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CENTRAL BANK INDEPENDENCE AND THE FEDERAL DOMESTIC DEBT: A STUDY OF THE BRAZILIAN CASE, 1966-1996.

by

VIVIANE LUPORINI

A dissertation submitted to the Graduate Faculty in Economics in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York

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Abstract

CENTRAL BANK INDEPENDENCE AND THE FEDERAL DOMESTIC DEBT: A STUDY OF THE BRAZILIAN CASE, 1966-1996.

by

VIVIANE LUPORINI

Advisor: Professor Alvin Marty

This dissertation analyzes the sustainability of the Brazilian federal domestic debt from 1966 to 1996, and reveals how the low degree of independence between the Treasury and the Central Bank allowed the federal government to continue financing itself despite the unsustainable path assumed by its debt after 1981. Through an institutional mechanism known as the 'repurchase agreement' and the issuance of central bank securities, the Brazilian monetary authorities became hostage to the Treasury's ever-growing fiscal necessities and lost control over the levers of monetary policy. A historical background and data analysis provide a general overview of the evolution of the Brazilian federal domestic debt since the financial reform of 1964-66, when the first price-indexed government security was created. The sustainability of the federal domestic debt is then tested through the mean-zero stationarity of the discounted debt/GDP ratio in the context of an infinite-horizon

framework, and the Central Bank's ability to control the money supply is discussed under two scenarios: absence and presence of the *repurchase agreements*. The analysis indicates that the federal domestic debt becomes unsustainable after 1981, and that the Brazilian central the *repurchase agreements* are used.

ACKNOWLEDGEMENTS

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This dissertation is dedicated to my parents and to José.

TABLE OF CONTENTS

1. Introduction

This dissertation analyzes the sustainability of the Brazilian federal domestic debt and evaluates how the relationship between the Treasury and the Central Bank contributed to the government's ability to finance itself despite growing debt/GDP ratios. Because of its low degree of independence, characterized by an institutional mechanism known as "repurchase agreement" and by the issuance of central bank securities, the Brazilian central bank became hostage to the Treasury's ever-growing fiscal necessities and enable the government to roll over its expanding domestic debt at the cost of loosing control over the monetary policy.

In 1965, the recently established military government initiated a financial reform which created the Brazilian central bank. Because of the high inflation rates and political instability experienced at the time, the federal government faced difficulties in placing government securities in the incipient financial market. In order to assure acceptance of its securities, the government indexed its bonds to the price level and instituted the so-called *repurchase agreements*.

Indexation was established through *monetary correction*, an escalator clause which, at least in theory,

provided for complete, automatic and nondiscritionary revisions of the value of government securities according to past inflation. With an annual inflation rate of 92 percent in 1964, indexation set a positive 'floor' for the real return on government securities.

The *repurchase agreements* were repurchase letters issued by the central bank along with Treasury securities. In Brazil, the central bank is the agent responsible for placing Treasury securities in the primary market. The repurchase letters insured financial institutions holding Treasury's debt that the central bank would reacquire the securities at the agreed rate in case dealers were not able to sell them in the secondary market.

Although in place since 1966, the *repurchase agreements* did not represent a problem for the central bank until 1982. During the 1970s, the Treasury had several years of fiscal surpluses, and even when that was not the case, it was able to finance itself abroad, in the Eurocurrency market. In 1982, however, the Mexican moratorium caused a severe reduction in the availability of these external funds, and the Brazilian Treasury had to turn to the domestic market to finance itself.

A combination of economic recession and increasing demands on the public sector produced growing fiscal

deficits throughout the 1980s. During this period, the federal domestic debt became unsustainable and the prices that government securities were able to command were falling. The Treasury, however, was able to continue rolling its debt over as the Central Bank kept a stable demand for government securities through the usage of *repurchase agreements* and issuance of its own securities.

Inflation, in the meanwhile, rose to unprecedented levels, leading to several attempts at price stabilization. The stabilization plans enacted during this period dealt mainly with indexation. Policymakers believed that Brazilian inflation was mainly "inertial", as past inflation rates were reproduced and carried over, month after month, through the mechanism of indexation. None of the attempts at stabilization during the 1980s addressed, however, the fiscal stance of the government, the domestic debt, or the institutional relationship between the Treasury and central bank which sustained them. On the contrary, the central bank continued to be used to accommodate the fiscal necessities of the Treasury.

This dissertation analyzes the sustainability of the Brazilian federal domestic debt from the perspective of the impact of the repurchase agreements and other institutional arrangements on inflation. Chapter Two presents an

overview of the Brazilian federal domestic debt over the period covered by this dissertation (1966-1996). In that chapter, I will provide a historical analysis of the evolution of the Brazilian federal domestic debt since the financial reform of 1964-66, and discuss how the fiscal needs of the Treasury, along with the several attempts at price stabilization, led to the increasing usage of *repurchase agreements* on one hand, and to the introduction of Central Bank securities on the other hand. The historical analysis is followed by a data analysis, which shows the responses of the debt/GDP ratio to changes in the variables of the government's budget constraint.

Chapter Three analysis whether the Brazilian government was heading towards excessive debt accumulation, which could threat the price stability achieved in 1994. As we shall see in this chapter, although the Brazilian debt was sustainable over the whole sample, it assumed an unsustainable path after 1981. The Treasury was able to continue financing itself, however, in spite of its excessive debt accumulation. The reason for this, can be found in the Treasury's peculiar institutional position vis-à-vis the Brazilian central bank. In Chapter Four, I will analyze the degree of central bank independence in Brazil based on the criteria proposed by the literature,

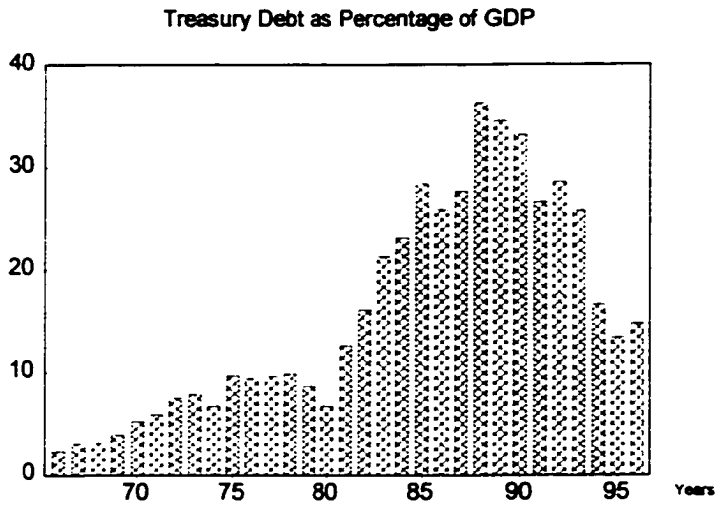
and discuss two aspects of the relationship between the Treasury and the Central Bank: the *repurchase agreement* and the issuance of securities by the Central Bank. I argue that the usage of these institutional mechanisms, while allowing the Treasury to finance its otherwise unsustainable debt, also had a discernable cost in terms of the Central Bank's capacity to implement monetary policy.

2. The Federal Domestic Debt in Brazil: an overview

The Brazilian federal domestic debt assumed increasing importance as an instrument for government finance since the financial reform of 1964-66. This chapter provides the reader with a general overview of the evolution of the Brazilian federal domestic debt since the financial reform of 1964-66, when the first indexed government security was created.

This historical analysis is followed by a data analysis, which shows the responses of the debt/GDP ratio to changes in the variables of the government's budget constraint.

The development of the Brazilian federal domestic debt as a ratio to GDP suggests two phases in its evolution. The first phase, from 1966 to 1980, is characterized by a steady, yet stable, increase in the debt/GDP ratio. During this period, external borrowing was the main form of government financing and indexed bonds were the most popular type of government security. Having their yield linked to a price index, these securities guaranteed its holder a positive real rate of return that was free from inflation risk.



During the second phase, from 1981 to 1993, the debt/GDP ratio not only increased faster than during the first phase, but also varied more. During this period, inflation rates soared, various attempts at price stabilization failed, and new types of government securities were issued. The main characteristic of these newly issued securities was that they were 'floating rate'. A 'floating rate' security accumulates interest daily, following the average yield on the secondary market for government securities, although it pays the accrued interest and principal on the maturity date.

The main difference between an indexed security and a 'floating rate' security is that while indexed bonds use a formal indexation factor that is announced by the government, 'floating rate' bonds use an informal indexation -- the average nominal interest rate on the

secondary market -- that is determined by the market. The informal indexation of 'floating-rate' securities is, therefore, out of the government's control.

'Floating rate' securities became increasingly more important for government finance at the end of the 1980s. As inflation rates increased and became more volatile, the indexation factor applied to indexed securities often lagged behind inflation rates, thus failing to provide full protection against inflation-induced losses. There are also accounts of the government's deliberately manipulating the indexation factor to economize on real interest payments on indexed securities [Tanner, 1995].

The high inflation rates observed in the period 1987-1994 along with the different time lags of data collection for debt and GDP cause severe distortions in the Debt/GDP ratio. Data for the debt is observed every month and accumulated over the year, while data for the GDP is observed quarterly. Thus, when the December values of the debt are used to calculate the Debt/GDP ratio, inflation affected the nominal values of the debt more severely than it affected the GDP, resulting in an overestimation of the debt/GDP ratio. The distortion is more severe, the higher is the inflation rate. In order to minimize the distortion, the yearly average value of the debt was used

to calculate the Debt/GDP ratio for this period. This procedure reduces the relative value of the debt in later months in the year, and therefore, reduces the effects of inflation on the total value of the debt[1].

2.1. Historical Analysis

2.1.1. First phase: 1966-1980

During the first phase, the federal domestic debt/GDP ratio averaged 6.6% from 1966 to 1980, with a standard deviation of 2.6, characterizing a relatively stable pattern. The government adopted the import-substitution strategy of development, and launched an ambitious government-stimulated investment plan, which relied on the then low cost funds from the Eurocurrency market. Prior to 1965, the government had encountered problems placing its securities in the market for three main reasons. First, the market for private securities was still incipient and there was no organized market for public securities; second, the inexistence of a central bank and the frequent use of monetary finance limited the use of open market operations; finally, negative real rates of

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[1] Average: $[D_J + (D_J + D_F) + (D_J + D_F + D_M) + \ldots + (D_J + \ldots D_D)] / 12$
$= [12D_J + 11D_F + 10D_M + \ldots + D_D] /12$
$= D_J + 11/12(D_F) + 10/12(D_M) + \ldots + 1/12(D_D)$, where J, F, M... stand for January, February, etc.

interest frequently resulted from high annual inflation rates, making the market wary about securities in general.

In 1964, the government initiated a financial reform that created an official central bank, and established the National Monetary Council (CMN- *Conselho Monetário Nacional*). Conceived to be similar to the U.S. Federal Reserve Board, the purpose of the Council was to establish a monetary authority that would limit the government's intervention on central bank affairs, and to deliberate on targets for monetary policy[2]. The financial reform also introduced a widespread indexation system, where escalation clauses linked to the price level prevented inflation from affecting the real value of economic contracts.

In this context, the Treasury issued its first price-indexed security, the Indexed National Treasury Obligation (ORTN- *Obrigações Reajustáveis do Tesouro Nacional*). With the annual inflation rate soaring at 92 percent in 1964, monetary correction set a positive 'floor' for the domestic real interest rate and enabled the emergence of the public securities' market. Later, the nominal price-indexed value of the ORTN (the so-called Standard Capital Unit, or UPC- *Unidade Padrão de Capital*) became the basic unit value of all

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[2] For details on the creation of the Brazilian central bank, the board composition and functions of the National Monetary Council, see Maxfield (1997).

indexed financial assets: time deposits of 360 days in maturity or longer, saving accounts, mortgages, private indexed bonds, some tax brackets, public utility profits and depreciation. All carried monetary correction according to the ORTN.

In the early 1970s, in order to facilitate open market operations and thus the implementation of monetary policy, the Treasury issued the National Treasury Bill (LTN - *Letras do Tesouro Nacional*). The LTNs were not indexed but issued at discounts through competitive auctions. Primary LTN sales were made to financial intermediaries which re-sold them at short term in the secondary market through a highly developed system of 'letters of repurchase', the Special System of Clearance and Custody of Federal and State Bonds and Bills (Selic - *Sistema Especial de Liquidação e Custódia*). The Selic was implemented in 1977 and allowed for three different kinds of operations: buying and selling of securities, portfolio financing operations, and reserve exchange operations among commercial banks for adjustments of their accounts.

The popularity of the fixed-rate security (LTN) increased during the 1970s: in 1970, holdings of LTNs comprised only 5 percent of the domestic federal debt held by the public; by 1980, holdings reached 28 percent. The price-

indexed ORTN continued to be, however, the most popular security throughout the first phase: in 1970, ORTN holdings represented 95 percent of the domestic federal debt held by the public; in 1980, it represented 72.2 percent (*Table 1*).

Although the government succeeded in creating a domestic market for its securities, at least until the first oil shock of 1973, it relied on the low cost funds available at the Eurocurrency market to finance its development programs. The initially good credit conditions available in the international market started to deteriorate in 1974, however, with a reduction in international trade volume and an increase in interest rates.

Despite the first oil shock in 1973 and the tightening in external credit, the Brazilian government avoided macroeconomic adjustments and decided to continue its investment programs. The strategy succeeded in sustaining high rates of growth: Brazilian product expanded at an average rate of 7 percent between 1973 and 1979. The counterpart of these high growth rates, however, was a very rapid increase in medium and long-term external debt: US$ 13.9 billions in 1973, US$ 30.9 bi in 1976, and US$ 53.9 bi in 1979[3].

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[3] Source: Cavalcanti (1988), p.29.

The pattern of the federal domestic debt follows the pattern of the country's external debt at least until 1974: in order to convert the incoming dollars into the local currency and avoid increasing the money supply, the government sold securities. After 1974, the domestic debt assumes a pattern of its own, as securities were issued to finance the previously acquired debt and the government's primary deficit [Tavares, 1978]. The debt/GDP ratio increases in 1975, but remains stable at around 10 percent until 1980.

2.1.2. **Second phase: 1981-1993**

During the second phase, the debt/GDP ratio not only increased faster than during the first phase, but also varied more. A reduction in external borrowings, coupled with the government's inability to control its finances, resulted in further expansions of the federal domestic debt during the 1980s. Also during this period, inflation rates soared, various attempts at price stabilization failed, and new types of government securities were issued. In 1994, price stabilization was achieved, real interest rates were reduced, and the debt/GDP ratio declined.

The availability of international funds fell sharply after the second oil shock in 1979 and the Mexico moratorium

in 1982. Shaken by the Mexican moratorium on interest payments, commercial banks' loans to Brazil were significantly reduced after 1982, and the limited new loans available had to be made from multilateral institutions, mainly the International Monetary Fund (IMF).

The IMF required that the new loans be deposited at the Central Bank, which would intermediate the payments of foreign liabilities owed by other institutions, mainly private businesses. The Central Bank not only intermediated payments, but also lent the new resources deposited at its accounts to other government branches, primarily the Treasury and state enterprises. More often than not, however, the demand for loans by other government branches exceeded the resources available for relending at the Central Bank (*Table 2*). The gap between the loans actually made and the availability of resources resulted in federal domestic debt expansions[4].

When external resources literally dried out after 1985, the financing of the federal government was made solely through expansions of the domestic debt. The borrowing requirements of the federal government increased from 4.8% of GDP in 1983 to 7.9% in 1984, and to 12.5% in 1985 (*Table 3*).

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[4] For a detailed account of how these relending operations were translated into federal domestic debt expansions, see Cavalcanti (1988).

During this period, the annual inflation rate soared from 110 percent in 1981 to 226 percent in 1985. As the uncertainty about future inflation increased, price-indexed securities (ORTN) became more popular than the fixed-rate ones (LTN). The relative participation of LTN in the total federal debt held by the public fell from 36.8 percent in 1981 to 14.6 percent in 1982, and to a mere 3.4 percent in 1985 (*Table 1*).

In February 1986, the government implemented the first stabilization plan based on wages and prices control, the Cruzado Plan. According to the mentors of the Cruzado Plan, the main source of upward pressure on prices was past inflation, which was carried on through the widespread use of price indexation clauses. Predicting inflation rates near zero, the government eliminated the monetary correction from the ORTN, creating the OTN (National Treasury Obligation-*Obrigações do Tesouro Nacional*)[5]. Inflation rates indeed fell sharply during the months following the stabilization plan as the government implemented an overall price freezing.

The reduction of inflation rate was accompanied by a fall in the nominal interest rate. Although initially the real rate was kept at its previous level, there was a sudden

[5] For a discussion of the Cruzado Plan and its design, see Modiano (1986).

increase in withdraws from savings accounts and a rise in aggregate demand. Moreover, an increase in real wages due to the falling prices also contributed to the sudden growth in aggregate demand.

Besides the increased aggregate demand, misalignment of relative prices caused by the unexpected overall price-freezing added to the upward pressure on general prices.

The government had eliminated the monetary correction (indexation) from its, until then, most accepted security, the ORTN. With expected inflation on the rise, the government lost its main financing instrument as the market became reluctant to accept the newly created unindexed security, the OTN.

The government then created its first floating-rate security, the Central Bank Bill (LBC- *Letras do Banco Central*). The LBCs were issued by the Central Bank and entered in its account as a liability. On the asset side, the Central Bank held the Treasury-issued OTNs. That is, issues of LBC by the Central Bank were backed by holdings of OTNs, and sold to the market with a small discount.

Besides being the first security issued by the Central Bank, the novelty about the LBCs was that the bills were mostly 273-day instruments, which accumulated interest at the

daily overnight rate, with accrued interest and principal paid upon maturity.

The cost to dealers of carrying OTN bonds was the cost of borrowing in the overnight market the amount necessary to finance them. If the market rate were greater than the yield on OTN bonds, the dealer would suffer a loss. Given the high legal leverage between assets and capital (about 30 times), a negative spread between the yield on OTN and the rate charged in the market of over 3.5 percent could drive the dealer into insolvency [Glaessner and Jorgensen, 1990]. This situation limited the Central Bank's ability to increase interest rates.

The issuance of floating-rate securities benefited both, dealers and the Central Bank.

The advantage of these securities to dealers who underwrote them was that losses would only occur if the interest rate varied wildly, and the financial institution offered to pay the investor a rate which turned out to be higher than the average rate in the 'overnight' market.

