The Monetary and Fiscal History of Latin America: Brazil

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Abstract

Brazilian inflation rate took off to three-digit levels in the early eighties, despite primary fiscal surpluses. Inflation kept increasing, reaching four digits in 1989 until it was stabilized by the Real Plan (July 1st, 1994). Compared to classical hyperinflations, Brazil experienced a much more protracted process. Inflation edged up slowly but surely for several years, being occasionally "hammered" by stabilization plans that usually froze wages and prices, but did not change the fiscal deficits, and did not last long. Three questions arise: Can a fiscal story explain the slow crawl of inflation towards hyperinflation? Why did so many stabilization plans fail? What was the difference in the Real Plan that made it eventually successful in conquering the Brazilian hyperinflation?

1 Introduction

The typical pattern of classical hyperinflations is an extremely rapid increase in the inflation rate for a short period of time, rarely longer than a couple of years.[1] Table 1 displays the data for some episodes. These episodes have in common a fiscal cause: for different reasons the government cannot tax enough and can no longer borrow, turning to seigniorage as the finance of last resort. Also, when hyperinflation takes hold, economic agents resort to currency substitutes, usually a foreign currency.

Table 1: Inflation and money growth during seven hyperinflations of the 1920s and 1940s

Country	Beginning - End	P_T/P_0	Avg. Monthly Inflation Rate (%)	Avg. Monthly M Growth (%)
Austria	Oct/1921 - Sep1922	61	50	31
Germany	Sep/1922 - Nov/1923	1.2×10^9	2234	2246
Greece	Nov/1943 - Nov/1944	4.7×10^6	365	220
Hungary I	Mar/1923 - Feb/1924	44	46	33
Hungary II	Aug/1945 - Jul/1946	3.8×10^{27}	19,800	12,200
Poland	Jan/1923 - Jan/1924	699	82	72
Russia	Dec/1921 - Jan/1924	1.2×10^5	57	49

Source: Blanchard (2000)

Hyperinflations in Latin America have a different pattern: they tend to be less intense, but they last longer. Table 2 displays the data for four cases: Argentina, Brazil, Nicaragua and Peru.

Table 2: Inflation and fiscal policy during high inflation episodes in Latin America

	Average Monthly Inflation (%)				
Country	1976-1980	1981-1985	1986-1990	1991-1995	1996-2000
Argentina	9.3	12.7	20.0	2.3	0.0
Brasil	3.4	7.9	20.7	19.0	0.6
Nicaragua	1.4	3.6	35.6	8.5	0.8
Peru	3.4	6.0	23.7	4.8	0.8

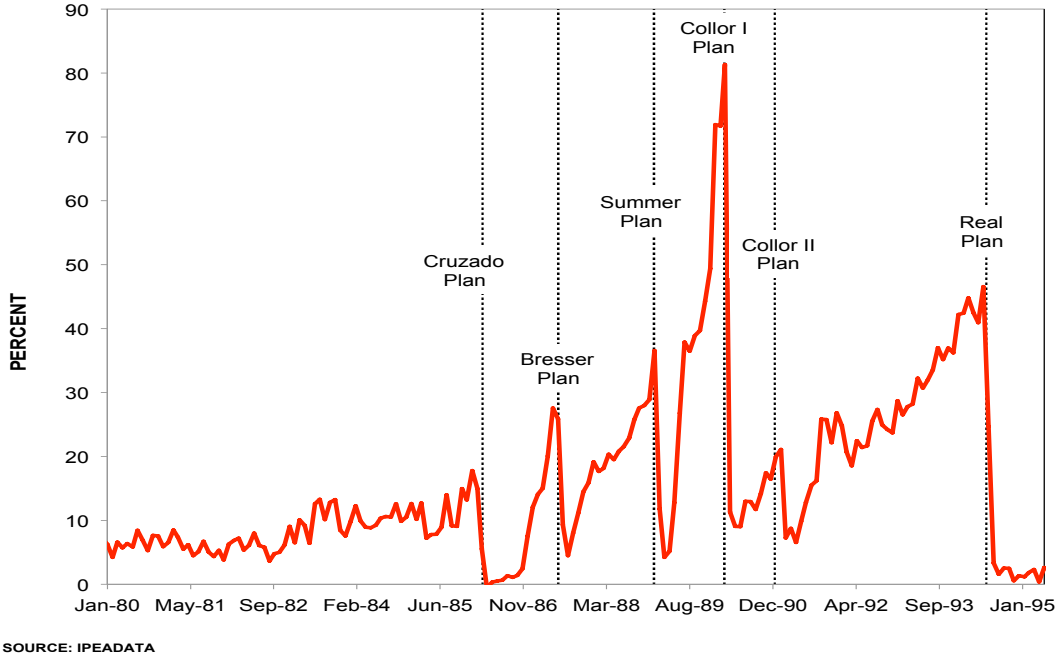
Source: Blanchard (2000)

[1] Sargent (1982).

In contrast to the stylized facts of classical hyperinflations displayed in Table 1, Brazil had yearly inflation rates well above 1,000% from 1989 (except 1991) until inflation was finally stabilized by the Real Plan (July 1st, 1994). Hyperinflation in Brazil was a much more protracted process. Inflation edged up slowly but surely for several years, being occasionally "hammered" by stabilization plans that usually froze wages and prices, but did not last long. Figure 1 displays the monthly inflation rates. If one abstracts from the forced falls in inflation, the upward trend is very clear.[2] Note that, according to Cagan's seminal definition of hyperinflation, Brazil only experienced it during a very short period, from December 1989 to March 1991, when the most famous failed stabilization plan, the Collor I Plan, froze a large part of financial assets as well as prices and wages.[3]

In Figure 1 we highlight some of the plans that tried to reduce inflation but the choice of such plans is also subjective. Within each plan, there were some small plans with different levels of effectiveness. At the same time, the evidence does not support the idea that there was a growth collapse during the high inflation period.

Figure 1: Monthly Inflation



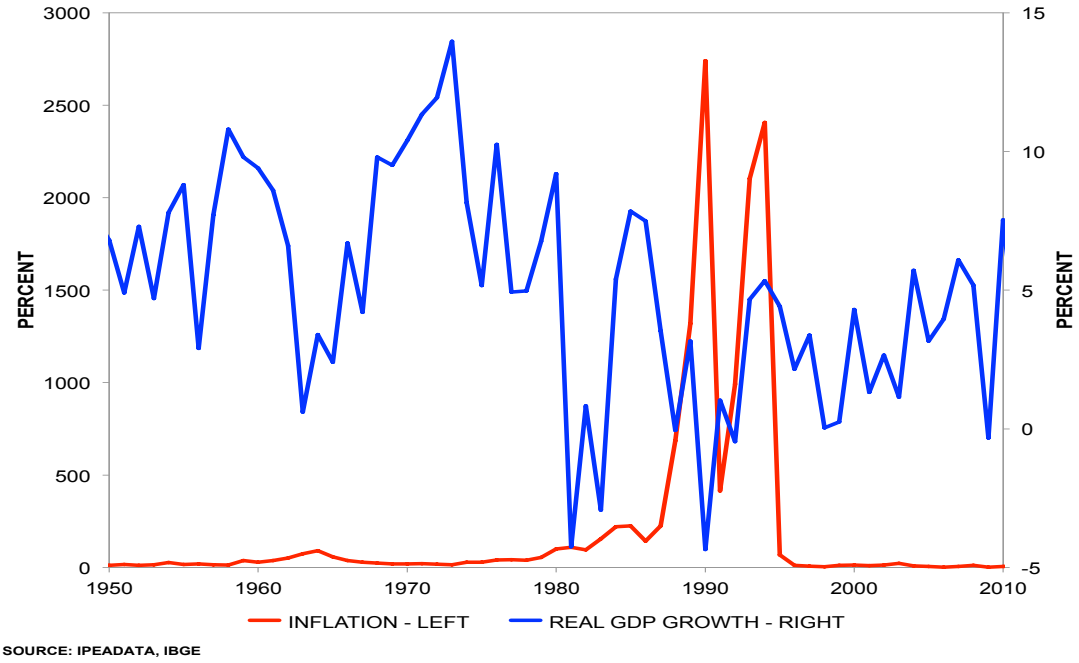
SOURCE: IPEADATA

[2]Cati et al. (1999).

[3]Cagan (1956) defines a hyperinflation episode as starting in the month when the monthly inflation rate exceeds 50% and ending when it drops below 50% and remains that way for at least a year.

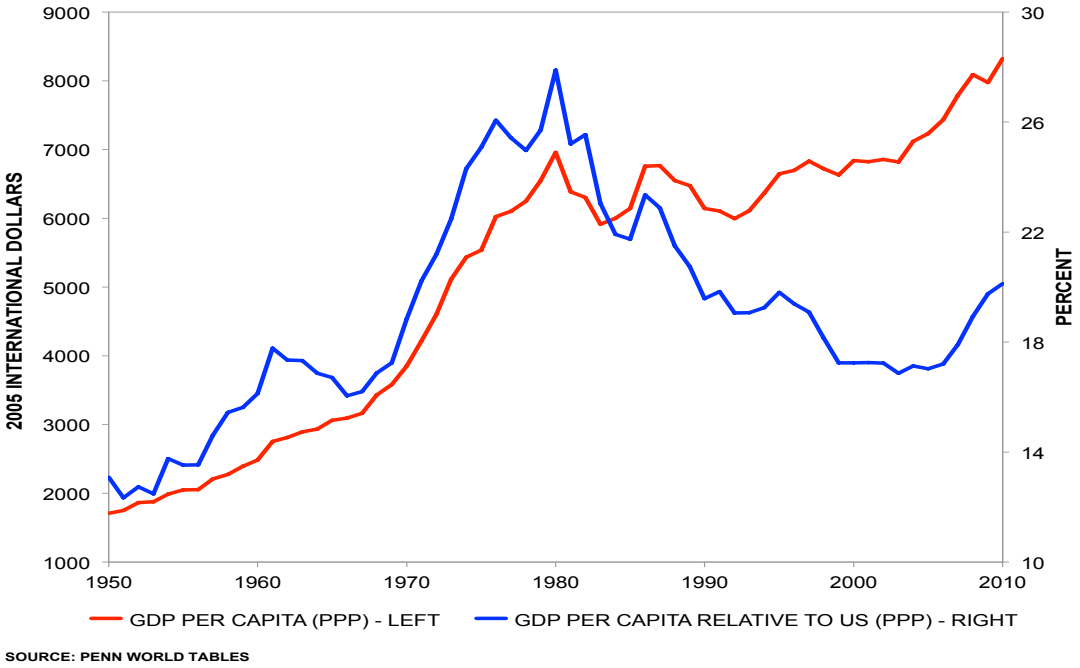
However, the reference to the 1980s as the "lost decade" is not misplaced. One can see in Figure 3 that from comparing GDP per capita PPP of Brazil to the U.S. Note that, starting in 1980, there's been a downward trend during most of the period.

Figure 2: Real GDP Growth and Inflation



This paper has three objectives. First, it will give a brief description of the macroeconomic environment in the last decades, aiming at giving a background on the monetary and fiscal policies adopted at that time. Secondly, it will provide the necessary data to construct the budget constraint account exercise that will be discussed below, in which we decompose the public debt by the index the bond is linked to. Third, we provide a simple framework to deal with the question if the high inflation in Brazil could be explained by fiscal policies. In that sense, we investigate how much of the inflationary experience can be attributed to fiscal deficits. Our results so far suggest that the hyperinflation can be rationalized by the fiscal policies, but we cannot explain the low inflation from the fiscal position. This leads us to develop two puzzles. The first one is related to the Laffer curve in the seigniorage revenues during the hyperinflation, and the second is why the Real Plan succeeded.

Figure 3: GDP per Capita



2 Brief Historical Description

2.1 The Early Period

In the early 1970s, Brazil was experiencing a very good phase. GDP was growing very fast and inflation had fallen to what was to be its nadir until the Real Plan. The mid-1960s financial reforms provided the government with a new and very important tool: domestic debt. The lack of marketable public securities as a possible alternative to finance fiscal deficits was perceived as part of the causes behind the increase in inflation from 15% to 80% between 1955 and 1964, as stated in the first military government's Economic Plan, the PAEG. Although the the new government that arose from the 1964 military coup had stern goals for fiscal improvement, the view that fiscal deficits would be the rule rather than exception in the following years led to the creation of a market for government debt based in the institutionalization of monetary correction (indexation). This would be one of the three pillars of the financial reforms (1964/65). The other two were the creation of the Central Bank and the adoption of a banking system based on a clear-cut separation among commercial banks and non-bank institutions.

The existence of indexed public debt held by private savers on a voluntary basis defined the bedrock for the development of financial markets in Brazil in the following years, in spite of the increasing annual inflation rates from 1973 to 1994. In the earlier years (between 1966 and, at least, 1971), the demand for public debt was growing faster ahead of the government's financial needs. The federal government over financing led, thus, to the institutionalization of mechanisms that increased the spending capacity of local governments, a phenomenon that would eventually pose great fiscal challenges taking years to be reverted.

In what became known as the years of the "economic miracle", the early 1970s, the annual GDP growth rates in excess of 10% led to the optimistic view that the Brazilian State had created a wholesome mechanism to capture private savings and channel them to public investment, thereby compensating for the underdevelopment of long term financial markets. The idea of complementarity between public and private investments reinforced the view that public debt was a key element in channeling funds for more investment, either public or private. When the first oil crisis in 1973 challenged the feasibility of the high growth path, the Brazilian government kept its long run strategy in the President General Geisel years (1974-79) to grow its way out of the first oil crisis, even if it had to rely on further deepening of public indebtedness supported by the growth of external liquidity.

