as an exogenous variable to

[5] The smoothing parameter $\lambda = 1600$ is chosen following Ravn and Uhlig (2002).

obtain the dynamic multiplier (i.e. impulse responses of the exogenous dummy) of a real fiscal spending shock on inflation. Formally, we model inflation in a similar fashion as before. That is:

$$\pi_t^k = \alpha + \sum_{h=1}^{p} \beta_i \, \pi_{t-h}^k + \sum_{j=0}^{m} \gamma_j \, EA_{t-j} + \sum_{i=1}^{l} \beta_i \, \pi_{t-i}^{*k} + \sum_{k=0}^{m} \theta_j \, D_{t-k} + \varepsilon_t$$

In this specification, since the impact of fiscal policy is captured with a dummy only, we also control for the lags of inflation; the current and lagged values of the estimated output gap, EA_t; lags of an underlying measure of core inflation, π_t^{*k}; along with the dummy. The equation is estimated as a bi-variate VAR, and treats the last two variables as exogenous.



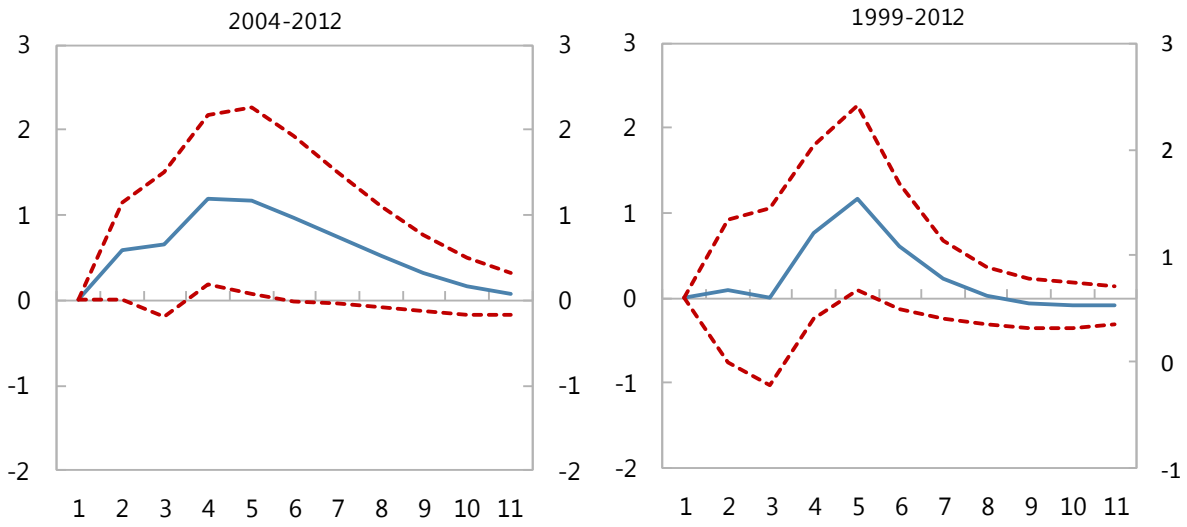
Source: Fund staff estimates.
Note: Real spending gap estimated as the percentage deviation from an HP filtered trend. Real fiscal Shock episodes are identified as those in which the real spending

10. Based on our definition, we identify four episodes of strong increases in real fiscal spending shocks, namely 1999Q4, 2007Q1, 2010Q1 and 2012Q1. Our dummy variable does not indicate how long the shock lasted or its size.[6] In this sense the methodology resembles Romer and Romer's (1988) analysis of whether monetary policy matters, and that of Ramey (2011) on fiscal multipliers.

11. Dynamic multipliers indicate that fiscal shocks have a positive impact on inflation. Specifically, we find for the subsample 2004Q1–2012Q4 that the maximum impact on inflation of strong increases in fiscal spending occurs after 4 quarters. At that time, inflation is found to be 1.2 percent higher than it would have been in the absence of a large increase in fiscal spending. This effect is statistically significant and quantitatively important. The results are of similar magnitude when the full sample is used, but the peak of the real fiscal shock occurs after 5 quarters and is less persistent.

[6]The corresponding estimated gaps for these episodes are equivalent to 4.5, 2.1, 1.1, and 0.91 percentage points of GDP, respectively.

Inflation Impulse Response to a Real Fiscal Shock
(In percent)



Source: Fund staff calculations.
Note: VAR of headline inflation and the output gap (2 lags each), including two exogenous variables: a fiscal shock and core inflation (4 lags each). Discontinuous lines report the 90 percent confidence intervals.

E. Does Fiscal Policy Influence Inflation Expectations?

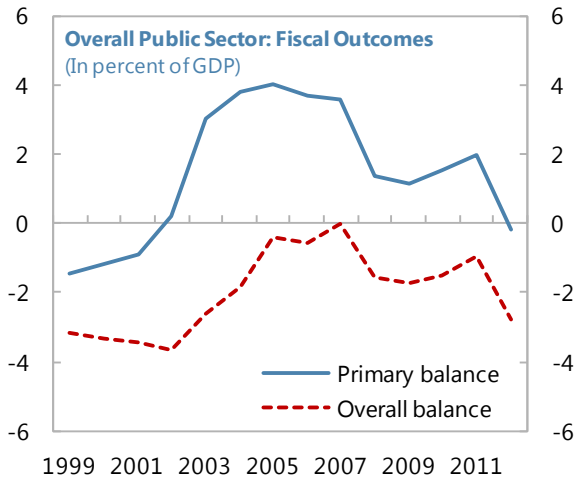
12. We also find changes in the central government primary balance to Granger-cause inflation expectations. In principle, inflation expectations would depend on the sequence of fiscal dynamics over the long run. The current behavior of fiscal variables could influence expectations on the future fiscal path, and thereby inflation expectations. The χ^2-statistic associated with the Granger causality test between inflation expectations (as measured by consensus forecasts) and changes in the central government fiscal balance is 7.56, which is significant at the 10 percent level.