For the Central Bank, there were two alleged advantages. First, the issue of LBCs eased the constraint on interest rate changes represented by the dealers' portfolios. Second, the cost of financing the public debt in LBCs could be reduced since the government would pay a

discount (around 0.2 to 0.4 percent per year) and a small real interest rate, administered by the Central Bank.

The issuance of floating-rate debt introduced a new problem for the government, however. When securities are sold at a discount (fixed-rate securities) or are indexed, changes in the interest rate affect only the new securities being placed in the market. With floating-rate securities, a change in the interest rate immediately affects, not only the newly issued securities, but the whole stock of government debt. Floating-rate debt eliminates, therefore, the frontier between the operation of monetary policy by the Central Bank and the stock public debt.

With inflation on the rise five months after the implementation of the Cruzado Plan and the elimination of indexation, the floating-rate securities were readily accepted by the market. Already in 1986, 56.4 percent of the federal debt held by the public was comprised by floating-rate securities. And this percentage would increase until the end of the decade, reaching 97.9 percent in 1989 (*Table 1*).

The debt/GDP ratio fell in 1986 as the borrowing requirements of the government declined to 6.2 percent of GDP (from 12.5 percent in 1985). The combination of a reduction of the inflation rate, even if temporary, and

strong economic growth (7.6 percent p.a.) led to a real increase in federal revenues of 24.2 percent. Data on interest payments on the federal debt prior to 1986 are sketchy, but interest payments in 1986 (1.7 percent of GDP) must have declined when compared to the previous year, since the real interest rate was often negative[6]. It is difficult to tell, however, if the introduction of floating-rate debt played any role in the reduction as the government had argued.

In 1987 the government implemented a new stabilization program, and restored indexation clauses to the OTN. But indexed securities had lost credibility and could not compete with the now very popular floating-rate ones. Public holdings of indexed securities continued to decline.

Considering that the stabilization plan of 1986 had failed because, among other things, real interest rates had been too low, the Central Bank kept delivering high positive real interest rates. But the stabilization plan failed once more, and as inflation accelerated the real value of tax collection declined. A sharp downturn in industrial production, from mid-1987 on, caused revenue

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[6] In 1986, the government was consolidating its accounts and publishing, for the first time, data for interest payments on its debt separated from total government expenditures. There are discrepancies, however, between values reported by the Central Bank and by the Treasury Secretariat.

from indirect taxation levied on industrial output to fall. Real tax receipts declined by 14.8 % in 1987 and by a further 7.8% in 1988 [Parkin, 1991]. The net tax burden as a percentage of GDP fell to 3.6%, less than one third the figure for 1980. The borrowing requirement of the central government jumped to 17.8% of GDP while the primary deficit more than doubled. The debt/GDP ratio also increased sharply.

Despite new laws regulating the treasury's budget, the central government's borrowing requirements increased to 26.6% of GDP in 1988[-]. Congress underestimated government expenditures and rampant inflation reduced real fiscal tax revenues. As a result, additional credit to the Treasury had to be approved. Moreover, the upper limit on federal debt issuance originally established by Congress was changed several times.

In January 1988, the LBC were substituted for the LFT (Treasury Financial Bill- *Letras Financeiras do Tesouro*). The LFT had the same characteristics of the LBC, except that it was issued by the Treasury. Although it is not clear why this change occurred, it seems to have been motivated by the set of new laws regulating government

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[-] With the new Constitution of 1988, the General Treasury Budget started to include upper limits on debt issuance and expenditures had to be approved.

finance being approved by Congress along with the new Constitution promulgated that same year.

In 1988, 68.5 percent of the federal debt outside the Central Bank were floating-rate (*Table 1*). The characteristics of these securities caused a dramatic shortening of the government debt's maturity period and questions started to be raised about the Treasury's ability to keep rolling them over.

The market perceived an increased risk associated with government securities and demanded higher rates of return and shorter maturity periods. Indeed, real interest rates increased to a record high and the average maturity period on government securities declined sharply in 1988. In a context of not only high, but also volatile (variable) inflation rates, shorter maturity period had the advantage of minimizing the forecast error in the securities' real rate of return. According to the Central Bank, a smaller forecast error in the real return would be translated into a lower risk-premia paid by the Treasury, which would reduce the costs of issuing debt.

It is probably true that the Treasury was able to sell its securities at a lower discount than otherwise by shortening their maturity periods in 1988. But it also had to redeem the securities at a faster pace and, as inflation's

variability increased, the maturity period had to be shorter and shorter, and, overall interest payments tended to rise. The result was the sharp increase in the debt/GDP ratio observed in 1988.

The debt/GDP fall in 1989, although the government's primary deficit (nominal deficit exclusive of interest payments the debt) increased as a ratio to GDP and the real interest rate was on the rise, resulting in increased interest payments (5.8 percent of GDP). The explanation for the decline in the debt/GDP ratio observed in 1989 is the monetization of the federal debt; that year, there was a dramatic increase in the monetary base in real terms (31.8 percent)[6].

As the inflation rate rose and the market became increasingly wary about government securities, it became more difficult to place federal debt in the market, despite high yields and short maturities. The Central Bank responded in two ways. First, it provided financial institutions the resources necessary to finance their portfolios at the average market rate, in case their dealers could not place the securities in the market until

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[6] The Central Bank Report for 1989, p.74 reads: "If one compares the real growth of federal debt issuance to the real growth of federal debt held by the public during 1989, one sees that the Central Bank absorbed a vast amount of debt into its own portfolio via open market

the end of the day. This procedure, called 'automatic zeroing' (or "*zeragem automática*") in the market's jargon, substituted for a normal discount window at the Central Bank where resources are provided at a penalty-level interest rate. The market's jargon referred to the possibility of having zero securities not placed in the market.

Second, being the agent responsible for placing the Treasury's securities in the primary market, the Central Bank reduced the contract length of its *repurchase agreements*. Through these contracts, the Central Bank would issue letters of repurchase along with the government securities being sold, which guaranteed to financial institutions that the Central Bank would repurchase the securities before the maturity date, on a date agreed on the repurchase letter. Through these repurchase agreements, the government substantially reduced the risks for investors associated with holding federal debt, thus easing the introduction of new bonds in the market when needed.

The *repurchase agreements* could last between one and forty-five days. In 1989, as the prices that government securities were able to command in primary auctions

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operations, characterizing the monetization of the federal debt..."

continued to fall, the Central Bank reduced the term lengths of *repurchase agreements* to one week. Through the use of these repurchase contracts, the Central Bank bought a growing share of new securities to roll over the government's debt, resulting in expansions of the monetary base.

In November 1989, a new president was elected and there were rumors that the new government would announce a delay in debt repayments after inauguration day in March, as had just happened in Argentina[9]. The volatility in the 'overnight' market was so great during this period that, in order to place new securities, the Central Bank gave informal assurances to primary dealers that it would buy the securities back one week later. Lack of credibility in the Treasury during the transition period between one president and the next, and rampant inflation running over 70 percent a month in January of 1990, meant that the Central Bank had no alternative but to validate the market's expectations about future inflation and risk when setting the interest rate.

The rumors about government intervention in the

(The translation is mine).

[9] The announcement that Argentina would delay repayments on its debt for 30 years drove the price of the US dollar in Brazil up by 28 percent in one single day , only to fall by 10 percent in the following day.

'overnight' market materialized after the new president took office in March 1990. The government imposed an 18-month freeze in the financial resources at the 'overnight' market and on savings accounts of more than US$1,200, which were linked to the 'overnight' market. The public were given price-indexed bonds in exchange for their seized financial assets, which paid 6 percent per year in real terms, beginning in September 1991. This maneuver did not represent, however, a default on federal securities, since the government simply replaced floating-rate debt by price-indexed debt. It represented instead a compulsory increase in the government's debt average maturity period, which increased to pre-1985 levels (*Table 4*) [10]. By shifting the debt into longer maturity, the government made a run on its debt less likely and became more able to withstand its debt.

The Collor Plan, as the stabilization plan that included the financial siege became known, caused a sharp reduction in the debt/GDP ratio in 1990 and 1991 for two main reasons. First, the Plan improved tax revenues by implementing a one-time tax on stocks, gold and savings, and by allowing the pre-payment of taxes with financial assets which had been seized. This one-time increase in tax revenues, along with

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[10] Some radical analysts argued at the time that the government had damaged its credibility and yet had lost the opportunity to implement a *de facto* default on its debt.

expenditure cuts, resulted in a turn around in the federal government's borrowing requirements, (from a deficit of 1.1 percent of GDP in 1989 to a surplus of 3 percent of GDP in 1990), thus reducing the government's need to issue debt. Moreover, the surplus was used for debt redemption.

Second, because of the financial siege, interest payments on the Treasury's debt were dramatically reduced, further reducing the need for new debt issuing. The participation of interest payments on the total Treasury's expenditure fell to a mere 0.2 percent in 1991, compared to 16.7 percent in the previous year.

The financial siege and the one-time increase in tax revenue had, however, only a temporary effect on federal government total revenue in 1990, and on domestic debt in 1991: the primary surplus as a percent of GDP fell 70 percent in 1991 when compared to 1990 (*Table 3*). Moreover, the financial assets seized by the government started to be redeemed in September of 1991, and the debt increases again in 1992.

In 1993, the government started a negotiation process with Congress to reduce spending and balance the budget, and implemented measures against tax evasion. The Treasury had a primary surplus of 1.4 percent of GDP. Interest payments on the federal debt were distributed throughout the 1994-1997

period and anticipated the redemption of some of its securities utilizing Central Bank financial profits. The overall result was the decline of the debt/GDP ratio in 1993.

Although the debt/GDP ratio declined in 1993, the return of high inflation rates (average of 38.3 percent per month) showed that the government's attempt at increasing the average maturity of its debt in 1991 proved to be temporary. Once again, the average maturity period of the government's debt declined from 11.2 months in 1992 to only 3.4 months in 1993. As argued earlier, a reduction in the debt maturity period has the advantage of reducing the forecast error in the securities' real rate of return.

In 1993, the government under a new finance minister implemented yet another stabilization program. The so-called Real Plan, an exchange rate-based stabilization program, had three phases: fiscal adjustment, creation of a new price index (URV- Unidade Real de Valor), and a monetary reform. High and accelerating inflation rates had caused a great variation in relative prices and made the currency loose its function as a store of value. The new index (URV) has its value adjusted daily and was anchored to the US dollar exchange-rate.

The authorities hoped that the private sector voluntarily adopted the URV as its guide to price

adjustments, thus allowing for the monetary reform in the third phase of the program. For this purpose, the government introduced the institutional changes to allow wage contracts to be converted to URVs, and to index its fiscal revenues. The public responded positively to the government's expectations, and credibility on the URV as a stable value unit guaranteed its wide use as a correction index. Although denominated in the current currency, prices, wages and contracts started to be adjusted according to the URV. In July 1994, a monetary reform was implemented with the creation of a new currency, the Real, which had parity of one-to-one with the URV. A comparison of prices in Real at the end of July against price in URV at the end of June, reveals that prices jumped 6.95 percent during the monetary conversion. When measured between the five first days of July and August, however, we observe a deflation of .69 percent. Since then, the government has managed to keep the inflation rate at low levels.

As part of the fiscal adjustment phase of the program, the government started a negotiation process with Congress to establish guidelines to reduce spending and balance the budget. Among its determinations, the guidelines authorized the issuance of new federal debt solely to roll over the existing debt. This meant that the Treasury had

to balance its budget. Moreover, the privatization program initiated by the previous government was reenacted. The result was a primary surplus of 1.4 percent of GDP.

The improvement in the government's fiscal accounts, the increase in revenue from the privatization program (earmarked to debt redemption), and a decline in the real interest rate explained the reduction in the debt/GDP ratio in 1994. With price stabilization and improvement in the government's credibility, the average maturity rate of the Treasury's debt increased in 1994 and allowed the government to finance itself mostly with price-indexed securities: 43.7 percent of the federal debt held by the public in 1994 were price-indexed securities (*Table 1*).

In January 1995, the government gave more emphasis on the privatization of its public enterprises as an instrument for the reduction of its debt and the improvement of its maturity period. Due to political difficulties the privatization program did not achieve the set goals and the primary surplus had a sharp reduction: 80.6 percent when compared with 1994. The nominal borrowing requirements of the central government, on the other hand, improved as a result of declining inflation rates. The increase in the debt/GDP ratio observed in 1995 was the result of the

increase in the real interest rate and the accumulation of foreign reserves.

Although the debt/GDP ratio increased, the average maturity period of the government's debt continued to improve, increasing from 5.4 months in 1994 to 6.4 in 1995.

In 1996, the government's attempts at approving an administrative and social security reforms considered necessary for reducing expenditure were frustrated by Congress. Payroll and social levies continued to represent almost 40% of total government expenditures (*Table 6*). There was also a decline in the primary surplus (from 0.6 to 0.4 percent of GDP) and a worsening in the nominal borrowing requirements (from 2.3 to 2.6 percent of GDP). Moreover, the continued inflow of foreign reserves necessary to finance deficits in the current account contributed to the increase in the debt/GDP ratio in 1996. This tendency persisted into 1997.

In summary, this section provided a general description of the evolution of the Brazilian federal domestic debt since the financial reform of 1964-66. It showed that the federal domestic debt increased steadily, but had low variance until 1980. After 1980, however, as funds in the international financial markets became less and less available and foreign loans to Brazil were

dramatically reduced, the federal domestic debt becomes the main channel of government finance. Given the financial requirements of the federal government, the federal domestic debt assumes an upward trend.

During the 1980s, concerns about price instability dominated economic policy and had enormous effect on the Brazilian federal domestic debt. As it will be argued in this dissertation, the impact of these policies on the domestic debt was heightened by the relationship that exists between the Treasury and the Central Bank in Brazil. Central Bank dependency on the Treasury constrained the actions of the monetary authorities and rendered the Treasury control over the operation of the monetary policy. The Central Bank was placed at the service of fiscal policy, reaching the extent of issuing its own securities, at floating-rates. Most important, the Central Bank furnished the Treasury with funds obtained through repurchase letters.

Another crucial aspect of fiscal and monetary policy in Brazil over this period was the inclusion of price-indexation in most contracts, in order to deal with persistent high inflation rates. Federal securities were no exception. Already in 1966, the Treasury introduced price-indexed securities. With the exception of 1989,

indexed securities comprised more than 50 percent of federal debt issues, even though during periods of high inflation variability, most indexed securities issued by the Treasury ended up in the Central Bank's portfolio (*Table 6*).

Price stabilization after 1994 allowed an increase in the public's holdings of fixed-rate securities (sold at a discount). In 1996, 25.6 percent of the federal debt held by the public consisted of indexed securities, while 55.8 percent comprised fixed-rate securities. The remaining 18.6 percent were floating-rate debt.

The real cost to the government of financing its fixed-rate securities increases when the inflation rate declines. At the same time, when the government has its tax revenues at least partially indexed, a fall in the inflation rate causes a decline in nominal revenues. That is, as the inflation rate declines, real revenue stays constant while the costs of debt finance increases in real terms. The movement towards more traditional securities after 1994 could, therefore, represent a source of pressure on the government's budget. If the government favors the issue of indexed-securities, on the other hand, the mismatch between real revenues and real interest payments does not occur.

The issuance of credible price-indexed securities gives the government no incentive to create unexpected inflation and reduce the value of its outstanding debt. Moreover, the monetary authorities can benefit from the coexistence of fixed-rate and indexed securities by gaining information about the market's inflationary expectations and real interest rates. The discount on fixed-rate securities reflects real interest rate, the market's expected rate of inflation, and an inflation risk premium. If the risk premium is considered constant over time, changes in the difference between the rates on fixed and indexed securities will reflect changes in the market's expected inflation rate[11].

Once the main characteristics of government securities have been laid out, disregarding international capital movements (mainly the accumulation of foreign reserves), the expansions of the federal domestic debt can be explained by either fiscal imbalances and/or by increases in the costs of financing the debt, namely interest

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[11] The nominal interest rate on a security sold at a discount is $i = r + \pi^e + \delta$, where r is the *ex post* real rate of interest, π^e is the expected inflation rate, and δ is the inflation risk premium. The *ex post* nominal rate on an indexed security can be expressed as $i^{md} = r + \pi$, where π is actual inflation. The difference between the nominal rates is $i - i^{md} = \pi^e + \delta - \pi$. If the inflation risk premium is constant over time, the difference between the two nominal rates will reflect changes in the market's expectated inflation rate.

payments. The understanding of the evolution of the federal domestic debt can be, therefore, further enhanced by analyzing the government's budget constraint directly. This exercise is undertaken in the next section.

2.2. Data Analysis

The historical analysis presented in the first part of this chapter will be complemented by an analysis of the data itself. Because the evolution of the federal domestic debt during the first phase (1966-1980) can be mainly explained by movements in the country's external debt along with inflows of foreign loans, the analysis of this section will be confined to the second phase of the federal domestic debt history, 1981-1996.

The first part of this section provides a multivariate analysis of the federal domestic debt, and analyses the dynamic responses of the debt to shocks in the several variables of the government budget constraint. The second part provides an univariate analysis of the federal domestic debt, and investigates how permanent is the effect of a random shock, or what is the degree of persistence present in the federal debt data.

2.2.1. Data Set

The data set was obtained from the Brazilian Central Bank and consists of monthly observations over the period 1981:01 to 1996:12. Monthly observations can provide a more accurate description of the short-run dynamics of the federal domestic debt. Government debt at par value is the series 'Federal Domestic Debt held by the Public' (*Dívida mobiliária interna federal fora do Banco Central*). The interest rate is the *overnight* rate, which is a weighted average based on the interest rates accorded between buyers and sellers (the Central Bank as the Treasury's agent) during a trading day. The daily average rate weighted by the volume of each day's operation is then used to calculate monthly rates.

Revenue is the series 'Total Treasury Revenue' (*Receita total do Tesouro Nacional*) and Expenditures is the series 'Total Treasury Expenditures' (*Despesa total do Tesouro Nacional*), which includes interest payments on the government debt. Data for government expenditures net of interest payments is, unfortunately, only available after January 1986 and not all the values obtained from the Central Bank are not in accordance with the 'Treasury Secretariat' (*Secretaria do Tesouro Nacional*).

