The Fiscal and Monetary History of Latin America:

The case of Uruguay (1960-2014)

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Abstract

In this paper, we analyze the fiscal and monetary history of Uruguay between 1960 and 2014. The aim is to explore the links between unfavorable fiscal and monetary policies and macroeconomic instability. We use the conceptual framework from Kehoe, Nicolini and Sargent (2013), which comprises a budget-constraint accounting exercise and models of balance-of-payment crisis and public-debt crisis. Chronic inflation in the 1960s was associated with sustained fiscal deficits. Since the 1990s, the opening of the economy, the price-stabilization plans and the more restrictive institutional framework of the Central Bank resulted in less inflationary financing of fiscal deficits. Although inflation significantly declined in 1960-2014, the inflation tax remained an important source to finance obligations. Public-debt dollarization increased the vulnerability of the public sector but primary fiscal surpluses and public-debt de-dollarization after the 2002 crisis reduced such vulnerability. We conclude that, in the last three decades, governments have slowly understood the importance of fiscal constraints to guarantee nominal stability.

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1. Introduction

The economic history of Uruguay can be characterized by the distinction of two growth strategies. Up until 1930 and since 1974, policy guidelines have laid down growth on international integration (*open economy*). In contrast and with nuances, between 1931 and 1973, the domestic market was the support of economic growth (*closed economy*)[2]. The two inflection points were associated with large international price shocks that affected Uruguay's terms of trade. The first occurred between 1929 and 1931 and was the result of the Great Depression. The second took place in 1973 during the first oil-price shock of the decade.

Despite the two different growth strategies, Uruguay experienced a long economic *decline* throughout the 20th century. In the closed-economy period, average growth was low relative to the open-economy periods, especially in the 1960s due to the early failure of the import-substitution model (Figure 1)[3]. In the open-economy periods, growth was slightly higher than in the closed-economy one but also more volatile (Figure 2).[4] As a result, GDP per capita fell from a level like United States at the end of the 19th century to almost one third of it in the first decade of the 21st century (Figure 3).

The *decline* is explained by inadequate policies and the type of external integration. Uruguay implemented trade-protectionist regulations between the 1930s and the 1970s and inadequate cycle-stabilizing policies such as the monetary financing of large fiscal deficits in the 1960s and the 1970s. Regarding external integration, Uruguay has specialized in undifferentiated natural-resource intensive products that have volatile prices and often face market-access restrictions. In addition, the opening of the economy since the 1970s increased the exposure to two unstable economies: Argentina and Brazil.

Since WWII institutions and policies have not been able to create a favorable climate for growth, despite the two different strategies. Until the 1970s, the economy was under the *interventionism* that characterized the closed-economy period as business profitability depended critically on non-economic factors, encouraging the deviation of resources and talent to rent-seeking activities. Then, after the opening of the economy and under a more *pro-market* policy orientation in the 1970s, weak institutions, characterized by inefficient macroeconomic regimes and incomplete markets, were unable to manage the effects of external shocks. In short, the institutional environment did not create a favorable environment for saving, investing and innovating.

The economic history of Uruguay in the last half-century has the *decline* as a backdrop, and monetary and fiscal policies help to understand this. Low growth and rising inflation in the late 1950s gave rise to changes in the monetary and fiscal policies of the early 1960s. Additionally, the inflationary financing of deficits in the late 1950s explains the origin of the nominal instability (i.e. high inflation) that lasted until the end of the 20th century (Figure 4). This chronic inflation affected the credibility of the macroeconomic policy, which contributed to demonetizing the economy. As a result, macroeconomic instability consolidated, making agents more impatient for their expected returns and affecting investment and, thus, growth (Oddone, 2008).

[2] Although changes were implemented since 1959, they had no consequences before 1973.
[3] The average GDP growth rate was 3.4% in the open-economy periods (1870-1930 and 1974-2014) and 2.4% during the closed-economy period (1931-1973).
[4] The standard deviation of the percentage deviation of GDP from its trend (using the HP filter) was 7% during the open-economy periods and 5.2% during the closed-economy period.

The paper is organized as follows. First, we present the results of the budget-constraint analysis for Uruguay in the period 1960-2014 based on the framework from Kehoe, Nicolini & Sargent (2013). Second, we contrast the stylized facts of the monetary and fiscal history of Uruguay during the same period with the main conclusions from the budget-constraint analysis. Along this, we use a number of theoretical models to have a better understanding of critical episodes such as the 1965, 1982 and 2002 crises. Finally, we present our conclusions.

2. The budget-constraint analysis for Uruguay

Table 1 shows the main results of the budget constraint for Uruguay in 1960-2014[5]. We consider four sub-periods in order to analyze these results. The first one (1960-1973) is the stagflation years. The second one (1974-1985) comprises the financial liberalization that ended with the aftermath of the 1982 balance-of-payment crisis. The third one (1986-2003) includes the public-debt restructuring under the Brady Plan, the trade opening and the price-stabilization plan until the 2002 banking crisis. Lastly, the sub-period 2004-2014 covers the years of strong growth and macroeconomic stability.

Table 1

Consolidated Budget Constraint of the Public Sector: 1960-2014 (% GDP)

	1960-1973	1974-1985	1986-2003	2004-2014	1960-2014
Sources					
Local-currency public debt (Δ)	-1,1%	0,3%	-0,1%	0,7%	-0,1%
Foreign-currency public debt (Δ)	0,9%	6,3%	0,4%	-2,9%	1,2%
Inflation-indexed public debt (Δ)	-	-	0,2%	1,4%	0,4%
Wage-indexed public debt (Δ)	0,1%	0,1%	-0,1%	0,2%	0,0%
Monetary base (Δ)	-0,2%	-0,1%	-0,4%	0,2%	-0,2%
Inflation tax	4,7%	3,4%	1,9%	0,6%	2,7%
Total	**4,4%**	**9,9%**	**2,0%**	**0,3%**	**4,0%**
Obligations					
Public-sector primary deficit	5,9%	3,3%	-1,1%	-1,9%	1,5%
Local-currency return	-	-	-	-0,2%	0,0%
Foreign-currency return	-0,1%	2,7%	2,3%	0,1%	1,3%
Inflation-indexed return	-	-	-	-0,1%	0,0%
Transfers*	-1,4%	3,9%	0,8%	2,4%	1,3%
Total	**4,4%**	**9,9%**	**2,0%**	**0,3%**	**4,0%**

**Estimated as a residual*

Source: based on Kehoe, Nicolini & Sargent (2013)

The financing of Uruguay's public sector was mostly inflationary in 1960-2014 as two thirds of the financing *sources* came from inflation tax and one third from the public debt. Nevertheless, Table 1 shows that the monetization and the inflationary financing of fiscal deficits (monetary issuance plus inflation tax) fell throughout the whole period.

Between 1960 and 1973, the main source to finance fiscal deficits was inflation tax due to limited access to external financing and financial repression (real interest rates in pesos were negative). The financial liberalization in Uruguay since 1974 and the greater access to external financing from emerging markets in the early 1970s increased the weight of

[5] The *consolidated budget constraint* includes the General Government, State-Owned Enterprises and the Financial Public Sector. See Annex 2 for a complete description.

public debt as a source, although inflation tax remained significant. Since the 1990s, inflationary financing was discarded because of greater access to public debt, lower obligations and macroeconomic reforms. Since 2004, public-debt management and fiscal discipline (until 2011) kept the need for inflationary financing relatively low (Figure 5).

On the obligations side, the primary fiscal deficit decreased continuously in every sub-period (Table 1). After the second half of the 1980s, the deficit remained relatively low, reflecting greater government commitment to macroeconomic stability. However, primary deficits in the late 1990s and since 2012 suggest this commitment is still weak (Figure 6).

In 1982 and 2002, the end of the price-stabilization plans based on exchange-rate anchors provoked strong currency devaluations. As we will see in section 3, these devaluations severely weakened public finances (Figure 7) given the highly dollarized public debt and the Central Bank's contingent liabilities due to the dollarization of bank deposits. This is the reason why the returns on that type of debt were large in 1974-1985 and 1986-2003 (Table 1).

Transfers (t_t) are, by definition, the residual of the budget constraint. They capture data limitations (estimation errors) as well as missing sources or obligations (Kehoe, Nicolini & Sargent, 2013). The residual shows an erratic path throughout the entire period, although a negative sign prevails in the 1960s and the 1990s and a positive one in the 1970s, the 1980s and the last decade (Figure 8). When there is a negative sign, there are missing *sources* in the budget constraint. Conversely, when the sign is positive, there are missing *obligations*.

In order to interpret the residual, we divided the period in two parts. Since 1994, the Central Bank has published detailed data on the public sector's financing sources other than the ones included in the budget constraint (monetary base and public debt). Nevertheless, for 1960-1993 such data are not available. As a solution, we try to explain, at least partially, the residual in 1960-1993 by using the stock of international reserves. This is because changes in the stock of public debt could reflect variations in international reserves, which are not captured by any of the budget-constraint obligations.

This is also the case for reserve requirements since they are a liability to the Central Bank. However, we exclude them when explaining the residual because of the following. First, an increase in public debt, as a result of higher peso-denominated reserve requirements, is offset by its corresponding decrease in the monetary base (already in the equation). Second, foreign-currency reserve requirements are already included in the stock of international reserves.

The path of the residual and the change in international reserves are similar to some extent (

Figure 9). This allows concluding that between 1960 and 1993, except in 1977 and around the 1982 crisis, the residual is mostly explained by changes in international reserves.

For 1994-2014, we use detailed official data on the financing of the public sector. Such data are divided into *monetary liabilities*, *public debt* (loans and bonds), *net deposits, financial assets and other extraordinary transfers*[6]. Strictly speaking, only the first two

[6] See Annex 2 for a detailed description of these terms.

sources (monetary base and public debt) are included in the left-hand side of the budget-constraint equation, so we conclude the residual is very likely to contain the other three sources. We use such sources to explain the residual in 1994-2014 under the following criteria. First, *net deposits* include reserve requirements of commercial banks deposited at the Central Bank. Second, *financial assets* comprise the financing for the purchase of reserve assets of the Central Bank and the Treasury. Third, *other extraordinary transfers* consist of transfers that occur during periods of severe fiscal constraints. Comparing both series shows that since 1994 the residual is almost completely explained by net deposits, financial assets and other extraordinary transfers (Figure 10).

In order to know to what extent these factors explain the residual, we calculate an *adjusted residual* by subtracting such factors (international reserves for 1960-1993 and net deposits, financial assets and other extraordinary transfers for 1994-2014) from the budget-constraint residual. The results in Table 2 show that, on average, the absolute value of the adjusted residual is lower than the absolute value of the budget-constraint residual. However, the absolute value remains relatively large in the 1960s, 1977, around the 1982 crisis, in 1999 and around the 2002 crises (Figure 11).

Table 2

	1960-1973	1974-1985	1986-2003	2004-2014	1960-2014
Residual (t)	-1,4%	3,9%	0,8%	2,4%	1,3%
Unexplained residual	-0,3%	3,3%	-0,2%	-0,3%	0,5%

Source: Own estimates

We propose some explanations for the remaining residual. First, the way the implicit interest rate is constructed for the period 1960-1993 (interest payments in t+1 over the stock of debt in t) may not be precise. That means estimation errors end up in the *adjusted residual.* Second, when estimating the implicit interest rate in 1960-2002, we assume all public debt is denominated in foreign currency. As a consequence, foreign-currency returns may be inaccurate and the ones denominated in other currencies are missing. The net effect of these errors is also contained in the *adjusted residual.* Third, some transfers associated with the 1982 and 2002 debt crises remain out of the budget constraint. For instance, transfers from the Central Bank to *Banco Hipotecario* during the 1982 crisis are not included in the deficit[7]. Fourth, residuals may also arise from appending different data sets. For example, the adjusted residual is significantly large in 1999, the year when estimations and official data on public debt are joined.

3. Stylized facts and the budget constraint

The economic history of Uruguay between 1960 and 2014 includes a brief stage (1960-1973) where *interventionism* and import-substitution policies predominated. After 1974, and especially since 1991, more market-oriented policies stimulated the opening of the economy and the international financial integration.

In order to contrast the stylized facts with the budget constraint results for Uruguay, we divide the period 1960-2014 into four sub-periods: i) *stagflation* (1960-1973); ii) *opening*

[7] See next section for further explanations.

and liberalization (1974-1985); iii) *boost and halt*[8] (1986-2003); iv) *the golden years* (2004-2014). Each of the following parts is devoted to analyzing these sub-periods.

2.1. Stagflation (1960-1973)

The 1960s were the end of a growth period as the economy stagnated and inflation remained high in historical comparison. The magnitude of the economic failure led to a social and political crisis that ended the long democratic stability of the country in 1973. GDP per capita grew 2.2% on average in the 1950s and only 0.5% in the period 1960-73. Annual inflation reached 51.7% on average in 1960-73 (it was 6.4% in the 1940s and 13.0% in the 1950s) (Figure 4).

The economic decay of the late 1950s had political consequences. In 1958, the Colorado Party lost the presidential election for the first time in the 20th century at the hands of its secular opponent, the National Party.

In 1959, the new government approved the *Monetary and Foreign Exchange Reform*, which was the first attempt to liberalize the economy since 1929. The aim was to restore the internal and external balances of the economy. The reform simplified and reunified the various types of exchange rates, dismantled trade controls and put an end on the tendency towards bilateral trade agreements. It also imposed drawdowns on exports and surcharges on imports. The reform restricted the expansion of payment methods by establishing an issuance regime based on gold and the rediscounting of private documents, thus eliminating other issuance props such as the assets of the state-owned commercial bank (Banco República)[9]. Under the reform, in 1960, Uruguay signed the first agreement with the International Monetary Fund (IMF). Even though most of the initiatives included in the reform were abandoned in the 1960s, some of them started to be implemented during the first part of the 1970s.

Between 1960 and 1973, under the low-growth situation, primary fiscal deficits were sustained (5.9% of GDP on average) as expenses grew more rapidly than revenues. This was because the public expenditure structure was very rigid, while revenues stopped growing due to the stagnation (Figure 12)[10].