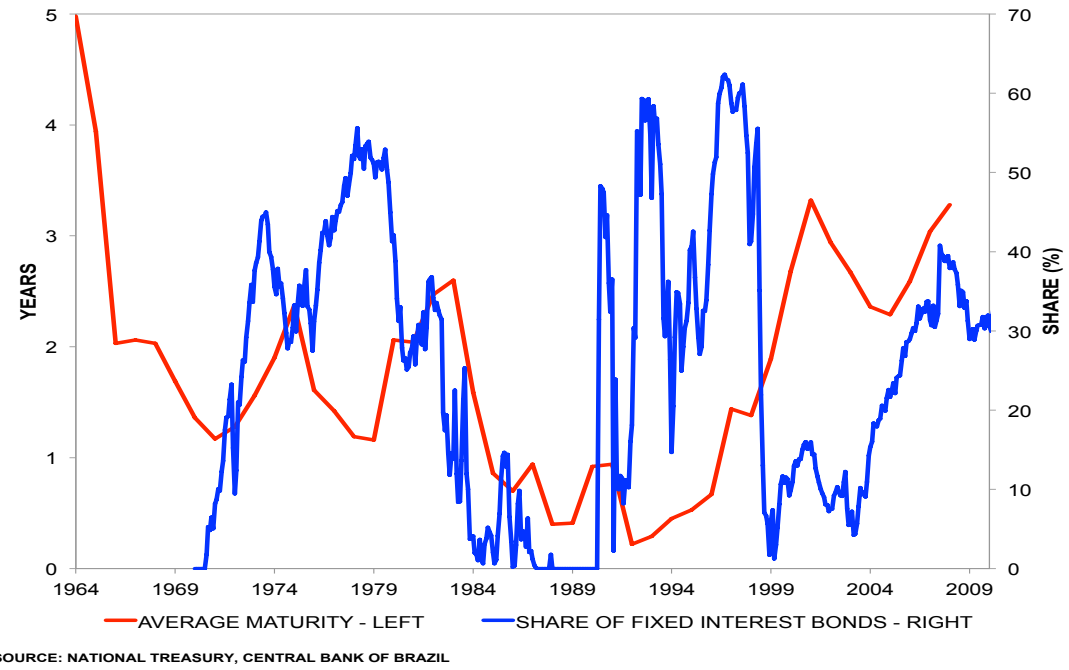
This strategy was successful for the first few years, as the accumulation of public debt was compatible with the maintenance of economic growth at high rates. Continuity of this process of growing indebtedness, however, relied on factors behind demand: on the growth of private wealth, on the wealth holders confidence in the prospects of public sector ability to serve the debt, and on the use that was ultimately being made of the savings captured by the government.

2.2 1970 to 1979: The Hopeful Years

The stock of government bonds was multiplied by a factor of five in the 1970s.[4] GDP growth declined sharply in the second half of the decade compared to the first half, as inflation doubled, and there were increasing difficulties to control the growth of the public sector financial needs.

Average maturity reached its peak in 1975 but the share of nominal bonds kept growing until the end of the decade, as interest rates began to rise in 1976 following the abandonment of the interest rate ceilings, which had prevailed until September 1976.

Figure 4: Average Federal Debt Securities Maturity and Share of Nominal Bonds



The first year of President General Figueiredo's term (1979) started with a reduction in the real value of public bond debt due to two effects: the decline in nominal interest rates promoted by Finance Minister Delfim Netto, the new economic czar, in an attempt to stimulate economic activity, and the increase in exchange rate uncertainty related to the second oil crisis. Both factors reduced the attractiveness of the public debt in private portfolios.

[4]Bevilaqua et al. (2001).

Public debt denomination has, thus, changed in response to changes in demand. From 1971 onwards, nominal Treasury Bills (LTNs) had been issued side by side with the old Indexed Treasury Bonds (ORTNs) as a result of the success of the reforms. In contrast with the ORTNs, which were held both by financial and non-financial institutions, LTNs were the typical assets used as reserves by financial institutions. They were auctioned at a discount only in large denominations, with maturity ranging from 30 to 720 days. Central Bank daily operations to regulate short-term liquidity via open market operations collateralized by LTNs, while ORTN were thought as adequate to provide steady finance for the Federal Government structural fiscal deficit. Central Bank portfolio, therefore, was concentrated by and large in LTNs.

The real value of indexed debt reached a plateau and stabilized in the middle of the decade, so that further finance for the public deficit came from the steady increase in the stock of LTNs between January 1975 and October 1978. The share of ORTNs held by the private sector declined by half at the end of the decade as the duration of the debt shrank in face of higher inflation and unstable interest rates. The average maturity of public debt fell from 1.42 to 1.16 years between 1977 and 1979 (see Figure 4) when the widespread practice of repurchase agreements, by the Central Bank, made it harder to ascertain the actual demand for longer term debt. The distinction between money and public debt, that would eventually all but vanish during the hyperinflation, started to become blurred.

2.3 1980-1994: The High Inflation Period

In this section, we will give a description of the stabilization plans during the 1980s and 1990s in Brazil, focusing on what the most important points were and why each plan failed, trying to find out the most important differences between the successful plan (Real) and all the other plans.

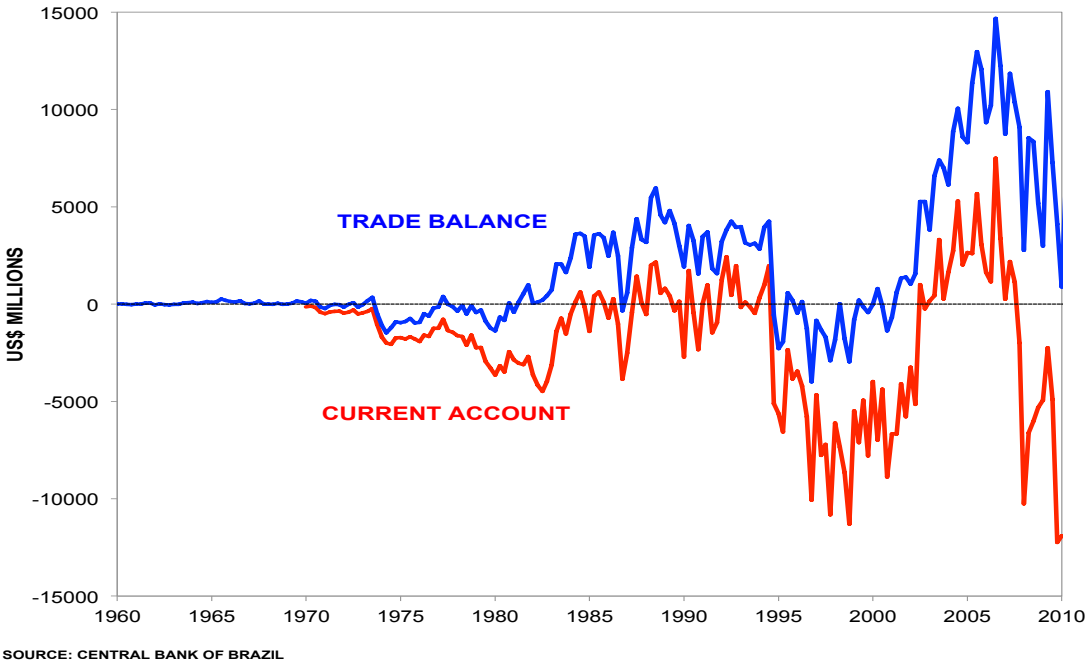
From 1970 until 1985, inflation had been rising consistently. Two major factors influenced its behavior of it. First, by the end of the 1970s, the second oil shock and an increase in the frequency of wage readjustment (from annual to half-annual) doubled in-

flation.[5] The second possible reason was that in 1983 there was a large devaluation of the national currency of 30%.[6]

However, even though inflation was increasing, the first half of the 1980s was more marked by plans targeting to reduce the external imbalances than reducing inflation. In Figure 5, we can see the current account and the trade balance during the high inflation period.

In 1981 and 1982, macroeconomic policy's main objective was to reduce the need of foreign capital. The control of aggregate demand from such worry led to a recession, with the industrial output declining 10% in 1981, but inflation did not fall.

Figure 5: Current Account and Trade Balance



Before discussing each stabilization plan in detail, it is important to put into perspective what was considered, at the time, to be the cause of high inflation. The Cruzado Plan, as well as the Bresser and Summer Plan, considered that inertia was itself the essence of inflationary process and, because of the highly indexed economy, it should be

[5]Simonsen (1986) shows that this rise in inflation is very close to what was needed to preserve the average real wage in face of the half-year indexation to past inflation.

[6]This is assuming that the exchange rate is quoted in terms of domestic currency units per US dollar (an increase in the exchange rate is a depreciation of the domestic currency). If the exchange rate were quoted as US dollar units per unit of domestic currency, the equivalent depreciation would be of 23.1%.

the main focus of the stabilization plan. These plans had a "neutral shock" of freezing prices as one of their main characteristics.

The staggering of wages and other prices under very high inflation was one of the main obstacles to a heterodox plan. At the moment a shock to stop inflation was introduced, agents with similar average real wages would have different real wages depending on when the last adjustment was set. This lack of synchronization would be one of the main problems in all plans. Since inflation was supposed to decrease substantially after the plan, the (arbitrarily distributed) differences in real wages at the moment of the plan would last forever. This, of course, would prompt losers to claim rights to be compensated, which forced nominal wages up again, fueling inflation.

As we will see, from the first to the last plan, there was a decrease on the emphasis on the heterodox part of the plan, i.e., price freezes and other income policies, and more emphasis on the orthodox part. Fiscal and monetary policies became a major component of the latter plans, while maintaining a device to synchronize the adjustment of nominal variables as to avoid threatening the new low inflation level.

2.3.1 Cruzado Plan (February 28, 1986)

The Plan As it became standard in some Brazilian stabilization plans, the first rule was to change the currency, in that case from cruzeiro to cruzado, which meant cutting three zeros. The Cruzado Plan can be described based on three aspects: price freezing, interest rate conversion and monetary and fiscal policy.

Price freezing As discussed above, the idea of a "neutral shock" with price freezing was one of the main goals of the plan. Due to staggering, wages were converted into cruzados, based on the average purchasing power of the last six months, but could be readjusted every time inflation hit 20% or during the annual readjustment cycle. Moreover, unemployment benefits were introduced. The minimum wage got an 8% raise on top of its normal inflation correction. Besides that, as we will see that happened in most of the plans, they set a nominal anchor pegging the exchange rate to the dollar.

In what relates to the other prices in the economy, most were kept constant apart from electricity that had an increase of 20%.

Interest Rate conversion Monetary correction was extinguished as well as any indexation clause shorter than one year. An interest rate conversion schedule was set for fixed rates. It was assumed that all nominal interest rates were based on the inflation expectation of 0.45% a day, which had been the average daily inflation in 1985/86. Given this inflation expectation, a real rate was computed. This real rate would, then, be the nominal rate in the new currency (cruzado), since the new expected inflation (at least for the government) was zero. For the variable interest rate contracts, which prescribed a nominal rate equal to the sum of the monetary correction and a variable (real) interest rates, the new nominal rates in cruzados were set to be the ones above the monetary correction before the plan.

Fiscal and monetary policy Fiscal and monetary policy were put in a second plan and under the discretion of the policy-makers, but there was an important change which was the end of the *Conta Movimento* between the Central Bank and the *Banco do Brasil*, a government-owned commercial bank. In fact, the *Conta Movimento* worked as an overdraft account that *Banco do Brasil* would use whenever prompted to further extend financing to sectors or firms targeted by economic policy. The split of budgets and functions would be one of the most important reforms that the Central Bank would undergo since its creation.

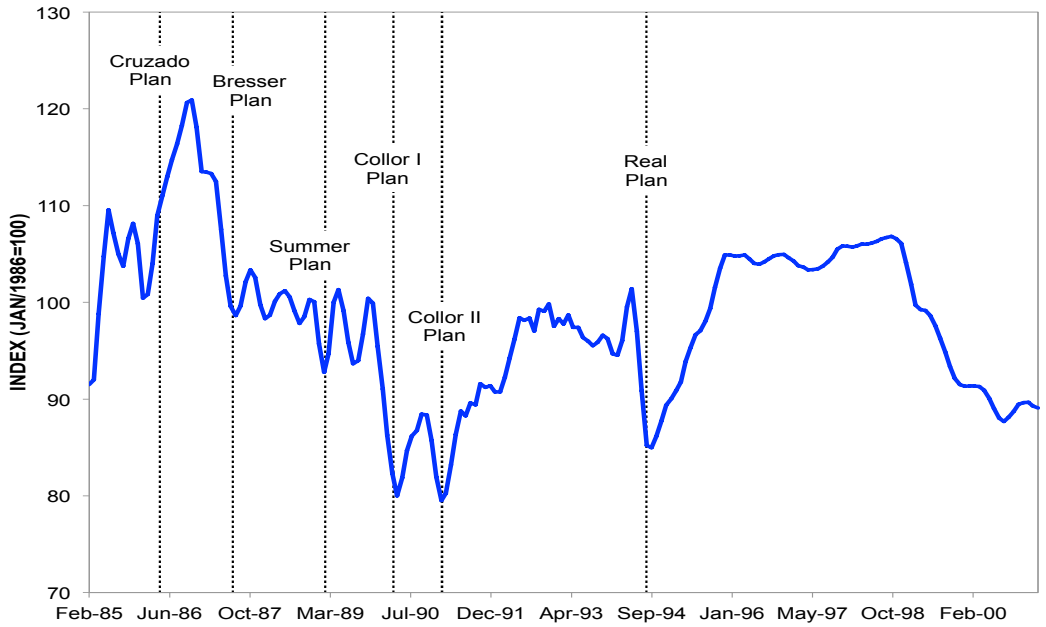
The Results

1st Period: Overheating with stable prices (March to October 1986) At first, the Cruzado Plan was very successful on reducing inflation. The average monthly inflation from March to July of 1986 was 0.9% (IGP-DI). Moreover, the claim to freeze prices had a civic impact since the population felt that they were "auditing prices". At the same time, the overheating was clear. Sales increased 23% in the first six months of 1986 compared to the first six months of 1985.

Figure 6 shows that real wages increased 14% from March to September of 1986. One consistent story with such evidence is that even though prices were not allowed to change, the "equilibrium prices" were increasing, which was producing overheating since prices were too low. It is clear that there was political pressure to avoid a recession or bring inflation back to high levels. On the other hand, the Central Bank tried to keep interest rates low to induce low expectations. In the end, remonetization was increasing much faster than inflation itself.

Something needed to be done. With overheating spread in economy, there was scarcity in many products, but nobody wanted to bear the political burden of a recession. In July 1986, the government did a timid fiscal package ("Cruzadinho") involving compulsory loans on fuel, car purchases, international airline tickets and foreign exchange sales for travel expenses. Actually, "Cruzadinho" had the opposite result that the policy makers wanted. With the expectation of defreezing prices, demand increased and the overheating problem was getting more dramatic.