Monthly values for the GDP are not available, so economic activity was proxied by the 'Industrial Production Index' (1981=100), published by *Conjuntura Econômica*. Seignorage is usually calculated based on variations of the monetary base or high-powered money. Because the reserve requirements against deposits are price-indexed and therefore the government can not collect seignorage on this part of the monetary base, the appropriate way to calculate seignorage for Brazil is to use variations of the monetary base *net* of reserve deposits.

Nominal variables (except interest and inflation rates) were converted into Millions of Cruzeiros Reais and divided by the *General Price Index* (IGP), internal supply, scaled so that 1989:12 price index equals 100. The real interest rate was calculated as $r = \frac{(1+i)}{(1+\pi)} - 1$, which is equivalent to the standard $r = i - \pi$ when the inflation rate is low. In a high inflation economy, however, the standard calculation causes distortions in the real rate of interest. Given the high inflation rates experienced by the country during the period analyzed here, I opted for the former definition.

2.2.2. Dynamic responses of the government's budget constraint

In order to further characterize the behavior of the federal domestic debt, it is important to statistically analyze the relationship between the debt/GDP ratio and the major variables in the government's budget constraint. This section shows how the federal domestic debt responded to innovations in the other variables in the government's budget constraint.

The budget constraint for the government expressed in nominal terms can be written as:

$$B_t - B_{t-1} + M_t - M_{t-1} = G_t - T_t + i_{t-1}B_{t-1} \qquad (1)$$

where B is the par value of the stock of domestic government debt held by the public; M is the money stock; i is the *ex post* nominal interest rate, interpreted as the holding-period return on the stock of debt outstanding; G and T are government expenditures and revenues, respectively.

In constant dollars and in ratios to GDP, the government budget constraint can be expressed as:

$$b_t - b_{t-1} + m_t - m_{t-1} = g_t - t_t + (r_{t-1} - \eta_{t-1})b_{t-1} - (\pi_{t-1} + \eta_{t-1})m_{t-1} \qquad (2)$$

where π denotes the inflation rate, $r \equiv i - \pi$ denotes the real rate of interest, and η denotes the rate of income growth.

The government has two ways of financing its deficit. It may borrow from the public by issuing bonds or it may use its monopoly over the country's currency and issue money. Although concerns about price stability leads to a general resistance to financing expenditures through money creation, countries which do not have an independent central bank have exercised it at various degrees. Particularly at times of high deficits and increasing debt accumulation, the government has an incentive to make use of seignorage, not only to improve its revenue collection, but also to induce a reduction of the real value of its debt[12]. Seignorage equals the inflation tax proceeds plus the change in the economy's real money holdings. It represents real revenue, which the government acquires by using newly issued money to buy goods and financial assets. Given the high inflation rates in Brazil, seignorage collection will be included in the dynamic analysis of the government budget constraint.

By defining a vector autoregression representation (VAR) of the variables in the government budget constraint,

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[12] For a discussion of the credibility issue and debt repudiation, open or through inflation, see Calvo (1988).

this part analysis the dynamic responses of the debt and relates them to other variables. The vector autoregression representation allows us to describe a system of equations where all the variables are interdependent, making the approach appropriate for the analysis of the government budget constraint.

Preliminary Stationarity Tests

The use of a vector autoregression system (VAR) requires that the variables involved be covariance-stationary (or weakly stationary) so that the parameters can be consistently estimated[13]. The Augmented Dickey-Fuller test (ADF), both for levels and first differences of the variables, was performed for different truncation lags. When the ADF statistic gave mixed results depending on the truncation lag, the test developed by Phillips and Perron (1988) was also employed. The Phillips-Perron (PP) test corrects the statistics for serially correlated and possibly heteroskedastic error terms.

Although graphical analysis of the series indicate that most of them seem to vary around a fixed mean, and therefore the stationarity tests should not include a trend

[13] A process Y_t is said to be covariance-stationary if neither its mean nor covariances depend on the date t.

term, unit root tests were performed with and without the inclusion of a trend and intercept terms. *Tables 7-9* report the results.

The Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) tests show that the debt (B) and inflation (π) contain a unit root at the 1% confidence interval for all truncation lags reported, and are, therefore, nonstationary in levels. The inclusion of an intercept rises the statistic for inflation and the 2-lag truncation PP test fails to reject the null of a unit root. However, both variables become stationary after first difference.

The null of a unit root can not be accepted at 1%, 5%, or 10% confidence intervals in the tests for the real interest rate (Int), indicating that the series is level stationary.

The ADF tests in levels give mixed results for expenditures (G), tax revenue (R) and seignorage (S) depending on the truncation lag used and the inclusion of an intercept and trend term. The correlogram of the series (not reported) seems to indicate some degree of serial correlation in the residuals. Thus, the Phillips-Perron test is more appropriate in this case. In fact, the test statistics rise dramatically when corrected for serially correlated and possibly heteroskedastic error terms and the

null of a unit root is strongly rejected. Thus, levels of expenditures, tax revenue and seignorage will enter the vector autoregression estimations.

Dynamic responses

As determined by the stationarity tests, the VAR was estimated with the following variables: seignorage (level), inflation rate (first difference), real interest rate (level), tax revenue (level), government expenditures (level), and debt (first difference). A likelihood ratio test (LR) suggested by Sims (1980) was used to determine the VAR lag length. The LR statistic of 82.62 for a two-lag against a four-lag VAR was smaller than the critical value for a $\chi^2(4)$ variable (after small-sample bias is taken into account). The null hypothesis that a two-lag VAR can adequately capture the dynamics of the system can not be rejected at the 5% confidence interval.

Although Box-Jenkins approach recommends the use of seasonal autoregressive and moving average terms for monthly data, the variables used in the VAR do not exhibit any systematic seasonal movements and, therefore, seasonal autoregressive terms were not included in the estimations.

The estimated coefficients of the VAR are difficult to interpret and the results can be better summarized by the

impulse response functions and variance decomposition of the error-covariance matrix.

The impulse response functions trace the responses of an endogenous variable to a change (one standard deviation) in one of the innovations in the variables of the VAR. Cholesky decomposition was used to orthogonalize the error terms so that the covariance matrix of the resulting innovations is diagonal and the impulse response functions can be interpreted. The ordering of the variables, however, can substantially alter the response functions and therefore should be decided with care. The ordering used here (seignorage, inflation, interest rate, government revenue, government expenditures and government debt) implies the following assumptions:

a) current values of inflation, real interest rate, revenue, expenditures and debt do not influence seignorage;

b) current values of seignorage, but not of real interest rate, revenue, expenditures or debt, influence the inflation rate;

c) current values of seignorage and inflation, but not revenue, expenditures or debt, influence the real interest rate;

d) current values of seignorage, inflation and interest rate, but not of expenditures or debt, influence revenues.

The first and third assumptions are the least palatable of the four: that current levels of inflation will not affect seignorage and that current levels of the debt will not affect the interest rate. One may think of changes in the inflation rate influencing the level of seignorage collection only with a lag, so that their current values should not be included in the regression and the same argument can be used for current levels of the debt not affecting the real interest rate. Other orderings resulted in stronger, if not unusual, assumptions.

Table 10 indicates the dynamic responses of the debt to the other variables in the government budget constraint. The results illustrate the relative unimportance of shocks to government expenditures and tax revenue in explaining responses of the debt. Instead, a shock to the interest rate is the most important factor explaining the debt response, besides an innovation to the debt itself.

The debt immediate response to an interest rate shock is positive, declining in intensity and being absorbed in approximately six months. The debt response to its own innovation is also positive, and follows the same pattern of the response to the interest rate shock, although with a lag. This is an indication of the feeding mechanism through which changes in the interest rate affect debt

issuing: a shock in the interest rate causes a shock in the debt, which induces a positive response in the debt itself.

The debt's initial response to an inflation shock is negative and its effect is completed after six months. As expected, inflation affects the debt by reducing the real value of government's outstanding liabilities. Most of Brazilian debt is price-indexed, however, and the real value of government's outstanding securities should not respond to an innovation in inflation. Although the shock was unexpected, during the period of higher inflation variance, the indexation factor applied to government securities was adjusted daily. The negative response of the debt to an inflation shock can be better explained by the inefficacy of the indexation factor in protecting the real value of the outstanding debt[14].

The debt responses to a revenue and expenditure shocks are equivalent in size, in opposite directions, but very small: the debt responds positively to a revenue shock and negatively to an expenditure shock. As expected, a shock to seignorage affects the debt negatively as an increase in seignorage reduces the government needs to borrow. But this response is also small. In fact, in spite of the high

[14] Tanner (1995) shows that the indexation factor was used by the Brazilian government as a fiscal policy instrument, with periods of

inflation rates experienced by the country, seignorage collection in Brazil is relatively small when compared to other high-inflation countries[15]. There are two main reasons for this result. First, the existence of the 'overnight' market guaranteed high degrees of liquidity for investors, who could switch between indexed securities (formally indexed or floating-rate) and cash, and therefore steer clear from the effects of inflation on their cash balances. The resulting increase in money velocity reduces the demand for real balances eroding the base for the inflation tax.

Second, banks were allowed to meet reserve requirements against deposits through the holdings of indexed government securities. As a result, this other source of seignorage was also unavailable for the Brazilian government.

In sum, the debt responses to innovations in other variables in the government's budget constraint have indicated that: (i) shocks to Revenue and Expenditure are relatively unimportant; (ii) the debt's initial response to Inflation is negative; (iii) the debt's response to

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increased government expenditures being followed by reductions in real indexation.

[15] The average seignorage collection in the 1980s was less than 4 percent of the Brazilian GDP, compared to 6.5 percent in Argentina and 10 percent in Chile [Thurston, 1997].

Seignorage is also negative; and (iv) a shock to the interest rate is the most important factor affecting the response of the debt.

Table 11 indicates the responses of the other variables in the government constraint to an innovation in the debt.

Debt shocks induce a slight negative response of the interest rate that is fully completed after seven months.

Inflation responds positively to a debt shock. The response is powerful and takes about ten months to be fully absorbed. This effect might come as a surprise since one would expect that a shock to the debt should induce a negative response on inflation through its effect on the money supply. During the 1980s, the prices that government securities were able to command in the market were falling. Prices were falling and security yields were on the rise, and several times the Central Bank had to cancel auctions. The existence of the so-called *repurchase agreements* and the Central Bank's policy of keeping a stable demand for government securities by pegging the interest rate, however, implied that an unexpected increase in the debt

was translated into increases in the money supply sooner or later[16].

Debt shocks have a small but negative impact on government expenditures during the second quarter following the shock. The effects on revenue are also slightly negative, but negligible. Finally, a debt innovation does not seem to affect seignorage.

In sum, the responses of the other variables in the government constraint have indicated that: (i) debt shocks have a small but negative impact on Expenditures during the second quarter following the shock; the effect on Revenue is also slightly negative, but negligible; (ii) debt shocks induce a slight negative response of the interest rate, completed after 7 months; (iii) debt shocks do not seem to affect seignorage; and (iv) the response of inflation is positive.

The variance decomposition of a VAR gives the relative contribution of an innovation to the mean-squared error of the forecasted variable *h* periods ahead.

Table 12 shows that after 24 months, 37.95% of the forecast error variance of debt is accounted for by its own innovations, 40.58% by innovations in the interest rate, 13.11% by innovations in the change of the inflation rate,

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[16] This issue is discussed in chapter IV of this dissertation.

and 7.40% by innovations in seignorage. Innovations in expenditures and revenue account for only 0.59% and 0.37% of the forecast error variance of the debt, respectively.

The importance of an innovation in the debt to the forecast error variance of seignorage is small and stable, ranging from 2.11% to 2.21% after the first quarter. But in addition to seignorage's own innovation, the debt is the most important variable, followed by the interest rate.

After 24 months, 9.02% of the forecast error variance of inflation is accounted for by innovations in the debt. Innovations in the real interest rate account for 55.13% of the forecast error variance in the change of the inflation rate, a percentage higher than that accounted for inflation's own innovation.

An innovation to the debt has a small feedback effect on the real rate of interest (0.75%), revenue (1.08%) or government expenditures (4.03%).

Although an innovation to the debt accounts very little to the forecast error variance of the real interest rate, an innovation to the real interest rate accounts for 40.58% of the debt's forecast error variance, a percentage higher than the debt's own innovation (37.95%). This high relative importance of innovations in the real interest rate combined with the low relative importance of

innovations in expenditures and revenue corroborate the idea of a self-feeding mechanism whereby the government borrows, meets interest payments by borrowing more, and keeps rolling its debt over.

2.2.3. Univariate analysis of the debt

Using time-series analysis, it is possible to investigate the effect of a random shock to the federal debt series *h* periods after it occurred.

The first step is to find the order of integration (or the degree of differencing) of the debt series, so that it can be modeled as a stationary ARMA process. The Augmented Dickey-Fuller tests for the presence of a unit root on the first and second differences of the debt were performed. The results in *Tables 7-9* show that first differencing the *log*(debt) yields a stationary series[17].

Having determined the order of integration, the number of autoregressive (*p*) and moving average polynomials (*q*) must be specified for the ARMA(*p*,*q*) estimation. The Box-Jenkins approach consists of matching the patterns of the sample autocorrelations and partial autocorrelations with the theoretical patterns of known models.

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[17] The log of the series was used in this section to facilitate the interpretation of the response function values.

The senoid wave pattern of the sample autocorrelation (not reported) suggests an AR(*2*) representation; the partial autocorrelation can be viewed as dying out after one lag, consistent with an MA(*1*) representation. Hence, an initial guess for a parsimonious model for the debt variable might be, after appropriate differencing, an ARMA(2,*1*). According to the Akaike's criterion, the best-fitted models were ARMA(1,0), ARMA(2,0) and ARMA(2,1); according to the Schwarz's criterion, the best models were ARMA(1,0), ARMA(1,1) and ARMA(2,0).

Due to the variety of models selected by each criterion, several models were estimated and the coefficients reported in *Table 13*. Given the estimated coefficients, it is possible to show, through impulse response functions, the impact of an innovation to the debt *h* months after the shock.

The impulse response functions assumed values above one for the models ARMA(1,1), ARMA(1,2) and ARMA(1,3) and are not reported. For the best fitted models, the impulse response functions stabilized after 24 months and the effect of a unit innovation ranges from 0.6 to 2.9 percent (*Table 14*)[18]. After 12 months, one can expect the debt to

[18] The response functions for models ARMA(3,2) and ARMA(3,3) oscillated in sign ($-1<\phi_1<0$) and did not stabilize after 30 months.

increase an average of 6 percent following a 1 percent increase in its original level.

The univariate analysis illustrates the degree of innovation persistence in the federal debt data, and suggests the presence of a considerable inertial component in the debt dynamics.

2.3. Concluding remarks

This chapter provided a historical overview of the evolution of the Brazilian federal domestic debt since the financial reform of 1964-66. The historical overview was complemented by a description of the short-run dynamics of the federal domestic debt after 1981.

The historical analysis showed that the steady, yet stable, increase of the debt/GDP ratio from 1966 to 1980 can be mainly explained by the credit conditions in the international markets. After 1981, the external borrowing conditions deteriorated and the government turned itself to the domestic market. The second phase is characterized by wide variations of the inflation rate, several failed attempts at price stabilization and the introduction of 'floating-rate' debt. The government's fiscal imbalances were further aggravated by the increase in the costs of

financing its debt as 'floating-rate' securities became its most important instrument.

The data analysis showed that shocks to government expenditures and tax revenue are relatively unimportant to explain the responses of the debt. Instead, a shock to the interest rate seems to be the most important factor explaining the debt response, besides an innovation to the debt itself. Moreover, the univariate analysis suggested the presence of a considerable inertial component in the debt dynamics. After twelve months, one can expect the debt to increase an average of 6 percent following a 1 percent increase in its original level.

The results of the data analysis seem to indicate that the federal domestic debt is feeding on itself. Has the government been borrowing from the public and meeting interest payments on its debt by borrowing more? Is the government headed towards excessive debt accumulation, which can ultimately threaten the price stability achieved after 1994? These questions are the subject of the following chapter.

3. Inflation and the Sustainability of the Government's Debt

The concept of debt sustainability pertains to the question of whether the government is headed towards excessive debt accumulation, which can ultimately threaten price stability. A debt is considered 'excessive', and therefore unsustainable, when the government does not satisfy an intertemporal budget constraint and, as a result, its debt can not be offset by expected future primary surpluses of equal present-value.

The question of whether or not persistent deficits are feasible and whether running them can be detrimental to economic performance has been the subject of intense debate in the economic literature.

In the traditional Keynesian *IS/LM* framework, persistent budget deficits may cause an upward pressure on the real interest rate as an increase in the government budget deficit represents a higher demand for credit, which, *ceteris paribus*, results in higher domestic interest rates. In an open economy, the differential between the domestic interest rates and the rates prevailing in international markets might induce capital inflows and an appreciation of the exchange rate, resulting in a worsening of the external current account balance. In a closed

economy, on the other hand, a higher interest rate crowds out interest sensitive components of aggregate demand, most importantly private investment. On a flow basis, the deficit crowds out productive investment while on a stock basis, the debt displaces capital in the households' wealth portfolio altering their consumption decisions. In this context, the government debt can affect the consumption opportunities of future generations.

In the neoclassical framework, Robert Barro (1974) rejects the notion that the government debt has an impact on household's consumption decisions. He forcefully argues that rational economic agents will anticipate the future taxes that current deficits will ultimately impose on them or on their descendents. For given amounts of government purchases, a tax cut (or a deficit) will not induce rational economic agents to consume more. Instead, they will save their disposable income increment to enable themselves, or their heirs, to pay for the postponed taxes. Government securities are, in fact, the perfect vehicle for the extra savings.

More recently, Cukierman and Meltzer (1986) proposed a model of intergeneration distributions where "rich" parents plan to leave bequests to their children and therefore are indifferent to any debt policy. "Poor" parents, on the

other hand, do not plan to leave bequests to their descendents and would like to "borrow" from future generations through budget deficits. Since only the current generation votes, and one group of agents is indifferent to any debt policy while the other one favors public debt, the social choice is likely to lead to debt. As a result, the authors argue, the burden of the debt is transferred to future generations anyway, unless 'rich' parents take into account the behavior of 'poor' parents when leaving their bequests.

In the absence of intergenerational transfers (no bequests), even if agents are equal, budget deficits ease the household's budget constraint, as agents perceive their bond holdings as an increase in their wealth, leading to a rise in their total life consumption. As a result, the consumption level of the current generation is increased at the expense of subsequent generations, which will be taxed. In this case, the government's choice of how to finance a given level of expenses (taxes or bond issuing) is not immaterial, and the burden of the debt is transferred to future generations.