The debt-to-GDP ratio remained stable in this period since the increase in dollar-denominated debt was offset by a fall in peso-denominated debt (Table 1; Figure 7). The latter began in the 1950s when negative real interest rates made peso-denominated debt unattractive for the private sector[11]. The government began to issue dollar-denominated Treasury bonds but it was not enough to finance the large fiscal deficits. A solution was to increase the debt held by the public sector, particularly by social-security institutions. Nevertheless, this financing source wore out as social-security institutions weakened in

[8] *Boost and halt* is a translation from Spanish of "*El Impulso y su freno*", a book written by Carlos Real De Azúa that referred to the import-substitution period between the 1930s and 1950s.

[9] Between 1896 and 1967, Banco República was both the state-owned commercial bank and the monetary authority.

[10] The financial balance of the Central Government was mostly negative since the beginning of the 1930s. Nonetheless, it was not necessary to monetize the deficits at least until the second half of the 1950s when the financial repression began.

[11] The Executive Branch set bank interest rates by law (Act No.9756 of 1938) until 1968. We assume bank interest rates in pesos were not significantly different from public-debt interest rates in pesos.

the 1960s because of the economic stagnation and the negative real returns on assets (public debt).

As a consequence, the financing of obligations in this period was inflationary[12]. The results of the budget constraint show that deficits were financed with inflation tax (4.7% of GDP on average) and other sources captured in the residual as negative obligations (1.4% of GDP on average) (Figure 5). We offer the following explanation for this negative residual. Since there is no available data on peso interest rates for the 1960s, debt obligations in pesos end up in the residual. Real interest rates were negative in this period so debt obligations in pesos are likely to be negative. Thus, our conjecture is that the residual is negative (that is, a missing source) because it contains transfers from debt holders to the public sector as a result of inflating away public debt in pesos. In other words, if we had data on interest rates in pesos, debt obligations in pesos would more likely be negative, increasing the sources and reducing the negative residual.

The 1965 banking crisis also contributed to the nominal instability (Vaz, 1999). In 1965, amid a large bank run, the government created an explicit insurance scheme on peso-denominated bank deposits, converting them into contingent public debt. Also, there existed an implicit insurance on dollar-denominated deposits, so the total contingent liabilities for the monetary authority depended on the exchange rate as well. "In this situation, the inflationary impact of having a lender of last resort or a deposit insurance facility increases" (Vaz, 1999). So, once bank runs intensified in 1965, the monetary authority had to monetize the deposits. And although deposits were falling, the frequent devaluations of the peso implied an increase in the amount of pesos to be monetized.

Moreover, the banks' weak position impeded to restrict secondary money creation, which could have been done by increasing reserve requirements or eliminating the inflation-tax subsidy in rediscounts[13]. Therefore, the monetization of bank deposits and the decision not to restrict money creation contributed to the growth of monetary issuing, and thus nominal instability, by mid-1960s.

The monetary issuing promoted currency devaluations and pushed inflation even further, provoking a vicious circle. The reserves-to-GDP ratio fell constantly in the first half of the 1960s and remained low until the first part of the 1970s. This was due to large capital outflows, the defense of the exchange rate and the scarce issuing of dollar-denominated public debt (Figure 13). Therefore, the monetary authority was forced to devaluate the peso several times, creating further inflationary pressures through higher import prices (Figure 14).

The scenario of the first half of the 1960s, featured by chronic inflation, scarce international reserves, the aftermath of the 1965 banking crisis and the inflation-devaluation spiral, encouraged a political consensus to create a specialized institution to be in charge of the monetary policy and the banking-system regulation and supervision. In 1967, the Central Bank of Uruguay was created[14].

[12] Azar et al. (2009) arrive to the same conclusion.

[13] Commercial banks charged investors a discount for amortizing debt in advance, collecting part of the inflation tax (Vaz, 1999).

[14] During the transition time (1967-1971), Banco República and the Central Bank of Uruguay shared Central-Bank functions.

Despite of the creation of the Central Bank, erratic monetary policy and nominal instability remained in 1967 and 1968. For instance, the monetary base continued growing at three-digit figures at the beginning of 1968 and annual inflation reached 183% by mid-year (Banda et al, 2017). In this situation, the social and political unrest became the main concern for the government, which led to implementing a price-stabilization plan based on mandatory price fixing.

The plan chose wages as the nominal anchor given that other instruments were unavailable under the prevailing macroeconomic-policy conditions. First, interest rates were set by law, so they could not be used as monetary target. Second, commitments on the exchange rate and monetary aggregates were not credible given the large primary fiscal deficit (12.2% of GDP) and scarce international reserves (1% of GDP)[15].

The plan also included a significant fiscal adjustment. The primary fiscal deficit shrank continuously to 2.4% of GDP between 1967 and 1970. Consequently, the need for inflationary financing was reduced (Figure 5), consistently with a fall in annual inflation (Figure 14). The stagnation period ended in 1968-1970 as GDP grew 4.1% on average in contrast to just 0.1% in 1958-1967.

In 1970, Argentina abandoned the price-stabilization plan that started in 1966. As a result, Uruguay received an external shock, which caused a GDP contraction in 1971 and 1972. The Central-Government primary deficit started growing as revenues decreased (Figure 12), creating incentives for inflationary financing (Figure 5). A larger deficit in a context of fixed exchange rate with a negative external shock put an end to the stabilization plan that began in 1968. Annual inflation rose back to three-digit figures by the end of 1972.

2.*2 Opening and liberalization (1974-1985)*

In 1973, amid growing political and social tensions that had persisted for almost a decade, the constitutional government fell and a *facto* government was instituted. It remained in power until 1985.

The economic policy of this period has three stages. The first one in 1974-78 focused on stabilizing the external sector and starting to dismantle the closed-economy model. Some of the initiatives were, as we mentioned before, included in the *Monetary and Foreign Exchange Reform* of 1959. Among these changes were greater integration with Argentina and Brazil, export promotion and financial liberalization. During these years, sustained fiscal deficits remained, reaching on average 5% of GDP. Average annual inflation was 62.7% and most of the deficit was financed with inflation tax (3.9% of GDP).

During the second stage in 1979-82, the government implemented an anti-inflationary plan based on a pre-announced crawling peg. The plan managed to reduce annual inflation from 83% in December 1979 to 11% in November 1982 (Figure 4), amid real currency appreciation (Figure 15) and strong GDP growth.

Nonetheless, in a context of crawling peg and positives shocks from Argentina and Brazil, two of Uruguay's main trading partners, the fiscal contraction was not enough to offset

[15] Obstfeld and Rogoff (1983) suggests that under certain conditions (consumption and real money balance preferences) hyperinflation is possible even without a monetary expansion.

private demand, causing a significant deterioration of the current-account balance (Figure 16).

The expansion of the aggregate demand was boosted by an increase in private spending, especially real-estate investment and consumption of durable goods. This was stimulated by a significant growth in private debt as a consequence of the financial liberalization initiated in 1974. By the end of 1981, 53% of the foreign-currency debt was held by the private sector, something unprecedented in the history of Uruguay (Antía, 1986).

Between 1978 and 1982, the primary deficit followed a U-shape path. In the first three years, the overall deficit-to-GDP ratio fell from 4.4% to 1.1% amid a strong economic expansion. The debt-to-GDP ratio shrank while a significant amount of inflation tax was still collected (annual inflation was 59% on average) and used to increase the stock of international reserves (Vaz, 1999). However, in 1981 real GDP growth slowed down, after Argentina abandoned its price-stabilization plan and contracted 9.4% in 1982. As a result, the government revenue was affected and the overall fiscal deficit of the public sector increased by 1.9% of GDP between 1980 and 1981 (Figure 6).

The simple version of Krugman's balance-of-payments crisis model (1979)[16] allows for a more precise interpretation of these events. Krugman's argument is that sustained fiscal deficits within a context of restrictions to external financing force the Central Bank to increase domestic credit. Under a fixed exchange rate, the increase of domestic credit leads to a loss of international reserves, which may cause a balance-of-payment crisis, currency devaluation and an increase in inflation.

In 1982, Uruguay suffered a balance-of-payment crisis. The year before, external financing became more restrictive (Figure 17) so, given the current-account deficit of around 5% of GDP, international reserves began to fall. In addition, net domestic credit started to increase in order to finance the fiscal deficit, which led to a further decline in international reserves (Figure 18). In November 1982, the stabilization plan was abandoned and the peso was devaluated by 149% against the US dollar. Annual inflation climbed from 20.5% in 1982 up to 51.5% in 1983 (Figure 14). The large stock of dollar-denominated debt of the private sector quickly caused serious solvency problems for debtors, which triggered a banking crisis.

The banking crisis became a public-debt crisis, as there existed an implicit deposit-insurance scheme. In other words, the banking system's liabilities were, at the end of the day, Central Bank's liabilities. The adapted-for-Uruguay *Calvo Ratio*[17], which relates these liabilities to the government's capacity to comply with them, grew slowly between 1978 and 1980 and more rapidly in 1981 and 1982 once international reserves began to fall (Figure 19). After the currency devaluation, the Central Bank had to bail out commercial banks as a large portion of debtors defaulted on their commercial credits. Therefore, the liberalization of the financial sector in Uruguay since 1974 led to a significant increase in contingent public debt and, soon after, a public-debt crisis.

[16] See Annex 5.

[17] The ratio of foreign-currency deposits over international reserves is an adapted version of the *Calvo Ratio* from Kehoe, Nicolini & Sargent (2013). In a highly-dollarized economy such as Uruguay´s, the contingent liabilities of the Central Bank were mostly foreign-currency deposits of the non-financial private sector in the banking system.

The third stage of the period begins with the end of the stabilization plan in November 1982 and lasts until 1985. During these years, the public debt-to-GDP ratio rose from 20% in 1981 to 122% in 1985 (Figure 7) due to three reasons. First, the private-debt restructuring after the crisis. The Central Bank purchased non-performing assets from four failed banks and exchanged dollar-denominated public debt for non-performing assets with Citibank and Bank of America[18].

Second, the need of the Central Bank to recompose its stock of international reserves (Figure 13). As a consequence, the reserves-to-GDP ratio grew from 5.5% in 1982 to 12.3% in 1984. This may explain part of the large residual of the budget-constraint exercise in 1982 and 1983.

Third, the effect of the currency devaluation on public debt as it was mostly denominated in US dollars (Figure 20)[19].

Therefore, after the 1982 crisis the public sector's budget constraint was dominated by public-debt service and international-reserve accumulation (Table 1). Public-debt returns, especially in foreign currency, became the main obligation, reaching 11.6% of GDP in 1982-85. The large residuals may reflect the recovery of international reserves (Figure 8). At the same time, primary expenses were reduced. Regarding the sources in the budget constraint, even though public-debt issuing was the main one, the rising inflation after the end of the stabilization plan allowed collecting an inflation tax of 3.3% of GDP in 1983-85.

2.3 Boost and Halt (1986 – 2003)

In 1986, after the end of the de facto government, the economy began to recover. Real GDP expanded 8.9% and 7.9% in 1986 and 1987, respectively, due to a sequence of positive external shocks: a fall in oil prices, lower dollar interest rates and strong demand from Argentina and Brazil as a result of price-stabilization plans. In addition, there was a positive net wealth effect on debtors given the fall in the real value of dollar-denominated loans.[20]

During these years, the public sector achieved a primary surplus, consistent with a heavy public-debt service. This, together with the strong GDP growth, allowed reducing the public debt-to-GDP ratio and the need for inflationary financing. As a result, 12-month inflation dropped from 84% in January 1986 to 54% in March 1988.

[18] The Central Bank purchased non-performing assets for USD 1,141 million and issued USD 755 million in public debt to Citibank and Bank of America (Vaz, 1999). These agreements caused an increase in the quasi-fiscal deficit that reached 3.7% of GDP in 1984, almost half of the overall deficit of the public sector (Roldos, 1990).

[19] Annex 2 describes the procedure followed to estimate RER-adjusted public debt.

[20] The government had proposed to keep a *stable real exchange rate* against the currencies of Uruguay's major trading partners. The sharp international weakening of the dollar strengthened the peso and ended up generating a positive net wealth effect for debtors in dollars. Borrowing from the private sector was mainly in dollars. Noya & Rama (1987) conclude that this effect was 14.7% and 10.9% for private companies and the public sector, respectively, between 1985 and 1986. In addition, given the high level of public debt in dollars, the real currency appreciation also had a significant positive net wealth effect on the public sector. According to Noya & Rama (1987), it was 15% of GDP between 1984 and 1985.

Nonetheless, as of 1988 Argentina's performance was no longer favorable and Uruguay's GDP stagnated. Argentina contracted 10% between 1987 and 1990, while Uruguay grew only 0.5% on average in 1988-90. The overall deficit stood at 5.9% of GDP in 1989, which consisted mostly of debt service (real returns on public debt reached 9.7% of GDP between 1988 and 1990). As a result, inflation rose back to almost 90% by the end of 1989.

In the 1990s, governments carried out an array measures and reforms geared to making public finances sustainable and guaranteeing nominal stability. These measures were: the Brady Plan in 1991, the price-stabilization plan in 1990-2002, the first Central Bank Act in 1995 and the social-security reform in 1996.

The large overall deficit, mostly because of a heavy public-debt service, explained the persistence of nominal instability in the second half of the 1980s. First, the weak public finances limited the access to external financing, forcing the government to issue money in order to purchase US dollars and, thus, comply with debt payments. Second, debt service exceeded primary surpluses while the stock of international reserves was low, giving rise to inflationary financing. After a large negotiation period, in January 1991 Uruguay reached an agreement on its external debt in the context of the Brady Plan. This agreement reduced the debt stock by 5% of GDP (Rial & Vicente, 2003) and reprogrammed short-term debt.

In 1990, the government began another price-stabilization plan. The plan consisted of a deep fiscal adjustment (around 6% of GDP in 1990-91) and a pre-announced crawling peg. The exchange-rate anchor was maintained for the whole decade and the primary fiscal deficit remained balanced until 1999 (Figure 6). The latter and the access to external financing reduced the need for inflation tax (Figure 5). As a result, in 1998 inflation reached a one-digit figure for the first time in thirty years: it went from 133.7% in January 1991 to 9.9% in October 1998 (Figure 4).