Figure 6: Real Wages



SOURCE: IPEADATA
OBS: NOMINAL WAGES DEFLATED BY IGP-DI

Inflation, that remained low, was not really representative since prices were low but products were scarce. As expected, the excessive aggregate demand jeopardized the trade and current account balances.

2nd Period: Default on the foreign debt and negative current account (November 1986 to June 1987) Due to the high demand, imports kept increasing from April to December 1986. Moreover, exports declined, thereby aggravating the external position. Reinforcing this pattern, there was a rumor of max-devaluation in the near future leading to a postponement of exports and anticipation of imports, which augmented the balance of payments problems.[7]

Facing all these problems, in November 1986 the government decided for a fiscal plan– Cruzado II–trying to increase the revenues through the readjustment of some public prices and some indirect taxes, which led to a high inflationary shock. Due to this inflationary shock, indexation was reintroduced and, with it, monetary correction. It was again an environment of high inflation (17% per month in January 1987).

The external crisis was just getting worse. In February 1987 the government suspended for indeterminate time the interest rate payments on the external debt (Figure 11). The idea was to stop the losses of international reserves and start a new phase on the renegotiation of the debt with the support of the population.

2.3.2 Bresser Plan (July, 1987)

The Plan The Bresser Plan was presented as a hybrid plan, with fiscal and monetary policies as well as aspects to deal with inertial inflation.

Price Freezing Just like Cruzado, it proposed a price freeze shock to break inflation inertia. It also kept the foreign debt default. As usual, the moment in which there would be a freeze was important since relative prices would remain stuck and possibly off-equilibrium. Trying to get a better result than Cruzado on this aspect, prices were frozen

[7]The government kept the mini-devaluations based on an indicator of the ratio exchange rate / wage (crawling peg). However this same indicator was suggesting that the exchange rate was appreciated.

but there was an increase on the public services or administered prices, like electricity, telephone and milk, to correct what was perceived as misalignment of relative prizes.

Triggering readjustment Another perceived improvement, when compared to the Cruzado Plan, was regarding the automatic trigger in wage resetting if inflation surpassed a given threshold. The trigger was extinct, but the economic team created another kind of wage indexation, the URP (Price Reference Unit). Every quarter, the government would specify the readjustment for the next three months and so on based on the average inflation of the period. This would keep a monthly readjustment, but there would be a gap between readjustment and current inflation.

Fiscal and monetary policies In contrast to the Cruzado Plan, monetary and fiscal policies were active. Real interest rates remained positive in the short term. In the fiscal policy arena, the government aimed to reduce the operational deficit from the expected 6.7% to 3.5% of GDP.[8] Another interesting aspect of this plan is that it did not target zero inflation, like the Cruzado Plan; it was meant to be just a deflationary shock.

The Results: Not so much of fiscal improvement (July 1987 to December 1987) The main purpose of Bresser-Pereira, Minister of Finance, was to have a fiscal reform that would reduce inflation. However, it was not successful. In 1987, the operational borrowing requirement was 5.5%, much higher than the promised 3.5%. Differently from Cruzado, that had popular support, the Bresser Plan lacked popular support and, in February 1988, there was some liberalization of prices, reducing the effectiveness of the price freezing. As a third pitfall of the economic plan, gross Fixed Capital Formation fell, increasingly affected by high prices of construction and capital goods.

[8]The operational balance excludes that part of interest outlays that compensate debt holders for the impact of actual inflation; in effect, this component of interest is treated as though it were amortization in order to maintain an unchanged real value of the debt. The use of the operational deficit concept facilitates the analysis of the underlying stance of fiscal policy, because the nominal deficit increases with inflation when the government is a net debtor and the nominal interest rate rises with inflation.

2.3.3 Feijão-com-Arroz Policy (Black Beans and Rice) – January 1988

The Plan This economic policy can be well summarized by the meaning of black beans and rice in the Brazilian culture. This is the dish that Brazilians eat every day, it is not considered to be very interesting, neither very difficult, but it does the job of providing a healthy meal. After Minister Bresser left, Maílson da Nóbrega, the second in command, took his position. Instead of freezing prices and conduct another heterodox shock, the targets were even more modest: 15% of monthly inflation and deficit gradually reduced, while expected to hit 7-8% of GDP in 1988. In order to reduce the deficit, there was a temporary freeze of public sector wages.

Results At first, there was some success avoiding the inflationary explosion, at the same time that fiscal stance was improving. The foreign debt default was suspended and the government started paying the interest rate on the debt. However, due to adverse agricultural shock, prices started rising and the target of 15% was not attained in the second quarter of 1988.

In October 1988, a new Constitution was enacted. Being crafted before the fall of the Berlin Wall, the Brazilian constitution increased expenditures and transfers from the central government to states, without transferring the corresponding responsibilities, thereby inducing an increase in the deficit of the central government. Just to put into perspective, 92% of the revenue was earmarked.

Among other measures not usually object of constitutional law, the new constitution reduced the standard weekly working time from 48 to 44 hours and increased the cost of overtime. Not only the constitution increased the fiscal expenditures and reduced the flexibility of expenditure switching between fiscal accounts, but it also increased labor costs substantially. On the external side, it should be mentioned that 1988 was a good year for trade balance and current account.

2.3.4 Summer Plan (January, 1989)

The Plan The Summer Plan was a hybrid plan, but the orthodox part was becoming predominant. From the Cruzado Plan, in which fiscal and monetary policies were passive, up to the Summer Plan, the debate of a need of change in policy was increasing.

Price Freezing Like the other plans, there was a component of price freezing as well as a nominal anchor, in that case exchange rate fixed at (1 Cruzado Novo= 1,000 Cruzados = US$1) for indeterminate time. Moreover, there was an attempt to end inflation indexation. It is interesting to observe that all these components were already present in the Cruzado Plan, in 1986.

Fiscal and Monetary Components The idea was to fight inflation by controlling the public deficit, with radical intentions to control expenditures and increase revenues, like privatization of public-owned assets and wages. Another aspect that was different in this plan was a tight monetary policy. The plan seemed to incorporate everything that lacked in the other plans. Although it kept a heterodox flavor, it was mostly an orthodox plan aiming at reducing subsidies, closing public firms, firing excessive public employees, and a deindexation plan that was sort of a small default.

Results The only problem was that the government did not have the political power to prevail in the long term. Without the Congress, privatizations were canceled, as well as the closing of public firms and other non popular points. In the end, the reform was not implemented. Moreover, the tight monetary policy put interest rates in high levels which would also increase the fiscal deficit of the government. With low credibility and a reform that did not go through, inflation came back and the Summer plan also failed.

The 1980s ended with almost 100% of the federal bond debt being rolled-over in the form of zero-duration bonds.[9] This state of affairs reflected not only the extremely high uncertainty regarding inflation and interest rates, but also the fear of an explicit debt

[9]Zero-duration bonds are bonds that pay ex-post the accrual of daily overnight interest rates. Therefore, the price of these bonds are insensitive to interest rate changes. It was a way to separate interest rate risk from maturity risk, thereby lengthening a bit the very short term public debt.

default by the incoming administration (President Collor de Mello). At the time, there was a widespread suspicion regarding the credit risk of the public securities, which were indeed validated by the new administration's actions.

2.3.5 Collor Plan I (March, 1990)

The Plan Fernando Collor was elected President of Brasil after 29 years of indirect elections or non democratic ones. The very day he took office, Collor launched the Plano Collor which had monetary and fiscal components.

Fiscal and Monetary Components

Fiscal Component Collor Plan also had a fiscal component. As it recognized that for the end of hyperinflation deficits should be reduced, Collor launched a fiscal plan with temporary and permanent policies. Among the temporary ones, there was a tax on financial intermediation and the suspension of tax incentives.

More important, though, were the permanent policies. First, there was an effort to reduce fiscal evasion (one of his "trademarks" during the presidential campaign) and an increase in some taxes. Privatizations and an administrative reform would be the second major component of the fiscal policy.

Monetary Component The Collor Plan attempted to reduce the money supply by forcibly converting large portions of consumer bank accounts into non-cashable government bonds, while at the same time increasing the printing of money bills. The idea was to decrease the money supply in the beginning to reduce expectations and after this first phase, increase money supply to avoid a recession. The suspension of convertibility, for 18 months, covered about 80% of bank deposits and financial investments.

Price Freezing Finally, prices and wages were frozen as usual.

Results Monetary aggregates, especially the higher ones, were greatly reduced. This reduction of liquidity however would turn out not to be sufficient. There was a big

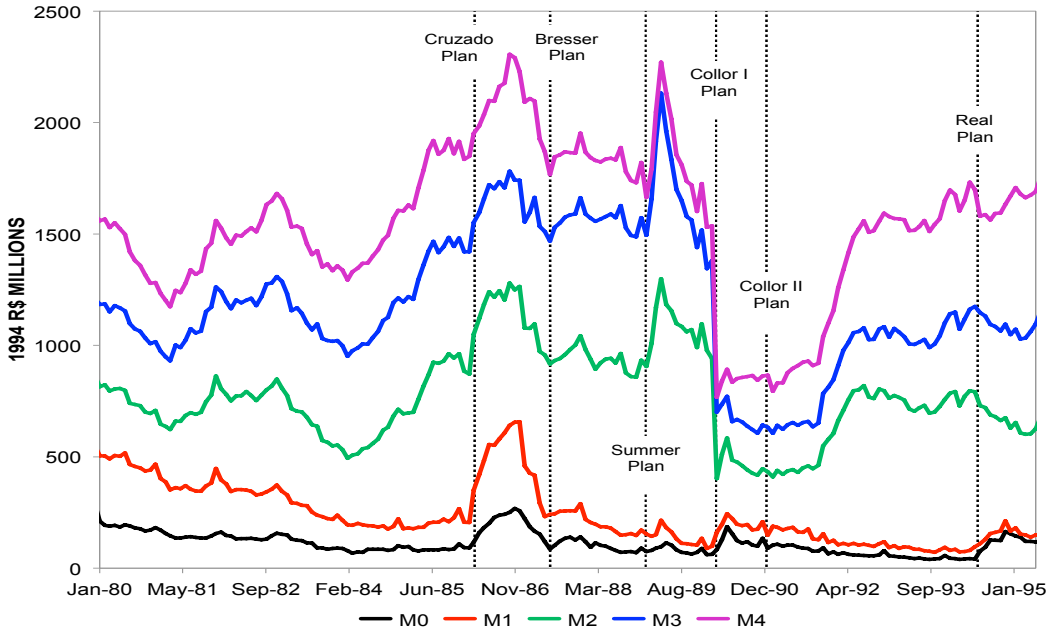
effort on reaching the targets, but it was questionable whether the target itself would keep inflation at bay. For the fiscal reform, the threatening behavior of the government towards the public sector employees turned the reform very unpopular. There was a lot of resistance and, in the end, it could not reach everything proposed. Some privatizations succeeded, but most of the fiscal reform were short lived. For the monetary policy, even though the monetary aggregates were reduced (see Figure 7), monetary policy was not active.

2.3.6 Collor II Plan (January, 1991)

The Plan The Collor II Plan had aspects very close to the previous one, then redenominated Collor I Plan

Fiscal Components Just like the previous one, it planned to reduce government expenditures, by firing civil servants and closing public services. It also proposed the privatization of state owned enterprises.

Figure 7: Monetary Aggregates (deflated by 1994 prices)



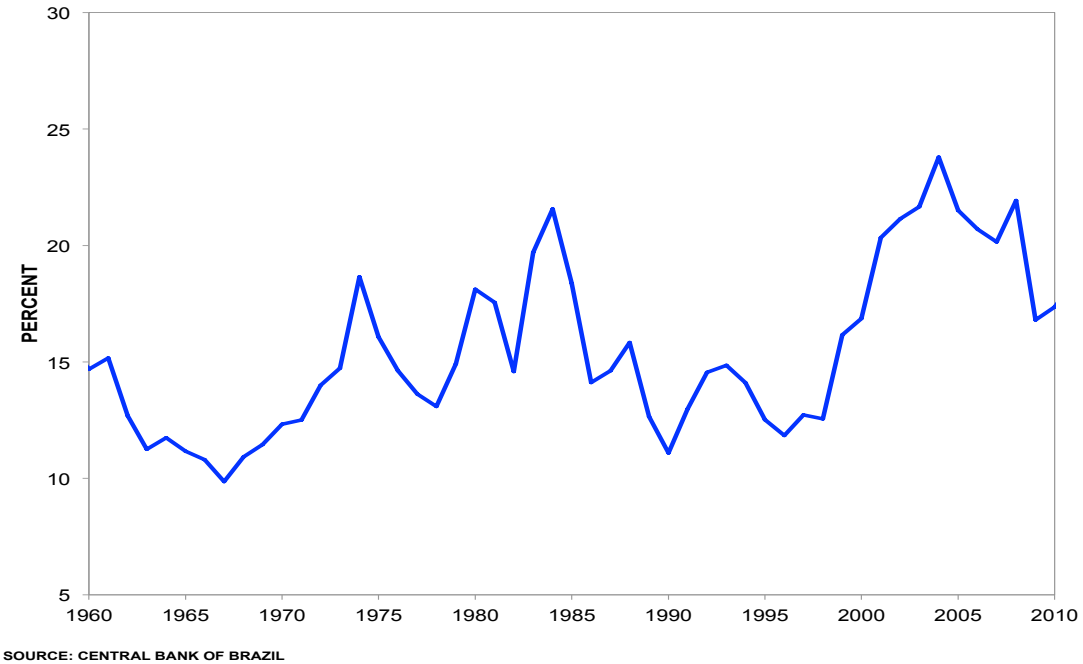
SOURCE: IPEADATA

Price Freezing As usual, the plan had a price freezing aspect. Wages were converted by a twelve-month average, a new *tablita* was adopted based on the assumption that the inflation would fall to zero and it put an end to indexation.[10]

Modernization Not entirely related to the inflation fight, this plan had a motif that Brazil had to improve the quality of its products. In the words of the President, "Brazil was producing horse-drawn coaches instead of cars". Because of that, Collor opened the Brazilian economy to foreign competition and also privatized state owned firms.

Results The first period had a recession but later the economy recovered, the recovery being usually attributed to enhanced competition. Inflation rose but this plan brought about two different permanent aspects. First, it opened up the Brazilian economy. The trade chain started increasing in 1990 reversing the previous trend. Second, productivity was somewhat increased.

Figure 8: (Imports + Exports) / GDP (%)



[10] *Tablita* was the name for the interest rate conversion table when the currency changed.