From the government's point of view, running large budget deficits and accumulating interest-bearing debt, limits its capacity to resort to expansionary fiscal

policies to support economic growth without engendering fears about its fiscal stance.

In principle, a country can reduce its debt/GDP ratio in four ways: open debt repudiation, once-and-for-all capital levy on debt holders, debt repudiation through inflation, and debt payment with a primary budget surplus. The first and second options, although attractive because they enable the government to start with a clean record, have the cost of "lost credibility" as expectations of future debt repudiation or capital levy may threaten the possibility of new borrowings by the government or even precipitate external capital flights.

Expenditure reductions and tax increases associated with the last alternative (paying off the debt with budget surpluses) are usually politically difficult. As a result, the government has an incentive to reduce the burden of its debt level by engaging in inflationary policies when facing high budget deficits and accumulating interest-bearing debt. If the debt is of long maturity and denominated in nominal terms in the domestic currency, an unanticipated rise in the inflation rate reduces the real value of the outstanding debt as well as of the interest payments on the debt.

When measuring the risk of debt default or of inflationary finance, the market will have to focus on the sustainability of the government's debt. Thus the relevance of the question: under what conditions will the government be able to maintain a positive deficit over time without inflation?

3.1. Harrod and Domar's model of debt growth

Evsey Domar (1944) and Roy Harrod (1948) pointed to the importance of comparing the net-of-taxes interest rate paid on government securities and the growth rate of income or output. If enough taxes are levied to pay interest on the debt, but not to pay for other government expenditures, the debt will grow. Harrod and Domar concluded that tax rates will have to be raised without limit, but only if the after-tax interest rate on government's securities exceeds the growth rate of the economy.

In the absence of monetary financing, let the government's budget constraint expressed in real terms and as a ratio to income be:

$$b_t - b_{t-1} = g_t - t_t + (r_{t-1} - \eta_{t-1})b_{t-1} \qquad (1)$$

where b is the par value of the stock of government debt; g and t are government expenditures (exclusive of interest payments on the debt) and tax revenue, respectively; r is

the *ex post* after-tax real rate of interest and η is the rate of income growth.

According to the budget constraint expressed in equation (1), if the after-tax real rate of interest is greater than the growth rate of the economy, a positive deficit will induce a growing stock of government debt and, therefore, growing interest payments that will have to be meet by an ever increasing tax rate. That is, the evolution of the debt/income ratio depends on two factors: the primary deficit $(g_t - t_t)$, and the product of the accumulated debt/income ratio and the difference between the real rate of interest and the income growth rate. If the difference is positive, a primary surplus is needed to maintain a constant debt/income ratio. If the difference is negative, it is possible to run a certain level of primary deficit and maintain a constant debt/income ratio.

In the context of comparing the real rate of interest with the growth rate of income, a primary deficit is considered sustainable if the resulting debt/income ratio is constant, given a specific rate of income growth and a constant real rate of interest. According to equation (1), the debt/income ratio will be constant when $b_t = b_{t-1}$, which implies that $-(g_t - t_t) = (r_{t-1} - \eta_{t-1})b_{t-1}$. Clearly, when the real

rate of interest exceeds the growth rate of the economy, the government will have to run a primary surplus in order to keep the debt/income ratio constant over time.

3.2. McCallum's market response

Harrod and Domar's concept of a financiable government debt rests on the assumption that the government will always be able to finance its interest-bearing liabilities as long as the net-of-taxes real interest rate paid on its securities does not exceed the growth rate of the economy. Lenders, however, impose two restrictions on government debt issuing. First, the demand for bonds sets an upper limit on the real stock of government debt relative to the size of economy; second and most important, lenders affect the interest rate the government must pay on its bonds in order to finance them. Although the comparison between the real rate of interest paid on securities and the growth rate of the economy can guide the government and help keeping the debt/GDP ratio from rising, it does not define the behavior of the market towards that particular ratio or enable the government to assess the financiability of its debt in the future. Moreover, depending on the debt/GDP ratio, the market can be quicker at influencing the real interest paid on the debt, than the government at promoting

changes in its fiscal budget. The role played by the market (lenders) should, therefore, be taken into account to determine the financiability of the government's debt.

Bennett McCallum (1984) introduces the market by providing the microfoundations for government debt financing. Adopting a discrete-time, perfect-foresight version of the well-known model of Sidrauski (1967), the author specifies a maximizing model that incorporates infinite-lived agents who correctly take account of the government budget constraint.

McCallum considers the validity of the hypothesis that a constant, positive deficit can be maintained permanently without inflation through bond issues. He concludes that permanent deficits exclusive of interest payments cannot occur because an optimizing individual will not keep buying financial claims from a government that does not intend to pay its debt. In the household's maximization problem, a transversality condition prevents the government from running a Ponzi scheme against the public, which would allow the government to borrow, meet interest payments by borrowing more, and roll over its debt indefinitely.

A sustainable fiscal policy under the Harrod and Domar criterion might not be a sustainable one under the non-Ponzi-game (NPG) criterion, for it follows that a policy

with initial outstanding debt and no subsequent primary surpluses would characterize a Ponzi scheme. Moreover, even though the government's taxing capacity might be infinite, when the growth rate of income exceeds the after-tax real rate of interest, uncertainty about future rates of economic growth should preclude one from using the Harrod and Domar's approach as the solely criterion for a sustainable government debt.

A sustainable debt thus implies that the government has to satisfy an intertemporal budget constraint and a non-Ponzi-game condition that formalizes the limited willingness of the public to lend.

Regardless of the sustainability criteria used, however, what are the consequences of persistent budget deficits and accumulating government debt? In particular, are persistent budget deficits, and the resulting accumulation of government debt, inflationary?

3.3. Sargent and Wallace's unpleasant arithmetic

In a controversial article, Sargent and Wallace (1981) describe a relationship between the monetary and fiscal authorities in which the fiscal authority is assumed to behave in its design of policy as a Stackelberg leader, while the monetary authority behaves as a Stackelberg

follower. That is, fiscal policy goals dominate monetary policy ones.

The authors assume that the fiscal authority independently sets its budget, determining the amount of revenue that must be raised through bond sales and seignorage, defined as revenue from money creation. Given the demand for government securities, the monetary authority must finance with seignorage any disparity between the revenue necessary to cover the fiscal authority's deficit and the proceeds from the sale of bonds that could be placed in the government's securities market. If the placement of bonds is not sufficient to cover the fiscal authority's deficit, the monetary authority is forced to expand the monetary base and tolerate a higher inflation rate.

This situation arises in Sargent and Wallace's model under two crucial assumptions: the demand for government bonds is such that the real interest rate exceeds the economy's growth rate, and the path of fiscal policy is given and does not depend on current or future monetary policies.

The economy, assumed to be in full-employment, has a constant rate of growth that equals the growth rate of the population. The monetary policy is determined by the

choice of the rate of growth of the nominal stock of high powered money, which is kept at θ up to time t*. Until time t* arrives, the amount of bonds being sold is residually determined by the fiscal authority's primary deficit, the government budget constraint, and the rate of monetary growth θ. At time t*, an arbitrary upper limit to the private sector's demand for bonds is attained and, from then on, given the pattern of budget deficits set by the fiscal authority, it is the rate of monetary growth θ that must be residually determined. Once the upper limit on the private demand for government securities is reached, the smaller the portion of the government deficit being financed with bond sales, the greater the pressure on the monetary authority to accommodate the fiscal imbalance with a higher rate of money growth. In other words, given the upper limit on the demand for government bonds, persistent bond-financed deficits will eventually have to be monetized, resulting in a higher inflation rate.

In this scenario, a lower inflation rate today achieved through a tight monetary policy without changing either the level of taxation or government expenditures, will eventually lead to more inflation in the future. The authors go even further and argue that under rational expectations the public might anticipate the future

increase in the money supply and, through its effects on the demand for real cash balances, expectations of a higher inflation in the future may result in a higher inflation rate in the current period, depending on specific parameter configurations. Hence the unpleasant arithmetic.

Exploring the consequences of large real per capita total deficits on the time path of inflation, Buiter (1983) concludes, however, that a lower inflation rate at the current period achieved through a tight monetary policy without a fiscal adjustment, does not necessarily imply a higher inflation rate after t* (the time when the arbitrary upper limit to the private sector's demand for bonds is reached). Moreover, the assumption that it is the fiscal authority who first dictates its budget is a crucial one in the sense that the monetary policy must be adjusted to the fiscal budget. That is, because the fiscal authority "plays" first, the monetary authority can not impose fiscal discipline, and higher inflation results. If instead the monetary authority, in a binding or enforceable way, chooses the path of monetary growth first, the fiscal authority has no alternative but to choose a sequence of primary deficits consistent with the announced monetary policy. The resulting fiscal discipline will then curtail the link between deficits and inflation.

Although studies about price stabilization often emphasize the importance of government budget deficits in the inflationary process, there seems to be a lack of empirical evidence[19]. Blanchard and Fischer (1989) argue that different expectations about the government's actions is a possible explanation for the lack of positive association between deficits and inflation rates: if some believe that the government will increase the money supply while some others believe that a fiscal reform will be introduced, inflation rates will most likely not bear a statistical correlation with budget deficits on a period-by-period basis.

In any event, as Bental and Eckstein (1990) have shown, a stylized fact about the end of most episodes of high inflation or hyperinflation is the dramatic reduction or virtual elimination of the government budget deficit.

3.4. Sustainability of the Brazilian federal domestic debt

As described in the first chapter of this dissertation, the federal government in Brazil ran budget deficits during several years since the financial reform of

[19] Examples of studies that emphasize the importance of budget deficits are Sargent (1982), Cardoso (1992), Labán and Sturzenegger (1994), Aghion and Hinestrosa (1995).

1964-66. The pattern of fiscal deficits, along with the expanding financial needs of the federal government to meet interest payments on its previously issued debt, resulted in increases in the debt/GDP ratio observed during the period 1966-1996. Is the Brazilian federal government headed towards excessive debt accumulation, which could ultimately jeopardize the price stability achieved since 1994? In other words, is the debt sustainable? In the context of an infinite-horizon framework, I will test the sustainability of the Brazilian federal domestic debt through the zero-mean stationarity of the discounted debt/GDP ratio.

3.4.1. Analytical Framework

The Economy

Suppose an economy with a large number of similar households, where a representative agent seeks at time t to maximize the following utility function:

$$u_t = E_t\left[\sum_{t=1}^{\infty}\beta^{t-1}u(c_t, m_t)\right] \qquad (1)$$

where c_t denotes consumption in period t and $m_t \equiv \frac{M_t}{P_t}$ stands for the household's real money stock at the start of period t. P_t indicates the price of the consumption good in t. The

utility function is assumed to be strictly concave so that unique, positive values are chosen for c_t and $m_t \equiv \frac{M_t}{P_t}$[20]. $\beta = 1/(1+\delta)$ is the discount factor with the time-preference parameter positive.

Lets further assume that the household has access to a production function f(k) which is homogeneous of degree one in its inputs, capital and labor[21]. Labor is assumed to be inelastically supplied and f(.) is assumed to be strictly concave and to satisfy the Inada conditions[22]. Thus a unique, positive value will also be chosen for k_t in each period.

The household's budget constraint in nominal terms at t is:

$$P_t f(k_t) - P_t T_t + B_{t-1}(1+i_{t-1}) + M_{t-1} = P_t C_t + B_t + M_t + P_t(k_t - k_{t-1}), \quad (2)$$

where:

$P_t f(k_t)$ is total household's production or total income;

$P_t T_t$ are lump sum taxes;

B_t is the dollar amount of government bonds holdings;

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[20] If a function is strictly concave and is maximized s.t. a linear constraint, any local maximum is also a global maximum.

[21] A linearly homogeneous (of degree one) production function exhibits constant return to scale.

[22] $f(0)=0$, $f'(0)=\infty$ and $f'(\infty)=0$.

i_t is the *ex post* nominal rate of interest paid on government bonds. $B_{t-1}i_{t-1}$ are, therefore, interest receipts on holdings of government bonds;

M_t are holdings of money (cash balances);

$P_t(k_t - k_{t-1})$ is the change of unconsumed output, which can be interpreted as the household's "investment";

P_tC_t is consumption at time t, and finally,

P_t is the price of the (single) consumption good.

The left-hand side of the budget constraint can be described as the household's "sources of funds" at the current period: net production or net income (total income less taxes paid), interest receipts from the holdings of government bonds, and the holdings of government bonds and cash balances from last period. The right-hand side can be described as the household's "uses of funds": consumption, holdings of government bonds and cash balances, and "investment".

Dividing the household budget constraint by the price level P_t, we obtain the budget constraint in real terms:

$$f(k_t) + b_{t-1}(1 + r_{t-1}) + (1 + \pi_{t-1})^{-1} m_{t-1} - t_t = c_t + b_t + m_t + k_t - k_{t-1} \qquad (3)$$

where $\pi_{t-1} = \frac{P_t - P_{t-1}}{P_{t-1}}$ is the inflation rate between periods t-1 and t.

The household's problem is to maximize

$$\max_{\{c_t, m_t, k_t, b_t\}} u_t = E_t\left[\sum_{t=1}^{\infty} \beta^{t-1} u(c_t, m_t)\right]$$ subject to its budget constraint (3).

The first-order Euler equations for c_t, m_t, and k_t for all t, describing the necessary conditions that must be satisfied on any optimal path, are[23]:

$$u_1(c_t, m_t) - \lambda_t = 0 \qquad (4)$$

$$u_2(c_t, m_t) - \lambda_t + \beta E_t \lambda_{t+1}(1+\pi_t)^{-1} = 0 \qquad (5)$$

$$[f'(k_{t+1}) - 1]\lambda_t + E_t \beta \lambda_{t+1} = 0 \qquad (6)$$

The Euler condition for b_t is written in two parts:

$$-\lambda_t + \beta E_t \lambda_{t+1}(1+r_t) \leq 0 \qquad (7a)$$

and

$$E_t b_t\left[-\lambda_t + \beta\lambda_{t+1}(1+r_t)\right] = 0 \qquad (7b)$$

if any bonds are demanded so that $b_t > 0$[24].

The infinite-horizon transversality conditions are:

$$\lim_{t\to\infty} E_t m_t \beta^t \lambda_{t+1}(1+\pi_t)^{-1} = 0 \qquad (8)$$

$$\lim_{t\to\infty} E_t k_t \beta^t \lambda_{t+1} = 0 \qquad (9)$$

$$\lim_{t\to\infty} E_t b_t \beta^t \lambda_{t+1}(1+r_t) = 0 \qquad (10)$$

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[23] Given the assumptions on u(.) and f(.) which assure positive values for c_{t+1}, m_{t+1}, and k_{t+1}, the Euler conditions can be written as equalities.

[24] The Euler condition for bonds must be written this way because bonds are not part of the utility function and an equilibrium where no bonds are held is not ruled out by the assumptions on u(.).

Conditions (3)-(10) are jointly sufficient conditions for optimality. Given initial asset stocks and the time path for prices, the household's choice for c_t, m_t, b_t and k_t will be described by (3)-(7).

The Government

Consider the following budget constraint for the government expressed in per capita nominal terms at time t:

$$B_t - B_{t-1} + M_t - M_{t-1} = P_t G_t - P_t T_t + i_{t-1} B_{t-1} \qquad (11)$$

where

$B_t - B_{t-1}$ is the dollar amount of the net interest-bearing government debt held by the public at period t;

$M_t - M_{t-1}$ is the change in the money stock;

i is the *ex post* nominal interest rate, interpreted as the holding-period return on the stock of debt outstanding[25];

G and T are government expenditures and tax revenue respectively[26].

In the absence of inflationary finance, the government budget constraint is:

$$B_t - B_{t-1} = -S_t + i_{t-1} B_{t-1} \qquad (12)$$

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[25] Note that it is not necessary to assume that the government issues only one-period bonds.

[26] Adding the household and the government's budget constraints yields the national income identity $f(k_t) = c_t + k_t - k_{t-1} + G_t$.

where S denotes the non-interest surplus (-S denotes the primary deficit, that is, the difference between government expenditures exclusive of interest payments on the debt and tax revenues).

The real government deficit can be defined as the change, in real terms, of the government debt over time. The government budget constraint must be adjusted for inflation so that changes in its components do not reflect price variations. Moreover, it is important to adjust the budget constraint for real changes in the income level or economic growth.

The government's budget constraint in real terms and as a ratio to income can be written as:

$$b_t - b_{t-1} = -s_t + (r_{t-1} - g_{t-1})b_{t-1} \qquad (13)$$

where $r \equiv i - \pi$ stands for the real rate of interest and g denotes the rate of income growth.

Just for simplicity, lets assume that the real rate of interest is constant (R) and that the growth rate of income is zero, so that equation (13) becomes simply[27]:

$$b_t = -s_t + (1 + R)b_{t-1} \qquad (14)$$

[27] In the empirical tests carried out in the next section, the real rate of interest and growth rates are allowed to vary and the rates actually experienced by the economy are used.

Applying recursive forward substitution to (14) and letting $B_{t+N} \equiv \frac{1}{(1+R)^N} b_{t+N}$ and $S_{t+J} \equiv \frac{1}{(1+R)^J} s_{t+J}$, we obtain the government intertemporal budget constraint:

$$B_t = B_{t+N} + \sum_{J=1}^{N} S_{t+J} \qquad (15)$$

The relevant question is what creditors expect to happen to B_{t+N} as N gets large.

Taking expectations as of time t of equation (15) and applying the limit as N goes to infinite, gives:

$$B_t = \lim_{N \to \infty} E_t B_{t+N} + \sum_{J=1}^{N} E_t S_{t+J} \qquad (16)$$

The government's budget is balanced in expected present-value terms when its debt can be offset by the sum of expected future discounted primary surpluses. According to equation (16), this is the case when $\lim_{N \to \infty} B_{t+N} = 0$. If $\lim_{N \to \infty} B_{t+N} < 0$, the expected discounted future primary surpluses exceeds the present value of the government's debt by an amount that does not converge to zero. The government is accumulating tax revenues which could be translated into higher disposable income for households

and, therefore, increased consumption level at all periods[28].