In 1995, the Parliament approved a new Central Bank Act that strengthened the commitment to avoid inflationary financing[21]. This new act set a limit on the assistance the Central Bank could offer to the rest of the public sector. First, it limited the stock of public debt the Central Bank could hold to 10% of the primary budget of the year before. Also, it allowed the Central Bank to concede loans ("temporary transfers") for an amount not greater than 10% of the primary budget of the year before. The former remains in force and the latter was derogated by law in 1997.

The social-security system weakened persistently before the 1990s due to administrative, demographic and structural reasons (Laens & Noya, 2000). In addition, in 1989 a referendum determined to index social-security pensions to the Average Wage Index. In a context of disinflation, this indexation led to a significant real growth of pensions and, also, an increase in the deficit of the social-security system from 2.2% of GDP in 1989 to 5.7% of GDP in 1997. In 1995, the government carried out a reform of the system to assure the long-term sustainability of the pension system and public finances[2223]. As we

[21] A 1964 law limited the assistance of the monetary authority to the Treasury to one sixth of the annual budget (Banda & Onandi, 1992).

[22] Noya and Laens (2000) estimate that at the time of the reform the implicit public debt was around 2.5 times Uruguay's GDP, one of the largest implicit debts in Latin America. They conclude that the reform reduced the system's primary deficit by 2% of GDP in the long run.

will see in the next section, the sufficiency of benefits and the sustainability of the pension system is still part of Uruguay's political debate.

In terms of the budget constraint, there is relative stability between 1990 and 1998. The public sector's obligations decreased after all the fiscal adjustment and the Brady Plan. On average, the primary surplus stood at 1.5% of GDP and the real returns on foreign-currency debt were 0.2% of GDP during these years. Regarding the sources, public debt decreased by 2.7 p.p. every year, while the inflation tax fell from 3.4% to 0.6% of GDP. These results suggest that lower obligations and greater access to public debt reduced the need for inflationary financing.

The real currency appreciation favored the consolidation of a public-debt profile in foreign currency (91.3% of total public debt in 1998[24]). By the end of the decade, the economy was featured by: i) an exchange-rate commitment; ii) a high share of public debt in foreign currency and; iii) an implicit deposit-insurance scheme (Figure 21)[25][26]. Thus, the international reserves were the key to guarantee: i) the exchange-rate commitment, ii) ultimately, public-debt service and, iii) implicitly, bank deposits.

Between 1999 and 2001, the economy received an array of external shocks amid gradual restriction to external financing. At the beginning of 2002, the end of the Convertibility in Argentina led to a run on bank deposits, especially from nonresidents, which caused a loss of international reserves (Figure 22). In this context, lower international reserves threatened the credibility of the exchange-rate commitment and, thus, public-debt service.

This scenario led to abandoning the exchange-rate commitment in July 2002. On the one hand, the devaluation slowly favored the growth of exports since the end of 2002. On the other, given the high share of dollar-denominated public debt, the currency devaluation severely increased the vulnerability of the public finances (Figure 7) and placed public debt on an unsustainable path (Rial & Vicente, 2003).

After the devaluation, the debt service due in 2003 was USD 471 million, equivalent to 4.4% of GDP in 2002 (De Brun & Licandro, 2005) (Figure 23). Thus, the market, and the IMF, expected a default on public debt. In other words, the fiscal adjustment necessary to comply with debt-service obligations and make public debt sustainable was too large to be reachable without provoking a strong recession (Calvo, 1998). Given the debt service due

[23] The system covers the risks of disability, old age and survival. It is a mixed system as it has two pillars: intergenerational solidarity and compulsory individual saving. The former is a defined benefit and the benefits of the liabilities are financed by contributions from active workers, employers, taxes affected and, if necessary, by State's financial assistance. The second pillar is defined contribution: each worker accumulates their contributions and returns in a personal savings account. At the time of cessation of activities in case of having established cause (35 years of contribution), or reaching 60 years of age, the worker has the right to receive a monthly income that is determined by the amount accumulated in his individual account, his sex and age, and a technical interest rate determined by the regulator. Likewise, the second pillar has a collective capitalization insurance, with a defined benefit, which covers the risks of disability and death in activity.

[24] According to data from the Central Bank.

[25] "There was the perception among economic agents that, should anything happen in the banking system, the government would bail them out. This implicit guarantee, in turn, became a potential liability of the state" (De Brun & Licandro, 2005).

[26] Similar to 1982, the ratio of foreign-currency deposits of the non-financial private sector to international reserves grew strongly since May 2002, showing that the contingent liabilities of the Central Bank became an additional source of risk.

in 2003 and the primary surplus in 2002 (0.2% of GDP), it was necessary to make a fiscal adjustment of at least 4% of GDP.

In May 2003, the government conducted a public-debt restructuring, which reprogrammed the maturity of 50% of the total public debt[27]. The swap obtained 93% of the proposed amount, while the 7% that did not adhere received the payments under the conditions originally agreed on (De Brun and Della Mea, 2003). [28]

As in the 1970s, the *boost* of the 1990s ended with a sudden *halt*. However, as opposed to 1982, the 2002 crisis was not originated in a BOP crisis but in a bank run (Figure 22). Notwithstanding the severity of the 2002 crisis that had significant economic, social and political consequences, many changes were made before 2002 that laid the foundation of a stronger economy. This explains part of the recovery as of 2003.

2.4. The golden years (2004-2014).

In the second half of 2003, Uruguay left the crisis behind and began the longest growth period since the 1940s. In 2004-14, GDP compound annual growth rate was 5.4%, three times the growth in the second half of the 20th century. This growth originated in the super cycle of commodity prices, strong external demand and extraordinary financial conditions for emerging markets especially after the 2008 international crisis. In addition, structural policies and reforms helped install a favorable business climate.

The economic policy implemented since 2003 attempted, in the first place, to reduce those macroeconomic fragilities that amplified external shocks in 1982 and 2002. The pillars of the strategy were to consolidate exchange-rate flexibility, to reduce the financial vulnerability of the public sector and to strengthen the prudential regulation of the financial system. For this, the macroeconomic-policy scheme adopted was based on inflation targets (since 2005), the consolidation of a primary fiscal surplus (Figure 6), and stronger management of the public sector's assets and liabilities, in particular public debt (Table 3).

Table 3

	% of gross public debt*	
	2001	**2014**
Debt with maturity < 1 year	13%	6%
Foreign-currency debt	82%	44%
Local-currency debt (nominal, CPI-indexed & wage-indexed)	18%	56%
Fixed-rate debt	43%	79%
Floating-rate debt	38%	15%

Source: Central Bank of Uruguay

*It includes reserve requirements on bank deposits.

[27] All dollar-denominated bonds were eligible, except for short-term instruments issued since January 2003 (De Brun & Licandro, 2005)

[28] The rating agencies considered it a default. S&P downgraded Uruguay's public debt to Selective Default and Fitch downgraded to DDD in 2003. Uruguay inserted a Collective Action Clause (CAC) in the new bonds as well, which many believed would trigger a Credit Default Swaps (CDS) event because it changed the underlying structure of the debt.

In parallel, the Central Bank was granted greater independence[29]. As a result, it strengthened banking regulations to manage the risks of currency mismatch and liquidity, improving capital requirements and reducing exposure to non-resident operations. The combination of a favorable external environment with a risk-oriented management macroeconomic policy returned the investment grade to Uruguay's public debt in 2012.

Regarding the budget-constraint results, relatively low obligations and access to external credit markets guaranteed a relative nominal stability. Primary surpluses during the first few years allowed complying with the 2002-crisis debt service and accumulating international reserves. Since 2004, foreign-currency public debt was partly substituted by peso-denominated and CPI-indexed public debt (Table 1, Figure 7). This was stimulated by relatively low inflation, real currency appreciation and debt de-dollarization policies. As a result, the financial vulnerability of the public sector decreased.

Nonetheless, since 2008, and especially after 2011, the primary surplus dropped (Figure 6) in a context of strong GDP growth (5.1% in 2008-2014). That is, the fiscal policy was not tight during the expansive phase of the cycle, while the wage policy attempted higher nominal rigidity in a context of full employment[30]. All this contributed to the end of the *golden years* with the consolidation of two imbalances: primary fiscal deficit and inflation above the Central-Bank target range. In addition, the RER-adjusted public debt shows the debt-to-GDP ratio is higher than the unadjusted one (Figure 20), which implies that the effort to comply with public-debt obligations could be larger than the observed one.

Regarding the social-security system in Uruguay, the current structure may be a threat to fiscal sustainability. Although there are not many recent studies that quantify the potential effects of contingent liabilities, associated with the sufficiency of contributions, and the sustainability of the pension system on public finances, there are reasons to believe that the pension system should be reformed.

First, the increase in life expectancy and the decrease in the birth rate are putting pressure on the sustainability of the system. In a recent work, Camacho (2016) shows that the financial deficit of the pay-as-you-go system has two long-term trends: it falls to 0.2% of GDP by 2030 but then rises to 2.2% of GDP by 2050 because of aging population. This suggests a reform is needed to reduce disbursements and/or increase future revenues.[31]

Second, many reforms such as the reduction in the minimum number of years of contribution from 35 to 30, the doubling of the minimum amounts of retirements of the mixed regime and changes in the distribution of contributions between systems of distribution and capitalization could affect the sustainability of the system.

[29] In 2008, the Parliament approved a new Central Bank Act that included the creation of the Macroeconomic Coordination Committee and the Monetary Policy Committee, and set restrictions to the type of bailout operations for the Central Bank. Also, the Banking Supervision and Regulation Committee was granted greater technical autonomy from the Central Bank.

[30] Collective bargaining has been active in Uruguay since 2005. Wage agreements in force since 2012 and 2013 have established clauses of period adjustments based on past inflation. This, together with a 10% inflation that triggers automatic wage increases in several sectors of the economy, resulted in a rigid nominal environment that favored inflationary inertia.

[31] In September 2017, the annual deficit of the general regime of the pension system was 1.8% of GDP. The general regime excludes the retirement funds of the military, police and bank officials, which have a deficit of 1.7% of GDP and are assisted by the government.

Lastly, a change to the system that would allow a non-negligible group of system assets[32] to abandon the mixed regime is currently under discussion by the Parliament. This would cost between 7% and 10% of GDP (at 2017 prices) over a 40-year horizon.

4. Conclusions and final remarks

In 1960-2014, the financing of Uruguay's public sector was mostly inflationary. On average, two thirds of the total sources came from the inflation tax and one third from public debt.

High inflation in the 1960s was associated with sustained fiscal deficits. Since the 1970s, but especially after 1991, the opening of the economy, the financial liberalization, greater access to external financing, the stabilization plans and the more restrictive institutional framework of the Central Bank, reduced the inflationary financing of fiscal deficits. Nevertheless, although inflation significantly declined during the whole period, the inflation tax remained as an important source to finance obligations.

Chronic inflation between the 1960s and the 1990s caused nominal instability, which ended up triggering nominal rigidities (prices/wage indexation) and dollarization of financial assets. Both limited the ability of macroeconomic policies to stabilize the economic cycle.

In the second half of 20th century, the financial vulnerability of the public sector grew because of public-debt dollarization. After the 2002 crisis, primary fiscal surpluses and the lower share of foreign-currency public debt reduced such vulnerability. Nevertheless, the loss of the primary surplus after 2011 managed to jeopardize the fiscal stability.

The budget constraint is smaller and less volatile after the 1982 debt crisis, except for 1991 (Brady Plan) and 2002 (debt crisis). This is clear especially between 2004 and 2014 and is due to lower primary deficits and a declining debt-to-GDP ratio.

The evidence suggests that in the last three decades governments in Uruguay have slowly understood the importance of fiscal constraints to guarantee nominal stability.

We offer some lessons that can be learned from the case of Uruguay and may be helpful to explain the performance of other Latin American economies. Stabilization plans based on exchange-rate anchors with insufficient fiscal adjustments could induce, under certain circumstances, BOP crisis, currency devaluations, banking crises and increases in the Central Bank's liabilities, which, eventually, can lead to public-debt crises and cyclical volatility. In addition, implicit insurance on bank deposits, public and private debt dollarization and commitments on the exchange rate, requires a strong and consistent fiscal policy.

[32] Between 40,000 and 70,000 according to estimates by *República AFAP*, one of the main pension fund managers.

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Annex 1: Figures

Figure 1

Log of real GDP

Source: Central Bank of Uruguay; Instituto de Economía - Universidad de la República.