Only at the beginning of 1992, when expectations of accelerated inflation did not materialize, did the effects of recovered investors' confidence start to show up in public debt markets. Such expectations had been based on the combination of price liberalization, public tariffs corrections and the devaluation which followed the floating of the exchange rate in October 1991, in face of the strong monetization of the hijacked assets during the first Collor Plan.[11]

The return of investors' confidence is also confirmed by the recovery of foreign exchange reserves after 1992. Following the high political turbulence that characterized the months before the impeachment of President Collor de Mello (October 2nd, 1992), the beginning of the Itamar Franco's presidency was once again marked by high uncertainty concerning economic policy. Proposals of another moratorium and even repudiation of the public debt were daily in the press and it was only after the President nominated his fourth Minister of Finance in less than six months that the recovered confidence materialized in higher external reserves.

2.4 1994-onward: The stable Period

2.4.1 The Real Plan

One of the conditions for the Real Plan was the availability of foreign finance. From April 1993 to July 1997, foreign capital inflows resumed as Brazil's relations with the international financial community were back to normal, putting an end of a long process of foreign debt rescheduling under the Brady scheme. The capital inflows were a main factor in the expansion of the interest-bearing public debt, as the Central Bank conducted massive sterilized purchases of foreign exchange.[12]

A new currency was created, the Real, valued at 2750 Cruzeiros Reais. The Plan

[11]The recovery of the stock of public debt in the portfolio of the private sector was a clear demonstration that asset-holders were willing to return to business as usual in spite of the violence of repeated interventions which had been made in the rules of indexation and liquidity of public securities in the previous twelve years. One should bear in mind that the majority of economic analysts at the time were forecasting that never again would the government be able to place new debt. The Brazilian experience, therefore, refutes reputational models that withdraw the government's ability to place new debt after a capital levy on the public debt.

[12]In 1993, so much capital was flowing into Brazil that the government implemented controls on capital inflows (Carvalho and Garcia, 2008).

that would eventually conquer the Brazilian inflation did not have the blessing of the IMF, an always troubled relationship in the past decades. It had different concepts from the ones before, aiming to reduce deficits, modernization of the firms, and to reduce the distortions that arose from previous price freezing.

Fiscal components The first stage of the Real Plan was defined by the fiscal element. Differently from the other ones that usually had the fiscal component but in the end did not succeed implementing it, the Real Plan had the fiscal component negotiated with the Congress. The *Programa de Ação Imediata* (Program for Immediate Action) was designed to focus on fiscal imbalances that would arise when the seigniorage revenues fell. A significant adjustment came in the beginning of 1994 with the *Fundo Social de Emergência* (Emergency Social Fund), a way to suspend part of states and municipalities earmarked revenues. Despite its ambitious reform goals, the government ended up targeting what was available at that time to generate fiscal revenues, and it increased taxes of financial intermediaries.

On the monetary side, a clearly stated intention to limit issuances of the new currency and the adoption of a high interest rate policy implemented a tight monetary policy, that lasts until today. In fact, the Real plan failed to achieve its monetary targets, but for a good reason: money demand vigorously expanded in face of low inflation. Not achieving its monetary targets had no effect, since monetary policy was very restrictive judging by the high real interest rates.

Price freezing The second aspect that every plan had was the price freezing. In the Real Plan, it was a different framework that did not involve the freezing itself, but was able to solve the problems of staggered wages and prices. Actually, this was considered the most controversial aspect of the plan, but probably the most ingenious and ultimately very successful.

The creation of a new unit of account URV – *Unidade Real de Valor* (Real Unit Value) was to establish a parallel unit of value to the cruzeiro real, the inflated currency. The idea was to be temporary and that while cruzeiro real suffered from hyperinflation, the

URV would not. Prices were quoted both in URVs and cruzeiros reais but payments had to be made exclusively in cruzeiros reais. The way the URV worked was like a shadow currency that had its parity to cruzeiro real defined, since it was one-to-one with dollar. Therefore, a conversion rate of the URV/cruzeiro novo (the old currency) rate was set every day.

With that system, the relative price problem was diminished. Many conversions were left to free negotiation between economic agents, with the government having more interference in oligopolized prices. Wages, for instance, were converted into URVs taking into account their real value in the last four months, as this was the inherited indexation horizon. The objective was to get relative prices right.

The URV was extinguished on July 1st, 1994, when it was converted to a new currency, Real, with the parity being 1 dollar = 1 real = 1 URV.

Modernization The Real Plan kept the process of opening the economy to foreign trade, enacted measures to support domestic industry modernization, and also accelerated the privatization program. It should be stressed though that Collor II had all these topics but in a more timid way.

2.4.2 Results

Even though it is always risky to discuss the success of a "contemporaneous" plan, it has been more than twenty years from its launch and inflation has been stable throughout most of this period. Many institutional reforms have been accomplished, like the introduction of a monetary policy committee, inflation targeting, and the Law of Fiscal Responsibility (to regulate expenditures of municipalities and states).

In the fiscal side, sustainable primary surpluses have been observed while the promised broader fiscal reform hasn't still been done in its entirety.[13] Social security, for instance, remains to be reformed.

In the monetary side, the great switch was in 1999 when the controlled exchange rate by a slow crawling-peg was replaced by a floating exchange rate and inflation targeting

[13]We discuss in more detail each of the fiscal surpluses in the next section.

a little later. Even though inflation was high when the currency regime switched in 1999 (9%), it was nothing compared to the high inflationary period.

Final Remarks

Before going into more detail on the structure of debt or a more quantitative exercise on the fiscal explanation of hyperinflation, we can sketch some qualitative conclusions.

First of all, from the description of the plans, one see that all of them were a convex combination of fiscal and monetary policies with some sort of policy to avoid the inertial effect. Moreover, there was an increase on the fiscal and monetary part across time, suggesting that the "orthodox" part was getting more importance. Looking from today's (2015) perspective, one could say that even though the monetary policy seems to have been fixed, in 1995, with a crawling peg and, since 1999, with inflation targeting, fiscal policy is still a major source of worries in Brazil.

Figure 9: Primary Expenditures and Tax Revenues (%GDP)

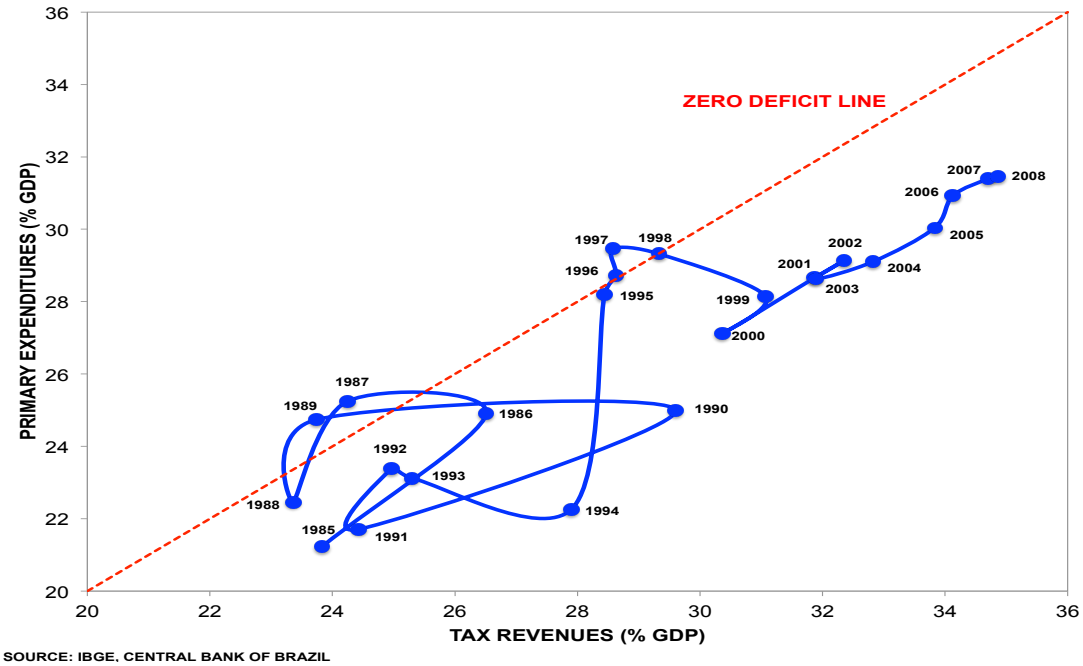


Figure 9 shows that primary expenditures and revenues have been rising fast since the late 1980s, when Brazil returned to democracy.

In order to understand a bit more the effect of fiscal policies on inflation, we first suggest a simple government budget constraint that disentangles most of the components of debt.

3 The Accounting Exercise

In this section, we discuss at first the composition of debt and how it was financed through time. Using the framework of a simple government budget constraint expanded to take into account the existence of indexed and foreign currency denominated debt, we discuss some of the variables that enter into this constraint.

3.1 The Accounting Model

We consider the following budget constraint:

$$B_t^N + M_t + P_t B_t^\pi + E_t B_t^* = P_t D_t + R_{t-1}^N B_{t-1}^N + P_t R_{t-1}^\pi B_{t-1}^\pi + E_t R_{t-1}^* B_{t-1}^* + M_{t-1},$$

where B_t^N is the nominal debt, M_t is the money supply, B_t^π is the debt indexed to the price level, B_t^* is the dollar denominated debt, D_t is the primary deficit, P_t is the price level, and E_t is the exchange rate. R_{t-1}^N, R_{t-1}^π, and R_{t-1}^* are the gross returns on nominal debt, debt indexed to inflation, and dollar denominated debt, respectively. The budget constraint shows that in order for the government to finance its primary deficit and the interest payments on its outstanding debt, it can either issue money, nominal debt, foreign debt, or debt indexed to inflation. In order to simplify the analysis, we abstract from long-term debt and default.

Next, we divide the budget constraint by nominal GDP, $P_t Y_t$. We use the following definitions:

$$\begin{aligned} b_t^N &\equiv \frac{B_t^N}{P_t Y_t}, \qquad b_t^\pi \equiv \frac{B_t^\pi}{P_t Y_t}, \qquad b_t^* \equiv \frac{E_t B_t^*}{P_t Y_t}, \qquad d_t \equiv \frac{D_t}{Y_t}, \\ m_t &\equiv \frac{M_t}{P_t Y_t}, \quad \frac{Y_t}{Y_{t-1}} \equiv 1 + g_t, \quad \frac{P_t}{P_{t-1}} \equiv 1 + \pi_t, \quad \frac{E_t}{E_{t-1}} \equiv 1 + e_t \end{aligned}$$

The budget constraint divided by nominal GDP can be expressed as:

$$b_t^N + m_t + b_t^\pi + b_t^* = d_t + \frac{R_{t-1}^N b_{t-1}^N}{(1+g_t)(1+\pi_t)} + \frac{R_{t-1}^\pi b_{t-1}^\pi}{1+g_t} + \frac{(1+e_t)R_{t-1}^* b_{t-1}^*}{(1+g_t)(1+\pi_t)} + \frac{m_{t-1}}{(1+g_t)(1+\pi_t)} \quad (1)$$

In the next subsection we analyze the evolution of the components of the equation above, i.e., debt to GDP ratios (domestic and foreign), interest rates, seigniorage, and primary deficits.

3.2 Data for the accounting

In this subsection, we show data for each of the terms of the budget constraint in (??).

3.2.1 Seigniorage

A standard explanation for inflation is that a country is running deficits and, to get revenues, it depends on the seigniorage. Therefore, the country cannot get away from the high inflation since it would loose the seigniorage revenues. In Figure 10, we show seigniorage revenues as % of GDP as well as the inflation tax.

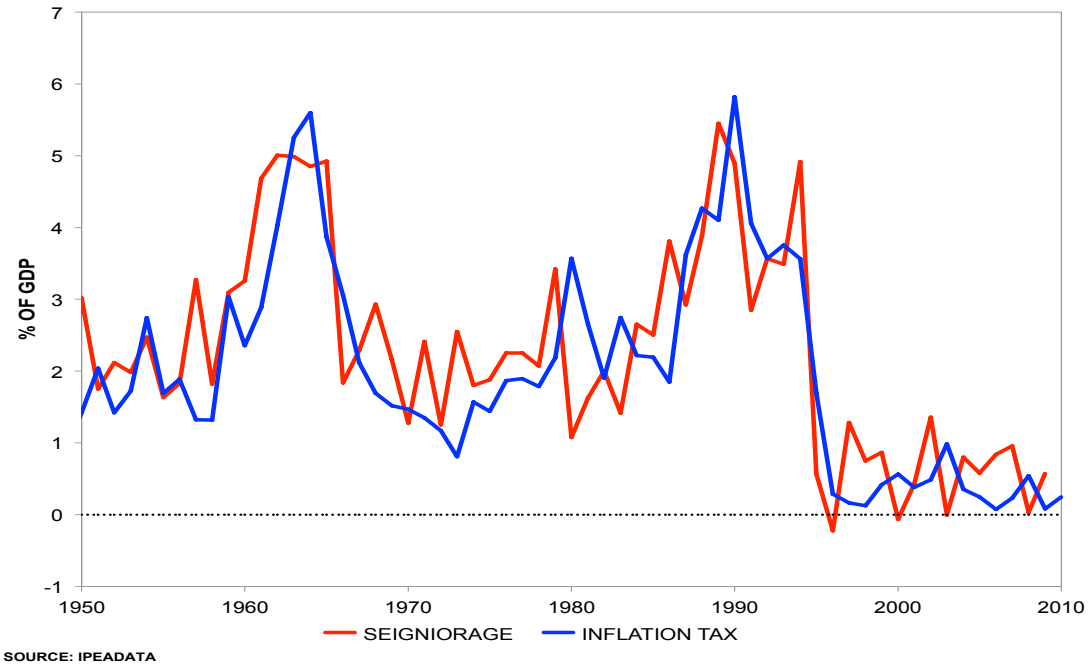
The ultimate message that one gets from this graph is that seigniorage has been roughly around 2%, spiking around 5%. If one takes into account that the revenues as a percentage of GDP had a mean of 26%, this means that seigniorage was responsible for less than 8% of the revenues on average.[14]

3.2.2 Debt Structure

On the other hand, a country could refinance its debt through the expansion of the debt. We report in Figure 11 the graph split into foreign and domestic debt.