In the opposite case, $\lim_{N\to\infty} B_{t+N} > 0$, the present-value of the government's debt exceeds expected primary surpluses. This implies that the government is continually borrowing to meet interest payments on its debt which will grow, *ceteris paribus*, at the rate of interest. But such a Ponzi scheme would violate the household's optimality condition (equation 10), since it amounts to providing the government with "free" resources. When $\lim_{N\to\infty} B_{t+N} = 0$ the government is asymptotically using the resources allowed by its budget constraint, no more and no less.

The role of seignorage

Seignorage represents real revenue which the government acquires by using high powered money to buy goods and/or financial assets.

In the theoretical models where seignorage is analyzed, the government is treated as one single entity. Then which branch of the government actually collects seignorage revenue and benefits from the acquisition of

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[28] Alternatively, the government could improve social welfare by increasing spending in public goods. Given that public goods were not included in the household's maximization problem, this alternative is not contemplated here.

goods and financial assets, or how it gets transferred between government branches is immaterial. In practice, the government institution responsible for the issuing of high powered money is separate from the one which actually uses the proceeds of seignorage to acquire goods and services.

When there are separate branches of the government responsible by the monetary policy and by the fiscal policy of the country, it is necessary to consolidate their balance sheets in order to understand how seignorage is collected and how the fiscal authority makes use of it.

Suppose that the fiscal authority issues debt to finance its purchases of goods and services. The debt is bought by the public and the proceeds of it are used to finance purchases. If the central bank in question is independent from the fiscal authority, the monetary authorities might choose to issue new money to buy the fiscal authority's debt from the public. In doing so, the central bank is *monetizing* the debt by printing money and buying it back from the public.

The issue of debt enters as a liability in the fiscal authority's balance sheet. The acquisition of debt by the central bank enters as an asset on the monetary authority's balance sheet. The newly issued money is a liability to

the monetary authority while the goods purchased are assets on the fiscal authority's balance sheet. When the two accounts are consolidated, the transfer of debt from the fiscal to the monetary authority has no effect in the balance sheet (they cancel each other since it is an asset in one account and a liability in the other). The net result is the issue of new money to finance expenditures. In other words, according to the consolidated accounts, the government is financing itself by simply printing new money. It is the use of its power over money issuing that characterizes the seignorage collection by the consolidated government; it is the consolidated government ability to finance expenditures through newly printed money. The newly issued money, in the context of the consolidated government, constitutes seignorage collection.

Because the relationship between the Treasury and the Brazilian central bank is characterized by a low degree of independence, it is reasonable, for the present purpose, to treat the government as a single entity and include seignorage collection in its budget constraint[29].

With money finance the government's budget constraint in real terms and as a ratio to income can be written as:

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[29] The relationship between the Treasury and the Brazilian central bank is discussed in the next chapter of this dissertation.

$$b_t - b_{t-1} + m_t - m_{t-1} = -s_t + (r_{t-1} - g_{t-1})b_{t-1} - (\pi_{t-1} + g_{t-1})m_{t-1} \qquad (17)$$

Rewrite (17) to obtain:

$$b_t - b_{t-1} = -\bar{s}_t + (r_{t-1} - g_{t-1})b_{t-1} \qquad (17')$$

where $-\bar{s}_t = -s_t - (m_t - m_{t-1}) - (\pi_{t-1} - g_{t-1})m_{t-1}$.

Now the government surplus must be interpreted as the primary surplus inclusive of the actually collected seignorage collection[30].

Given the newly defined government surplus and assuming for the moment that the real rate of interest on government securities is constant (R) and that the rate of income growth is zero, the government intertemporal budget constraint can be written as:

$$B_t = B_{t+N} + \sum_{j=1}^{N} \bar{S}_{t+j} \qquad (18)$$

Taking expectations as of time t of equation (18) and applying the limit as N goes to infinite yields equation (19):

$$B_t = \lim_{N \to \infty} E_t B_{t+N} + E_t \sum_{j=1}^{N} \bar{S}_{t+j} \qquad (19)$$

---

[30] Inflation tax is the total capital loss that inflation inflicts on holders of real money balances ($\pi_t . \frac{M_t}{P_t}$). Seignorage equals inflation tax proceeds plus the change in the economy's real money holdings, that is $\left(\pi_t . \frac{M_t}{P_t}\right) + \left(\frac{M_t}{P_t} - \frac{M_{t-1}}{P_{t-1}}\right)$.

This version of equation (16), which includes seignorage collection in the government surplus, is the basis for the empirical tests presented in the section bellow. It is assumed that the amount of seignorage collected by the government is consistent with a non-accelerating rate of inflation, that is, seignorage collection is bounded by its maximum given the public's demand for real cash balances[31].

3.4.2. Econometric tests and results

The data set was obtained from the Brazilian Central Bank and consists of annual observations over the period 1966, a year after the financial reform which allowed the government to issue interest-bearing debt was implemented, and 1996.

The market value of the debt/GDP ratio is defined as the debt/GDP at par divided by (1+r), where r is the annualized monthly average *overnight* real rate of interest. Government debt at par value is the series "Dívida Mobiliária Interna Federal Fora do Banco Central." That is, the series is the internal government debt outside the central bank (held by the public).

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[31] For a discussion of the dynamics of inflation and debt under alternative ways of financing the government deficit, see Blanchard and Fischer (1989), p.513-16.

The currency was changed six times between 1966 and 1996. Nominal variables (except interest and inflation rates) were converted into Millions of Cruzeiros Reais and divided by the *General Price Index* (IGP), internal supply, scaled so that 1989 price index equals 100. The real interest rate was again calculated as $r = \frac{(1+i)}{(1+\pi)} - 1$, which is equivalent to the standard $r = i - \pi$ when the inflation rate is low.

Ideally, the cost to the government of servicing its debt should be assessed by using the net-of-taxes real rate of interest, given that the taxable part of interest payments actually flows back to the government. Obtaining data on net-of-tax yield on government securities proved, however, to be a rather difficult task: tax rates vary whether the security holder is an individual, a financial institution or a large firm; some tax rates are applied to nominal returns, while others to real returns; the tax code for government securities has been changed several times[32]. Given the limited information on the identity of government securities' holders and the frequent changes in the tax code, there is no straightforward way to calculate the real

[32] In 1986, for example, the government waved taxes on holdings of its securities [Carvalho, 1992].

interest rate net-of-taxes on government securities. I opted therefore to use the real interest rate gross-of-taxes.

The government's budget is balanced in expected present-value terms when its debt can be offset by the sum of expected future discounted primary surpluses. According to equation (19), this is the case when $\lim_{N\to\infty} B_{t+N} = 0$.

In order to implement the sustainability tests to be developed in this section using the real rate of interest and growth rates actually experienced by the economy during the period of this analysis, I used discounting technique presented by Wilcox (1989).

Let $\alpha_t \equiv (r_t - g_t)$ and rewrite equation (17') to obtain:

$$b_t = -\bar{s}_t + (1+\alpha_{t-1})b_{t-1} \qquad (20)$$

Define $Q_t = \prod_{j=0}^{N-1}(1+\alpha_j)^{-1}$; $Q_0 = 1$. Multiplying equation (20) through by Q_t gives:

$$Q_t b_t = Q_{t-1}b_{t-1} - Q_t\bar{s}_t \qquad (20')$$

Rewrite (20') and obtain a version of equation (20) discounted back to period zero:

$$B_t = B_{t-1} - \bar{S}_t \qquad (21)$$

The budget constraint now involves the market value of the government debt which is expressed at its present value

of the initial date. Equation (21) means that the change in the discounted value of the debt equals the discounted value of the non-interest deficit inclusive of seignorage revenue. Note that no assumptions about the interest rates are necessary.

A sustainable fiscal policy can be defined as a policy such that the government debt as a ratio to GDP is backed by future primary surpluses of equal present value, $B_t = E_t \sum_{j=1}^{N} \bar{S}_{t+j}$. Alternatively, according to equation (19), the $\lim_{N\to\infty} B_{t+N}$ must be zero. Uctum and Wickens (1996) show that the condition $\lim_{N\to\infty} B_{t+N} = 0$ is equivalent to the proposition that B_t is a zero-mean stationary series.

Testing for the unconditional-mean stationarity of the discounted debt series does not exclude the case where the government is accumulating primary surpluses causing the debt to fall. Although this case would not pose a problem for payment of the government debt *per se*, it is clearly non-optimal. The government would be accumulating excess tax revenues which could be translated into higher disposable income and consumption levels.

The test for zero-mean stationarity of B_t involves the following procedure:

a. calculate the series mean;

b. subtract the mean from each observation;

c. test for stationarity of the resulting series.

Dickey and Fuller (1979) suggested that the following equation be estimated by OLS to test for the presence of a unit root in the y_t series:

$$\Delta y_t = \beta_0 y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta y_{t-i} + \varepsilon_t$$

The Augmented Dickey-Fuller (ADF) test for unit root consists of testing whether the coefficient on y_{t-1} is zero. The inclusion of higher-order autoregressive terms in the regression controls for serial correlation of the disturbance term. Under the null $H_0: \beta_1 = 0$, the series y_t contains a unit root and therefore is nonstationary. Under the alternative $H_1: \beta_1 < 0$, the series is stationary.

Table 15 presents the results of the unit root tests for the (mean reduced) discounted debt. The first column gives the result for the case where only one lagged change in the variable is included in the regression equation, the second column presents the results for two lagged changes, and finally, the third column gives the results for four lagged changes in the regression equation.

The ADF test statistics for the discounted debt in the first regression is -2.30, which compared with the critical values -2.65 (at 1% level) and -1.95 (at 5% level), gives

mixed results. The null hypothesis that the mean adjusted B_t has a unit root cannot be rejected at the 1% level indicating that B_t is not zero-mean stationary. At the 5% and 10% levels, however, the ADF statistics indicates a rejection of the null.

The inclusion of a second lag difference in the regression equation increases the ADF statistics to -1.70, as indicated by column (2). In this case, the null of a unit root is not rejected neither at 5% nor at 1% level, but is still rejected at 10%. Once again, the test yields mixed results.

The Akaike criterion places a penalty on extra coefficients. Although it selects only one lag for the regression equation, the stationarity test including four lags was performed. The ADF statistic is -1.72 and again the null hypothesis of unit root cannot be rejected at 1% or 5% levels.

The Phillips-Perron test (PP) was also performed. This unit root test, developed by Phillips and Perron (1988), corrects the statistics for serial correlated and possibly heteroskedastic error terms. The null of a unit root cannot be rejected at the 1% level and is rejected at the 10% level in all three cases, one, two or four lags; the tests give mixed results at the 5% level.

Because the ADF and PP tests offer somewhat mixed results about the stationarity of the discounted debt series, yet another test was performed.

Dickey and Fuller (1981) used Monte Carlo experiments to calculate the distribution of the Wald form of the OLS F test of the joint null hypothesis that $\alpha = 0$ and $\rho = 1$ in the regression $y_t = \alpha + \rho y_{t-1} + \eta_t$. Since the mean of the adjusted B_t series is zero by construction, a rejection of the joint hypothesis as proposed by D&F's Wald test would indicate that B_t is zero-mean stationary. The results are presented in *Table 16*.

The coefficients of the regression show that the constant term is highly insignificant, as expected. The *F* statistic for the joint hypothesis is smaller than the critical value F(2,25) of 5.18, and the null is accepted at the 5% level[33]. According to this test, the mean-adjusted discounted debt series is, therefore, not stationary and the policy is not sustainable.

Sub-samples

After the oil shock of 1979, the government implemented a series of currency devaluations in an attempt

[33] The critical values for the sample size T=30 has not been reported by Dickey and Fuller (1981). Although the appropriate critical value could be calculated by interpolation, the calculated F statistic guarantees the acceptance of the null hypothesis even for T=50 (4.86).

to promote exports and finance large current account deficits. In order to alleviate their inflationary impact, the Brazilian government increased direct subsidies to key consumer goods and agriculture which caused an increase in the primary deficit. Moreover, after 1980, the federal domestic debt became the main channel of government finance as foreign loans to Brazil were dramatically reduced. I divided the sample in two parts, prior and after 1980. The sub-sample results are presented in *Table 17*.

In the first sample, the ADF test statistics for the mean-reduced discounted debt is -1.66 for the first specification and -1.76 for the second. The critical values indicate a rejection of the unit root hypothesis at the 10% level in both specifications, but the null cannot be rejected at 1% or 5% confidence interval. The Phillips-Perron test also indicates a rejection of a unit root at the 5% and 10% confidence levels.

The results indicate then that the discounted debt series is stationary during the first sample period and that the government's budget was balanced in present-value terms during 1966-80.

In the second sample, the ADF statistic for the first specification (column 1) is -1.70 and the null of a unit root is accepted at 1% and 5% percent levels, but is

rejected at the 10% confidence interval. The inclusion of the second lagged difference reduces the ADF statistics significantly and the null of a unit root is accepted at the 1%, 5%, and 10% confidence intervals. The Phillips-Perron test, furthermore, indicates that the null of a unit root is only rejected at the 10% level for one-lag specification, while it cannot be rejected at all for two lags.

Since the ADF statistics seemed sensitive to the model specification, the sample was tested using three and four lagged differences in the regression equation (not reported). The null of a unit root could not be rejected at the 1%, 5%, or 10% levels indicating that the discounted debt is not stationary in second sample. Furthermore, the Phillips-Perron test cannot reject the presence of a unit root in the discounted debt series. The conclusion is that the mean-reduced discounted debt series is not stationary indicating that the government's budget is not intertemporally balanced and, therefore, fiscal policy assumes an unsustainable path after 1981.

Further tests

The mixed results about sustainability given by the ADF and PP tests for the whole sample prompted me to apply

still another test on the mean-reduced discounted debt series.

Classical hypothesis testing is designed to accept the null unless there is strong evidence against it. As a result, standard unit root tests fail to reject the null hypothesis of a unit root in several economic series.

Kwiatkowski, Phillips, Schmidt and Shin (1992), herein KPSS developed a procedure to test the null of stationarity. The test for level stationarity is based on the statistic $\hat{\eta}_{\mu} = T^{-2}\frac{\sum_{t=1}^{T} S_t^2}{s^2(l)}$, where

S_t is the sum of the residuals from the regression $y_t = \bar{y} + e_t$;

$s^2(l) = T^{-1}\sum_{t=1}^{T} e_t^2 + 2T^{-1}\sum_{s=1}^{l} w(s,l)\sum_{t=s+1}^{T} e_t e_{t-s}$ is a consistent estimator of the error variance;

$w(s,l) = 1 - s/(l+1)$ is a weighting function which guarantees the nonnegativity of $s^2(l)$; and

l is the lag truncation parameter. A zero truncation lag ($l=0$) implies no correction for autocorrelation.

The authors show that for small values of l, the test has good power even for small samples like the one used here.

Table 18 presents the test statistic for the null of stationarity around a level (zero in the case of the mean-

reduced discounted debt series) for the lag truncation parameter *l = 0,1...4,* and also *l=8* [34]. The critical values at 5 and 10 per cent levels are 0.463 and 0.347 respectively.

The calculated statistics are smaller than the critical values and indicate that the null of stationarity can not be rejected at the 5% or 10% level for all used values of *l*. In fact, the test statistics falls as the lag truncation parameter increases suggesting stronger evidence of stationarity (around the level zero) when correction for error correlation is made.

The KPPS test clearly indicates that the discounted debt is mean-zero stationary, and that, therefore, the government's fiscal policy has been sustainable over the whole sample.

It would be interesting to test the sustainability of fiscal policy in the two subsamples previously used. Unfortunately, there are not enough degrees of freedom to run the KPPS test on a subset of the data.

Finally, the government's intervention in the securities' market suggests a possible break in the series in 1990. There are not enough data points after 1990 in

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[34] Kwiatkowski, *et al.* (1992) argue that *l=8* is a compromise between the test size distortions under the null when *l=4* and the test low power when *l=12*.

the sample used in this chapter, however, to justify the inclusion of a dummy variable to test this possibility. Moreover, as argued in chapter II, the government's intervention did not represent a default *per se* in its federal debt, but simply a slight increase in its average maturity period. One should not expect, therefore, that the dummy be statistically different from zero.

3.5. Concluding remarks

This chapter analyzed the sustainability of the federal government debt in Brazil since 1966. A debt is considered sustainable if its discounted value as a ratio to GDP is backed by expected discounted surpluses of equal present value.

In the context of an infinite-horizon framework, sustainability was tested by means of the zero-mean stationarity of the discounted debt/GDP ratio.

Standard unit root tests (ADF and PP) gave mixed results about the stationarity of the mean-reduced discounted debt in Brazil. The test for the null of stationarity developed by Kwiatkowski, *et al.*(1992) indicated that the government's budget constraint has been balanced in present-value terms and that, therefore, fiscal policy in Brazil has been sustainable since 1966.

Sustainability was also tested in two sub-samples of the original data, 1966-80 and 1981-1996. The results indicated that the government fiscal policy was sustainable prior to 1980, but it assumed an unsustainable path after that. This is not surprising given the severe macroeconomic imbalances of the 1980s, such as hyperinflation episodes and stop-and-go economic growth. The sub-sample results can be reconciled with the overall sample conclusion in light of the primary surpluses experienced by the government during the 1970s. These primary surpluses may have had a compensatory effect for the primary deficits of the 1980s, although, the fiscal policy after 1981 cannot be considered sustainable. The federal domestic debt became unsustainable after 1981, in the sense that the government has been heading towards excessive debt accumulation, and that the federal government may have an incentive to repudiate its debt, either openly or through monetization.

But the most interesting fact is that, despite the unsustainable path assumed by the federal debt after 1981, the Brazilian government was able to continue placing its securities in the market. How did the Treasury manage to do so? The answer can be found on the low degree of independence that characterizes the relationship between

the Treasury and the Brazilian central bank. The Central Bank helped the Treasury to finance itself in a context of falling credibility and market pressure for higher yields (or larger discounts) by managing interest rates through the usage of *repurchase agreements* and issuing its own securities. As discussed in the previous chapter, the Central Bank was able to calm investors, guaranteeing a stable market for government securities and preventing a sudden rise of interest rates on government securities, which could ultimately have driven the Treasury to default on its debt. Indeed, the Treasury did not have to default, but the consequence was that the Central Bank, by fixing the interest rate, lost control over the money supply.

The degree of independence of the Brazilian central bank and the effects of the *repurchase agreements* on the money supply are the subject of the next chapter.

4. Central Bank Independence

The concept of central bank independence (hereafter CBI) alludes to the alternative arrangements characterizing the relationship between the central bank and the treasury of a particular country. In general, a central bank is considered independent from the treasury when it has control over the levers of monetary policy, and it is free to set and pursue monetary goals, such as price stability.