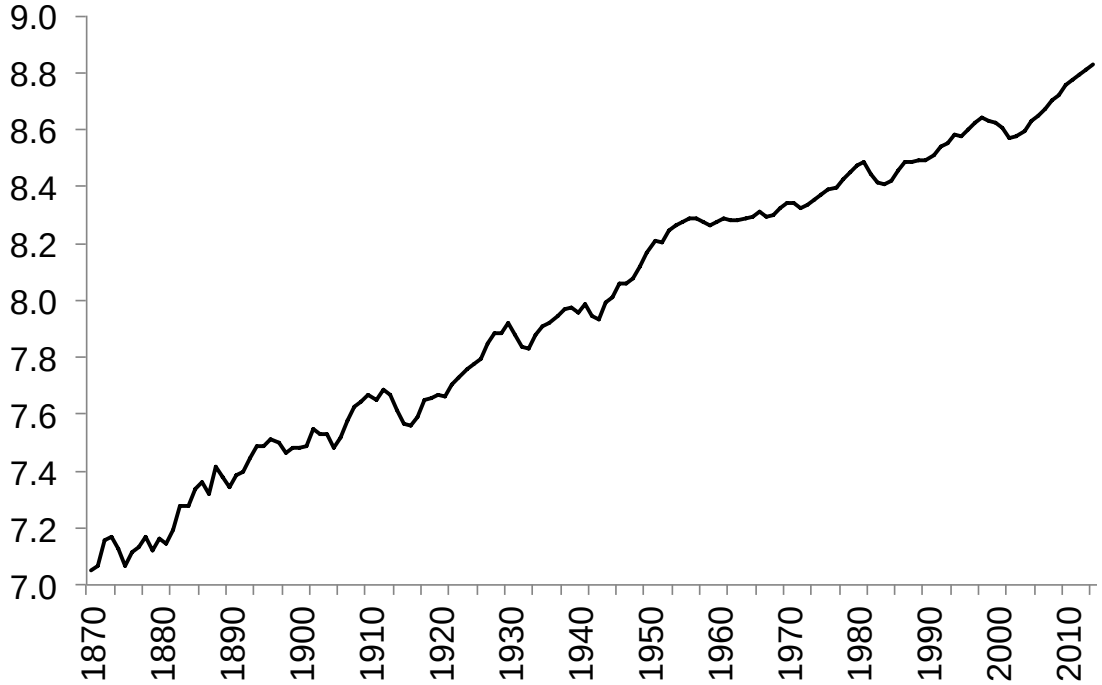


Figure 2

Ln of GDP per capita: percentage deviation from trend (HP filter)

Source: own elaboration based on data from Instituto de Economía - Universidad de la República