F. Conclusions

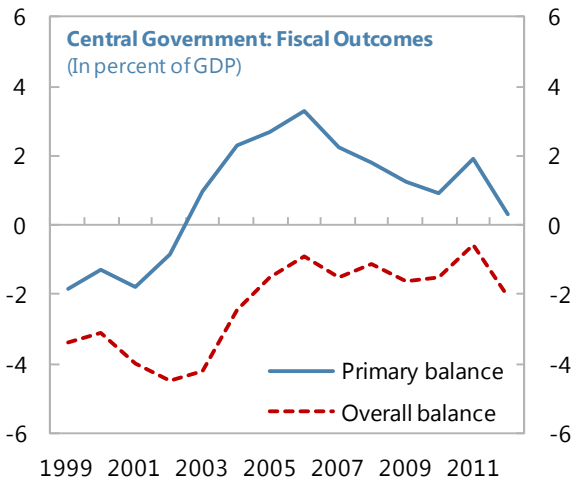
13. The econometric analysis in this *Selected Issues* paper suggests that inflation is not immune to fiscal variables in Uruguay. In particular, the estimates suggest that a one percent of GDP improvement in the primary balance reduces headline inflation by 0.4 percent after four quarters. Also, large increases in real fiscal spending contribute to inflation. Thus, tighter fiscal policy could support monetary policy in reducing inflation.

Annex I. Fiscal, Debt, and Inflation Dynamics

Figure A1.1

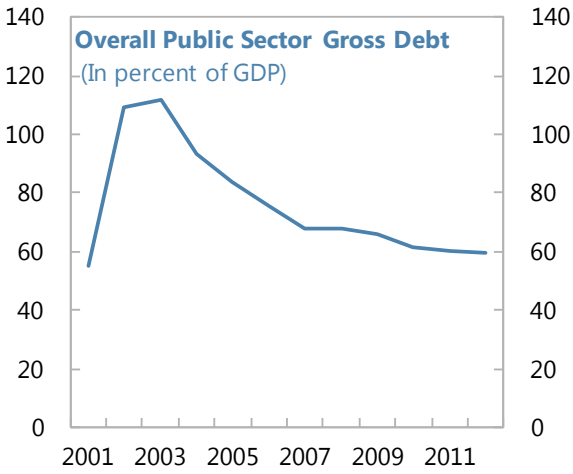


Source: MEF.



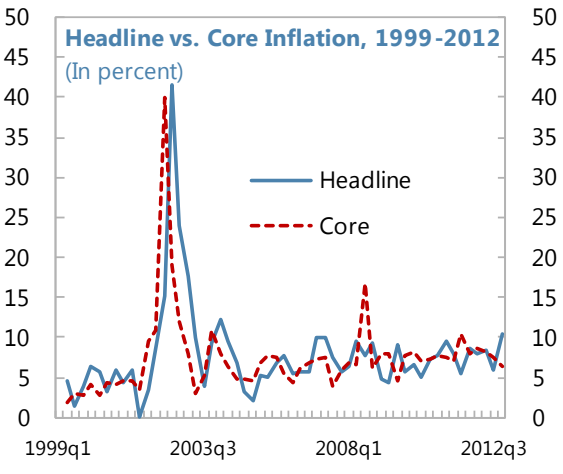
Source: MEF.

Figure A1.2



Source: BCU.

Figure A1.3



Source: BCU.

Table A1.1.Uruguay: Summary Statistics of Inflation and Fiscal Variables, 2004–2012[1]

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
A.- Inflation					
Headline	52	8.0	4.5	3.5	24.6
Core	52	7.6	3.8	2.9	20.6
Non-tradable	52	8.3	3.2	4.2	20.1
Non-regulated	52	8.2	4.5	2.8	23.5
B.- Fiscal					
Primary balance (% of GDP)	56	0.9	2.4	-4.3	4.9
Fiscal impulse (%of GDP)	52	-0.2	2.2	-4.5	5.9
Real current primary spending growth	52	2.4	10.1	-18.9	23.9
Real discretionary spending growth	52	2.3	12.4	-31.4	25.9

Sources: BCU, INE, and MEF. Fund Staff Estimates.

[1] Sample 1999q1–2012q4. For institutional coverage of fiscal variables see text.

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THE FISCAL REGIME FOR LARGE-SCALE MINING IN URUGUAY[1]

This paper provides a review of the fiscal regime applicable to large-scale mining in Uruguay and gives a preliminary forecast of potential government revenue from the Valentines mining project. The current mining fiscal regime in Uruguay is found to be capable of capturing for government a fair share of fiscal take while remaining competitive for investment. At the same time, there is room to strengthen the rules for determining the tax base, and to reduce the administrative burden and transfer pricing opportunities associated with the current basis for determining the royalty rate.

A. Introduction

1. This paper reviews the current fiscal regime for large-scale mining in Uruguay and provides some preliminary forecast of potential government revenue from the Valentines iron ore mining project in the country. There are two main purposes for this review: (a) to assess the Uruguayan mining fiscal regime against modern mining taxation practices, and (b) to provide some preliminary forecast of potential government's revenue from the iron-ore mining project.

2. The paper is organized as follows. The first part of the paper provides a qualitative assessment of the current mining fiscal regime, with an outline of the major fiscal instruments followed by an assessment of their design and related fiscal provisions (Sections A–D). It also provides a quantitative assessment of the competitiveness of the current mining fiscal regime in Section E, followed by a summary of key conclusions and recommendations in Section F. The second part of the paper provides the results of potential government revenue forecast from the Valentines project using the Fiscal Assessment for Resource Industries Model (FARI) of the IMF's Fiscal Affairs Department. A summary description of the current mining fiscal regime examined in this review is contained in Annex I, followed by a summary of economic assumptions used in the analysis in Annex II, and a set of mining fiscal regimes used for fiscal comparison in Annex III.