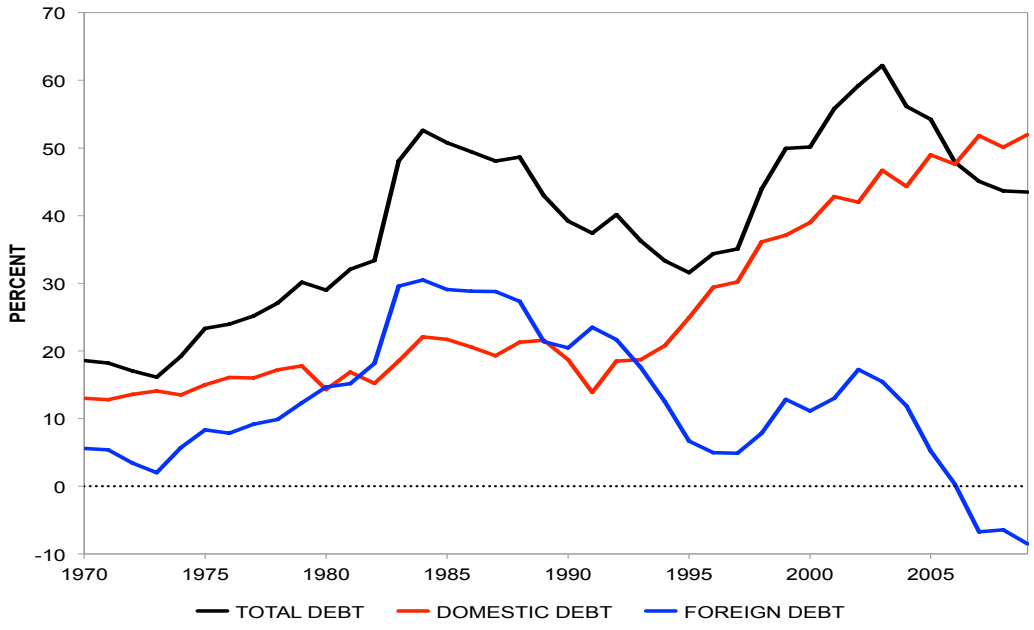
[14]Seigniorage is given by $\frac{M_t - M_{t-1}}{P_t}$ and inflation tax is given by $\pi_t \frac{M_t}{P_t}$. Jaloretto (2005) compares different methods for calculating seigniorage, while Rezende and Rocha (1995) explain the methods for calculating the inflation tax.

Figure 10: Seigniorage and Inflation Tax (%GDP)



SOURCE: IPEADATA

Figure 11: Total, Foreign and Domestic Debt (%GDP)

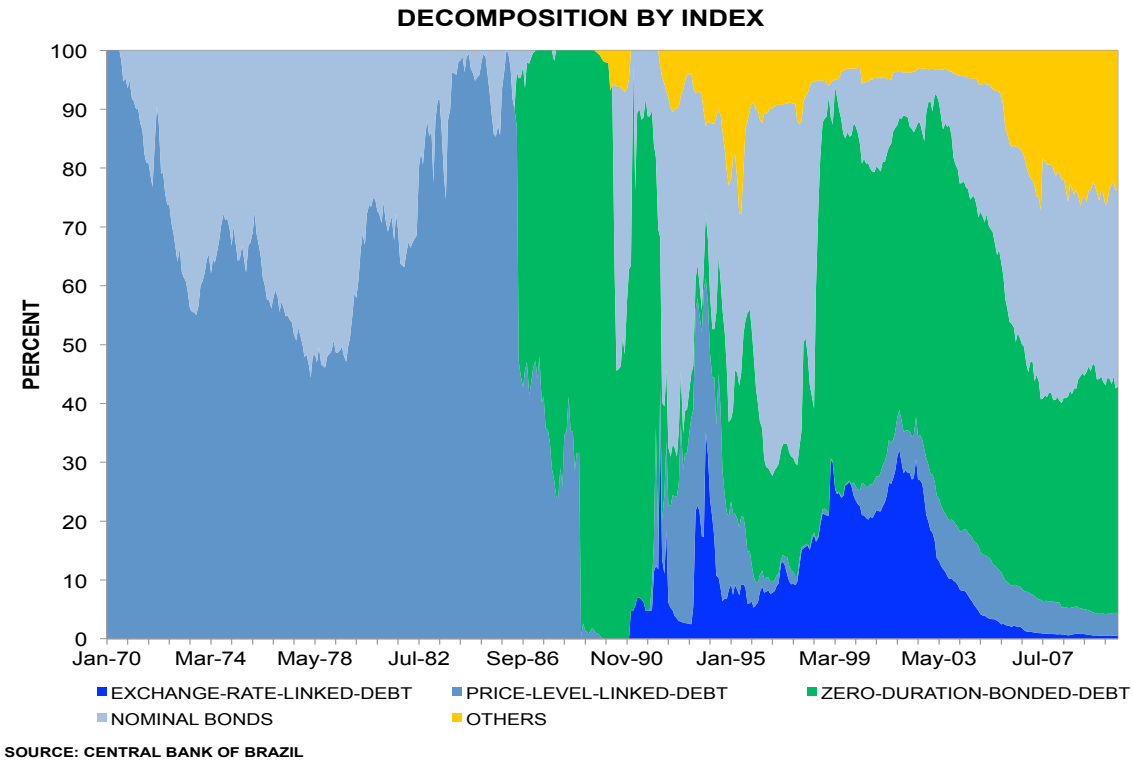


SOURCE: WORLD BANK, REZENDE (2000)

One of the remarkable aspects of this graph is that during the low inflation period, there has been a trend to reduce foreign debt, replaced by domestic debt. However, this is just one of the many ways we could decompose the debt. Another way is to investigate

the percentage of debt linked to each index.

Figure 12: Federal Domestic Debt Decomposition by Index (% of Total)



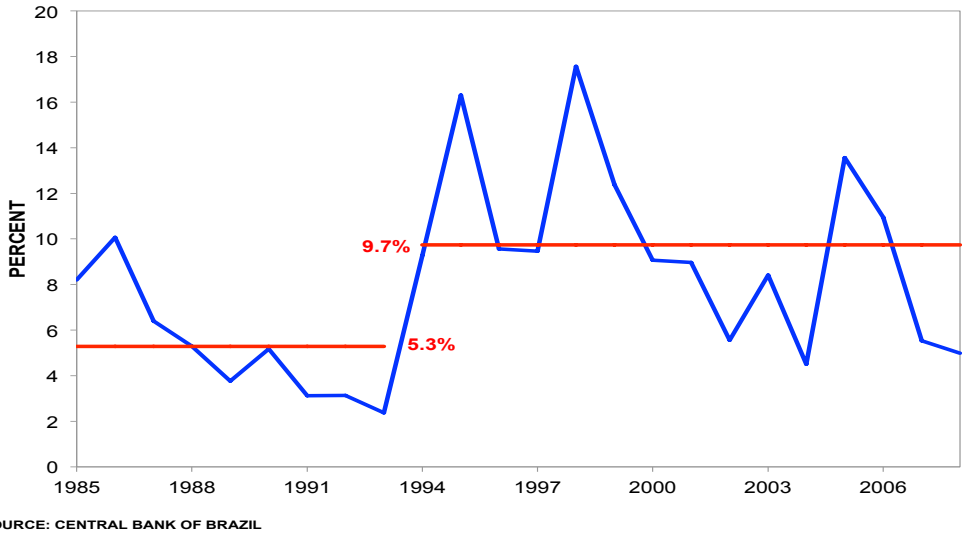
In Figure 12, we show the composition of the federal domestic securities.[15] As one can see, during the 1980s, debt was mostly preset and indexed to IGP-M (price level index). In the most recent years, preset and debt indexed to Selic (nominal interest rate set by the Central Bank) accounts for roughly 90% of the federal domestic securities.

3.2.3 Interest Rate

Calculating the interest rates is not an easy task. Each bond has its own characteristics with different maturities and coupon ratios. One possible task to avoid going into the minor details of every bond issued is to evaluate the borrowing requirement for payment of real interest rates (in millions of R$) over the total debt on that month. This ratio gives us the graph Real Interest Payments.

[15] A minor comment is that in 1990 this does not sum up to 100 because we do not have data for BTN (Bonus do Tesouro Nacional) that was indexed to price level. We added this difference (3 to 4%) to Others.

Figure 13: Real Interest Payments (% annual)



After the Real Plan, interest rates increase significantly. The high real rates necessary to keep inflation at bay in Brazil are an anomaly until this day. [16]

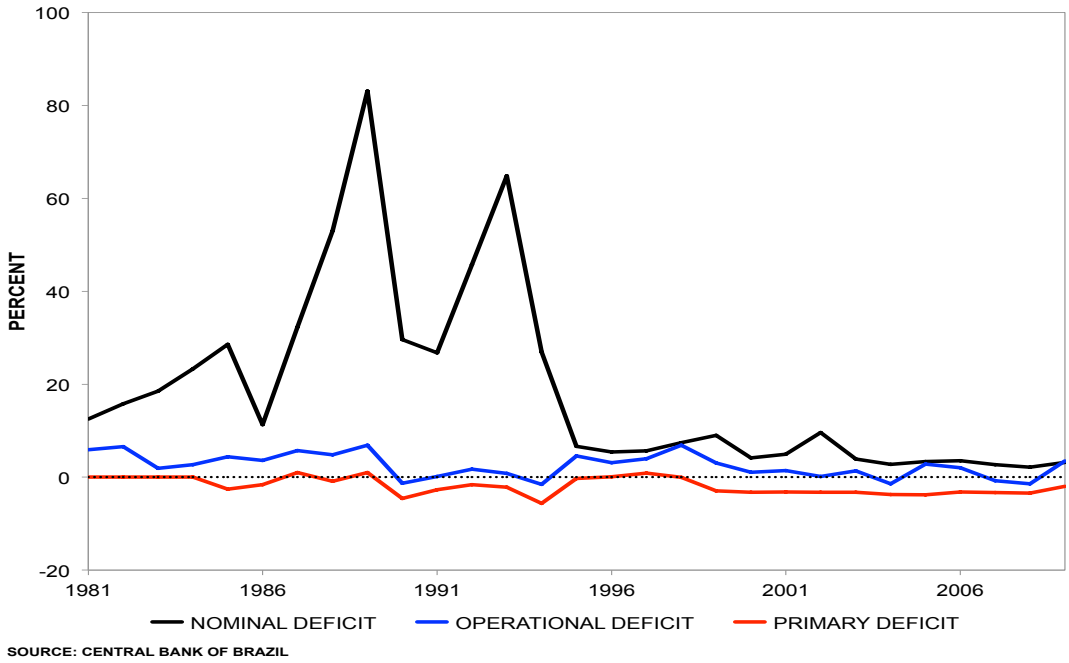
3.2.4 Deficits

It is opportune to stress the difference between primary, nominal and operational deficits. The nominal deficit is the difference between expenditures and revenues plus the burden of nominal interest rates. For the operational deficit, one uses real interest rates. Finally, the primary deficit does not consider the payment of interest rates.

The difference between the nominal deficit and the other two, operational and primary, becomes dramatic during high inflation. This is because nominal interest payments, included in the nominal deficit concept, contain the inflation correction of the nominal debt. When inflation is very high, even if the primary deficit and the real interest payments are zero, the nominal interest payments will equal the inflation rate times the debt, which would produce a high figure. The fact that you divide these interest payments by GDP does not solve the problem.

[16] In most of the studies, when dealing with the interest rate in this period, one uses Selic (the interbank interest rate) but this could not be a truthful image of the interest rate of the public debt.

Figure 14: Primary, Operational and Nominal Deficit (%GDP)



This graph makes it clear the distinction between these concepts. Note that, when there is high inflation, including or not nominal interest rates makes a huge difference. Besides that, it should be stressed that there was was a positive primary surplus during most of the period.[17]

4 The Fiscal Theory of Inflation

So far, we have seen a macroeconomic background as well as the government budget constraint in some detail. However, there still lies the question if seigniorage and deficits could explain the inflation observed in Brazil.

A striking graph that suggests that the explanation could be easier than one would guess is the one that relates money growth and inflation (Figure 15).

As one can see, even though there is some sort of dance because of remonetization, they correlate contemporaneously. To be more precise, the correlation coefficient is 0.71.

However, trying to take out some short term oscillations, we plot also the annual graph on the growth of M0 and inflation in Figure 16.