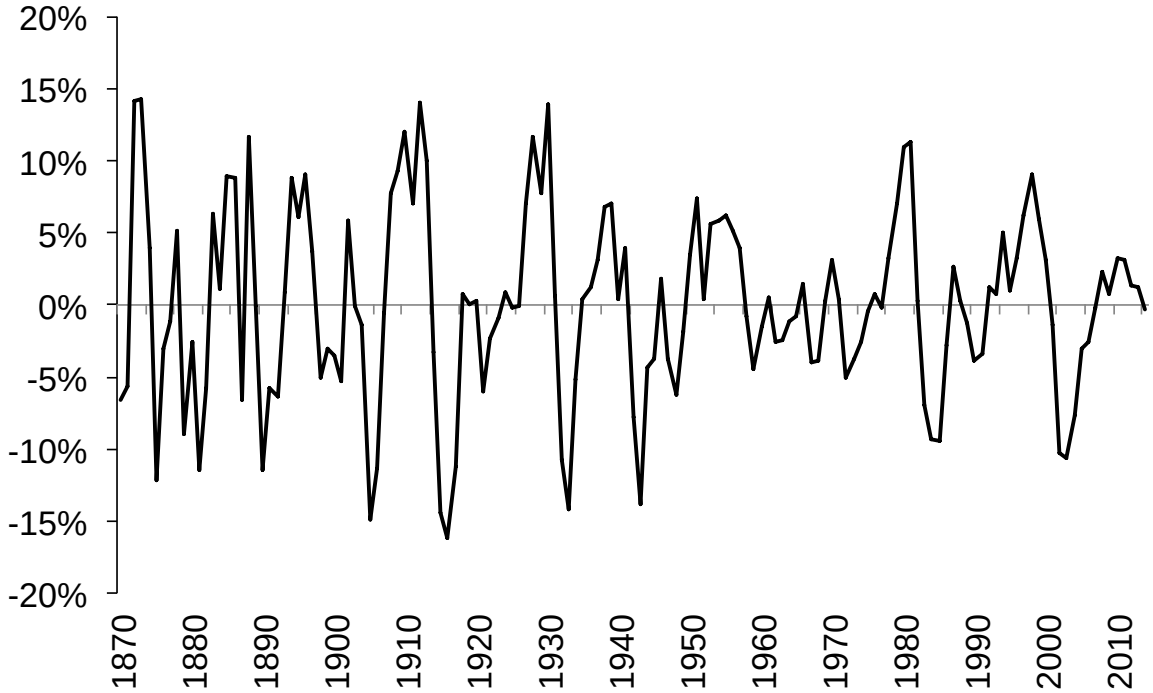


Figure 3

Figure 4

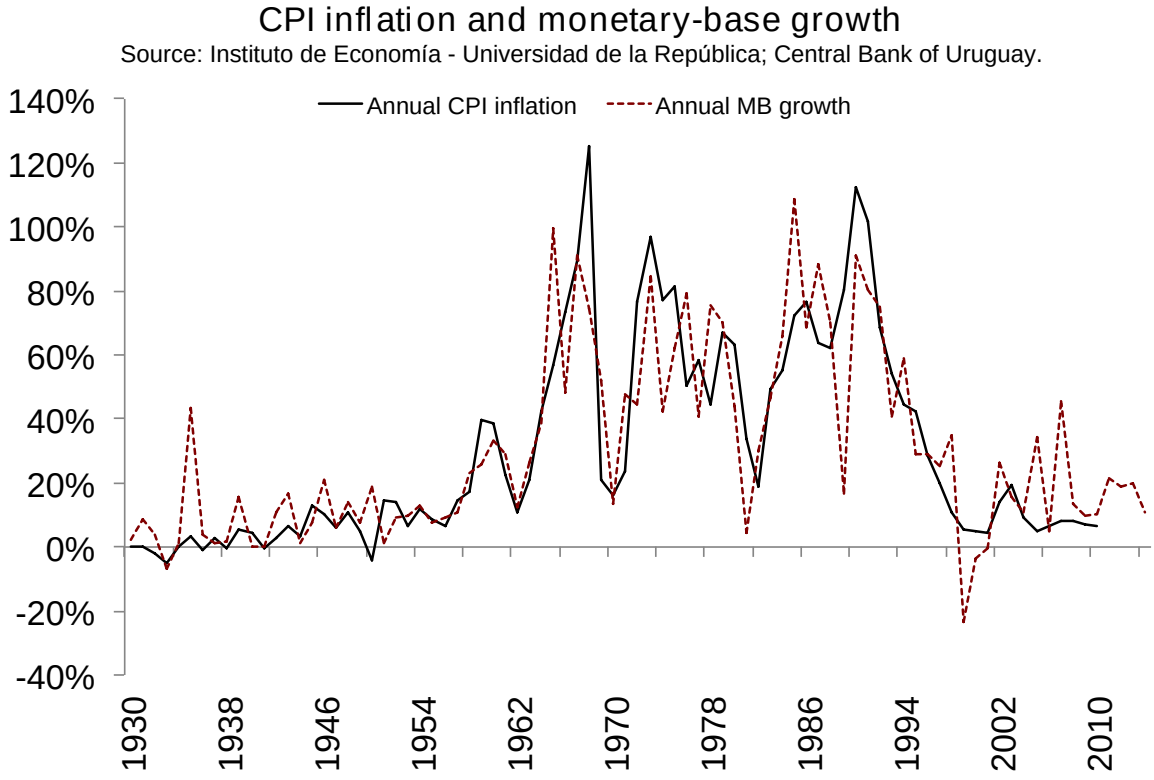


Figure 5

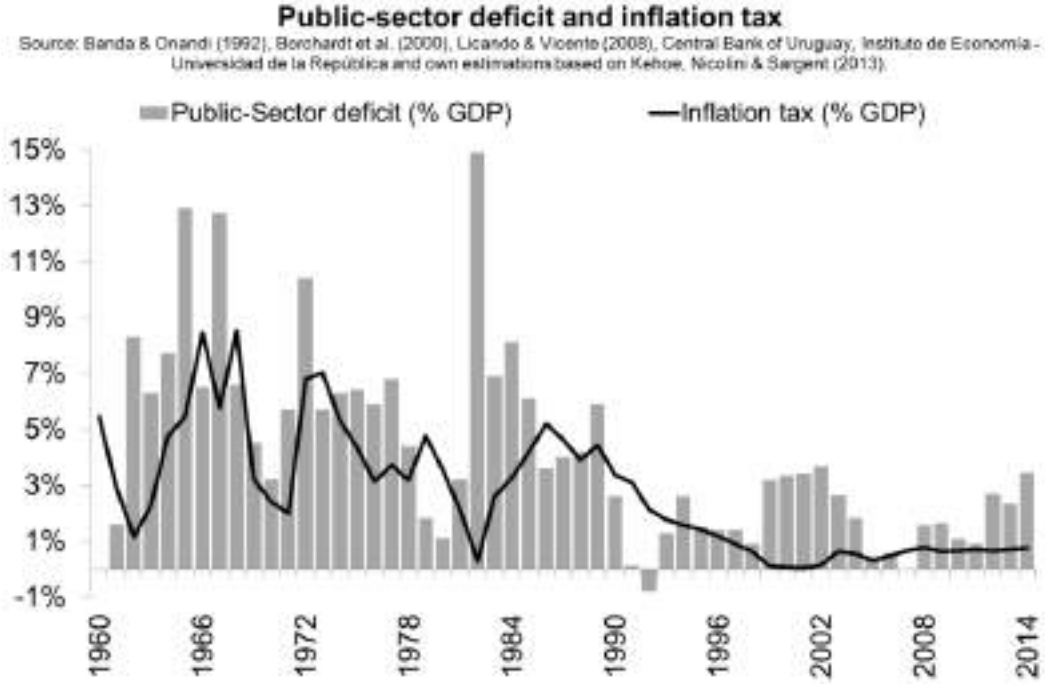


Figure 6

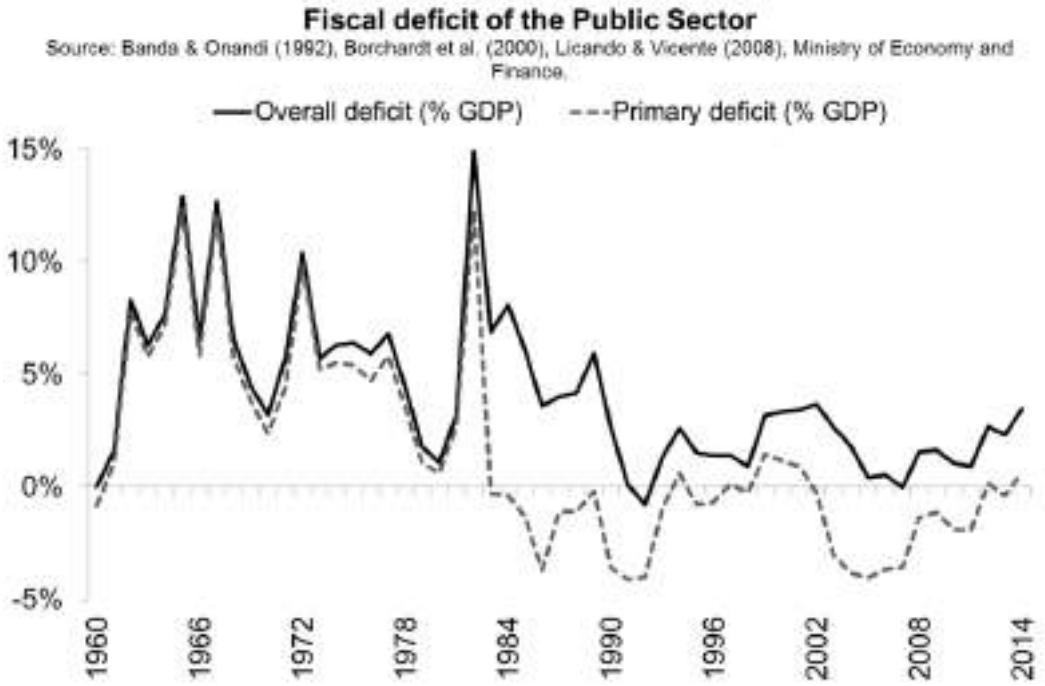


Figure 7

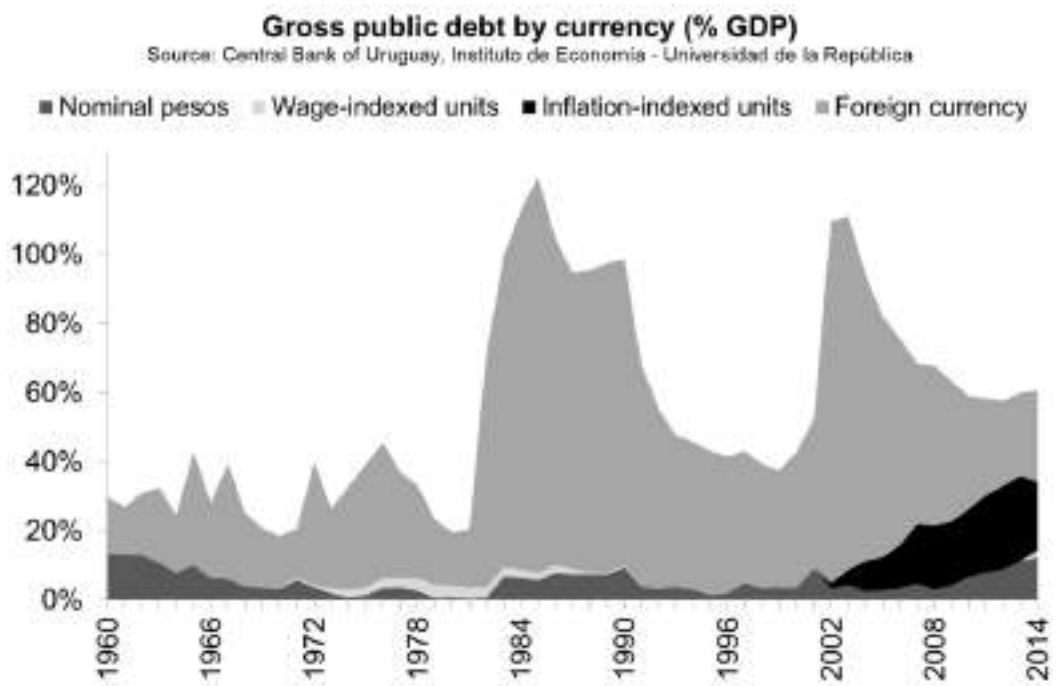


Figure 8

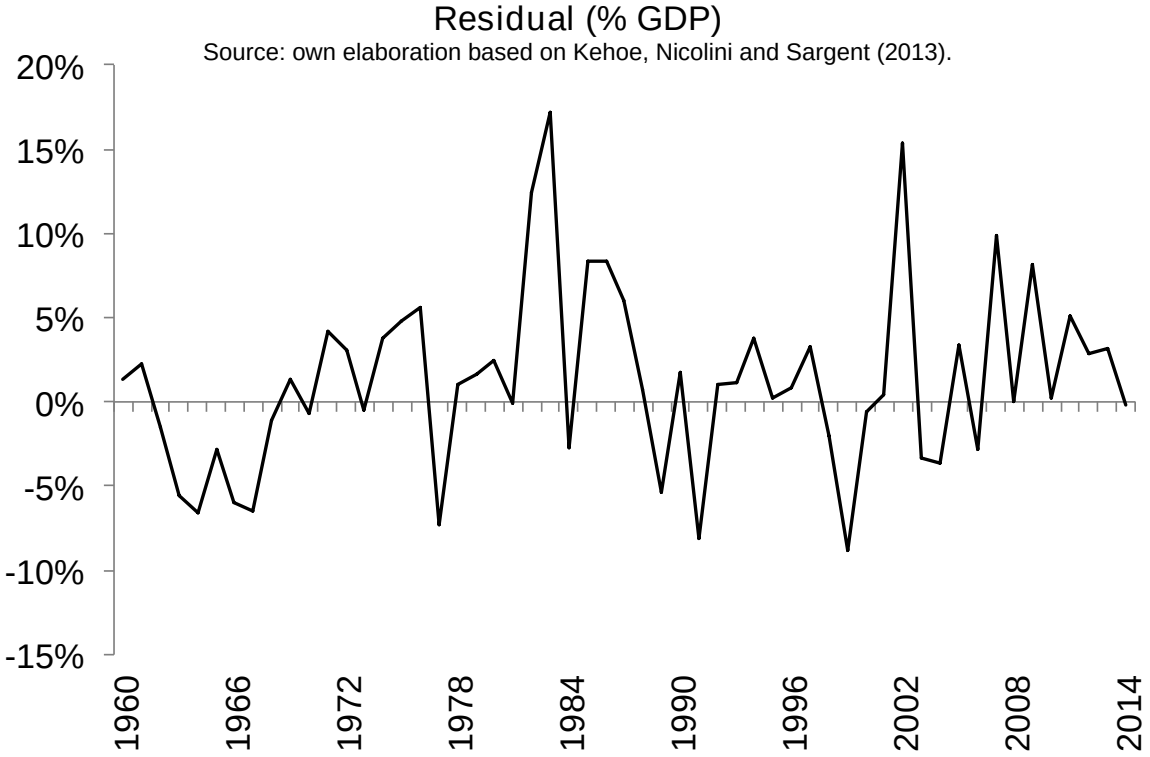


Figure 9

Residual and international reserves (1960-1993)

Source: own elaboration based on Kehoe, Nicolini and Sargent (2013); Instituto de Econo*mí*a - Universidad de la Rep*ú*blica.

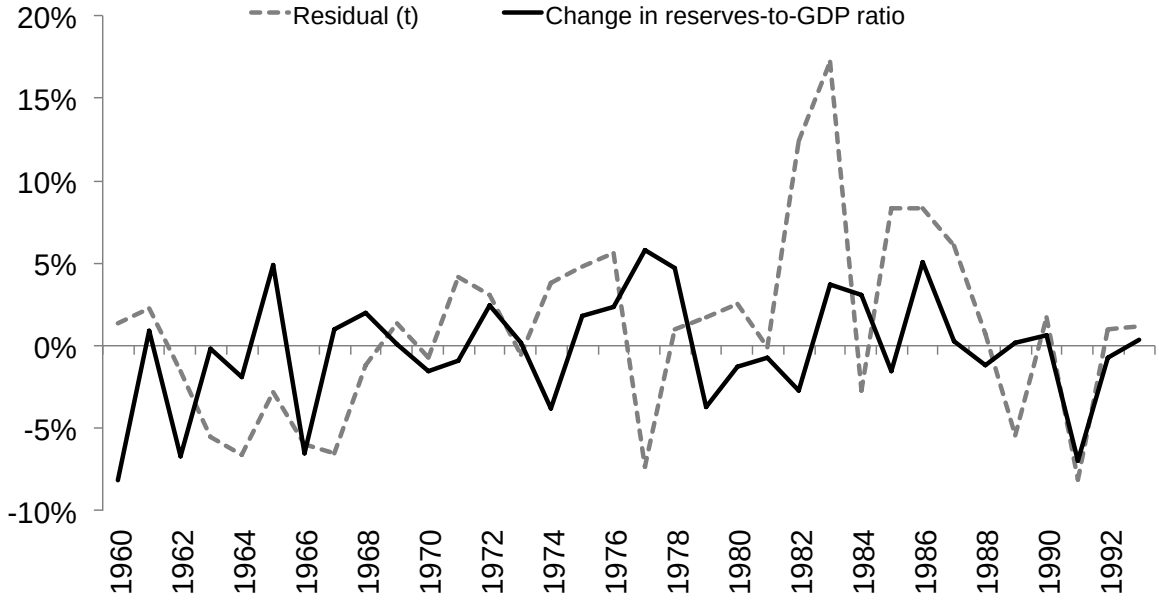
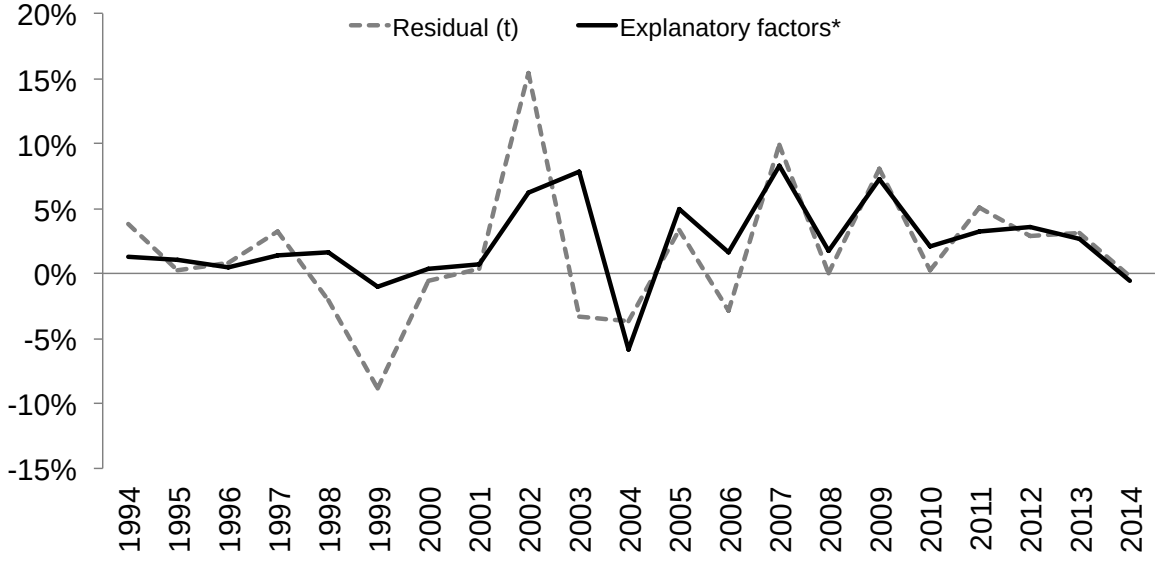


Figure 10

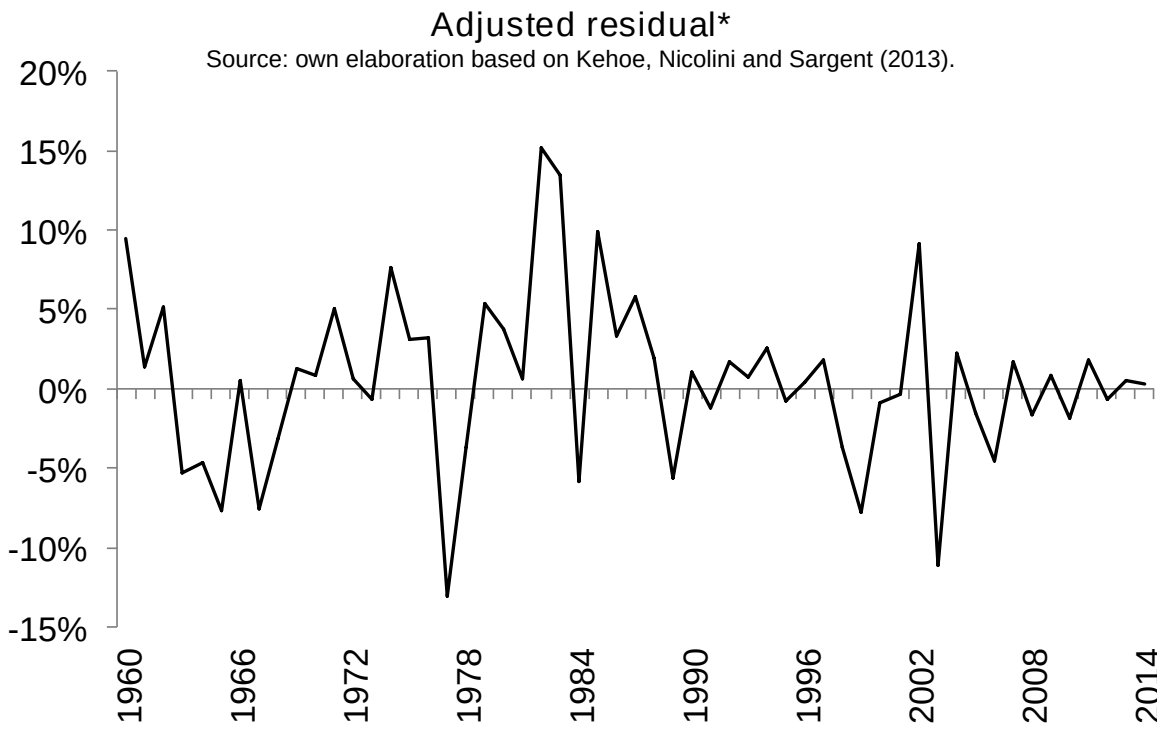
Residual and its explanatory factors (1994-2014)

Source: own elaboration based on Kehoe, Nicolini and Sargent (2013); Central Bank of Uruguay.



* Between 1994 and 2014, the explanatory factors include net-of-credit deposits, financial assets and other extraordinary transfers.

Figure 11



* Adjusted residual is defined as the budget-constraint residual minus the explanatory factors.