In the past few years, the growing concern with price stability and control over the government deficit, along with a wave of changes in central bank legislation since the end of the 1980s (Chile and New Zealand are common examples), have led to a growing literature on how to prevent the so-called 'inflationary bias' that will be present in monetary policy if the central bank is not independent from the Treasury.

This chapter analyzes the institutional mechanisms existent in Brazil over the past thirty years which have given the Treasury control over the Central bank and monetary policy.

4.1. Theoretical Background

The importance given to central bank independence relies upon the assumption that policy-makers are subject

to an inflationary bias. This bias refers to the dynamic inconsistency of monetary policy whereby the government has an incentive to either explore the trade-off between inflation and unemployment in an expectational Phillips-curve model of output determination, or to collect inflation-induced revenue (inflation tax), once the monetary policy has been announced. In the first case, the government is able to induce a higher employment level because an unexpected higher inflation rate reduces the real wage of workers, who are either locked in a nominal wage contract or have imperfect information about the economy's price level. Lower real wages represent lower labor costs to employers and result in higher employment levels.

In the second case, the government is able to increase its revenue collection by taxing the public's holding of real cash balances. By increasing the inflation rate unexpectedly, the public cannot reduce its holdings of real cash balances and prevent the reduction of their real value.

In both cases, the government has an incentive to use discretion on the monetary policy implementation to achieve short-run objectives, such as higher revenue and/or employment, in detriment of price stability, once the

monetary policy has already been announced and incorporated by economic agents in their decision process.

The time inconsistency problem that allows for the inflationary bias of 'discretionary' monetary policy was first identified by Kydland and Prescott (1977) and Barro and Gordon (1983). One possible solution to the time inconsistency problem of monetary policy is to create some form of fixed rule to be followed by the government when setting its monetary policy, such as a constant growth rate for the money supply. Fixed-rules have, however, the disadvantage of not allowing the monetary authorities to react to unanticipated disturbances, such as supply shocks or shifts in the demand for money. And, although there is a middle ground between a fixed-rule and a 'discretionary' policy with arrangements that can improve the credibility of monetary policy, separating the Treasury (which benefits from unexpected changes in the monetary policy) from the central bank (which is actually responsible for the monetary policy) allows for some degree of discretion while significantly reduces the incentive to change policy unexpectedly.

The theoretical problem of central bank independence entails finding ways of insuring that the inflationary bias will be overcome.

Suppose that the central bank seeks to minimize the following single-period loss function:

$$L(\pi_t) = w\pi_t^2 + (y_t - k\bar{y})^2, \quad w>0, \quad k>1 \qquad (1)$$

In this economy, output obeys $y_t = \bar{y} + \beta(\pi_t - \pi_t^e + u_t)$, where π_t stands for the inflation rate at time t, y_t is the output at time t, π_t^e is the expected inflation rate at time t. β is positive indicating that output will increase if the inflation rate turns out to be greater than expected. $\bar{y}$ may be interpreted as trend or the full employment output. The term u_t is a random shock.

Is is assumed that tax distortions or imperfections in the labor market result in some wage or price stickness and cause the natural rate of employment to be "too low". This assumption justifys k being greater than unit in equation (1) above, and allows the loss function to comprise with a government's objective to seek to raise output above the natural rate. In this context, the expectational Phillips curve results from distortions or imperfections in the labor market rather than from imperfect information.

Using the output function to eliminate y_t from the loss function, minimizing the resulting expression on a period-by-period basis, and taking the expected inflation rate as given, the chosen values for inflation will be:

$$\pi_t = \frac{\beta(k-1)\bar{y}}{w+\beta^2} + \frac{\beta^2}{w+\beta^2}\pi_t^e - \frac{\beta^2}{w+\beta^2}u_t \qquad (2)$$

Under rational expectations, the equilibrium inflation rate will be:

$$\pi_t = \frac{\beta(k-1)\bar{y}}{w} - \frac{\beta^2}{w}u_t \qquad (3)$$

If, however, the choice of inflation rate conforms to a consistent rule that takes into account the private agents' (rational) expectation behavior, the chosen value for inflation will be:

$$\pi_t = \frac{-\beta^2}{w}u_t \qquad (4)$$

The inflation rate obtained in equation (4) will also describe the equilibrium output, which will be the same, on average, under the discretionary policy described in (3) and under the consistent policy described in (4). Because the equilibrium inflation rate will be lower under (4), the outcome in terms of inflation and output is superior under the consistent rule. The adoption of a discretionary policy (3) reflects the inflationary bias of the government, which results in inflation rates higher than the socially optimum rate.

In the conservative-central-banker approach of Rogoff (1985), the loss represented by higher inflation rates can be reduced if the central bank is allowed to develop a

reputation or if the monetary policy is entrusted to a person or institution that weights inflation deviations more heavily than society as a whole, i.e., by appointing a conservative central banker (high w in equation 1). The author shows that the appointment of a conservative central banker results in lower levels and more stable inflation rates. Output variability increases, however, as the conservative central banker will be more reluctant to use monetary policy to accommodate real shocks.

In the principal-agent approach of Person and Tabellini (1993) and Walsh (1995), the inflationary bias is reduced by formulating a contract that induces the central banker to behave conservatively by imposing costs on him in case inflation deviates from the optimal level.

In both cases, the monetary authority must be independent from the fiscal authority. In the case of a conservative central banker, the monetary authority must be able to ensure its preferences about inflation over society's preferences; if the central banker's behavior is bound by a contract (principal-agent approach), the monetary authority must be allowed to take action and follow the contract without the interference of the fiscal authority.

Fischer (1995b) further elaborates the problem by pointing to two different forms that CBI may assume: goal independence and instrument independence. A central bank has goal independence if it is able to set its own policy goals, while it has instrument independence if the central bank has control over the levers of monetary policy to attain the established goals. Rogoff's conservative central-banker has control over the monetary policy and seeks the goal of price stability according to its own loss function, having therefore, both instrument and goal independence. The central-banker in the principal-agent approach, however, has control over the instruments of monetary policy but has to pursue the goals established in its contract. In this case, the central-banker has instrument but not goal independence, although it is held accountable for the outcome of the implemented monetary policy[35].

Examples of conservative central-bankers can be found, among others, in the German Bundesbank, the Swiss National Bank, and in the American Federal Reserve. The system recently implemented in New Zealand provides an example of the principal-agent approach: the central-banker has to

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[35] The distinction pointed out by Fischer can be also found in Grilli *et al* (1991) under *political independence* (the capacity to set goals for

pre-announce an inflation target and his position is on the line in case the target is missed, and no external shocks justify the deviation from the announced target.

Although the delegation of authority to an independent central bank has often been criticized on the grounds that it entrusts an important part of economic policy to unelected personnel, empirical evidence suggests that more independent central banks are associated with better economic performance, not only in terms of lower inflation rates, but also in terms of less output variability.

There are several single and multi-country studies on CBI, but the most comprehensive study on the relationship between CBI and price stability is the cross-country analysis of Cukierman, Webb and Neyapti (1992), which includes 72 countries[36]. Through the construction of formal and informal indicators of CBI, Cukierman *et al* (1992) analyze the legal aspects of CBI and show that there is, in general, a negative correlation between CBI and inflation. The negative correlation is expected because usually the policy implemented in practice is the result of a compromise between the monetary and the fiscal authorities, and a more independent central bank will have a greater

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monetary policy) and *economic independence* (the capacity to choose and use the instruments of monetary policy necessary to achieve the goals).

[36] See Cukierman *et al* for a vast list of articles dealing with CBI.

input on the outcome, resulting in lower inflation rates on average. For the same reason, countries with less independent central banks are more likely to develop high rates of inflation when hit by adverse shocks.

The formal indicators designed by the authors are based on legal issues, such as how the head of the central bank is appointed, how long is his/her term in office, who formulates monetary policy, and what are the central bank's objectives. Because central bank charters often lack precise guidelines on the bank's functions and operations, the authors also use informal indicators based on a questionnaire about the actual practice of the central banks. The questions involve issues such as the degree of overlapping in the tenures of the head of the central bank and the government, the strictness of limitations on lending to the government, the importance of central bank's charter in guiding its operations, the priority given to price stability, and the degree of turnover of central bank governors. Besides the formal (legal) and informal indicators, the authors constructed an index of overall independence, which combines the legal index for CBI with the rate of turnover of central bank governors, allowing the direct comparison among countries. Frequent changes of the central bank governor are a strong indication of low

level of CBI, because it shows that the political authorities have more opportunity to have central bank governors that will follow their policies than governors that will challenge them. Moreover, frequent turnovers of central bank governors that coincide with the turnover of the government (executive branch or the finance minister) are even a stronger indication of low CBI as it makes the monetary policy susceptible to political changes.

The evidence provided by Cukierman *et al* (1992) indicates that all countries will annual inflation rates above 50 percent have less than median central bank independence. Moreover, the turnover of central bank governors significantly contributes to inflation rate variability.

For industrialized countries, legal central bank independence can be negatively related to inflation rates, and more legal independence limits credit expansions by the central bank to the public sector. The degree of central bank governor turnover is very low for the industrialized countries and it does not have much influence on inflation rates for this group of countries.

For developing countries, legal independence has little correlation to inflation rates or to the degree of credit expansions to the public sector. Instead, the

degree of turnover of central bank governor seems to be a more important measure of CBI: higher turnover of central bank governors is associated with higher inflation rates and contributes to faster credit expansion to the public sector.

One possible reason for this result is that, in many developing countries, the law regarding the operation of the central bank is not observed or can be easily circumvented. Restrictions on lending to the public sector, for example, are often altered through the creation of informal arrangements that, although meant to be only temporary, end up rendering the central bank charter limited meaning. In the case of Brazil, for instance, the use of letters of repurchase (the *repurchase agreements*) to assure a stable demand for government securities, and the issuance of securities by the central bank have circumvented the law that prohibits the Brazilian central bank from financing the government and public enterprises.

On Cukierman *et al* coding system, the aggregate index for legal central bank independence during the 1980s ranges from a maximum of 0.69 for the Federal Republic of Germany to a minimum of 0.10 for Poland. Brazil scores at the lower end, along with Taiwan and Pakistan, with an index of 0.21. The study did not capture, however, the legal

changes occurred after 1986. From a legal point of view, therefore, the coding probably underestimated the degree of CBI of the Brazilian central bank.

The legal or institutional aspects of CBI in Brazil and the relationship between the Central Bank and the Brazilian Treasury characterized by the use of letters of repurchase and the issuance of securities by the central bank are discussed in the following sections.

4.2. Central Bank Independence in Brazil

4.2.1. Institutional Aspects

Although the institutional aspects of central bank independence do not reveal the actual behavior of the central bank and, therefore, its actual independence, they indicate the degree of independence that legislators meant to confer to the central bank at the time of its creation, and provide the basis for possible legal changes that could enhance independence.

The institutional guidelines regarding the operation of the central bank in Brazil were generally laid out in 1964, when the Central Bank was created. The changes that

did occur regarded, in their most part, the provisions of credit to the public sector and will be discussed bellow[37].

Following the legal independence coding developed by Cukierman *et al* (1992), this section discusses the institutional features that characterize CBI in Brazil, particularly, the institutional aspects concerning the role of the Central Bank in providing credit to the public sector.

Legal independence is analyzed through four clusters of issues: a) the appointment, dismissal and term in office of the head (or governor) of the central bank; b) the role of the central bank in policy formulation; c) the central bank objectives; and d) the provisions of credit to the public sector.

The lower the legal authority of the executive branch of the government in appointing and dismissing the central bank's governor, and the longer his/her legal term in office, the more legally independent is the central bank. Also, the greater the governor's ability to formulate monetary policy, the more independent is the central bank.

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[37] During the years of 1967 to 1979, there were changes in the composition of the Bank's board of directors, intended to bolster the authority of the executive branch of the government. Although these changes cannot be considered unimportant from the political point of view, they did not affect the *modus operandi* of the Central Bank, and therefore its degree of CBI as measured by the legal independence code of Cukierman *et al* (1992). For an account of these political changes, see Maxfield (1997).

Items (a) and (b) are related in the sense that, even if the central bank has a decisive role in formulating monetary policy, the central bank will have low legal independence if the central bank's governor can be easily dismissed by the executive branch of the government when a conflict arises.

Although only Germany and the Philippines have explicit legal mandates for price stability, a central bank that has price stability as its main or only objective is considered more independent than a central bank that has other objectives along with price stability -- such as stability of the financial system -- or even objectives that conflict with price stability -- such as full employment.

Finally, the conditions under which the central bank is (or is not) allowed to finance the public sector indicate its degree of legal independence. Clearly, the stricter the limitations on lending to the public sector, the more independent is the central bank to pursue price stability.

In Brazil, the governor of the central bank is appointed by the finance minister (or Treasury secretary), which is, in turn, appointed by the executive branch of the government, more specifically, the President. The

governor's appointment does not have any specific time length, and the contract is at the discretion of the finance minister. The governor can be dismissed at any moment by the executive, and it is not unusual for the Treasury secretary (finance minister) to dismiss the governor when a conflict between the government and the central bank arises. In fact, during the years of great economic instability (1980-89), the average tenure of central bank governor was only 15 months.

The role of the Central Bank in formulating the monetary policy is limited. The finance minister and the Central Bank's governor, along with a board of directors comprised also of representatives of the private sector, approve together the targets for monetary policy, which always accord with the government established goals. The Central Bank does not have any influence on the government's budgetary process, and it does not set the interest rate and the exchange rate independently from the government's targets for economic activity. As a result, the central bank's capacity to promote price stability, which is not included in the bank's stated objectives, is severely curtailed.

The low autonomy of the Central Bank of Brazil is also brought to light by the provisions on credit to the public

sector. From a legal point of view, there are two phases in the financing relation between the Central Bank and the public sector in Brazil. The first one, from the financial reform of 1964-66 to the beginning of the democratic government in 1986, is characterized by a 'mixed-banking' operation of the monetary authorities, which assumed fiscal responsibilities along with the Treasury. In the second phase, the government and Congress implemented institutional changes to unify the Treasury's accounts under a single budget, and to prohibit the Central Bank from participating in the primary market for government securities.

First Phase

The structure of the Brazilian monetary authorities operating until 1986 was defined in the reform implemented by the military government in 1964-66. The main objective of that reform, as mentioned earlier, was to create an institutional framework for government financing through the issue of securities and the implementation of monetary policy.

The central bank functions had until then been performed by the Bank of Brazil (*Banco do Brasil*), a state-owned commercial bank. The Bank of Brazil had already been in operation and had branches in several locations in the

country, and it was designated as the executing agent of the Central Bank. In order to perform this function, a special account, called the "movement account" (*conta movimento*), was established to deal with imbalances of funds between the two institutions. This account carried interest of 1% per annum on the outstanding balance, and was cleared weekly.

The Bank of Brazil continued to function as a regular commercial bank and played a central role in launching the massive federal government lending program of the 1970s. To meet the government lending targets, the "movement account" was used to transfer resources, originally raised by the Central Bank, to the Bank of Brazil.

The recently founded Central Bank, in addition to receiving resources from the commercial banks and the federal debt, administered fiscal funds derived from the Treasury. These funds were then transferred to financial institutions to be lent mainly to agriculture, and also to the business sector, through the National Economic and Social Development Bank (BNDES- *Banco Nacional de Desenvolvimento Econômico e Social*), in order to promote manufacture exports.

As a result of the financial reform, the first stage of financial intermediation comprised three federal

institutions: the monetary authorities (the Central Bank and the Bank of Brazil), the National Economic and Social Development Bank (BNDES), and the National Housing Bank (BNH- *Banco Nacional de Habitação*). The objective of the National Economic and Social Development Bank, established in 1964, was to carry out credit operations directed to sectors considered important for the government's import-substitution investment program. The National Housing Bank was also established in 1964 to cope with a serious housing shortage. Its resources depended mainly on savings deposits made to state and federal savings banks[36]. All three institutions (BNDES, BNH, and the monetary authorities) could lend directly to final borrowers or non-financial institutions, and provide funds for relending by institutions at a second stage of financial intermediation.

As a result of the arrangement established by the financial reform of 1965-66, the responsibilities of the monetary authorities were extended beyond its conventional operations: the Central Bank managed development funds and programs, and the Bank of Brazil was also the largest commercial bank in the country. Both carried out credit operations which, in turn, were determined by the Treasury

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[35] Until 1964 tenancy laws virtually froze nominal rents by indefinitely extending rent contracts after their maturities, at the tenants option.

and ultimately implemented (executed) by the Bank of Brazil. The passive adjustment of the "movement account" in the Bank of Brazil was used to accommodate increased credit operations (often at subsidized rates) created by the BNDES. At the same time, part of the resources raised through the sale of federal debt were assigned to the monetary authorities, mainly the Central Bank[39]. That is, the institutional framework established by the financial reform resulted in the diffusion of fiscal and monetary responsibilities between the Treasury and the monetary authorities, the Central Bank and Bank of Brazil: the Central Bank was responsible for issuing and managing the federal debt, although its proceeds were rendered to the Treasury to finance part of its borrowing requirements; the Bank of Brazil, besides being the largest commercial bank in the country, also played an important role in executing the Treasury's sectorial lending operations. These lending operations were in turn sanctioned by the transfer of resources (adjustments) between the Bank of Brazil and the Central Bank through the "movement account".

Since annual inflation rates were high (92% in 1964), home owners would rather leave the property vacant, causing the housing shortage.

[39] For example, interest payments on the public debt were included in the monetary, rather than in the fiscal budget. From 1980 on, interest payments are included in the fiscal budget.

The unconventional operations of the monetary authorities implied that controlling the monetary base and total expenditures required efforts from both the monetary authorities and the Treasury. For example, according to the Central Bank data for 1985, interest payments on a particular Treasury security (ORTN) totaled Cr$ 9.6 trillions. The Treasury accounts for the same year shows that only Cr$ 5.4 trillions were transferred to the Central Bank to meet interest payments for that particular security. The difference, Cr$ 4.2 trillion, is unaccounted for in the Treasury's budget and this amount, owed in interest payments, was probably paid for with new issues of debt. Because fiscal expenditures were part of the monetary authorities' budget, part of the fiscal deficit was unaccounted for in the Treasury's accounts. The unconventional operation of the monetary authorities represented difficulties of achieving fiscal and monetary targets and led to institutional changes, starting in 1986, aiming at the consolidation of the federal accounts.