B. Mining Fiscal Regime Review

3. This review examines the major revenue-raising fiscal instruments and related special fiscal provisions against modern practices.[2] The fiscal regime for large scale mining in Uruguay comprises three major fiscal instruments, namely, mineral royalty (canon production),

[1] Prepared by Victor Kitange.

[2] For a detailed discussion of the design and implementation issues for extractive industry fiscal regimes see *Fiscal Regimes for Extractive Industries*, IMF Board Paper (August 2012).

income tax (IRAE) and additional income tax (additional IRAE). Other tax instruments of minor fiscal impact, including rental charges (canon surface) and a fee for contract stability have also been noted.

C. Royalty

Assured Minimum Flow of Revenue

4. The inclusion of mineral royalty (canon production) in the Uruguayan fiscal regime serves a useful purpose of providing the host government an assured minimum flow of revenues as long as there is mineral production. This is an important feature of a modern mining fiscal regime. In developing host countries given their budgetary and other financial needs, mineral royalties are particularly important for mining projects to be politically sustainable. Increasingly, revenues from mining are earmarked for local government or community use, and mining projects are expected to provide a source of financial support for local social and economic development.

5. The two tier royalty rate structure for Class III[3] mineral deposits (including iron-ore mining) adds a complexity to the Uruguayan mining fiscal regime. The mining fiscal regime fixes in the law a 5 percent royalty rate in the first five years of production and 8 percent in the subsequent years. The same revenue objective could also more simply be achieved by a single standard royalty rate. The two tier structure gives a lower rate presumably to reduce the fiscal burden on mining companies in the early production years when they are still recovering their initial capital outlay. However, since royalty is not sensitive to mine profitability, it is a blunt instrument to give incentive to invest. Better alternatives include accelerated depreciation that allows companies to recoup investment before paying taxes combined with a modest single royalty rate. In addition, since a royalty adds to production costs, it may lead to premature shutdown of production particularly towards the end of production life as a mine becomes more costly to produce. It is therefore not uncommon for mining fiscal regimes to provide for targeted royalty relief (reduction or deferral), on a project-by-project basis, to prevent premature production shutdown *towards the end of production life*. But even in such cases, clearly spelt out justification must accompany an application for such a relief to authorities and in accordance with transparent economic criteria and procedures set out in the law.

6. The royalty rates for Class III deposits applicable to iron-ore are broadly in line with international trends. Table 1 shows a comparison of royalty rates on metallic minerals (base metals) including iron ore in a selection of countries, showing headline ad valorem rates ranging from 3 percent (Kazakhstan) to 10 percent (India). Minnesota in the United States and China both levy specific royalty rates (per unit quantity of mineral). The royalty rates in the Uruguayan

[3] Metallic and non-metallic resources not included in other categories. Any person is able to mine minerals of this class subject to a permit.

regime are levied as a percentage on some measure of the value of production (ad valorem royalty rates), 5–8 percent. These rates are largely in line with the international trends. However, it should be recognized that they add to cost and can make the extraction of some resource deposits unviable or reduce mine economic life. It is thus, best practice for royalty rates to be levied at modest levels in keeping with international trends.

Table 1. Comparison of Royalty Rates for Base Metals (Including Iron-Ore)

	Country	Royalty Rate	Royalty Base
1	Australia - Western	5%–7.5% [depending on types of iron ore]	Gross invoice value of the mineral less transport and packaging
2	Brazil	2%	Sales revenue less taxes levied on revenue, insurance and freight costs
3	China	0.5–4% + RMB 10–25/ton	Sales revenue
4	India	10%	Sales revenue
6	Kazakhstan	3%	Gross revenues less extraction cost
7	Liberia	5%	FOB Liberia; London pm gold fixing
8	Russia	4.8% (conditioned ferrous metal ore)	Sales less freight and refining cost
9	South Africa	Formula-based max 5% (refined minerals) max 7% (unrefined minerals)	Gross sales
10	Tanzania	4% (metallic minerals incl. precious)	Gross value
11	United States - Minnesota	$2.412/long ton in 2011, adjusted by GDP deflator	Weight

Source: Fund staff estimates.

7. The existing royalty rate base determination on a net-back approach—based on gross sales minus certain costs—is more burdensome to administer. It also means that the effective royalty rates are likely to be lower than their face values. Ad valorem royalty rates can be charged on the value of mineral sale (gross value basis) or the value remaining after deduction of certain costs from the gross sale value of mineral product (net-back basis). The latter approach is the case in Uruguay where transportation costs and other related costs are deductible to arrive at the rate base (mine gate value) for charging the royalty. Compared to the gross value basis, the net-back basis requires accounting and auditing of deductible costs and creates challenges in addressing associated transfer pricing problems. Because of the trade-off between the rate level and the rate base, to achieve the same effective royalty rates, headline royalty rates on a net-back value basis should be higher than on a gross value basis. As a revenue neutral simplification measure, the government's fiscal objective could simply be achieved by levying a lower single royalty rate on the gross value of iron ore production and thus simplify the current royalty regime.

D. Income Tax

Major Revenue Source

8. Income tax is a key feature of a modern mining fiscal regime. The current income tax rate for mining is the corporate income tax rate of 25% applicable to all businesses. Its application to the mining businesses ensures that the normal return to equity is taxed at corporate level just as in other economic sectors. In the Uruguayan mining fiscal regime, income tax would be one of the most important sources of government's revenue from profitable mines. Since it is profit related, it is less distorting than royalty but government revenue from this source can be unpredictable and volatile.