Figure 12

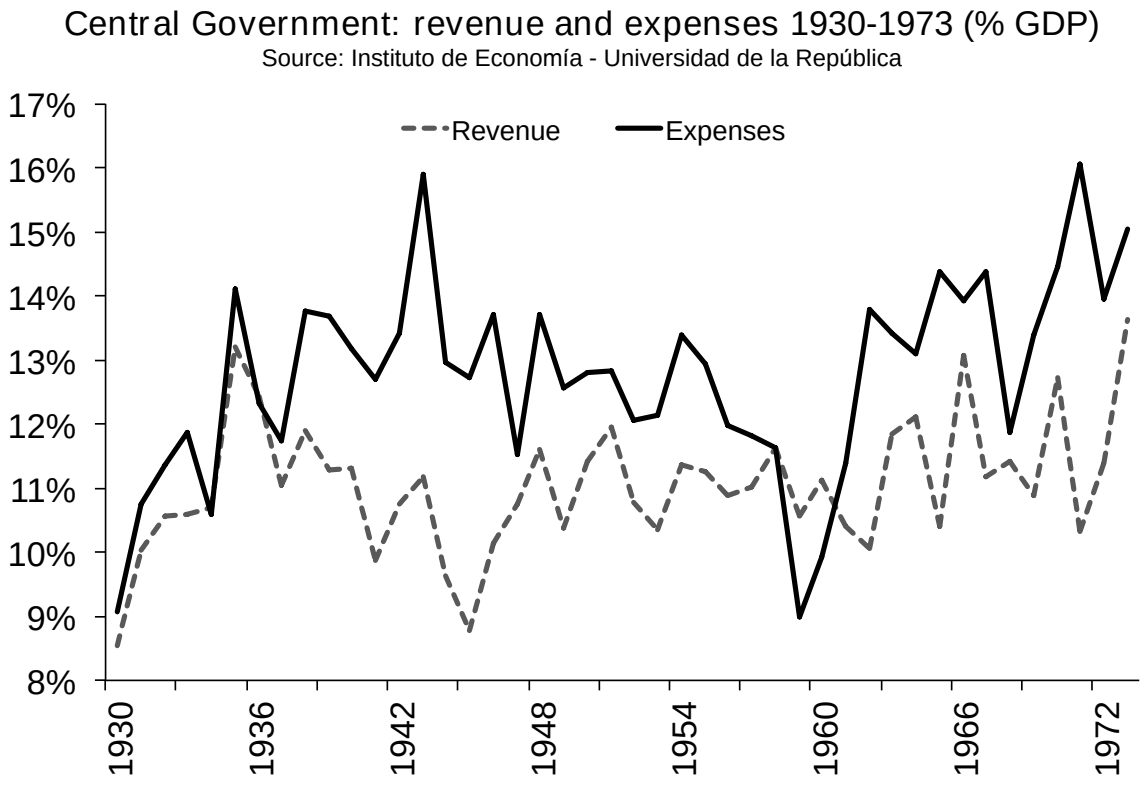


Figure 13

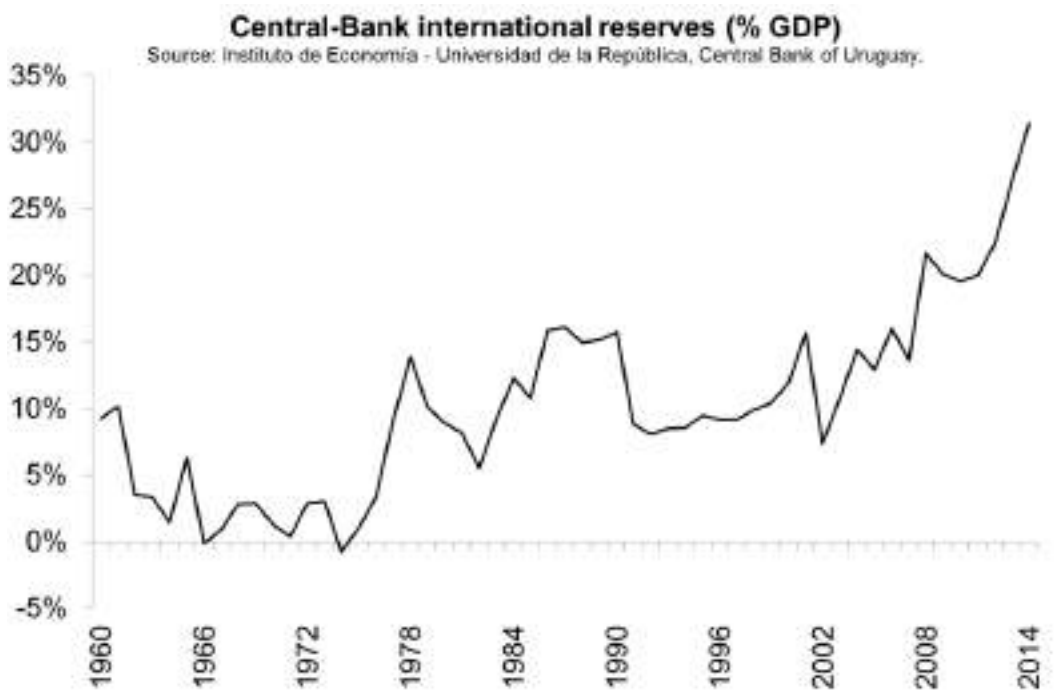


Figure 14

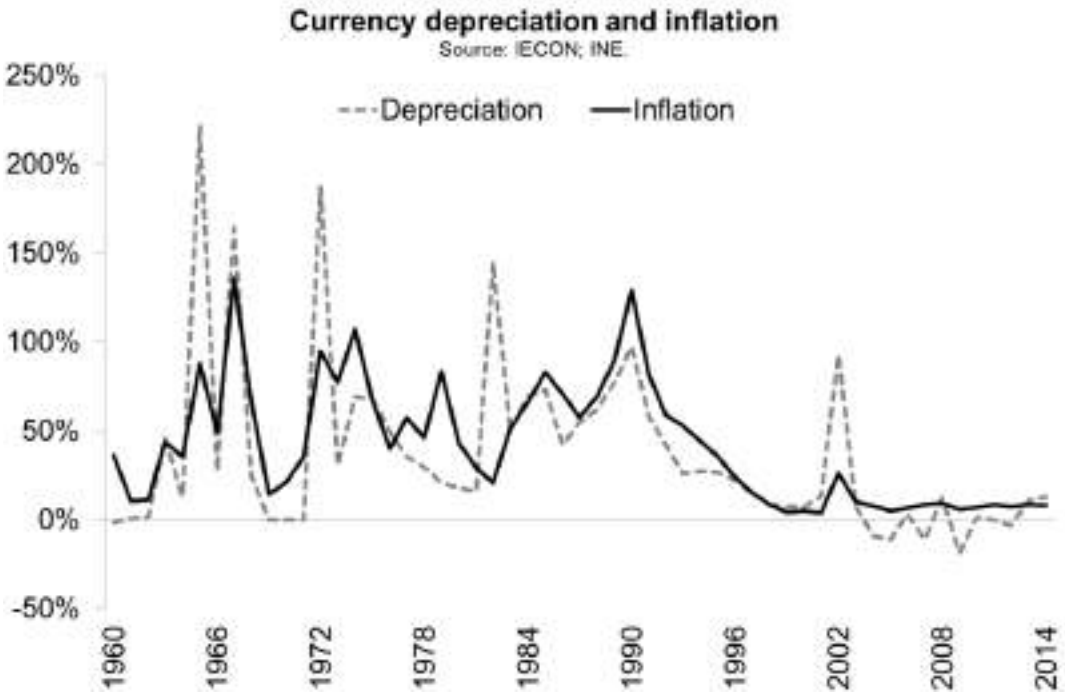


Figure 15

Real Exchange Rate with the U.S. (Index 100 = average 1913-2014)

Source: Aboal D. (2003); own elaboration based on data from FRED, INE and BCU.

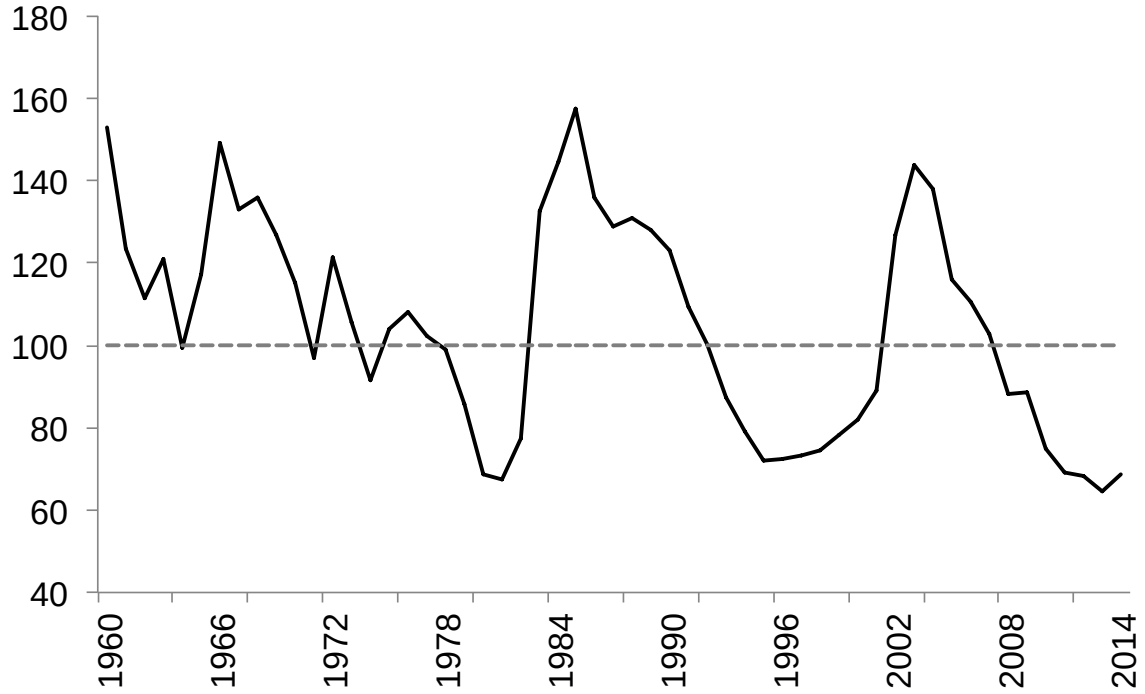


Figure 16

Public-sector overall balance & current-account balance (% GDP)

Source: Banda & Onandi (1992), Borchardt et al. (2000), Licando & Vicente (2008), Ministry of Economy and Finance, Central Bank of Uruguay and Instituto de Economía - Universidad de la República.