Figure 15: Money Growth and Inflation (5 month moving average)

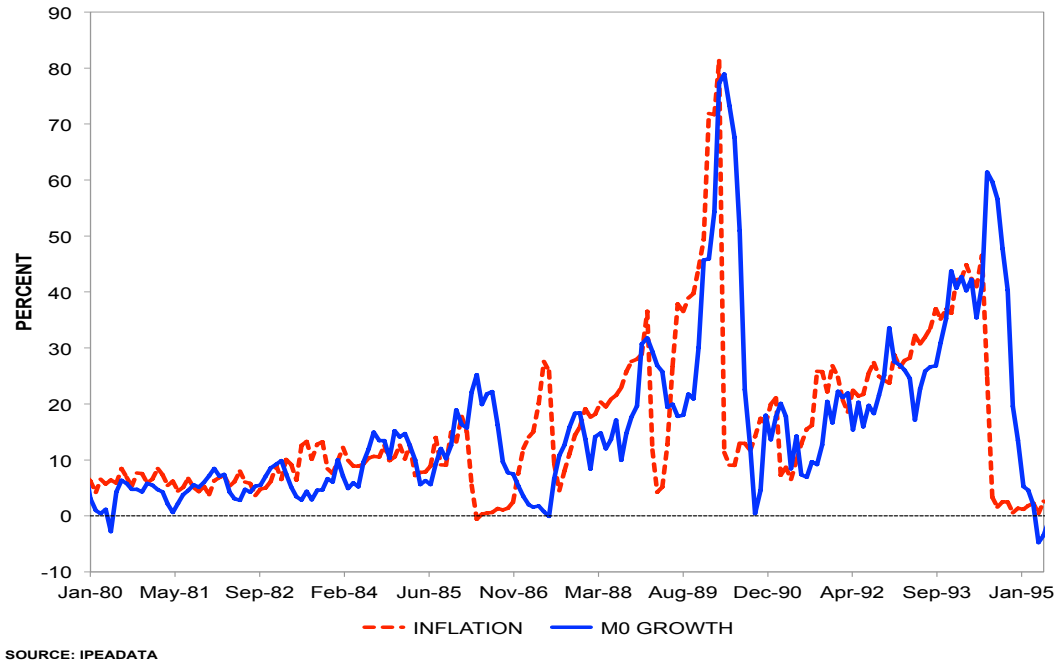
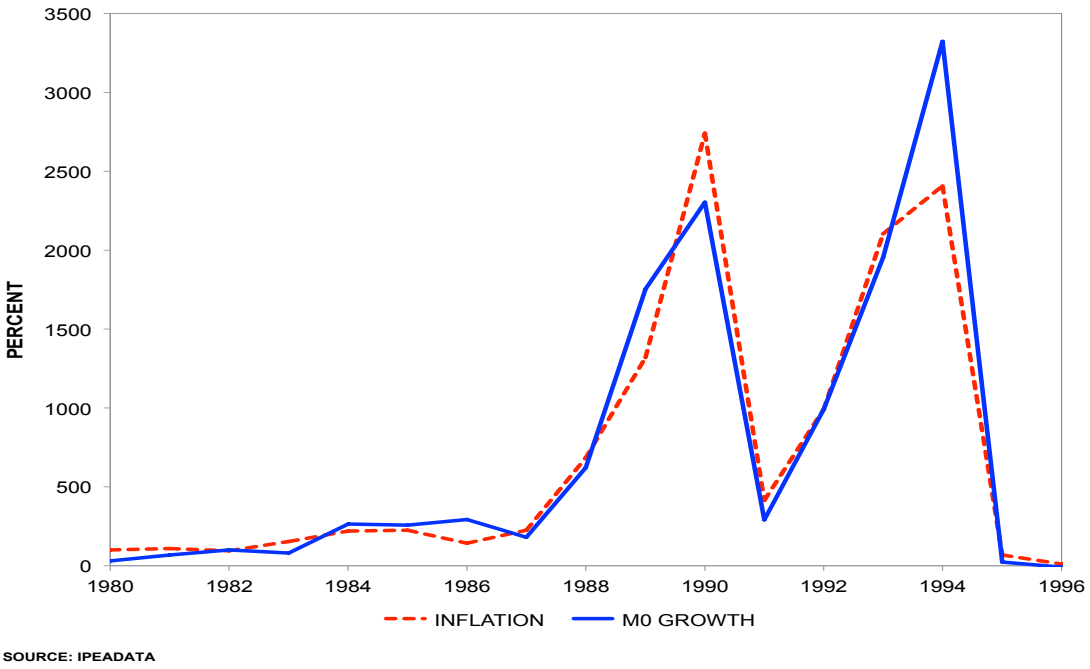


Figure 16: Annual Money Growth and Inflation



In that graph, the correlation is .97. We, of course, do not want to claim causality in any direction, but the high correlation is at least indicative that a more simple-minded explanation could exist.

[17]We have computed the deficits based on Rezende (2000) and they are almost identical.

In this section, we aim to answer two questions. Are seigniorage and deficits consistent with the inflation observed during the high inflation period?

The road map of the section is the following: first, we split into steady state analysis and difference equations. In each of these subsections, we derive the government budget constraint and consider the most popular money demand specifications trying to see if they give reasonable numbers or not.

4.1 Steady State

In this subsection, we consider a simple steady-state version of a standard government budget constraint with money on it. The question we aim to answer with this is if the inflation that the model spits out is close to the one observed if we feed the model with the observed numbers for deficit, seigniorage and debt.

Take the following equation that describes the government budget constraint:

$$B_{t+1} - B_t + M_{t+1} - M_t = i_{t,t+1} B_t + P_{t+1} \left(G_{t+1} - T_{t+1} \right)$$

where B is the nominal debt, M is the nominal money supply, i is the nominal interest rate, $G$is government expenditures and T is tax revenue.

Consider the following assumptions:

1 - $\frac{B_t}{P_t} = b$

2 - $\frac{M_t - M_{t-1}}{M_t} = \pi$ or $M_{t+1} = (1 + \pi) M_t$

3 -$P_{t+1} = (1 + \pi) P_t$

4 - $\frac{G_t - T_t}{Y_t} = d$

Now we add these assumptions to the government budget constraint:

$$\pi = \frac{(1 + g) d + b (r - g)}{m - [(1 + g) d + b (r - g)]}$$

Another important equation that proves to be useful is the following:

$$seigniorage = \frac{(\pi + g + \pi g)}{(1 + \pi)(1 + g)} m$$

Having specified the budget constraints, we can consider the different money demand specifications.

4.1.1 Specifications

Quantitative Theory The first money demand theory that comes to mind is the quantitative theory. Basically, it says that $M_t V = P_t Y_t \Rightarrow m_t = \frac{1}{v}$.

This theory, that uses to hold more in the long term, has some nice properties as it does not depend on the nominal interest rate and it is purely static. Therefore, we could substitute back into the equations found before:

$$\begin{aligned} \pi &= \frac{(1+g)\,d + b\,(r-g)}{\frac{1}{v} - [(1+g)\,d + b\,(r-g)]} \\ S &= \frac{(\pi + g + \pi g)}{(1+\pi)\,(1+g)}\frac{1}{v} \end{aligned}$$

Once we have the equations, the question we ask is if it is consistent with the Brazilian data, but before plugging numbers in, we will suggest two other popular money demand functions.

Log-Log Demand Another popular specification is suggested in Chari et al. (2002):

$$\log \frac{M_t}{P_t} = \tilde{a} + \log Y_t - \eta \log\left(\frac{i_{t,t+1}}{1 + i_{t,t+1}}\right)$$

From this specification we have:

$$\begin{aligned} \pi &= \frac{(1+g)\,d + b\,(r-g)}{a\left(\frac{i}{1+i}\right)^{-\eta} - (1+g)\,d + b\,(r-g)} \\ S &= \frac{(\pi + g + \pi g)}{(1+\pi)\,(1+g)} a \left(\frac{i}{1+i}\right)^{-\eta} \end{aligned}$$

Log-linear Demand Another popular money demand function is the log-linear, suggested by Cagan (1956). Let the demand function be:

$$\log \frac{M_t}{P_t} = \log \kappa C_t - \gamma i_{t,t+1}$$

Plugging in the value for m , we have:

$$\begin{aligned} \pi &= \frac{(1+g)\,d + b\,(r-g)}{\frac{\kappa}{e^{\gamma i}} - (1+g)\,d + b\,(r-g)} \\ S &= \frac{(\pi + g + \pi g)}{(1+\pi)\,(1+g)} \frac{\kappa}{e^{\gamma i}} \end{aligned}$$

4.1.2 Parameterization

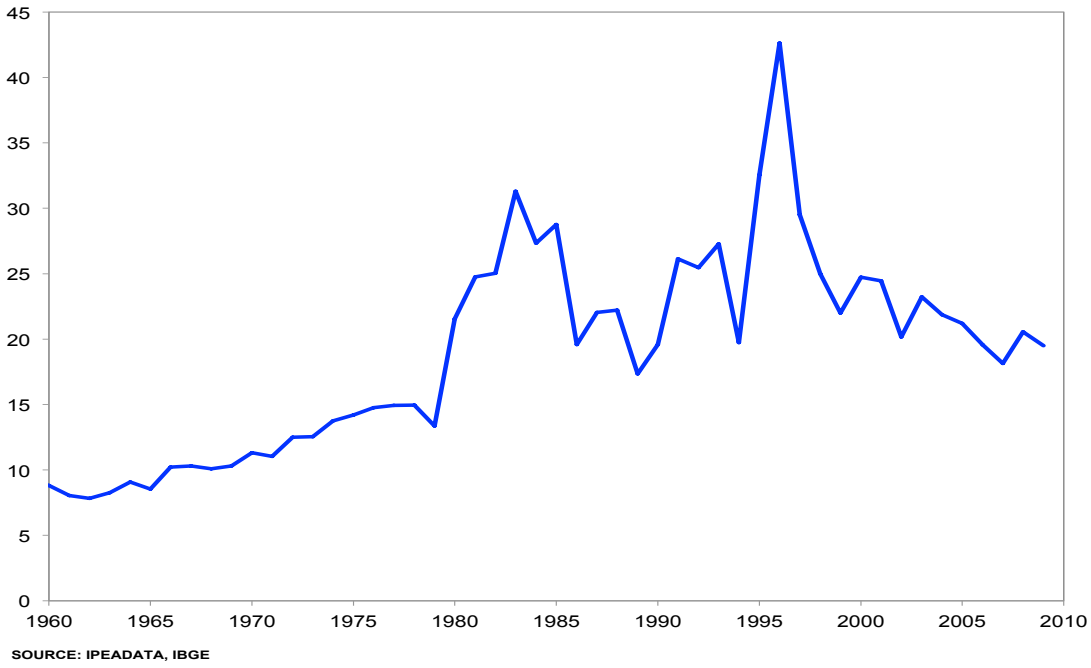
Even when we consider the steady-state evaluation of such economy, we have to assign some values for the parameters as well as how to treat the steady-state variable. We assume basically that there are two observed steady-states: one during hyperinflation and another during low inflation. In that sense, our choices of the steady-state variables rely on averages of the period 1981-1994 and 1995-2009, as Table 3 highlights:

Table 3: Steady-State Values

		Before Real Plan	After Real Plan
Debt to GDP Ratio	b	44.0	45.2
Primary Deficit (% of GDP)	d	-2.80	-2.36
Annual Real Interest Rate (%)	r	14.00	13.26

Given these values on steady-state, we still have to compute values for the velocity (v), and the parameters of the log-log demand (a, η) and of the log-linear demand (γ, κ). Velocity is directly observable. By dividing the nominal GDP by $M0$, we have the value of velocity.

Figure 17: Velocity



As one can observe, it is not clear that there is a different pattern during high inflation years and Real Plan's year. It is important to stress that with a velocity like 25, and inflation going to infinite, the most one can get from seigniorage is 4%. In that sense, the values observed of 3% that seemed to be small in the previous section are actually really high, since they are almost up on the roof.

For the log-log specification, we have two unknown parameters: a and η. The question therefore is how to get them. One can see that seigniorage could be found if we knew these parameters but we do have the realized value for seigniorage. The implicit assumption is that in every period of time we are in a steady state but this steady state changes across time, so that the expression derived would be valid, but not constant[18]. Therefore, we find these values by:

$$\min \sum_t \left(S_t - S_t^{theory} \right)^2$$

The results so far suggest that $\eta = -.43$, which is the elasticity of money demand with respect to the interest rates and $a = 0.047$.

[18]One could try to get from the inflation equation, but we cannot easily disentangle the nominal interest rate to get inflation depending on the interest rate and the other variables.

A couple of comments are worth mentioning. First of all, the log-log demand curve does not give rise to a Laffer curve; the seigniorage is monotonically increasing, while in the log-linear demand it may have the Laffer curve.

We perform a similar exercise to the one done before for the log-linear case. We minimize the quadratic deviations from the observed and the predicted seigniorage of every point from 1980 to 2009, and the results suggest that $\kappa = 0.0376$ and $\gamma = -.0108$[19].

4.1.3 Results

The results discussed here are split into two parts: hyperinflation and low inflation periods.

The idea of the exercise is to find the point in which seigniorage intersects the borrowing requirement. This value of seigniorage is translated into a value of inflation and we can evaluate if such inflation is consistent or not with what was observed.

A couple of points should be mentioned. First of all, this is a steady-state analysis. This means that not only the borrowing requirement is the one that prevailed under all years, but also that the seigniorage found and, consequently, the inflation should be thought as the steady-state values under such fiscal stances.

In order to evaluate if we could get the high inflation observed, consider the following values, which are the means in the 80's pre-stabilization plans. The real interest rate was 14%, $b/y = 44\%$, $d/y = -2.8\%$, and $V = 25$. If we assume that the growth was zero at that time, we have that seigniorage was 3.36%, close to the maximum of 4% discussed before. Moreover, when we plug this back into the inflation equation, we have that $\pi = \frac{d+br}{\frac{1}{v}-d+br} = \frac{-2.8\%+44\%14\%}{\frac{1}{25}-[-2.8\%+44\%14\%]} = \frac{3.36\%}{4\%-3.36\%} = 525\%$

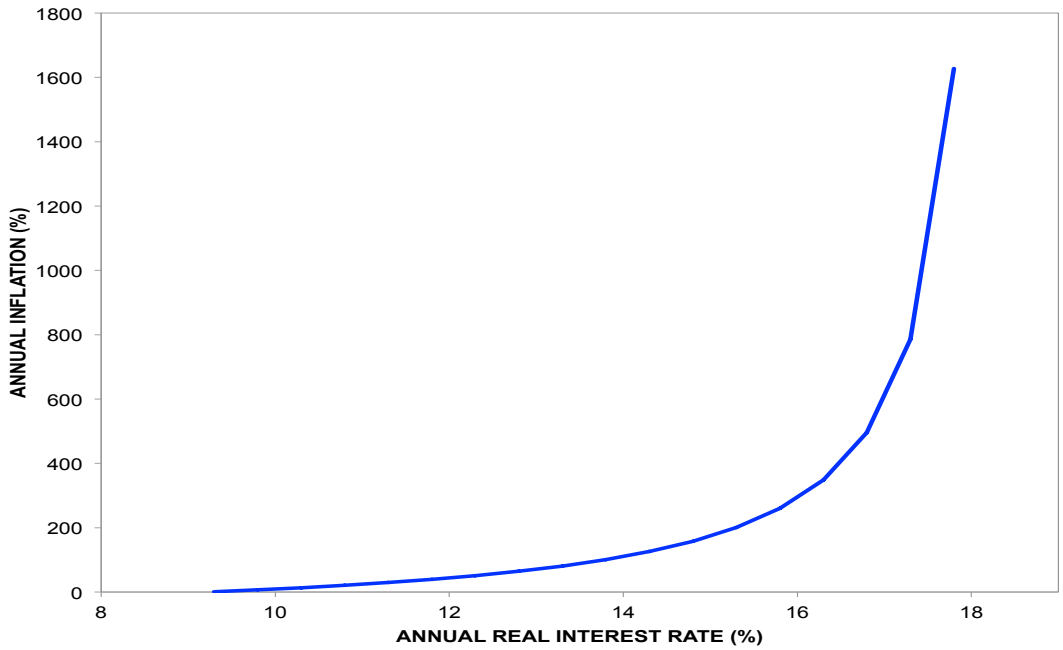
It is striking that with the values observed in the pre-stabilization plans period, we have that inflation should be 500%, which is in a first-order a good accounting of the high inflationary period.