Second Phase

The institutional changes, that characterized the second phase of public sector-Central Bank relations, were initiated by the newly instituted democratic government in 1986, consolidated in the constitution promulgated in 1988,

and are still taking place nowadays, as the general legislation laid out in 1988 is detailed for implementation and approval by Congress.

In 1986, the government initiated an administrative reform that altered the relationship between the Treasury and the monetary authorities in three important ways. First, the reform created the National Treasury Secretariat (STN- *Secretaria Nacional do Tesouro*) with the objective of managing the central government's budget, including its stock of debt and its domestic and external borrowing operations.

Second, the reform created the so-called "single account" (*conta única*) for the Treasury at the Bank of Brazil. The "single account" consolidated the accounts held by the Treasury and promoted a better control of revenues and expenditures, limiting them to the approved budget.

Finally, the reform demoted the Bank of Brazil from its position as part of the monetary authorities and eliminated the "movement account". As a state-owned bank, however, the Bank of Brazil continued its credit operations, but without the passive adjustment in the "movement account".

In 1987, the government established the guidelines of the Treasury's unified budget to be implemented in 1988[40]. Starting in January, the Central Bank was not to be involved, either directly or indirectly, on any credit operation whose objective was not the implementation of monetary policy. The issuance of Treasury securities could only be used to finance the public deficit as established and approved by the Treasury's budget, and to roll over the already existing debt. The purpose of this determination was to avoid the issuance of debt to finance expenditures not accounted for in the originally approved budget. Starting in January 1988, moreover, the Central Bank, the Bank of Brazil and the Treasury had to consolidate their assets and liabilities.

Finally, the government transferred the management of the federal government's debt from the Central Bank to the Treasury, and Congress approved a law which prevented the central bank from participating in the primary market for public debt.

The reform initiated in 1986 thus legally prevented the Central Bank from financing the public sector, and better equipped the Treasury with the instruments to gain control over its finances: it eliminated the 'movement

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[40] Details about the first unified budget were laid out on government's

account' in the Bank of Brazil, and unified the Treasury's accounts under a single budget[41]. From a legal point of view, the institutional measures implemented after 1986 represented an increase in the autonomy of the Central Bank and represented important steps towards independence.

Although legal independence is important, the actual degree of central bank independence, depends not only on the law, but also on more informal arrangements between the Central Bank and the public sector, which can not be captured by an analysis of the bank's charter.

4.2.2. Practical Aspects

The relationship between the Central Bank and the Treasury in Brazil is characterized by the use of letters of repurchase (the *repurchase agreements*) and the issuance of special securities by the central bank. How did these two aspects of the Treasury-Central Bank relationship affect the degree of independence of the Brazilian central bank?

The study by Cukierman *et al* (1992) recognizes the importance of actual central bank practice for price

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Decree no. 94442.

[41] Although the "single account" has helped the government to limit expenditures to the approved budget, changes are easily made by the Senate through additions of expenditure items to the original budget

stability, and also measures CBI through the responses to a questionnaire sent to specialists on monetary policy. Brazil was not included on this part of the analysis, however. This section analysis the implications of using *repurchase agreements* and Central Bank-issued securities for price stability and the relationship between the Central Bank and the Treasury.

4.2.2.1. Repurchase Agreements

The Brazilian central bank has issued letters of repurchases since its creation during the financial reform of 1964-66. The use of *repurchase agreements* for government securities revealed an important aspect of the low degree of independence of the Brazilian central bank, particularly during the last years of the 1980s. As the market became increasingly wary of government securities, it became more difficult to place federal debt in the market. The prices that government securities were able to command were falling and their yields were on the rise. In order to guarantee a stable demand for government securities at a particular interest rate and help the Treasury finance itself in a context of falling credibility and market pressure for higher yields (or larger

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under "supplementary items". An important source of pressure has come

discounts), the Central Bank used the *repurchase agreements* to calm the market and prevent a sudden rise on the interest rate on government securities. Financing the Treasury and guaranteeing the market for government securities were the primary concerns of the Central Bank. By preventing a fall in the price of government securities, the Central Bank in effect pegged the nominal interest rate and lost control over the money supply. On the other hand, the Central Bank helped the Treasury to roll over its unsustainable debt in detriment of price stability.

The implications of using *repurchase agreements* for price stability will be analyzed through their effect on the money supply (M1) and on the interest rate when there is an increase in the demand for real cash balances. In the following discussion, I let aside the debate about the so-called transmission mechanism (from money to prices) and assume throughout that increases in the money supply ahead of output growth will, eventually, result in higher prices.

Suppose the public believes that the inflation rate for the next period will turn out to be higher than the inflation rate expected by the Central Bank -- which determines the indexation on government securities -- and that holders of government securities will suffer a loss.

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from local governments.

Agents will want to sell their officially indexed securities, converting them into cash, in order to acquire some other asset believed to offer a positive real return.

Given the legal capital leverage required by the Central Bank, a simplified, yet typical, portfolio of a financial institution in Brazil is comprised of interest-bearing deposits on the liability side, and of government securities on the asset side[42]. Let the interest paid on deposits be i^d and the interest received on government securities be i^s.

Facing increasing deposits' withdraws (or a rise in the demand for cash balances), the financial institution has two options: it may either sell part of its assets to provide the demanded cash, or it may increase the interest rate paid on deposits (i^d) to attract new deposits and/or convince part of the public to keep their money in the form of interest-bearing deposits. It may, of course, do both. In fact, if the increase in the demand for cash is too sudden, the institution will probably have to sell assets and increase interest paid on deposits, shedding some of its capital. But for the sake of the argument, lets assume

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[42] A stylized balance sheet of a typical financial institution dealing with government securities in Brazil is:

Assets	Liabilities
LFT	interest bearing deposits
capital	

that the institution will choose either to sell assets or to increase i^d, but not both. We can then analyze the effect of an increase in the demand for cash balances under two scenarios: (a) absence of repurchase agreements and (b) presence of repurchase agreements.

a) Absence of Repurchase Agreements

As indicated above, the financial institution facing deposits withdrawals may either sell assets (government securities in this case) or raise the interest paid on deposits, i^a. In the absence of repurchase agreements, the analysis is standard and the Central Bank may or may not choose to accommodate part of the increase in the demand for real balances.

Institutions sell assets

A generalized increase in interest-bearing deposits withdrawals leads the financial institutions to sell off their holdings of government securities in the secondary market. The price of securities will fall pushing yields upwards until a new equilibrium is reached. There will be no effect on the money supply (M1). The resulting increase in the interest rate, however, will rise the costs of new issues of interest-bearing debt by the Treasury. In the

case of floating rate debt, the increase in the interest rate will not only rise the cost of new issues, but also increase interest payments on the outstanding stock of government securities.

If the pressure on yields is considered too sharp, the Central Bank may acquire government securities in the secondary market accommodating part of the increase in the demand for nominal balances and stabilizing the interest rate. In this case, there will be a positive effect on M1 and on the interest rate, depending on the degree of monetary accommodation.

Institutions raise i^d

If the financial institutions opt to increase the interest rate paid on deposits, two situations arise. In the first one, the newly increased i^d is lower than the interest rate received on government securities ($i^d < i^s$), but sufficiently high to convince depositors to stick to their original portfolios. In this case, there will be no impact on the money supply or on the cost of issuing new government securities, at least in the short run.

In the second situation, the increase in i^d sufficient to convince agents to maintain their portfolios is higher than the interest received on government securities ($i^d >$

i^S). The financial institutions' liabilities will be increasing faster than their assets, and they will have to sell the government securities at their portfolios in order to pay the higher i^d. As securities are sold in the secondary market, their prices will fall and their yields will increase until i^S is at least equal to i^d, reestablishing the equilibrium between assets and liabilities. Again there will be no effect on the money supply, but the cost of issuing new government securities will be higher. This result is equivalent to the one obtained when financial institutions sell assets and there is no monetary accommodation.

b) Presence of Repurchase Agreements

How does the presence of repurchase agreements change the results of the analysis above? With repurchase agreements, the Central Bank no longer has the option of not repurchasing government securities in the secondary market when dealers (financial institutions) want to sell them. Once more, lets assume that the financial institutions facing an increase in the demand for cash balances can either sell their assets or increase the interest paid on deposits.

Institutions sell assets

Once more a generalized increase in interest-bearing deposits withdrawals will lead financial institutions to sell off their holdings of government securities in the secondary market. In the absence of the repurchase agreements, security prices would fall pushing yields upwards until a new equilibrium was reached. With the repurchase agreements in place, however, the Central Bank will stand ready to repurchase the securities and prevent the prices' fall. As a result, the securities sell off will not depress their prices and, therefore, not increase the interest rate.

Because the Central Bank stands ready to buy government securities on the secondary market preventing adjustments on the interest rate, an increase in interest-bearing deposits withdrawals will ultimately cause an increase in the money supply. As the interest rate on government securities stays pegged, the cost of new issues remains constant. Moreover, in the case of floating rate debt, by avoiding the otherwise increase in the interest rate, the Central Bank prevents interest payments on the outstanding stock of government securities from rising as well.

If the securities sell off is considered too great, instead of simply providing M1, the Central Bank may offer the market to swap 'old' securities for 'new' ones at a higher discount. With their assets rendering higher interest, the financial institutions can increase the interest rate paid on deposits (i^d), and bring the increased demand for cash balances to a halt. In this case, the effect on the money supply will depend on the degree of security swaps, remaining constant if all 'old' securities are swapped for 'new' ones, or rising if only a fraction of the 'old' securities is swapped. The effect on the cost of issuing new government securities is, however, unambiguously positive.

Institutions raise i^a

Facing an increased demand for cash balances, financial institutions may increase the interest rate paid on deposits to prevent withdrawals. If the increase in i^d sufficient to convince depositors to stick to their original portfolios is such that ($i^d < i^s$), there will be no impact on the money supply, or on the cost of issuing new government securities, at least in the short run. The increase in i^d will simply squeeze financial institutions' profits.

What if the required increase in the interest rate paid on deposits would result in i^d being greater than i^S ? In this case, financial institutions' liabilities will be increasing faster than their assets, and they will have to sell the government securities at their portfolios in order to pay the higher i^d.

In the absence of repurchase agreements, as securities are sold, their prices fall, rising yields until a new equilibrium ($i^d = i^S$) is reached. With the repurchase agreement in place, security prices do not fall because the Central Bank is standing ready to acquire them. If prices do not fall and, therefore, yields do not rise, i^S will never equal i^d. The persistent gap between i^d and i^S will result in the complete depletion of financial institutions' securities and, eventually, lead to their insolvency.

The gap between i^d and i^S will not persist in the presence of repurchase agreements, however, if the Central Bank provides 'new' securities at a higher discount in exchange for the ones being sold in the market. That is, if the Central Bank swaps the 'new' securities for the 'old' ones, instead of increasing the money supply. In this case, there will be no effect on M1, but the Central Bank will be sanctioning the interest rate increase promoted by the financial institutions and, therefore,

causing an increase in the cost of issuing new government securities.

Because financial institutions have no guarantees that the Central Bank will provide higher discounted securities, the situation just described is not likely to occur. Security swaps have occurred, however, as the Central Bank tried to control the money supply and yet was obliged to repurchase government securities in the secondary market.

The most important aspect of the usage of *repurchase agreements* for CBI is that the Brazilian central bank effectively lost control over the money supply, as it stood ready to buy government securities on the secondary market letting the money supply to float and accommodating any increase in the demand for cash balances. That is, the Central Bank did not provide any anchor to the money supply.

A second aspect of the usage of *repurchase agreements* for CBI is the subordination of the Central Bank to the financial needs of the Treasury. By guaranteeing a stable demand for government securities, the Central Bank helped the government place them in the market even though the federal domestic debt had assumed an unsustainable path during the 1980s. Moreover, by calming the market and preventing a run on the government debt, the Central Bank

prevented a rupture on the market for government securities and guaranteed that the Treasury would be able to finance itself in the future once stability was achieved. The use of *repurchase agreements* meant that the Central Bank functioned as a lender of last resort, not to the market, but to the Treasury itself, and relinquished its role of protecting the value of the country's currency.

As the borrowing requirements of the central government increased dramatically after 1986, the Central Bank started relying more and more on *repurchase agreements* to convince market participants to hold Treasury securities, even if only for one day. The Central Bank was, in practice, financing the Treasury, even though the constitution of 1988 prohibited it from buying Treasury securities in the primary market. The scheme 'worked' for everybody: the Treasury could have instant cash and finance itself; the market could protect their wealth from the effects of inflation and earn a positive attractive real return. The Central Bank, however, became hostage of the situation, losing control of the monetary policy. As the fiscal stance of the Treasury did not allow for much leverage, the market dictated the interest rate on the primary market for government securities and ultimately determined the money supply.

4.2.2.2. Central Bank Securities

The second characteristic of the relationship between the Treasury and the Central Bank is the use of securities issued by the Central Bank. These securities are part of the Central Bank liabilities, and their issues are backed by holdings of securities issued by the Treasury.

The first security issued by the Central Bank was the Central Bank Bill (LBC-*Letras do Banco Central*), created in 1986. As discussed earlier (Chapter II), the LBCs were created to enable the Central Bank to increase interest rates without imposing losses to financial institutions holding securities previously issued by the Treasury, the price-indexed ORTN and the pre-fixed LTN. By avoiding losses to financial institutions, the Central Bank prevented problems for the placement of Treasury securities later on.

The second Central Bank security, the Central Bank Bond (BBC- *Bonus do Banco Central*) was issued in 1991 after the government implemented the financial siege that resulted in the compulsory increase in the average maturity period of its debt. The Treasury securities held by the Central Bank were of longer maturity and not well accepted by the market in a time when inflation was making a strong

come back. According to the Central Bank, in order to facilitate the operation of the monetary policy, the Central Bank issued the BBC, of shorter maturity.

The Central Bank Note (NBC- *Notas do Banco Central*) was issued later on in 1991 and is backed by the Treasury-issued National Treasury Note (NTN-D -*Notas do Tesouro Nacional, série D*). Both securities, the one issued by the Treasury and the one issued by the Central Bank, share the same characteristics, except for their maturity periods. Having a maturity period of no longer than a year, the security issued by the Central Bank is more tradable than the longer maturity Treasury security.

Finally, the Central Bank issued the Central Bank Special Note (LBCE- *Letra Especial do Banco Central*) in 1994. The costs to local governments (states and municipalities) of financing their debts was higher than the cost to the federal government, as their securities were being traded at a rate 4.4 percent higher than federal securities. The Central Bank's charter allows only the central government to use credit lines at the Bank. In order to circumvent the law and yet be able to finance the local governments, the National Monetary Council (CMN) authorized the Central Bank to issue securities to be exchanged for securities issued by local governments.

The issuance of Central Bank securities reveals another aspect of the low degree of independence of the Brazilian central bank. It shows how the goals of the executive branch of the government are imposed on the Central Bank, which ends up financing the government, even at the local levels, and at the same time, protecting the market to make sure that the Treasury will continue to be able to finance itself.

4.3. Concluding Remarks

This chapter has analyzed the degree of central bank independence in Brazil based on the criteria proposed by the literature, and discussed two aspects of the relationship between the Treasury and the Central Bank, the *repurchase agreement* and the issuance of securities by the Central Bank. Central bank independence refers to the alternative arrangements characterizing the relationship between the central bank and the treasury. A central bank is considered independent from the treasury when it has control (formally and/or informally) over the levers of monetary policy, and it is free to set and pursue monetary goals, such as price stability.

This chapter has discussed legal and practical aspects of the degree of independence of the Brazilian central

bank. The degree of legal independence of the Central Bank, although still low, has increased after the administrative reform initiated in 1986, and sanctioned by the constitution promulgated in 1988. Since 1988, the Central Bank has not been allowed to acquire Treasury securities in the primary market or finance any state-owned enterprises.

Although legal independence is important, the actual degree of central bank independence, depends not only on the law, but also on more informal arrangements between the Central Bank and the public sector, which can not be captured by an analysis of the bank's charter. Two aspects of the practice of the Brazilian central bank were discussed: the use of *repurchase agreements* and the issuance of securities by the Central Bank. The Central Bank's ability to control the money supply is discussed in two scenarios: in the absence and in the presence of *repurchase agreements*. It is shown that the Brazilian central bank effectively looses control over the money supply when the *repurchase agreements* are used. The issuance of securities by the Central Bank has indicated how policy goals of the executive branch of the government are imposed on the central bank, further reducing its autonomy.

5. Final Remarks

This dissertation has analyzed the sustainability of the Brazilian federal domestic debt, and showed how the low degree of independence between the Treasury and the Central Bank was the determining factor in allowing the government to continue financing itself despite the unsustainable path assumed by its debt after 1981. The *repurchase agreements*, used particularly during the final years of the 1980s, and the issuance of securities by the Central Bank were the instruments that enabled the government to roll its debt over.

Although in place since the financial reform of 1964-66, the *repurchase agreements* only became a problem for the Central Bank after 1986. As the borrowing requirements of the Treasury increased dramatically, the Central Bank started relying more and more on the *repurchase agreements* to convince the market to hold Treasury securities and prevent a fall in security prices. The most discernible consequence was that the Central Bank lost control over the country's money supply.

The fiscal stance of the government has improved since 1993 through economic reforms, which include privatization of government enterprises and changes in the social security system.

The need to restructure the Treasury's domestic debt remains, however. Payroll and social levies continue to represent almost 40% of total government expenditures and the interest payments on the government's debt have increased dramatically since the Central Bank raised domestic interest rates to counter a speculative attack on the country's currency in October 1997. Moreover, falling primary surpluses and the continued inflow of foreign reserves necessary to finance deficits in Brazil's trade accounts has caused increases in the debt/GDP ratio.

As shown in this dissertation, the unsustainable federal debt, perpetuated through the institutional mechanisms discussed herein, led the Central Bank to loose control over the money supply and helped fuel the Brazilian inflationary process in the 1980s. The federal domestic debt, along with the rising state and municipal debts, still linger, therefore, as a threat to the price stability achieved by the Real Plan.