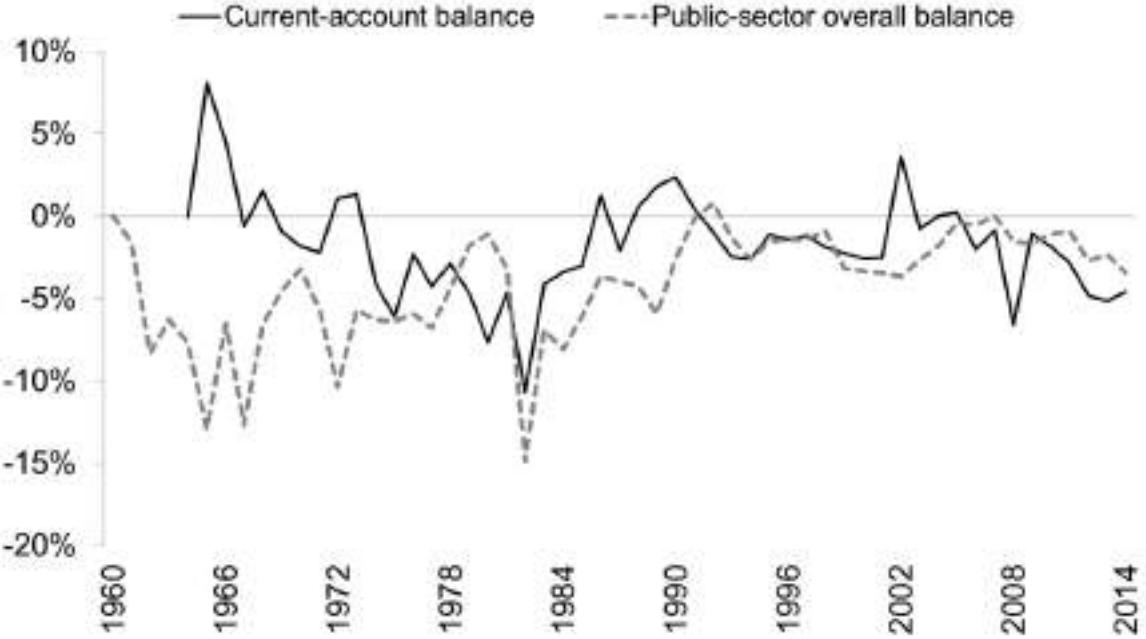


Figure 17

Figure 18

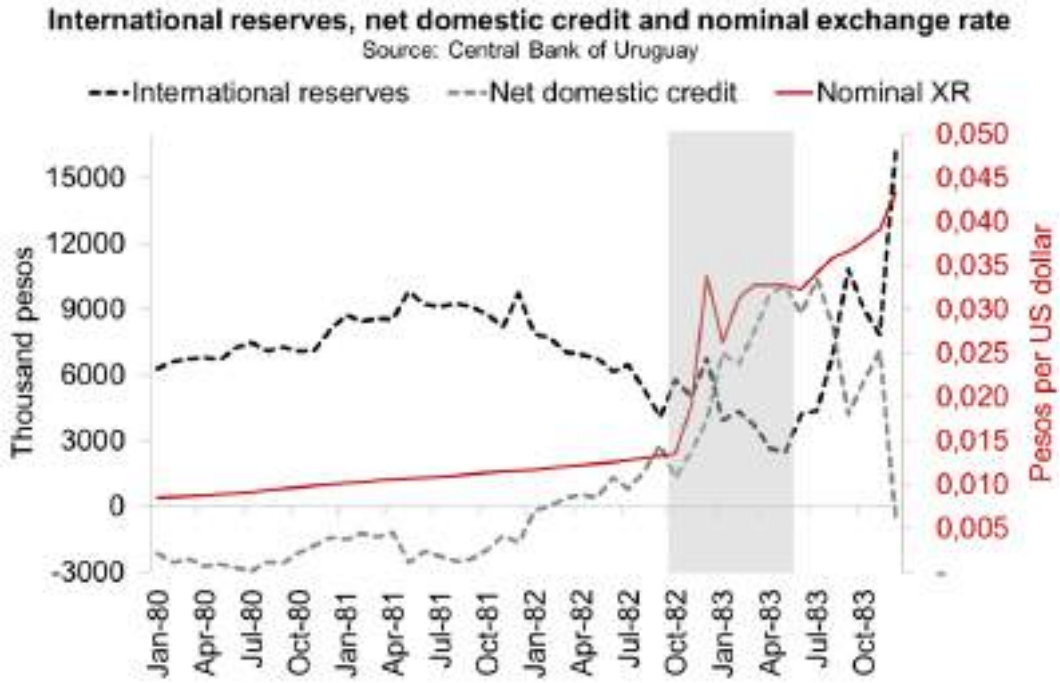


Figure 19

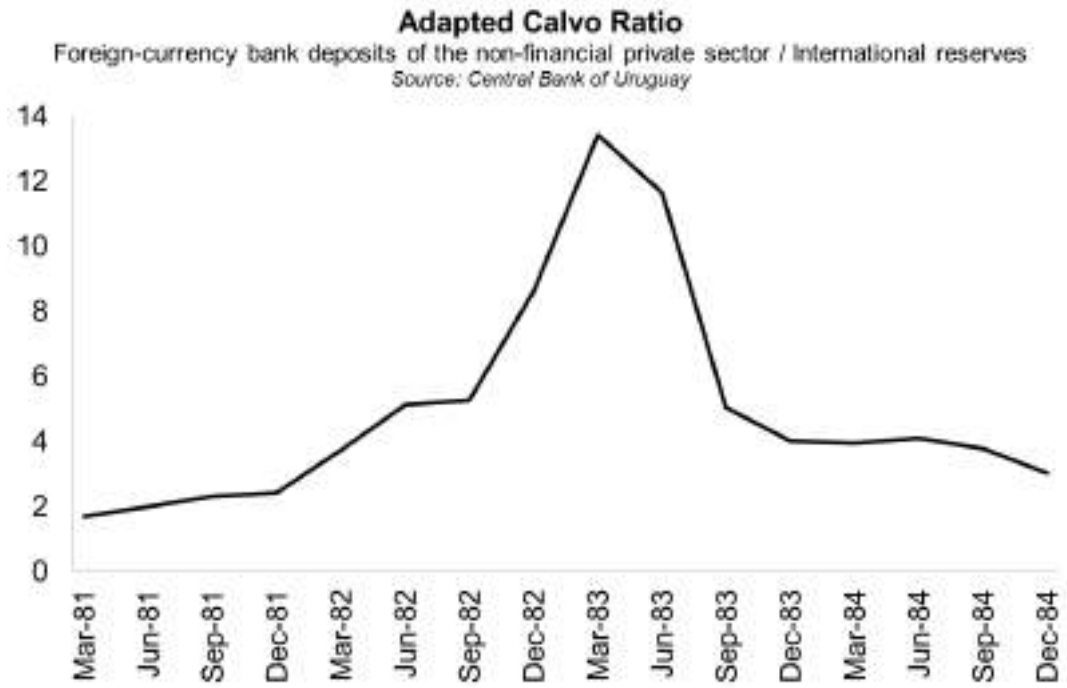


Figure 20

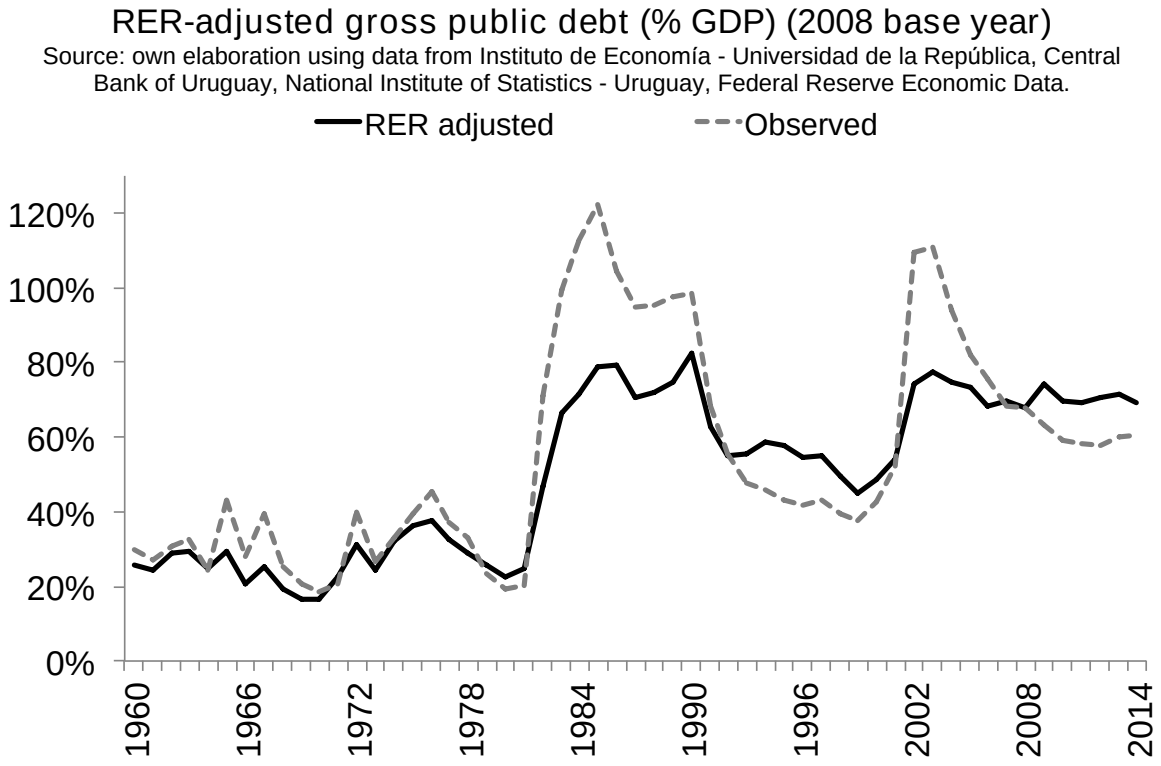


Figure 21

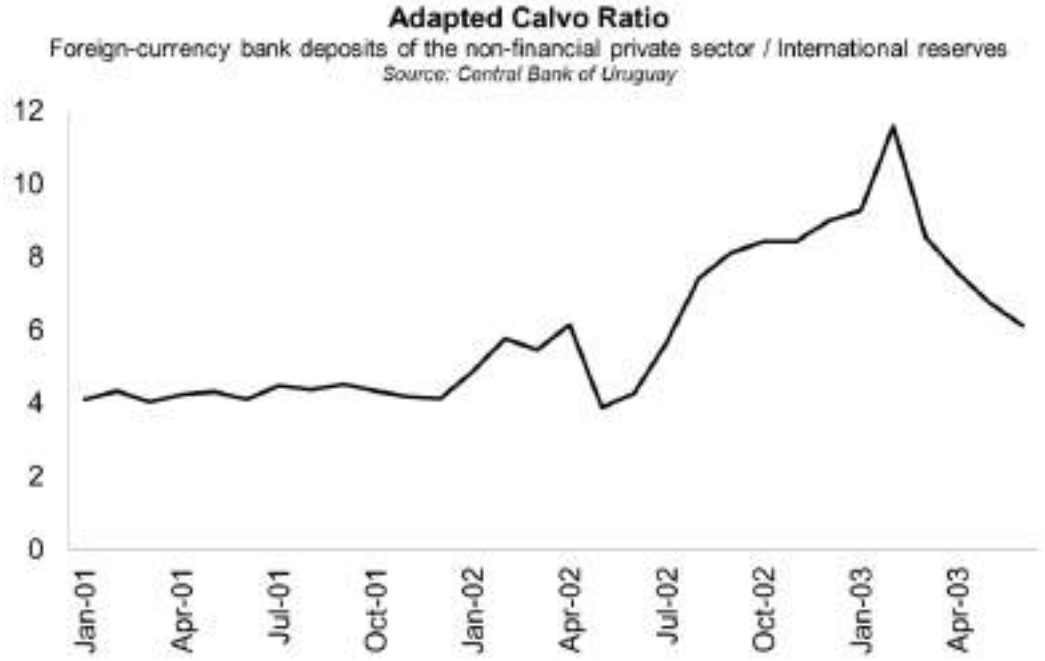


Figure 22

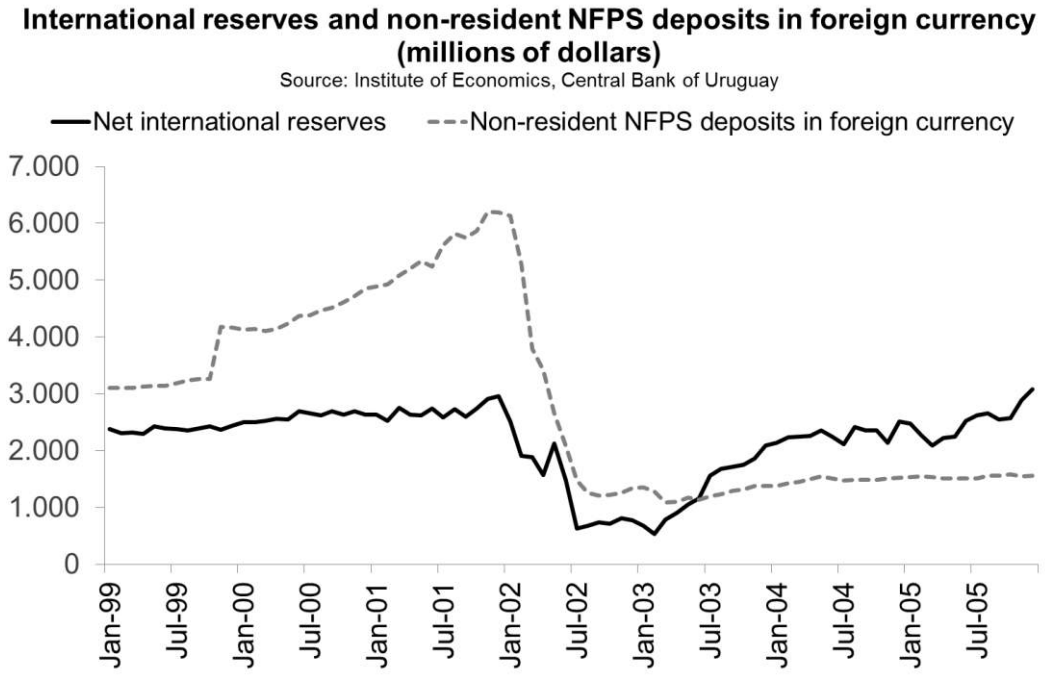
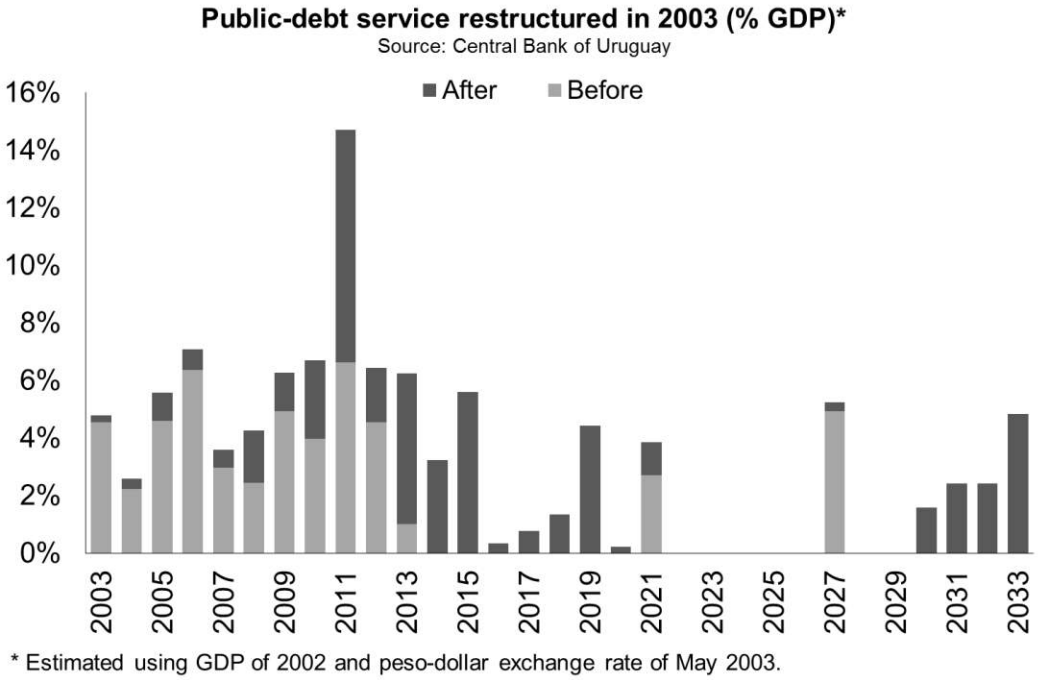


Figure 23


Public-debt service restructured in 2003 (% GDP)*
Source: Central Bank of Uruguay
After
Before
16%
14%
12%
10%
8%
6%
4%
2%
0%
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
2023
2025
2027
2029
2031
2033
* Estimated using GDP of 2002 and peso-dollar exchange rate of May 2003.

Annex 2: Description of data and variables

Public Sector
The definition of Public Sector we use in this paper comprises: i) General Government (Central Government and Local Governments); ii) State-Owned Enterprises (Fuel, Electricity, Telecommunications, Water, Insurance, Railway, Ports); iii) Financial Public Sector (Central Bank, the state-owned commercial bank or *Banco de la República Oriental del Uruguay* and the mortgage bank or *Banco Hipotecario del Uruguay*).

Consumer Price Index for Uruguay
The Consumer Price Index (CPI) comes from the National Statistics Institute (INE) and corresponds to the December figure.

Gross Domestic Product
Two sources are considered for the Gross Domestic Product (GDP) in nominal terms: Bonino et al. (2012) for the period 1959 to 2008 based on data from the Central Bank of Uruguay, and the series of National Accounts of the Central Bank of Uruguay (BCU) for the period 2009-2014.
The CPI from INE is used as a deflator to calculate real GDP. Although the Central Bank published a deflator index for GDP since 1999, and an implied deflator can be extracted from Bonino et al. (2012) for the remaining years, we use the CPI in the budget-constraint exercise so as to be consistent with the conceptual framework.

Nominal exchange rate
The nominal exchange rate is the value of the US dollar measured in Uruguayan pesos in December of each year. The exchange rate comes from INE for the period 1968-2014 and from *Instituto de Economía* (IECON) of Universidad de la República based on Maubrigades, S. (2003) for the period 1959-1967.

US Consumer Price Index
The US Consumer Price Index comes from the Bureau of Labor Statistics of the United States and corresponds to the December figure. It was used as an approximation of the price index of tradable goods in dollars (P_t^W).

Gross public debt
This series corresponds to the stock of public debt denominated in pesos, foreign currency and CPI-indexed units (*unidades indexadas*) issued by the Central Government (CG), state-owned enterprises (SOE's), local governments and the Central Bank. For the period 1959-1998, we use the historical series of *Instituto de Economía*, to which we add series of treasury notes and wage-indexed mortgage obligations since they are not included in the former. Since 1999, data come from the Central Bank under different denominations (pesos, dollars, euros, yen, special drawing rights, CPI-indexed units and "others"). For the years 1959 and 1960 and the period 1963-1966 there is no data on public debt denominated in foreign currency so we assume a linear evolution.

Public debt adjusted by real exchange rate
The public debt-GDP ratio is adjusted by the real exchange rate as follows. Public debt is comprised by a local-currency stock and a foreign-currency stock. Both the local-currency stock and GDP are expressed in constant pesos using Uruguay's CPI. Foreign-currency debt is first expressed in constant US dollars using the US CPI and then expressed in pesos using the 2008 nominal exchange rate. We chose this year because it is when the

bilateral RERs of Uruguay with Brazil, Argentina and the US were close to the historical averages (1913-2014).

Monetary base
The data correspond to the December figure and come from Instituto de Economía for the period 1959-2001 and from the Central Bank for the period 2002-2014.

Overall fiscal deficit of the Public Sector
Since there is no unique estimation that covers the entire period (1960-2014), we use different sources to construct a series of the overall fiscal deficit. We use Band & Onandi (1992) for 1959-1969, Licandro & Vicente (2006) for 1970-1998, and official data from the Ministry of Economy and Finance since 1999. The series in Banda & Onandi (1992) was constructed before the IMF Manual 2001-2010 and is not clear enough whether the fiscal result includes stated-owned enterprises and local governments. However, it is the only available data for the 1960s.

Interest payments
Between 1959 and 1973, data come from Instituto de Economía and correspond only to the Central Government. The estimations in Borchardt et al. (2000) were considered for the period 1974-1996 and correspond to the entire public sector. Because official data begin in 1999, interest payments from Instituto de Economía are used for 1997 and 1998.

Primary fiscal deficit of the Public Sector
The primary deficit of the consolidated public sector was constructed using the overall deficit and interest payments. However, for 1959-1973, 1997 and 1998 data on interest payments are available only for the Central Government.