Table 2. Income Tax Regime for Mining in a Selection of Countries

Country	Income Tax Rates	Depreciation Rules
Australia - Western	30%	100% exploration; declining value or prime cost method for capital expenditure
Brazil	34%	100% for exploration and development costs; straight-line 10 years for equipment and machinery and buildings
China	25%	100% on exploration; 10% straight-line on development; 0.25% straight-line on replacement
India	30% + a 5–10% surcharge if above certain thresholds	15% declining balance for plant and machinery
Kazakhstan	18%	Rates chosen by companies with max. 25% per year
Liberia	30%	100% pre-production cost; 20% production capital cost
Russia	20%; reduction possible	Ten groups of assets with different depreciation rates; straight-line or declining balance
South Africa	28%	100% development; straight-line (unspecified rate) exploration
Tanzania	30%	100% exploration and development
United States - Minnesota	15–35% (federal); 2.45% (state)	70% in first year on exploration and development cost, balance on straight-line over 5 years; other methods possible
Uruguay	25%	100% or 20% straight-line for pre-production expenditures; 10% for production capital expenditures

Source: Fund staff estimates.

Tax Rate

9. The existing income tax rate of 25% is within international trends. Corporate income tax rates in the 25–35% range are common around the world. However, investors are not only concerned with the level of tax rate, but also the tax base on which it is levied. Therefore it is important to consider tax rates in the context of allowable tax deductions since critical to determining effective tax rates are depreciation rules (Table 2 above).

Tax Base

10. The special rules for mining income tax base under the existing fiscal regime in Uruguay are generally consistent with best practices. It is customary for the calculation of taxable income in the mining industry to take place under special rules regarding allowable expenditures (expenses and depreciation), treatment of losses and related matters. This approach recognises the special characteristics of mining, particularly the magnitude and timing of capital expenditures in developing mines and mine infrastructure. These are already features of the current Uruguayan mining fiscal regime.

Pre-production Expenditure

11. The rules regarding allowable deduction of pre-production capital expenditures under the existing regime are consistent with best practices. The existing mining fiscal regime provides for pre-production expenditures to be capitalised and depreciated from the year production starts. It is best practice to start initial capital allowances in the year of commencement of commercial production. In addition, modern taxation practices provide for a partial year rule (i.e. if production starts after six months, only half a year's capital allowance will be allowed) and in this way, all assets are treated identically relative to income produced, irrespective of when they are purchased or constructed. It is unclear how the partial year rule would be implemented under the current Uruguayan mining fiscal regime.

Depreciation Rate

12. The rules regarding depreciation rate for tax purposes under the existing mining fiscal regime suggest room for further improvement. Mining companies under the existing fiscal regime can choose whether to deduct in full or depreciate their pre-production capital expenditures over 5 years from the production year. This option to decide the depreciation method is an unnecessary complexity. It is international practice however for pre-production expenditures to be allowed in full in the production year (Table 2) recognising the risk involved when the expenditures were being incurred. For capital expenditures incurred during production, less generous rates of depreciation are used but generally 3–5 year depreciation period is not uncommon internationally (Table 2). The 10 percent rate (10 years) under the existing regime in Uruguay is not so generous compared with other regimes in Table 2 above except for China even though it has the advantage of bringing forward government revenue compared to faster depreciation rates.

Thin Capitalization and Interest Deductibility

13. The current mining fiscal regime does not include special rules for dealing with transfer pricing associated with debt financing in mining projects. It is common for commercialisation of large mining projects to be financed by both debt and equity. Not only is the use of debt help to finance the large capital requirement for mining but also, to reduce income tax liability since interest on the debt is usually deductible in determining the income tax base. Hence, modern tax practices seek to provide safeguards against excessive use of debt

financing or excess interest rate eroding the tax base. Thus, general rules regarding thin capitalization, including rules to disallow deduction of excessive interest charges are standard features of modern mining fiscal regimes. They may include provisions to deny immediate deduction for interest payments that exceed some proportion of income (for instance, 50 percent plus interest earned) and a "safe harbor" at a debt equity ratio of, say, 1.5:1. Other provisions may include limiting deductibility of interest rate to an arm's length equivalent criterion and including it in tax legislation, normally as part of a general transfer pricing rule. An alternative is to specify a margin over a benchmark international US$ interest rate. The advantage of specifying such criteria is the transparency and certainty thereby created between tax payers and tax administrators.

Ring-Fencing

14. The Uruguayan mining fiscal regime does not provide special rules for restricting deductibility of costs and tax losses incurred under separate mining licenses. A mining company may hold several licenses to carry out mining activities in Uruguay and can consolidate its income and costs in determining its income tax base. Thus a company generating income from mining activities anywhere in the country will be able to seek tax relief for the expenditures incurred wherever mining activities are conducted in the country. The government must determine whether to allow such relief and, if so, on an unrestricted or restricted basis (commonly referred to as "ring-fencing"). Ring-fencing helps to protect the tax base of a producing mine from being eroded by the company's expenditure incurred in activities unrelated to the production of the mine profits**.**

15. A country must balance between maximising immediate revenue and the risk of immediate revenue loss with potential increase in future revenue. Allowing a mining company to include exploration costs incurred under other licences (unrestricted basis) for example may reduce the company's risk, encourage further mineral exploration and lead to opening of future new mines. However, a country with only one large mine such as Uruguay and limited potential for developing similar large mines in the future, ring-fencing (restricted basis) is particularly relevant to protect its profit tax base on which profit related tax instruments i.e. the IRAE and additional IRAE are relied upon to generate the largest government share from the mine.

Tax Losses

16. The rule limiting carrying forward of tax losses up to 5 years under the Uruguayan fiscal regime means that companies may pay income tax before they have fully recovered their costs. The loss carry forward limit brings forward revenue whereas removing the limit may lead to deferral of government revenue. However, this feature tends to increase the perceived commercial risks particularly in marginally profitable mines. In spite of this, imposing a time limit on the losses as is the case in Uruguay is commonplace in mining fiscal regimes because tax authorities with weak administration may find it difficult to audit very old losses. The best

practice supports longer time limit e.g. 7 years for loss carry forward to reduce the risk of taxing losses rather than profits.