Introducing output growth, which reached 2.7% on average from 1980 to 1985, we have that inflation would be 110% and seigniorage about 2.1%.

[19]With these parameters, we do not have the Laffer curve. Changing the weights we give to the different observations, we could get the Laffer Curve.

Two points are worth mentioning though. In the same sense that the result changes with the output growth used, the same happens when we change the interest rate. In the graph below, we discuss what would be the inflation assuming velocity, primary deficits and debt constant and changing the real interest rate.The result is very sensitive to the real interest rate used and that is why one has to be careful about it.

Figure 18: Inflation vs. Real Interest Rate



As we see above, a change in 2% could trigger an increase of inflation of more than 1000% if we are close to the maximum seigniorage possible. However, if one were to take a message out of this exercise, it would be that, even if with primary surplus, inflation could be really high if there is a significant amount of debt and a high real interest rate.

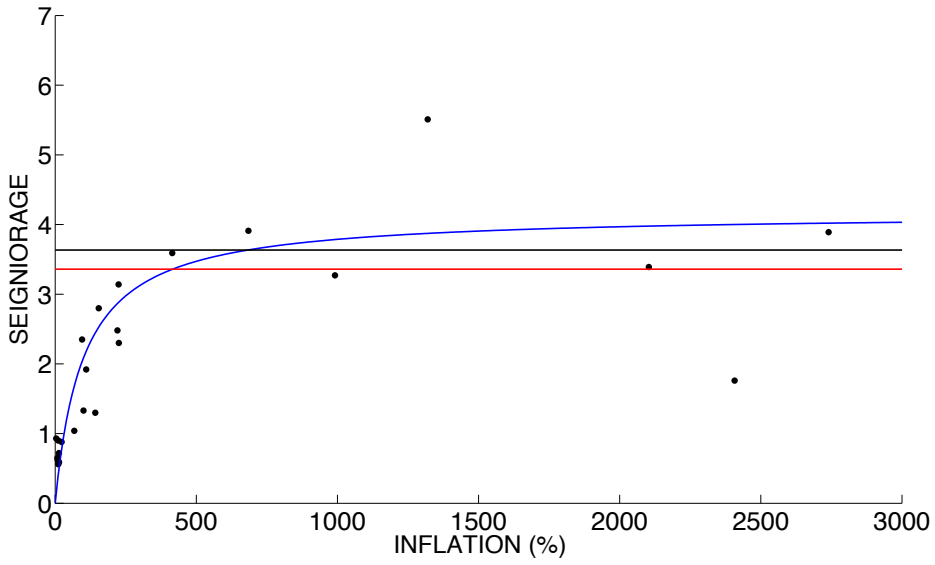
An analogous exercise can be replicated for the Real Plan. The primary deficit was $d/y = -2.36\%$, while real interest rate had a mean of 13.26%, $v = 24$ and the ratio debt/GDP was 45.2%. If we assumed no growth, we would have an inflation of $\pi = \frac{3.63\%}{4\%-3.63\%} = 981\%$ and with growth of 2.9% (average of 1995-onwards), inflation would be 131%.

From this simple exercise, it emanates the first puzzle: why did inflation decrease during the Real Plan?

The fiscal theory of inflation seems to account to the high inflation observed in the eighties, but we cannot explain the low inflation after the Real Plan.

In Figure 19, one can see what would be the equilibrium values of inflation under the early years as well as the Real Plan. As mentioned before, the horizontal lines are the steady-state values of seigniorage that would be explained once we solve for primary surplus, velocity of money, debt and real interest rate. Hence, the horizontal lines can be thought as the revenues coming from seigniorage needed to attain the budget constraint. The blue line uses the mapping between the velocity of money and inflation as shown in the previous section. The horizontal red line is the steady-state seigniorage under the Real Plan, while the black horizontal line is the steady-state seigniorage pre Real Plan (under constant velocity, we have 3.36%).

Figure 19: Seigniorage and Inflation - Constant Velocity



We perform a similar exercise to the one we have done before, in which we minimize the quadratic deviations of every point from 1980 to 2009 using other specifications of money demand function. As we see in Figure 20, we continue to get high inflation during the Real Plan, i.e., the fiscal numbers of the Real Plan, whether we use constant velocity or Log-Log demand ($a = 0.0380$ and $\eta = 0.0693$), still suggest that inflation should have been above 300%. The same applies for Figure 21, where we use the Semi-Log specification ($\kappa = 0.0414$ and $\gamma = 0.0063$). Note that in Figure 21 we have a Laffer curve

for seigniorage, but we cannot explain the low inflation during the Real Plan even if it was on the "right side" of it.

Figure 20: Seigniorage and Inflation - Log-Log

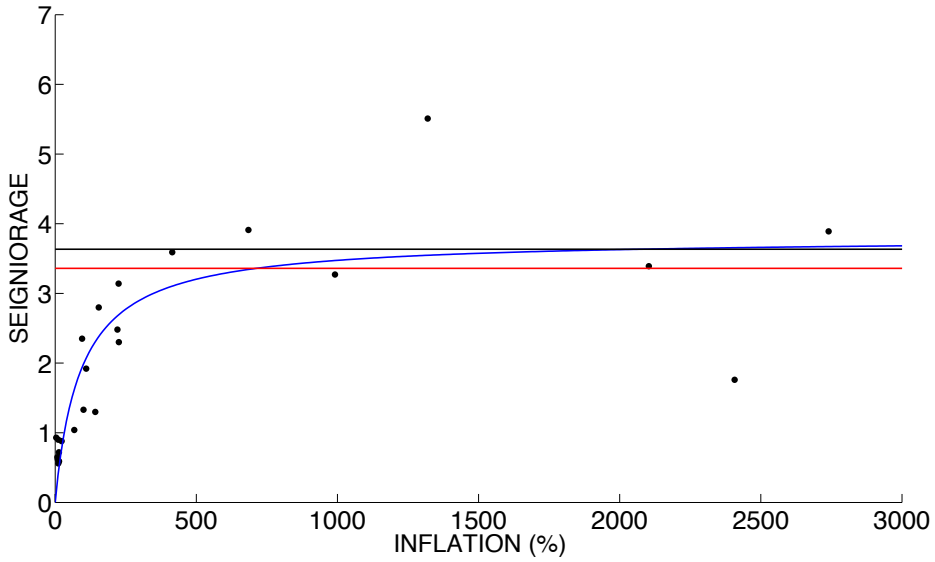
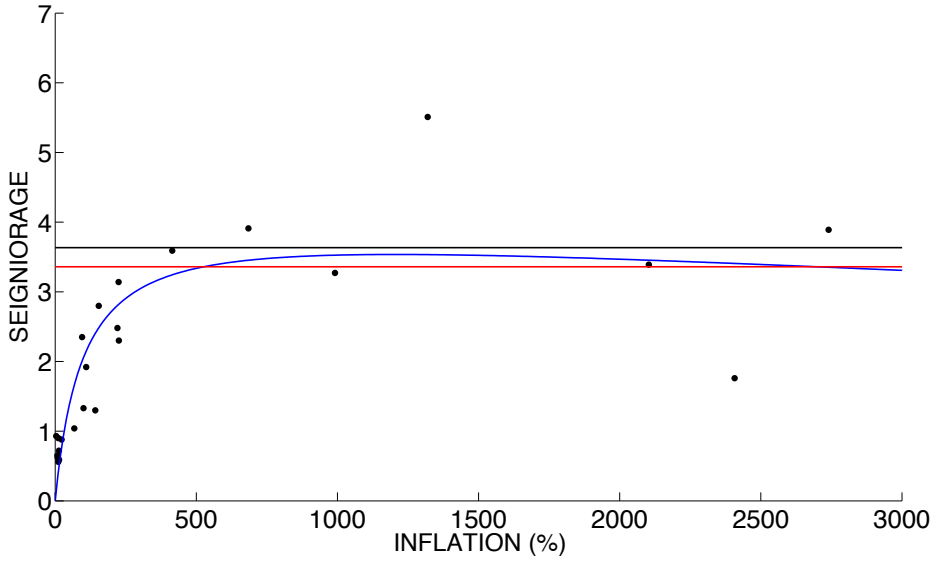


Figure 21: Seigniorage and Inflation - Semi-Log



No matter which specification or method one believes in, the question that remains is why the Real Plan succeeded in lowering inflation. The fiscal side worsened, the real interest rate increased, and growth did not improve substantially. With data until 2013, we can say that it took a very long time for the real interest rate to fall, and, even so, it remained high by international standards.

5 Further Details of the Brazilian Experience

This paper has so far presented a very interesting puzzle: why, unlike its six predecessors, did the 1994 Real Plan succeed in lowering inflation if it did not bring much fiscal improvement? The most likely explanations for this puzzle are currently missing from the paper. The explanations involve fiscal aspects, but also have to do with indexation, inflation inertia and passiveness of monetary policy.

1) Inflation effects on fiscal (perfectly indexed) revenues and (not so well indexed) outlays:

a. Usually, the hyperinflation literature refers to the so-called Olivera-Tanzi effect. This is the effect that high inflation has on government revenues. Since usually government revenues are computed from nominal values, e.g., nominal income, and there is a lag until tax payment, the real value of taxes collected tend to fall with inflation.

b. However, for the Brazilian case before the Real Plan, there are empirical indications (Bacha, 2003) that the Olivera-Tanzi effect worked the other way round, because of two reasons: First, fiscal revenues were very well indexed to inflation. Tax indexation was perfected to a point of almost keeping the real value of taxes collected immune to inflation. A daily index, the UFIR (Fiscal Reference Unit), was computed based on inflation. Taxes would be denominated in this indexed unit of account, and translated to the nominal hyperinflated currency on the very day taxes were paid at the banking system. Second, fiscal expenditures were only imperfectly indexed to inflation. The fiscal budget was not so perfectly indexed as tax collection and always underestimated true inflation. Therefore, the real value of expenditures budget would invariably undershoot the originally budget real amount. The Executive branch could, and indeed did so, cut the real value of expenditures only by disbursing the originally planned nominal amounts with delay. Higher inflation would rapidly erode the real value of those expenditures. Of course, this had the collateral effect of creating large problems, since public hospitals would run out of money at the end of the year, several bridges or roads would stay unfinished for many years, and so on. Nevertheless, it was an effective way to actively make the budget fit the revenues (including, of course, seigniorage).

Guardia (1992), studied with detail the budget for 1990 and 1991, and concluded that the first point to emphasize is the significant difference between the the total expenditures in the (federal) budget and the actual expenditures. In 1990, for a global budget of the order of US$ 303.3 billion, total expenditures disbursed by the (Brazilian) Treasury hovered around US$ 190.1 billion, or 62.68% of the expenditures voted (Table 6). Similar behavior may be observed in 1991, when the actual expenditures reached the level of US$ 84.7 billlion, representing 60,0% of the total budgeted expenditures of US$ 149.5 billion (pages 121-2).

The way out of this bad equilibrium required that either fiscal expenditures be lowered, or fiscal revenues increased. Both were pursued by the Real plan. The key fiscal aspect was the 1994 Emergency Social Fund (FSE). The FSE freed 20% of federal revenues from mandatory expenditures, supposedly in health and education. The FSE therefore allowed the Brazilian government to balance the budget without having to resort to the reverse Olivera-Tanzi effect created by hyperinflation.

Also, the renegotiation of state and municipalities debts gave the federal government an opportunity to curb sub-national deficits and excess debt. This process was further strengthened with the Fiscal Responsibility Law, in 2000.

2) Monetary policy became much more active, i.e., real interest rates became positive, high and were used to fight inflation:

a. During hyperinflation, monetary policy was completely passive, i.e., real interest rate would be low and would not be used as a tool to fight inflation. This passiveness was built in the framework of the Brazilian monetary policy of the hyperinflation years, as explained below.[20] There was very little dollarization associated with the Brazilian hyperinflation. Firms and households would have deposit accounts at banks. These deposit accounts, which took different formats over time, would provide a good hedge against inflation. Sometimes they were directly indexed to inflation, other times the inflation hedge would be provided by variable nominal short-term interest rates, which would rise with inflation. Sometimes they would be offered directly by banks, other

[20]Pastore (1995, 1996) analyzes the passiveness of monetary policy during the hyperinflation.

times, via mutual funds managed by banks. In all cases, the inflation hedge of these bank deposit accounts would successfully prevent dollarization, which never happened in Brazil, or, at least, not nearly in the same dimension as it occurred in other Latin American countries, as Argentina or Peru.

b. For the banks to be able to provide this domestic currency substitute (Carneiro and Garcia, 1993), it was imperative that the real rate of interest did not rise much. After all, the counterpart of those inflation-hedged deposit accounts were government bonds on the asset side of the banks (or mutual funds). If the real interest rate were to significantly rise, banks would suffer major losses, and become unwilling or unable to provide the inflation-hedged deposit accounts (Garcia, 1996). Therefore, monetary policy was almost always conducted in a way so that the expected real rate of interest was low and would not jump upwards. Carneiro and Garcia (1993) even argue that if the Brazilian Central Bank were to try to stop money growth, thereby significantly raising the real interest rate, it would cause major losses to banks that would then leave the business of providing the inflation-hedged account, prompting economic agents to look for alternatives, most likely, the US dollar. Therefore, they quip that the obvious cold-turkey alternative to end hyperinflation—just stop money growth—could be the proximate cause of a much worse hyperinflation, prompting the dollarization that Brazil never suffered.

c. During hyperinflation, the most profitable banking business in Brazil was to become a "government partner" in collecting seigniorage via these deposit accounts (Garcia, 1996), since for payments to be made, they required that the funds stayed for a while in non-interest bearing deposit accounts, which entailed high, but much less than 100%, reserve requirements. Therefore, the banks profited handsomely with the float.

d. This process created a large moral hazard problem between banks and the Central Bank. Financial institutions understood this peculiar monetary policy regime and tried to profit from it in a similar way that banks nowadays use the "Too Big to Fail" implicit threat. Banks would leverage to the maximum level allowed by regulation (30x), so that if ever the Brazilian Central Bank got ideas of imposing some active monetary control, it would have to deal with massive bank failures.

The Real Plan dealt with that problem by closing the zombie banks that were kept alive during the hyperinflationary years by float profits and Central Bank forbearance. With low inflation, much larger changes in real interest rate became possible, and were used by the Brazilian Central bank.