Interest rates on public debt
For 2004-2014, average interest rates by currency come from the Debt Management Unit of the Ministry of Economy and Finance. For 1959-2003, official data on interest rates by currency are not available so we proceed as follows. First, we assume all public debt was denominated in foreign currency in 1959-2003 (which is not a strong assumption since the share of foreign-currency debt averaged 84.7% in this period). Then, for 1959-1993 we estimate an implicit foreign-currency interest rate in *t* as the ratio of total interest payments in *t-1* over the whole stock of public debt in *t*, which is consistent with the budget-constraint conceptual framework. For 1994-2003, we add the Uruguay Bond Index (a measure of country risk) by RAFAP to the U.S. 10-year Treasury rate.

Financing of the Public Sector
According to data from the Central Bank of Uruguay, the Public Sector is financed, besides public debt and loans, by net deposits, financial assets and other extraordinary transfers.
Net deposits include "net deposits of the non-financial public sector at commercial banks", "net deposits of commercial banks at the Central Bank" and "the assistance of the Central Bank to commercial banks in 2002".
Financial assets "correspond to the financing through financial assets since January 2007" and before this date such financing is "net of reserve liabilities and assistance of the Central Government to commercial banks through its account at the Central Bank".
Other extraordinary transfers comprise: "deposits at the Central Bank and export currencies to be claimed by the Non-Financial Public Sector", "internal suppliers of the Non-Financial Public Sector", "cash, foreign deposits and tenure of private securities held

by the Non-Financial Public Sector, “counterpart of transfers of stand-by loans from the Central Bank to the Central Government in 2002”, “counterpart of 2,800,000,000 million pesos of an agreement between *Banco Hipotecario, Banco República* and the Central Government in July 2004” and “Government’s deposits at the Central-Bank special accounts since May 2005 due to international issuance of public debt”.

Annex 3: Complete derivation of the budget constraint (Kehoe, Nicolini and Sargent, 2013)

The budget constraint of the consolidated public sector is defined as follows:

$$B_t + M_t + b_t P_t + b_t^* E_t = (D_t + T_T)P_t + B_{t-1}R_{t-1} + M_{t-1} + b_{t-1}r_{t-1}P_t + b_{t-1}^* r_{t-1}^* E_t \quad (\mathbf{1})$$

The left hand side of equation **(1)** represents the sources of financing of the consolidated public sector in period t, while the right hand side includes the obligations that this sector has to face in the same period. The sources include the stock of debt in t (denominated in different currencies) plus the monetary base also in t. The obligations include the primary deficit of the public sector consolidated in t, the monetary base in $t-1$and the public debt service calculated as the principal plus interest payments in $t-1$.

The termT_t, included next to the deficit, gathers extraordinary transfers that occur during periods of crisis or severe fiscal constraints. This variable is calculated as a residual and is the one that enables to balance sources with obligations.

By dividing equation **(1)** by nominal GDP the following is obtained:

$$\frac{B_t}{y_t P_t} - \frac{M_t}{y_t P_t} + \frac{b_t}{y_t} + \frac{b_t^* E_t}{y_t P_t} = \frac{(D_t + T_t)}{y_t} + \frac{B_{t-1}R_{t-1}}{y_t P_t} + \frac{M_{t-1}}{y_t P_t} + \frac{b_{t-1}r_{t-1}}{y_t} + \frac{b_{t-1}^* r_{t-1}^* E_t}{y_t P_t} (\mathbf{3})$$

The level of domestic prices is defined as follows:

$$P_t = \left(P_t^h\right)^{\alpha} (P_t^W E_t)^{1-\alpha} (\mathbf{4})$$

whereP_t^h is the price level of non-tradable goods, P_t^W is the price level in dollars of tradable goods and α is the share of non-tradable goods in the domestic deflator. Therefore,

$$\frac{E_t}{P_t} = \frac{E_t}{\left(P_t^h\right)^{\alpha} (P_t^W E_t)^{1-\alpha}} = \frac{E_t}{\left(\frac{P_t^h}{P_t^W E_t}\right)^{\alpha} P_t^W E_t} = \frac{\xi_t}{P_t^W} (\mathbf{5})$$

whereξ_t is the real exchange rate.

If the following variables are defined as

$$\theta_t^N = \frac{B_t}{y_t P_t}, \theta_t^r = \frac{b_t}{y_t}, \theta_t^* = \frac{\frac{b_t^*}{P_t^W}}{y_t}, m_t = \frac{M_t}{y_t P_t}, \pi_t = \frac{P_t}{P_{t-1}}, \pi_t^W = \frac{P_t^W}{P_{t-1}^W}, g_t = \frac{y_t}{y_{t-1}}, d_t = \frac{(D_t + T_t)}{y_t} \quad (\mathbf{6})$$

the budget constraint can be expressed as follows:

$$\theta_t^N + m_t + \theta_t^r + \theta_t^* \xi_t = d_t + \theta_{t-1}^N \frac{R_{t-1}}{\pi_t g_t} + \frac{m_{t-1}}{\pi_t g_t} + \theta_{t-1}^r \frac{r_{t-1}}{g_t} + \theta_{t-1}^* \frac{r_{t-1}^*}{\pi_t^W g_t} \xi_t \quad (\mathbf{7})$$

This equation can be reformulated so that:

$$\left(\theta_t^N - \theta_{t-1}^N \frac{R_{t-1}}{\pi_t g_t}\right) + \left(m_t - \frac{m_{t-1}}{\pi_t g_t}\right) + \left(\theta_t^r - \theta_{t-1}^r \frac{r_{t-1}}{g_t}\right) + \left(\theta_t^* \xi_t - \theta_{t-1}^* \frac{r_{t-1}^*}{\pi_t^W g_t} \xi_t\right) = d_t \quad (\mathbf{8})$$

By analyzing each of the terms the following result is obtained:

$$\left(\theta_t^N - \theta_{t-1}^N \frac{R_{t-1}}{\pi_t g_t}\right) = \left(\theta_t^N - \theta_{t-1}^N + \theta_{t-1}^N - \theta_{t-1}^N \frac{R_{t-1}}{\pi_t g_t}\right)$$
$$= (\theta_t^N - \theta_{t-1}^N) - \theta_{t-1}^N \left(\frac{R_{t-1}}{\pi_t g_t} - 1\right) \quad (\mathbf{9})$$

$$\left(m_t - \frac{m_{t-1}}{\pi_t g_t}\right) = \left(m_t - m_{t-1} + m_{t-1} - \frac{m_{t-1}}{\pi_t g_t}\right) = (m_t - m_{t-1}) - m_{t-1}\left(\frac{1}{\pi_t g_t} - 1\right) (\mathbf{10})$$

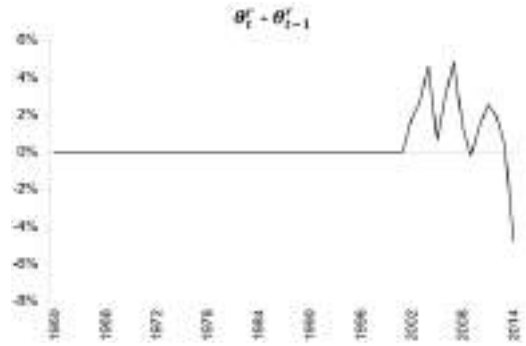
$$\left(\theta_t^r - \theta_{t-1}^r \frac{r_{t-1}}{g_t}\right) = \left(\theta_t^r - \theta_{t-1}^r + \theta_{t-1}^r - \theta_{t-1}^r \frac{r_{t-1}}{g_t}\right) = (\theta_t^r - \theta_{t-1}^r) - \theta_{t-1}^r \left(\frac{r_{t-1}}{g_t} - 1\right) \quad (\mathbf{11})$$

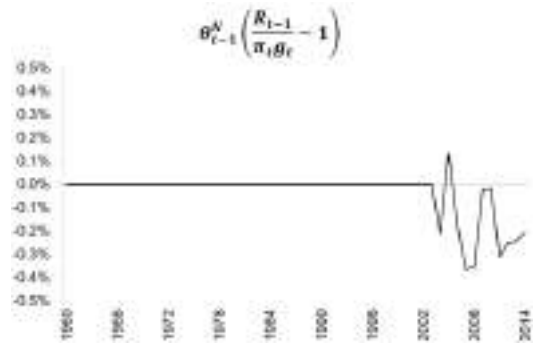
$$\left(\theta_t^* \xi_t - \theta_{t-1}^* \frac{r_{t-1}^*}{\pi_t^W g_t} \xi_t\right) = \xi_t \left(\theta_t^* - \theta_{t-1}^* + \theta_{t-1}^* - \theta_{t-1}^* \frac{r_{t-1}^*}{\pi_t^W g_t}\right)$$
$$= \xi_t (\theta_t^* - \theta_{t-1}^*) - \xi_t \theta_{t-1}^* \left(\frac{r_{t-1}^*}{\pi_t^W g_t} - 1\right) \quad (\mathbf{12})$$

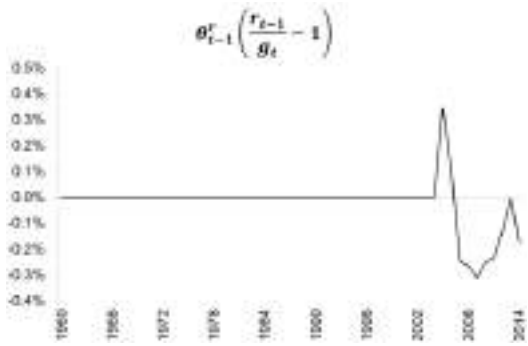
Therefore, the budget constraint can be expressed as:

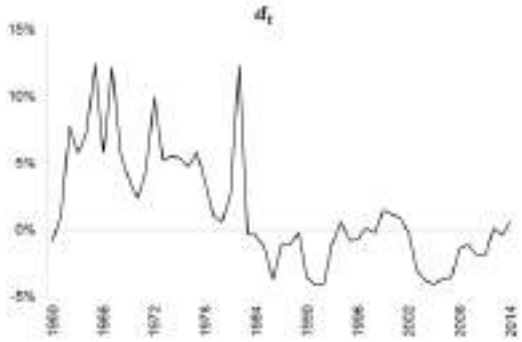
$$(\theta_t^N - \theta_{t-1}^N) + (\theta_t^r - \theta_{t-1}^r) + \xi_t (\theta_t^* - \theta_{t-1}^*) + (m_t - m_{t-1}) + m_{t-1}\left(1 - \frac{1}{\pi_t g_t}\right)$$
$$= \theta_{t-1}^N \left(\frac{R_{t-1}}{\pi_t g_t} - 1\right) + \theta_{t-1}^r \left(\frac{r_{t-1}}{g_t} - 1\right) + \theta_{t-1}^* \left[\xi_t \left(\frac{r_{t-1}^*}{\pi_t^W g_t} - 1\right)\right] + d_t \quad (\mathbf{13})$$

Annex 4: Results of the budget-constraint equation for the public sector





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2014

Annex 5: Model of balance-of-payments crisis (Krugman, 1979)

Assuming α=0 (share of non-tradable goods in the basket), the purchasing power parity can be represented as:

$$P_t = P_t^w . e_t \qquad \textbf{(14)}$$

whereP_t is the domestic price level in period t, P_t^w is the price level of tradable goods in t and e_t is the nominal exchange rate in t. Equation **(14)** indicates that, in a context of a fixed exchange rate, the price level is determined by the prices of tradable goods expressed in dollars.

Assuming that the demand for money can be represented by:

$$M_t . v = P_t y_t \qquad \textbf{(15)}$$

where$v$ is the velocity of money assumed constant and y_t is the real GDP determined as an exogenous variable. Therefore, the monetary base is the relevant monetary aggregate, which from the sheet of the Central Bank is defined as:

$$M_t = F_t + DC_t \qquad \textbf{(16)}$$

whereF_t is the stock of international reserves held by the Central Bank and DC_t is the stock of domestic credit.

Krugman's argument (1979) is that sustained fiscal deficits within a context of restrictions to external financing force the Central Bank to increase domestic credit. Under a fixed exchange rate, the increase of domestic credit leads to a loss of international reserves, which may cause a balance-of-payment crisis, currency devaluation and rising inflation.

Annex 6: Maturity model (Calvo 1998; Cole & Kehoe, 1996)

Consider a two-period economy with a government that inherits an amount *B* of debt. The budget constraint will therefore be

$$B - s_1 - \frac{s_2}{1+r} = 0 \qquad \textbf{(17)}$$

where $s_1 = -d_t$ is the surplus of period t, and r is the international interest rate. As the debt is positive, the government will need positive surpluses to pay it back. For simplicity, assume away any enforcement problems. Assume also that s^{max} is the maximum surplus that the government can raise without provoking a recession. Finally, assume that a recession means that the following period no surplus can be raised.
Under this assumptions, if

$$B \leq s^{max} \qquad \textbf{(18)}$$

Then the debt can all be paid in the first period. Also, the interest can be paid the first period and the debt paid back on the second period. On the other hand, if

$$B \geq s_1^{max} + \frac{s_2^{max}}{1+r} \qquad \textbf{(19)}$$

The debt cannot be paid without provoking a recession. Thus, the most interesting case is for intermediate values of the debt.

$$s_1^{max} < B < s_1^{max} + \frac{s_2^{max}}{1+r} \qquad \textbf{(20)}$$

Assume also that all the debt is due on the first period. In this case, there are two equilibria. The first equilibrium is characterized by positive surpluses in the first period that cover the interest payments and part of the debt, while a share of the debt is refinanced for the second period. Along this equilibrium, all the debt is paid back. The other equilibrium, however, is characterized by default. In this equilibrium none of the debt gets refinanced, so the government is forced to raise a surplus higher that s^{max}. This provokes a recession such that the government in the second period is unable to raise a surplus, making rational the behavior of the lenders of not refinancing the debt.

Note that in this case the maturity of the debt can be managed to eliminate the second equilibrium. If an amount equal to s^{max} is due in the second period, then the government has automatic refinancing, it does not need to raise a surplus larger than the maximum and avoid the recession.