17. In Uruguay, a mining company can transfer losses from other mining areas to its profitable mines elsewhere in the country and hence, reduce its tax payments. Where mining profits are ring-fenced on a mine area by mine area basis (including contiguous mine areas), the risk to government of revenue deferral through unlimited carry forward of tax loses is reduced. Uruguay could consider introducing a longer, if not unlimited, carry forward of tax losses together with tight ring-fencing rules (i.e. within a company's mine area or contiguous mine areas), and thin capitalization and limit on interest deductibility to safeguard against base erosion.

Payments to Decommissioning Fund

18. The existing mining fiscal regime's rules on tax deductible expenditures do not have an express provision to allow project payments to fund future mine site decommissioning costs. Unless expressly provided in the tax code, provision against a future expense is not usually tax deductible. Modern mining fiscal regimes provide special rules to allow as tax deductible contributions made to an abandonment or reclamation fund. It is recommended that the government consider introducing an appropriate provision in the tax legislation.

E. Additional Income Tax

19. The additional income tax on large-scale mining provides for fiscal progressivity of the current mining fiscal regime. Fiscal progressivity is one of the modern principles for mining taxation. The additional income tax is a profits tax in which the rate of tax varies automatically with annual profitability of a mining project to capture for the government a share of the annual profits generated by the project. It means that mining projects of relatively low ratio of profit to revenue will bear a lower tax burden, and this could reduce perceived risk and, thus, encourage investment.

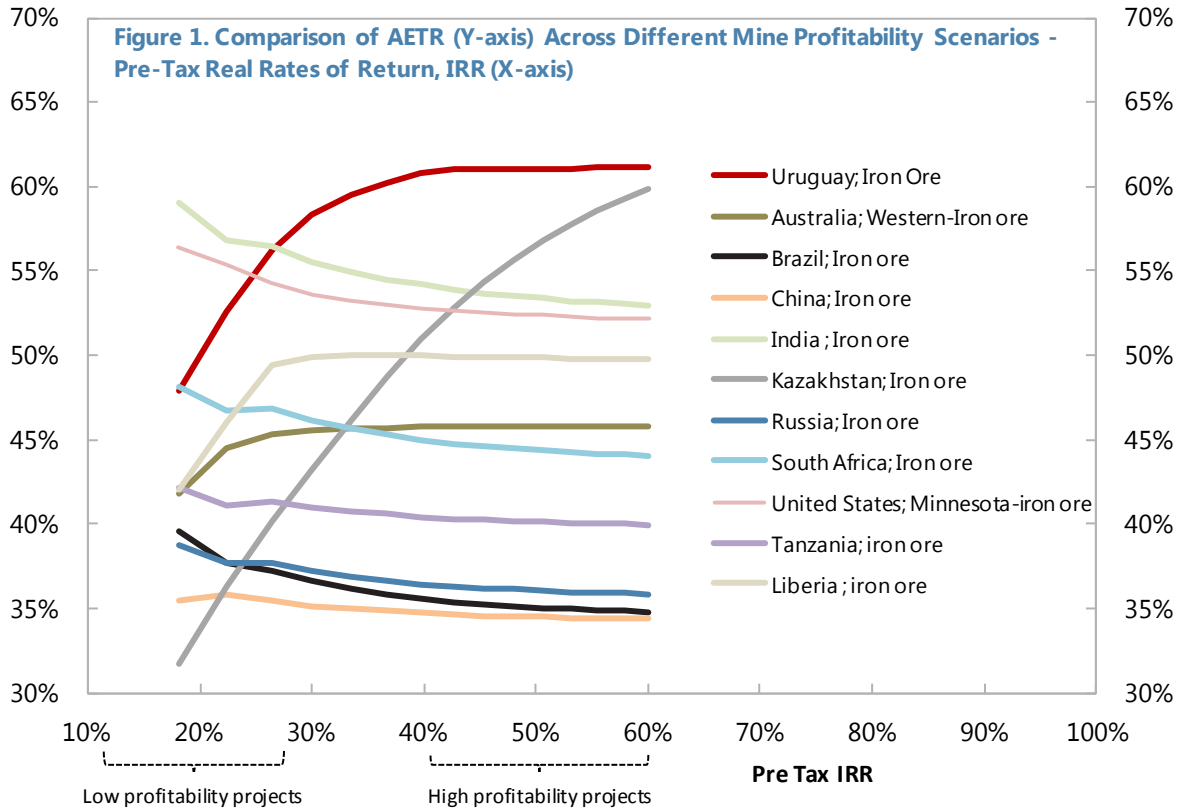
The additional income tax rate is determined by the following formula:
(MOM x 0.9 – 0.25) x 100; and MOM is capped at 0.70
Where:

- Operational Mining Margin (MOM) is the quotient resulting from dividing net operational mining income by operational mining income.
- Operational mining income equals to mineral sales multiplied by sale price.

F. Competitiveness of the Mining Fiscal Regime

20. The tax burden expressed as a percentage share of mining profits captured by government is a useful measure to evaluate competitiveness of a mining fiscal regime in a host country. This is usually known as government take and expressed as average effective tax rate (AETR). A mining company can compare AETR in Uruguay with ones in competing investment opportunities in other competitor countries and if the AETR in Uruguay is higher for substantially the same risk investment opportunity, investment is likely to be directed elsewhere. Investors will choose those investment opportunities that meet their minimum required risk adjusted rate of return on investment ("hurdle rate").