3) Inflation inertia caused by indexation to previous inflation:

a. In hyperinflations, prices are usually adjusted according to some index, most often the exchange rate. That explains why so many stabilization plans resorted to the exchange rate (nominal) anchor to help stabilize inflation. To be sure, the exchange rate anchor was also used during the first years of the Real Plan, but the point here is that, during the hyperinflation, prices and incomes, including the exchange rate that followed a crawling peg, were indexed to previous inflation.

b. Price indices are lagged measures of current inflation. This is because they are usually computed as the percentage increase between two consecutive thirty-day averages of prices. This means that, if inflation is accelerating, as it is typically the case of a hyperinflation, there will be lag for "marginal" or point inflation to show up in the average. Furthermore, statistical bureaus also take time (two weeks) to compute the price indices, thereby worsening the lag-in-measurement problem. If one assumes that inflation is gradually accelerating, the use of one-month ahead inflation becomes a proxy for "marginal" or point inflation.[21] Garcia (1993) shows that this approximation indeed was incorporated by Brazilian financial markets during hyperinflation, where a sort of Fisher effect developed even for inflation-indexed securities.

c. Because of the way prices are measured, as the percentage increase between two consecutive thirty-day averages of prices, even if a stabilization plan achieves total price level stability after the first day of the plan, there will be some remaining inflation that will show up in the standard price index measures. This is because the hyperinflation before the start of the plan implies that the price level average before that day will be much lower than the price level average (computed as an average of constants) after the plan. Therefore, if this measured inflation is passed, via indexation, to the prices after

[21]For the US, Gurkaynak (2010) estimate that the lag for the indexing of TIPs was of the order of 2 and a half months.

the plan, this is incompatible with the new equilibrium.

d. Wage indexation also posed a problem. Since wages are staggered, the real wage at the day a stabilization plans start may be much lower or higher than the average real wage for the whole wage cycle (wages were usually adjusted every six months according to inflation). Therefore, a transition rule must be implemented to avoid imbalances that would certainly prompt the (randomly assigned) losers to ask for higher wages, threatening the new low inflation equilibrium.

Previous failed stabilization plans in Brazil resorted to price freezes and forced conversion rules, expressed in spreadsheet tables ("tablitas"). The Real Plan used a much more clever idea, the URV, explained before. The URV made the whole transition process much smoother and hassle-free. Also, unlike previous plans, it did not invite lawsuits against the price freezes or forced conversion rules. In summary, the Real Plan improved, yes, the fiscal stance of the country, but we cannot find this improvement in the usual fiscal deficit numbers. On the other hand, the transition mechanism that fought inflation inertia was also crucial. Finally, giving back to the Central Bank the basic tool of monetary policy—gauging the real interest rate—played a key role in the Real Plan's success. A model of the Brazilian hyperinflation would have to take these three aspects into account. As a result, the transmission from fiscal to monetary policy would be much more complex that simply "issue whatever currency it is needed to finance government expenditures". Nevertheless, the link between fiscal and monetary policy would be there, and the fiscal adjustments made by the Real plan were crucial to conquer the Brazilian hyperinflation.

6 Conclusion and Next Steps

This paper aimed at achieving three objectives. First, it provided a brief description of the Brazilian macro economy in the last few decades, including the hyperinflationary period and the stabilization period. The several failed stabilization attempts are reviewed and contrasted with the Real Plan, of 1994, that finally conquered the hyperinflation. Our

focus are the monetary and fiscal policies of the different periods.

The second objective was to perform a budget constraint exercise, involving the decomposition of the public debt by the index each class of bonds is linked to. So far, the data we have collected did not allow us to fulfill this second objective. We expect that, at the 11/6 Conference, we will get suggestions of new datasets that will help completing the accounting exercise. Building a dataset of each country's high inflation experience is one of the goal of the project this paper is part of.

The last objective is to answer whether or not the Brazilian hyperinflation may be justified by fiscal policy. We have provide a simple framework to investigate this question. So far, we have accomplished half of our goal. The Brazilian hyperinflation can, indeed, be rationalized by the fiscal deficits and the need for seigniorage. However, we are unable to justify why the Real Plan succeed, since the fiscal deficits increased in the aftermath of the plan, while real interest rates increased and growth did not pick up substantially.

Our hope is to get many comments and suggestion, not only but also about fiscal and debt data, during the 11/6 Conference.

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7 Appendix

7.1 Fiscal Theory of Inflation

In this section, we redo the calculations done with Jaloretto's data for seigniorage but using seigniorage constructed by ourselves. Firstly, we get annual data just like before but with a different seigniorage variable.

Figure 22: Seigniorage and Inflation - Constant Velocity - Annual Data

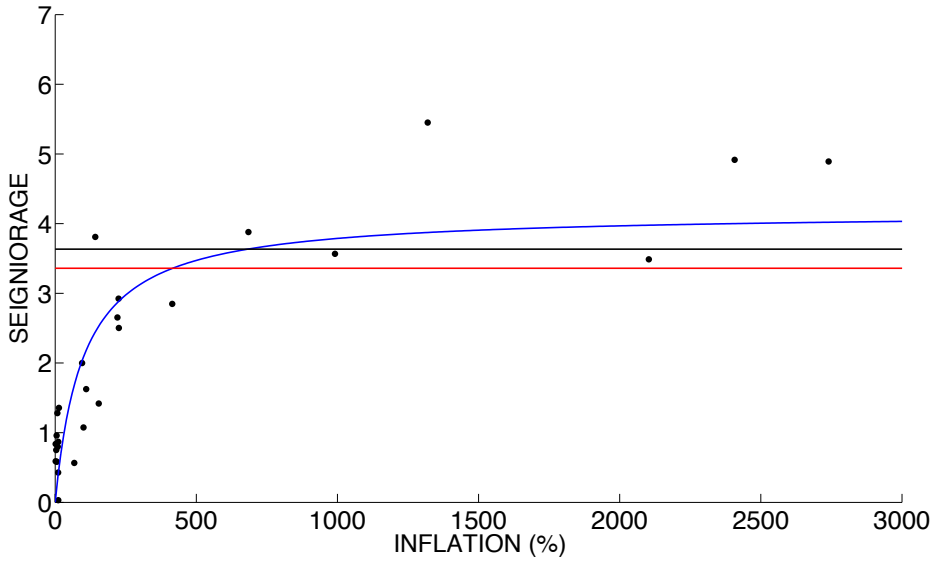


Figure 23: Seigniorage and Inflation - Log-Log - Annual Data

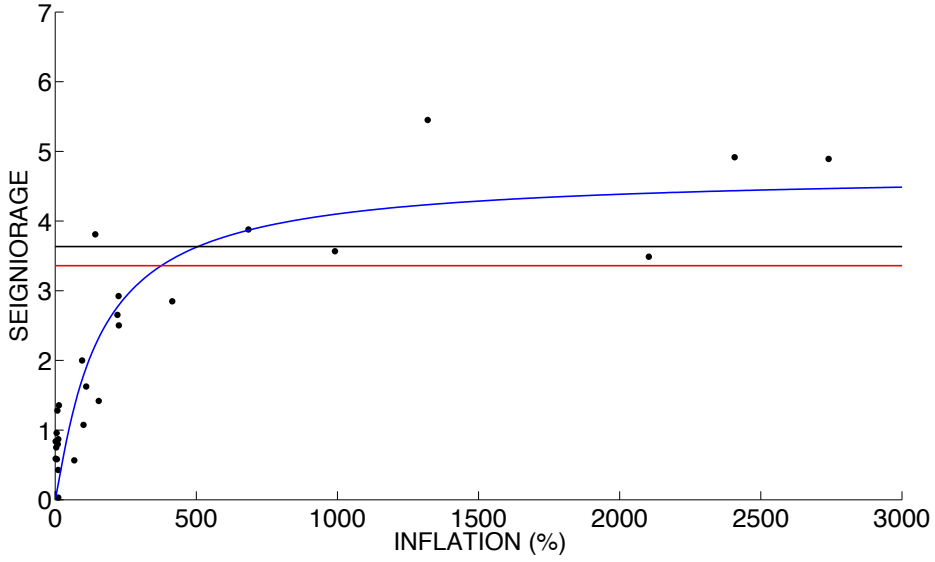
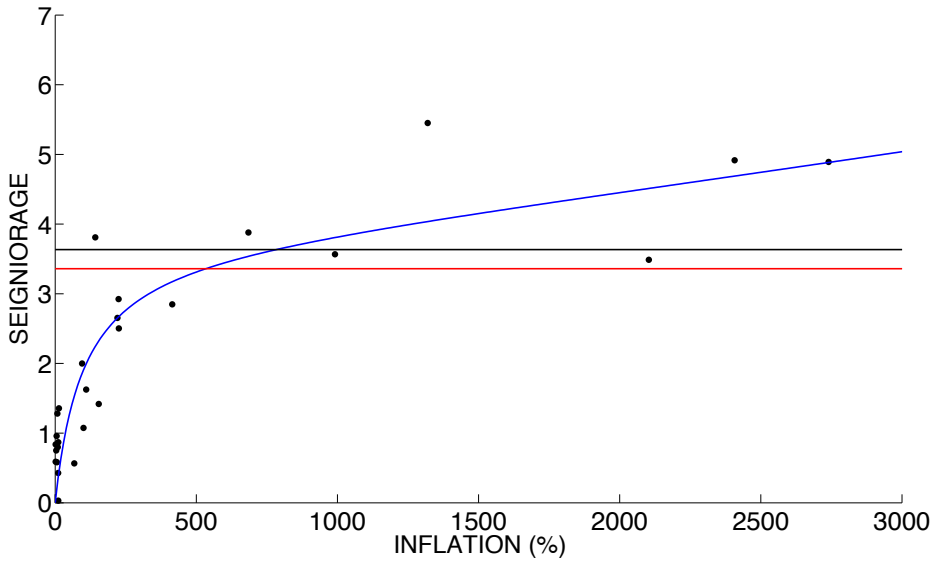


Figure 24: Seigniorage and Inflation - Semi-Log - Annual Data



The results do not change much if we compare it to the ones in the body of the paper. However, we have been fitting a curve with just a few points. Therefore, we rerun the same exercise with monthly data

Monthly data brings the possibility of many more points, but, for instance, from one month to another, sometimes the monetary base reduces, which gives us a negative seigniorage. Apart from that, some adjustments have to be changed to keep everything in the same periodicity. Real interest rates are monthly, velocity is 12 times lower in the case of constant velocity since the output (flow) is reduced, but the monetary base is not). Analogously, debt / GDP is multiplied by 12. We assume that primary deficit/ GDP is constant so it is not changed.

The results are very different from the ones we have discussed so far. The quantity theory does not give a good result.

Finally, the puzzle why Real Plan could reduce inflation persists once we take into account different specifications for the money demand and seigniorage variables.

Figure 25: Seigniorage and Inflation - Constant Velocity - Monthly Data

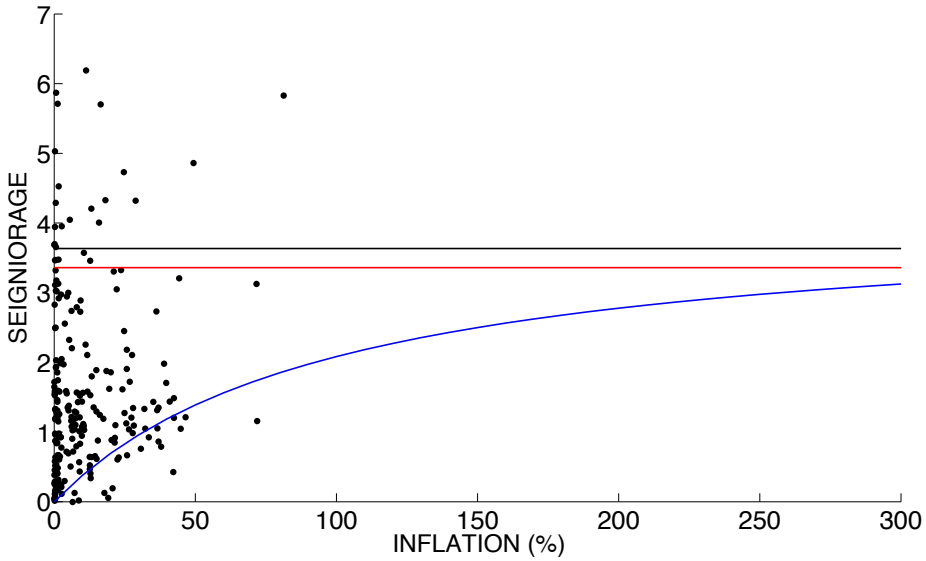


Figure 26: Seigniorage and Inflation - Log-Log - Monthly Data

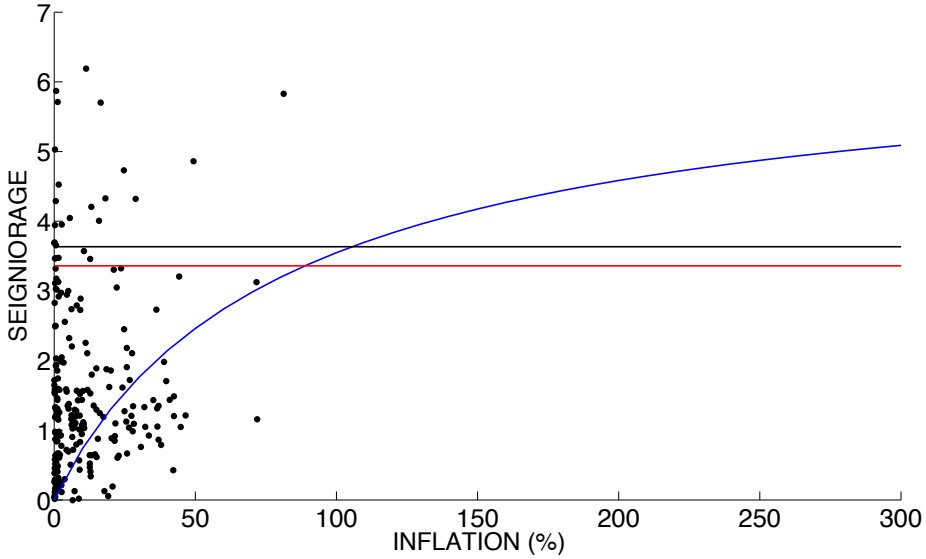


Figure 27: Seigniorage and Inflation - Semi-Log - Monthly Data