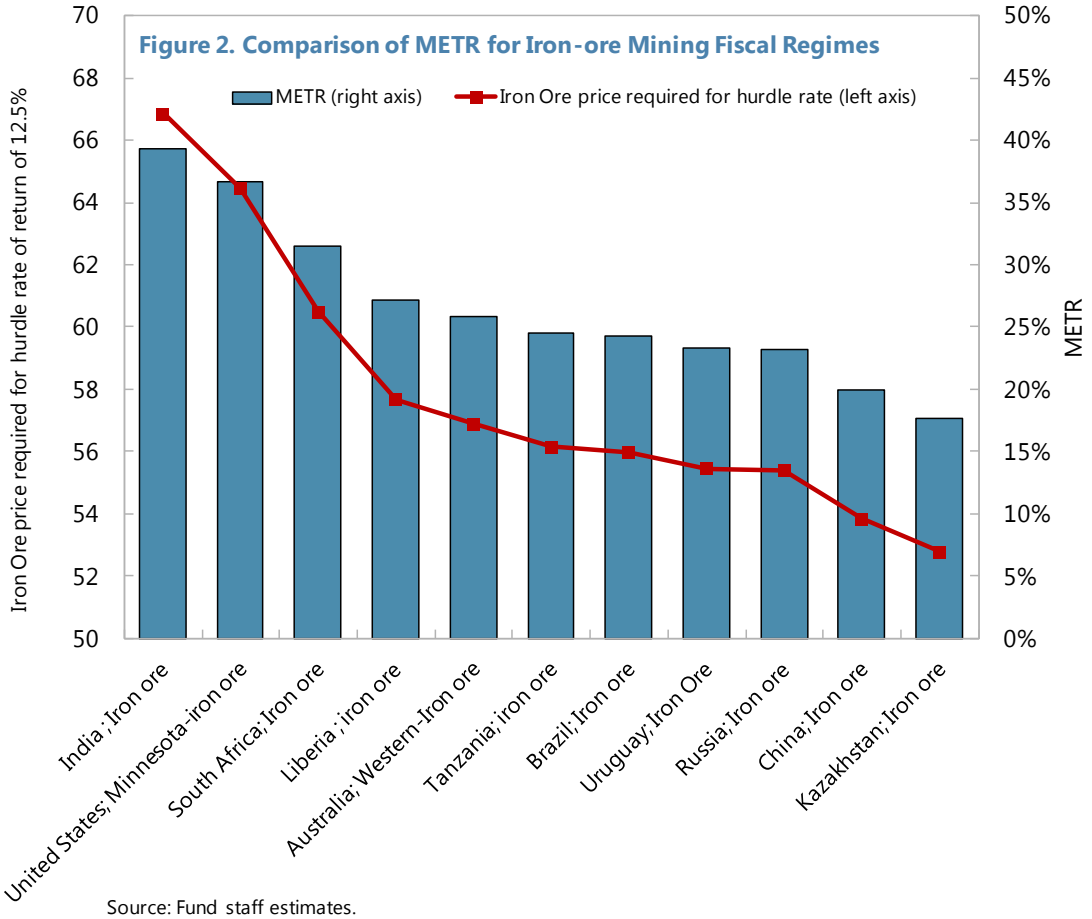
21. The tax burden on iron-ore mining under the current fiscal regime is considered to be reasonably within the international range. IMF simulations of mining fiscal regimes around the world using its FARI model suggest reasonably achievable AETRs for mining range from 40–60 percent. The simulation of the Uruguayan mining fiscal terms suggests an AETR ranging from 40 for low profitability outcomes increasing to 60 percent high profitability outcomes (Figure 1 below). In addition, the fiscal regime seems to be fairly progressive making it capable of generating a fair share of fiscal take for government. The economic assumptions used are set out in Annex II and mining fiscal regimes in Annex III.



Source: Fund staff estimates.

22. The efficiency of the fiscal regime in encouraging investment in mine expansion can be measured by Marginal Effective Tax Rate (METR). This is the government's proportion of pre-tax profits for a project which is just viable for the investor post-tax. It is calculated as pre-tax rate of return minus investor's hurdle rate of return as a ratio of pre-tax rate of return. It shows the relative fiscal "burden" placed on the project by the fiscal regime at the margin of project viability.

23. The METR of the mining fiscal regime in Uruguay is relatively low, depicting a relatively efficient fiscal regime. The results of simulations conducted using the IMF FARI model to compare the METR for the fiscal regime for iron-ore in Uruguay and a selection of comparator countries are shown in Figure 2 below. To carry out this simulation, iron ore prices were varied to generate pre-tax return for a typical iron-ore mine under each fiscal regime required to achieve a post-tax hurdle rate of return of 12.5 percent. The results show the METR for Uruguay to be within the lower end of the results among comparator countries, meaning that it is relatively efficient and less distortive to investment decisions.



Source: Fund staff estimates.

G. Conclusions and Recommendations

24. The current mining fiscal regime in Uruguay is considered capable of capturing for government a fair share of fiscal take while remaining competitive for investment. It imposes a lower tax burden on less profitable mines, thus encouraging development of marginally profitable iron ore deposits and captures a higher take in highly profitable mines. This progressivity of the fiscal regime allows it to generate a competitive government take without deterring investment in profitable mines.

25. The fiscal regime could benefit from further improvements by reducing one of the major revenue risks to government of base erosion. In particular, it is recommended that rules for determining the tax base could be strengthened by:

- Ring-fencing the tax base by mine area (to include contiguous mine areas) for IRAE and Additional IRAE purposes
- Introducing thin-capitalization and limits on deductibility of interest for tax purposes
- Introducing express provision for deductibility of financial contributions by a mining company to fund future mine site closure and rehabilitation costs.

26. The administrative burden and transfer pricing opportunities associated with current *net-back* basis for determining the royalty rate base can be reduced. In this respect, it is recommended the government consider:

- Charging royalty on a *gross value basis* (at the price realized at point of sale within the country for domestic sales or FOB price for exports) but at a lower rate than the current rate on net-back back basis.
- Introducing arm's length pricing principle for the rate base valuation for royalty purposes coupled with advance pricing agreement for iron-ore sales.

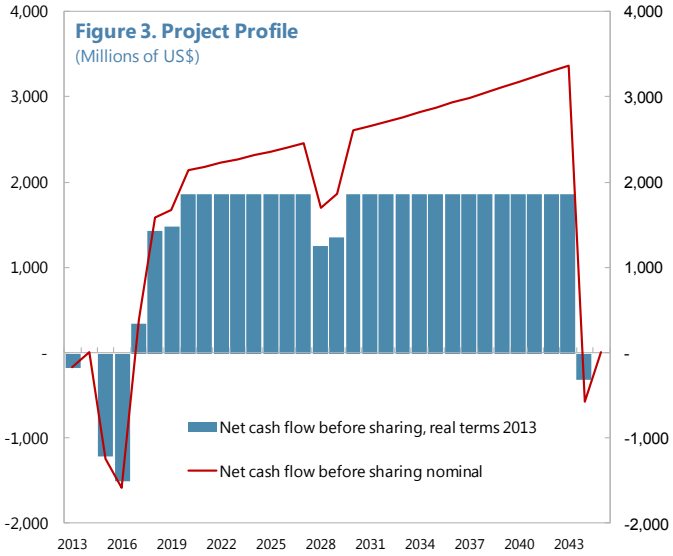
H. Revenue Forecast

27. The revenue forecast from Valentines mine project is based on an illustrative iron-ore project example with 27 year project life and average project profitability at pre-tax real IRR of 37.5 percent. The key project features and profile are set out below in Table 3 and Figure 4. A temporary drop in the profile in years 2008–2009 reflects additional capital investment of about US$1,100 million for new development including drilling and pre-stripping operations.

Table 3. Illustrative Key Parameters of the Project

Total production (million tons)	467
Production Life (years)	27
Production (million ton/yr)	18
Total pre-production capital costs	2870
— Exploration	170
— Development	2700
Production capital costs	3590
Total operating costs	5645
Decommissioning	315
Iron ore base price (US$ per ton)	120
Pre-tax IRR	37.5%

Source: Fund staff estimates.



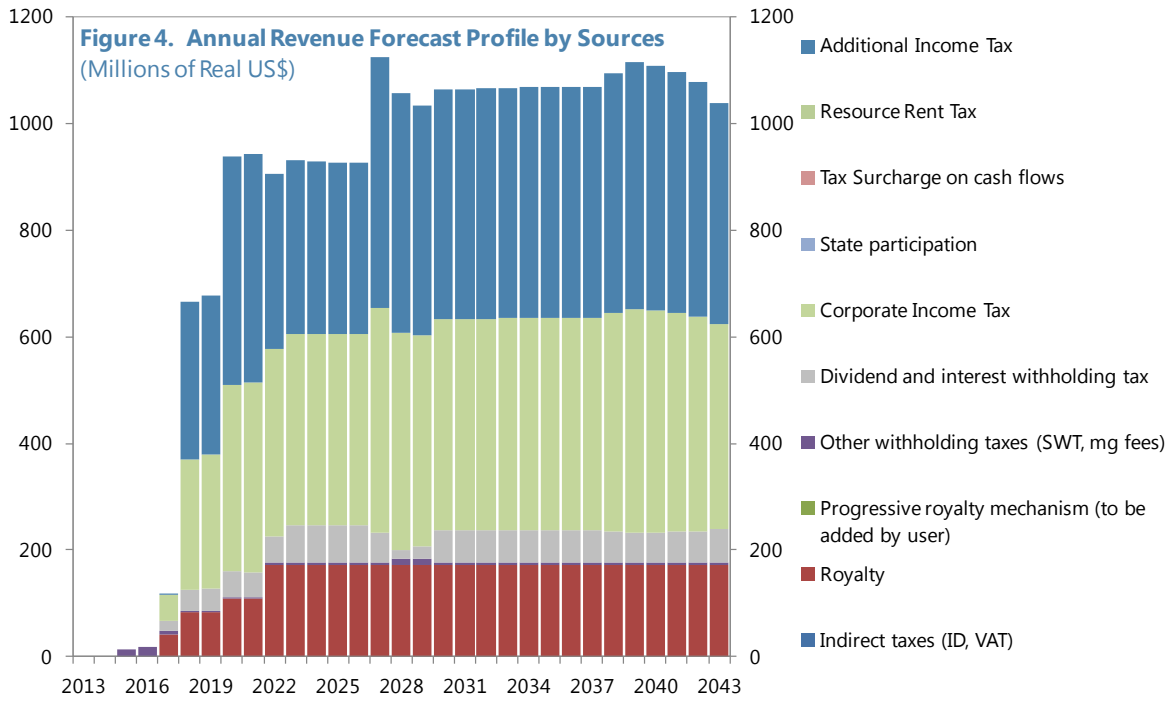
Source: Fund staff estimates.

Table 4. Revenue Forecast Over 27 Years (Real US$ Million)

Royalty	4,228
Other withholding taxes (SWT, mg fees)	147
Dividend and interest withholding tax	1,452
Corporate income tax	9,885
Additional income tax	10,557
Total government revenue	26,269

Source: Fund staff estimates.

28. The government's revenue from the project over the 27 year project life is forecast to be US$26 billion. The revenue is derived primarily from the three major taxes, namely, royalty, income tax and additional income tax. Other fiscal instruments making minor contributions include withholding tax on dividends and interest payments (Table 4 and Figure 5 below).



Source: Fund staff estimates.

Remarks on the Revenue Forecast

29. The revenue forecast is based on project assumptions that may not reflect the actual project data. However, the project example used in generating the forecast reflects a plausible iron-ore mine development, based on production figures and pre-production capital cost estimates obtained using publicly available data on the Valentines project. Comparison was also drawn from similar iron-ore mining projects in Sierra Leone, and Liberia. Nonetheless, the forecast should be treated as primarily indicative**.**

Annex I. Summary of the Fiscal Regime for Mining in Uruguay

Country	**Uruguay**		
Regime	**Royalty + CIT**		
Industry	**Mining**		
	Rate/value	**Comments /Base for calculations**	**Source**
Royalty (canon production)			
Class III deposit	5% yr 1–5 8% from yr 6	as a percentage of gross revenue (Class III: metallic and non metallic)	Mining Code - Law no. 15242 A *Canon Production*
Class IV deposit	10%	(Class IV: incl. building material)	
Additional Income Tax (IRAE)	0–38%	Tax rate = MOM x (0.9–0.25) x 100 MOM is capped at 0.70, where: MOM = net operational mining income divided by operational mining income	Tax Code: Obligation(Article 102) MOM (Article 107) Rate(Article 110) Tax base(Article 111)
Additional production fee	2%	Fee for contract stability. Same base as canon production	Tax Code (Article 43)
Income Tax (IRAE)	25%		IBFD 2013
Ring fencing	mine	Income from mining products	Mining Code (Article 103)
Capital expenditure allowance for tax calculations			
Pre-production costs	5 years	Straight line depreciation (also full expensing at production start allowed)	Tax Code (Article 51)
Capital expenditure	10 years	Straight line depreciation (Equipment and Machinery)	IBFD 2013
Loss Carry Forward	5 years		Tax Code
Decommissioning	none	No funding scheme established	Tax Code
VAT	22%	General rate	IBFD 2013
Custom Duties			
Import taxes	Exempt	General rate: 6%, 15% and 20%,	IBFD 2013
Export taxes	Exempt		IBFD 2013
Withholding Taxes			
On Dividends	7%		IBFD 2013
On Interest	12%		IBFD 2013
On Royalties	12%		IBFD 2013
On Subcontractors	12%		IBFD 2013
Income Tax Treaties		Available with several countries	IBFD 2013
Thin capitalization	None		Tax Code
Rentals (N$ per ha.) (currency: new peso)	Year 1: 200 Year2: 400	Prospecting period (*canon surface*)	Mining Code (Article 45)
	Year 1: 200 Year2: 400 Year3+: 600	Exploration period (*canon surface*)	Mining Code (Article 45)
State Participation Equity	None	No direct State equity interest in mines	Mining Code

Source: Fund staff estimates.

Annex II. Summary of Economic Assumptions

Field Name	Valentines Project
Base year	2013
Development start year	2014
Real interest rate	2%
Discount rate general	10%
Discount rate for net benefits	10%
Hurdle rate	12.5%
Grace period after last drawdown startup	0
Debt repayment years	6
Interest rate, margin over LIBOR	3%
Exploration costs borrowed	0%
Development costs borrowed	75%
Pre-tax IRR (nominal)	39%
Production starts in year	2016
Years of production	27

Source: Fund staff estimates.

Annex III. Summary of Fiscal Regimes Evaluated for Comparison

Country	Royalty rate	Royalty base	Corporate Income Tax	Depreciation rule	VAT	Import duties	Export Tax	Loss carry forward	Additional Profit Tax	Dividend Withholding Tax	Interest Withholding Tax	Equity
Australia - Western Australia	5%–7.5% [depending on types of iron ore]	Gross invoice value of the mineral less transport and packaging	30%	100% exploration; declining value or prime cost method for capex	10%; 0% exports	Concessions apply if values >$10 million	None [assumed]	Indefinite	22.5% MRRT; excluding "small miners" (less than AUD 75m of MRRT mining profits per year)	30% [unfranked]; 0% [franked]	10%	None
Brazil	2%	Sales revenue less taxes levied on revenue, insurance and freight costs	34%	100% for exploration and development costs; SL 10 years for equipment and machinery and buildings	17%; 0% exports	5%–12%	Exempt	Indefinite	None	None	15%	—
China	0.5–4% + RMB 10–25/ton	Sales revenue	25%	100% on exploration; 10% SL on development; 0.25% SL on replacement [assumed]	0% exports	Exempt	None [assumed]	5 years	None	10%	10%	—
India	10%	Sales revenue	30%+5%–10% surcharge if above certain thresholds	15% DB for plant and machinery	2%–10%; 0% exports	Exempt	20% [iron ores and concentrates]	8 years	None	16.22%	21.01%	—
Kazakhstan	2.8%	Gross revenues less extraction cost [assumed]	17.5%	Rates chosen by companies with max. 25% per year	0% exports	Exempt	None	10 years	0%–60% excess profit tax, based on ratio of income to deductions	15%	15%	—

Country	Royalty rate	Royalty base	Corporate Income Tax	Depreciation rule	VAT	Import duties	Export Tax	Loss carry forward	Additional Profit Tax	Dividend Withholding Tax	Interest Withholding Tax	Equity
Liberia	4.50%	FOB Liberia; London pm gold fixing	30%	100% pre-production cost; 20% production capital cost	Zero-rated on exports	Exempt until production starts; max around 4% thereafter	None	7 years	20% Surtax when pre tax IRR exceeds 22.5%; deductible for income tax	5%	5%	—
Russia	4.8% [conditioned ferrous metal ore]	Sales less freight and refining cost	20%; reduction possible	Ten groups of assets with different depreciation rates; SL or DB	18%; 0% exports	Exempt	None	10 years	None	15%	20%	—
South Africa	Formula-based max 5% [refined minerals] max 7% [unrefined minerals]	Gross sales	28%	100% development; SL (unspecified rate) exploration [100% assumed]	14%	Exempt	None	Indefinite	None	15%	15%	—
Tanzania	4% [metallic minerals incl. precious]	Gross value	30%	100% exploration and development	Exempt	Exempt during pre-production and 1st year of production; max 5% thereafter	—	5 years	None	10%	10%	—
United States - Minnesota	$2.412/long ton in 2011, adjusted by GDP deflator	Volume	15%–35% [federal]; 2.45% [state]	70% in first year on exploration and development cost, balance on SL over 5 years; other methods possible	None	0%–4.5% for machinery	None	20 years	None	0%–30%	0%–30%	None

Source: Fund staff estimates.