Table 1: **Domestic Debt Held by the Public[1]**

	ORTN	BTN	NTN	**INDEXED (TOTAL)**	LTN	BBC	**FIXED (TOTAL)**	LFT	LBC	**FLOATING (TOTAL)**	**TOTAL**
1970	95.0	-	-	**95.0**	5.0	-	**5.0**	-	-	**-**	100.0
1980	72.2	-	-	**72.2**	27.8	-	**27.8**	-	-	**-**	100.0
1981	63.2	-	-	**63.2**	36.8	-	**36.8**	-	-	**-**	100.0
1982	85.4	-	-	**85.4**	14.6	-	**14.6**	-	-	**-**	100.0
1983	96.1	-	-	**96.1**	3.9	-	**3.9**	-	-	**-**	100.0
1984	95.8	-	-	**95.8**	4.2	-	**4.2**	-	-	**-**	100.0
1985	96.6	-	-	**96.6**	3.4	-	**3.4**	-	-	**-**	100.0
1986	41.4	-	-	**41.4**	2.2	-	**2.2**	-	56.4	**56.4**	100.0
1987	26.9	-	-	**26.9**	1.8	-	**1.8**	-	71.3	**71.3**	100.0
1988	31.5	-	-	**31.5**	-	-	**-**	68.5	-	**68.5**	100.0
1989	0.1	2.0	-	**2.1**	-	-	**-**	97.9	-	**97.9**	100.0
1990	0.0	4.7	0.0	**4.7**	31.1	0.0	**31.1**	62.9	1.4	**64.3**	100.0
1991	0.0	4.2	12.6	**16.8**	0.0	16.1	**16.1**	61.3	5.9	**67.2**	100.0
1992	0.0	0.1	36.0	**36.1**	0.0	54.8	**54.8**	5.4	3.6	**9.0**	100.0
1993	0.0	0.1	69.7	**69.8**	4.8	21.6	**26.4**	3.8	0.0	**3.8**	100.0
1994	0.0	0.1	43.7	**43.8**	0.8	39.4	**40.2**	12.6	3.5	**16.1**	100.0
1995	-	0.0	19.7	**19.7**	18.0	24.6	**42.6**	16.9	20.8	**37.7**	100.0
1996	-	0.0	25.6	**25.6**	27.3	28.5	**55.8**	-	18.6	**18.6**	100.0

1. Values of December
Source: Banco Central do Brasil

Table 2: **Supply and Demand for loans at Central Bank (US$ Millions)**

	1983	1984	1985	1986
Resources for relending	9421.0	13800.0	7834.0	10004.0
Demand for loans	12447.0	15820.0	15177.0	12628.0

Source: Cavalcanti (1988), p.52, 53.

Table 3: **Public Sector Borrowing Requirements Federal Government and Central Bank***

Year	Nominal	Primary	Operational
1986	6.2	0.0	1.6
1987	17.8	1.7	3.1
1988	26.6	0.9	3.3
1989	49.3	1.1	3.7
1990	10.4	-3.0	-2.4
1991	6.5	-0.9	-1.4
1992	14.9	-1.3	0.8
1993	20.5	-1.4	0.0
1994	17.4	-3.1	-1.6
1995	2.3	-0.6	1.7
1996	2.6	-0.4	1.7

* Nominal: Deficit as usually defined
Primary: Deficit exclusive of interest payments
Operational: Deficit exclusive of monetary correction
Source: Banco Central do Brasil, Relatório Annual

Table 4: **Debt Maturity Period**

Year	Average in months
1984	19.30
1985	10.33
1986	8.40
1987	3.77
1988	n.a.
1989	n.a.*
1990	n.a.
1991	n.a.
1992	11.20
1993	3.43
1994	5.40
1995	6.40
1996	n.a.

Source: Banco Central do Brasil
*Maturity averaged 3.0 months in 1988-1989.

Table 5: **Expenditures Items as Percentage of Total- Treasury**

	Payroll and Social Levies	Transfers to local governments	Interest payments on debt
1990	34.1	21.0	16.7
1991	32.7	24.9	0.2
1992	32.1	24.2	7.4
1993	29.4	21.0	19.5
1994	39.2	19.4	7.7
1995	39.3	20.1	7.9
1996	37.9	20.0	10.8

Source: Banco Central do Brasil.

***Table 6*: Treasury-Issued Debt Composition[1]**

	ORTN*	LTNE	BTN	BTNE	NTN	LTN		LFT		TOTAL
						INDEXED (TOTAL)	**FIXED (TOTAL)**		**FLOATING (TOTAL)**	
1971	74.9	-**	-	-	-	**74.9**	25.1	**25.1**	-	-	100.0
1981	64.3	-	-	-	-	**64.3**	35.7	**35.7**	-	-	100.0
1982	81.4	-	-	-	-	**81.4**	18.6	**18.6**	-	-	100.0
1983	81.5	-	-	-	-	**81.5**	18.5	**18.5**	-	-	100.0
1984	93.9	-	-	-	-	**93.9**	6.1	**6.1**	-	-	100.0
1985	84.7	-	-	-	-	**84.7**	15.3	**15.3**	-	-	100.0
1986	62.9	-	-	-	-	**62.9**	37.1	**37.1**	-	-	100.0
1987	50.0	41.4	-	-	-	**91.4**	8.6	**8.6**	-	-	100.0
1988	36.8	24.8	-	-	-	**61.6**	0.0	**0.0**	38.4	**38.4**	100.0
1989	0.2	10.9	-	-	-	**11.1**	0.0	**0.0**	88.9	**88.9**	100.0
1990	0.0	22.3	0.6	60.6	-	**83.5**	4.8	**4.8**	11.7	**11.7**	100.0
1991	0.0	20.9	0.5	45.1	13.1	**79.6**	-	**-**	20.4	**20.4**	100.0
1992	0.0	19.5	0.0	-	72.7	**92.2**	-	**-**	7.8	**7.8**	100.0
1993	0.0	-	0.0	-	96.3	**96.3**	2.1	**2.1**	1.6	**1.6**	100.0
1994	-	-	0.0	-	86.0	**86.0**	0.9	**0.9**	13.1	**13.1**	100.0
1995	-	-	0.0	-	55.0	**55.0**	23.2	**23.2**	21.8	**21.8**	100.0
1996	-	-	0.0	-	53.1	**53.1**	46.9	**46.9**	-	-	100.0

Source: Banco Central do Brasil
1. Values of December
* ORTN was transformed into OTN in 1986.
** Not issued

Table 7: **Unit Root Tests (No trend or intercept)**

Variable	ADF(2)	ADF(4)	ADF(8)	PP(2)	PP(4)	PP(8)
G	-3.435	-1.855	-1.112	-11.265	-13.087	-16.200
ΔG	-16.447	-12.240	-7.420	-	-	-
R	-3.961	-2.084	-1.145	-13.327	-15.079	-18.356
ΔR	-17.025	-12.713	-8.255	-	-	-
Int	-8.052	-6.250	-4.142	-11.524	-11.346	-11.468
ΔInt	-12.960	-10.541	-8.025	-	-	-
S	-3.893	-2.878	-1.858	-10.647	-12.346	-14.491
ΔS	-14.328	-10.932	-6.104	-	-	-
B	-0.125	0.035	-0.027	-0.149	-0.113	0.022
ΔB	-8.075	-5.675	-4.320	-15.877	-15.883	-15.901
Δ(logB)	-6.820	-4.941	-3.462	-13.491	-13.652	-14.451
π	-2.489	-1.926	-1.660	-2.559	-2.053	-2.184
$\Delta\pi$	-9.731	-7.614	-5.837	-13.572	-14.594	-15.155

ADF(*d*): Augmented Dickey-Fuller Test, null of unit root, lag truncation *d*
PP(*d*): Phillips-Perron Test, null of unit root, lag truncation *d*
McKinnon critical values 1%, 5% and 10% confidence interval: -2.58, -1.94, -1.62.

Table 8: **Unit Root Tests (Intercept)**

Variable	ADF(2)	ADF(4)	ADF(8)	PP(2)	PP(4)	PP(8)
G	-8.381	-4.936	-2.818	-19.093	-18.201	-17.935
ΔG	-16.404	-12.210	-7.410	-	-	-
R	-10.405	-6.569	-3.488	-26.431	-23.951	-22.775
ΔR	-16.981	-12.683	-8.252	-	-	-
Int	-8.412	-6.173	-4.700	-11.716	-11.536	-11.533
ΔInt	-12.927	-10.512	-8.003	-	-	-
S	-6.375	-5.065	-3.562	-14.355	-14.593	-14.783
ΔS	-14.289	-10.902	-6.089	-	-	-
B	-2.209	-1.936	-2.095	-2.342	-2.253	-2.373
ΔB	-8.102	-5.709	-4.364	-15.888	-15.902	-15.939
Δ(logB)	-6.851	-4.969	-3.478	-13.527	-13.669	-14.424
π	-3.798	-3.017	-2.790	-3.895	-3.353	-3.589
$\Delta\pi$	-9.705	-7.593	-5.821	-13.536	-14.538	-15.100

ADF(*d*): Augmented Dickey-Fuller Test, null of unit root, lag truncation *d*
PP(*d*): Phillips-Perron Test, null of unit root, lag truncation *d*
McKinnon critical values 1%, 5% and 10% confidence interval: -3.47, -2.88, -2.57.

***Table 9*: Unit Root Tests (Intercept and trend)**

Variable	ADF(2)	ADF(4)	ADF(8)	PP(2)	PP(4)	PP(8)
G	-8.371	-4.932	-2.772	-19.058	-18.169	-17.905
ΔG	-16.368	-12.205	-7.476	-	-	-
R	-10.642	-6.862	-3.855	-27.468	-24.951	-23.881
ΔR	-16.940	-12.667	-8.309	-	-	-
Int	-8.566	-6.910	-4.952	-11.821	-11.667	-11.709
ΔInt	-12.892	-10.483	-7.978	-	-	-
S	-6.494	-5.188	-3.718	-14.448	-14.625	-14.747
ΔS	-14.251	-10.875	-6.066	-	-	-
B	-2.547	-2.274	-2.454	-2.698	-2.626	-2.769
ΔB	-8.093	-5.709	-4.386	-15.859	-15.872	-15.914
Δ (logB)	-6.839	-4.962	-3.485	-13.495	-13.639	-14.396
π	-3.803	-2.971	-2.707	-3.908	-3.348	-3.600
$\Delta\pi$	-9.699	-7.604	-5.861	-13.509	-14.538	-15.187

ADF(*d*): Augmented Dickey-Fuller Test, null of unit root, lag truncation *d*
PP(*d*): Phillips-Perron Test, null of unit root, lag truncation *d*
McKinnon critical values 1%, 5% and 10% confidence interval: -4.01, -3.43, -3.14 .

***Table 10*: Debt responses to one standard deviation innovation**

Innovation in	Lag in months				
	1	2	3	4	5
Int	0.240	-0.072	-0.001	-0.048	0.004
	(0.022)	(0.027)	(0.026)	(0.023)	(0.015
ΔB	0.246	-0.001	0.017	-0.010	0.009
	(0.013)	(0.027)	(0.027)	(0.014)	(0.010
$\Delta\pi$	-0.111	-0.069	-0.061	-0.010	0.000
	(0.026)	(0.025)	(0.019)	(0.015)	(0.011)
R	0.023	0.001	-0.001	0.006	0.001
	(0.018)	(0.026)	(0.025)	(0.016)	(0.006
G	-0.025	-0.011	-0.012	0.007	-0.000
	(0.018)	(0.022)	(0.023)	(0.012)	(0.001
S	-0.086	-0.063	-0.015	-0.017	-0.007
	(0.023)	(0.028)	(0.028)	(0.015)	(0.001)

Standard deviations in parenthesis

***Table 11*: Responses to one standard deviation Debt innovation**

Lag in months	Response of				
	Int	$\Delta\pi$	R	G	S
1	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
2	-0.269	2.129	-0.005	0.017	0.000
	(0.255)	(0.312)	(0.025)	(0.022)	(0.000)
3	0.174	-0.117	-0.040	-0.031	0.000
	(0.261)	(0.500)	(0.028)	(0.023)	(0.000)
4	0.035	0.228	0.006	-0.066	0.000
	(0.140)	(0.422)	(0.014)	(0.014)	(0.000)
5	0.067	-0.266	-0.007	0.026	0.000
	(0.095)	(0.192)	(0.009)	(0.016)	(0.000)
10	0.002	-0.013	-0.000	-0.000	0.000
	(0.007)	(0.027)	(0.000)	(0.002)	(0.000)

Standard deviations in parenthesis

***Table 12*: Variance Decomposition: Proportion of forecast error *h* months ahead produced by each innovation (%).**

Variance Decomposition of	*h*	Contribution of an innovation in S	$\Delta\pi$	Int	R	G	ΔB
S	1	100.000	0.000	0.000	0.000	0.000	0.000
	2	98.703	0.536	0.024	0.371	0.092	0.273
	3	95.925	0.821	0.570	0.431	0.139	2.115
	6	94.928	0.913	1.368	0.431	0.147	2.213
	12	94.905	0.917	1.382	0.432	0.148	2.215
	24	94.905	0.917	1.382	0.432	0.148	2.215
$\Delta\pi$	1	7.710	92.290	0.000	0.000	0.000	0.000
	2	4.108	30.800	55.941	0.040	0.015	9.096
	3	4.139	30.992	55.625	0.044	0.130	9.059
	6	4.049	31.387	55.133	0.107	0.301	9.024
	12	4.054	31.378	55.131	0.108	0.307	9.023
	24	4.054	31.378	55.131	0.108	0.307	9.023
Int	1	1.056	7.067	91.878	0.000	0.000	0.000
	2	5.294	10.034	84.135	0.006	0.012	0.519
	3	5.468	11.549	81.973	0.041	0.253	0.716
	6	5.616	11.567	81.718	0.056	0.259	0.754
	12	5.617	11.571	81.744	0.056	0.259	0.754
	24	5.617	11.571	81.744	0.056	0.259	0.754
R	1	2.959	0.070	0.000	96.940	0.000	0.000
	2	2.531	0.058	0.039	96.885	0.478	0.014
	3	3.106	0.071	0.045	95.194	0.553	1.030
	6	3.135	0.129	0.117	94.574	0.976	1.070
	12	3.136	0.133	0.189	94.480	0.979	1.084
	24	3.136	0.129	0.189	94.480	0.979	1.084
G	1	4.618	1.772	0.053	1.021	92.536	0.000
	2	5.578	3.294	0.182	1.058	89.627	0.258
	3	6.006	12.512	0.223	0.939	79.344	0.978
	6	5.124	11.536	15.925	1.019	62.120	3.975
	12	5.113	11.485	16.273	1.030	62.069	4.030
	24	5.113	11.485	16.273	1.030	62.120	4.030
ΔB	1	5.294	8.921	41.475	0.374	0.464	43.472
	2	7.386	11.248	41.475	0.374	0.464	43.472
	3	7.328	13.299	39.900	0.350	0.565	38.561
	6	7.405	13.112	40.576	0.369	0.586	37.953
	12	7.404	13.114	40.576	0.369	0.587	37.950
	24	7.404	13.114	40.576	0.369	0.587	37.950

***Table 13*: Model estimate parameters (1-L) *log*(Debt)**

Model (p,q)	ϕ_1	ϕ_2	ϕ_3	θ_1	θ_2	θ_3
0.1	-	-	-	0.031	-	-
				(0.073)		
0.2	-	-	-	0.017	0.129	-
				(0.072)	(0.072)	
0.3	-	-	-	0.020	0.125	0.026
				(0.073)	(0.072)	(0.073)
1.0	0.029	-	-	-	-	-
	(0.073)					
1.1	0.850	-	-	-0.781	-	-
	(0.153)			(0.183)		
1.2	0.823	-	-	-0.824	0.092	-
	(0.147)			(0.159)	(0.078)	
1.3	0.830	-	-	-0.829	0.109	-0.025
	(0.171)			(0.184)	(0.094)	(0.083)
2.0	0.024	0.133	-	-	-	-
	(0.072)	(0.072)				
2.1	0.691	0.103	-	-0.692	-	-
	(0.219)	(0.082)		(0.212)		
2.2	0.559	0.218	-	-0.559	-0.106	-
	(0.658)	(0.611)		(0.668)	(0.591)	
2.3	0.629	0.162	-	-0.627	-0.046	-0.016
	(1.110)	(0.913)		(1.111)	(0.914)	(0.131)
3.0	0.014	0.130	0.048	-	-	-
	(0.073)	(0.073)	(0.073)			
3.1	0.719	0.114	-0.021	-0.718	-	-
	(0.315)	(0.091)	(0.103)	(0.305)		
3.2	-0.190	0.741	0.076	0.192	-0.630	-
	(0.449)	(0.284)	(0.108)	(0.445)	(0.314)	
3.3	-0.003	-0.192	0.804	0.061	0.305	-0.776
	(0.052)	(0.058)	(0.043)	(0.032)	(0.043)	(0.002)

Standard deviations in parenthesis

***Table 14*: Univariate analysis: Debt impulse responses *h* months ahead**

Model(p,q) ; *h*	1	2	3	6	12	18	24
(1,0)	0.001	0.029	0.001	0.029	0.029	0.029	0.029
(2,0)	0.133	0.006	0.018	0.000	0.000	0.000	0.000
(2,1)	0.591	0.473	0.387	0.211	0.063	0.019	0.019
(2,2)	0.530	0.418	0.350	0.195	0.061	0.019	0.006
(2,3)	0.557	0.152	0.375	0.210	0.066	0.021	0.007
(3,0)	0.131	0.051	0.018	0.003	0.000	0.000	0.000
(3,1)	0.631	0.514	0.426	0.239	0.076	0.024	0.008
(3,2)	0.777	-0.213	0.601	-0.202	-0.144	-0.092	-0.055
(3,3)	-0.192	0.805	0.031	0.082	0.187	0.248	0.266

***Table 15*: Stationarity of Discounted Debt**

$$\Delta B_t = \gamma_0 B_{t-1} + \sum_{j=1}^{4} \gamma_j \Delta B_{t-j} + \varepsilon_t$$

	(1)	(2)	(3)
B_{t-1}	-0.279	-0.222	-0.274
	(0.121)	(0.131)	(0.159)
ΔB_{t-1}	0.218	0.213	0.319
	(0.184)	(0.183)	(0.219)
ΔB_{t-2}		-0.307	-0.294
		(0.200)	(0.244)
ΔB_{t-3}			0.226
			(0.224)
ΔB_{t-4}			0.020
			(0.229)
ADF Stat	-2.30	-1.70	-1.72
PP Stat	-2.24	-1.89	-2.08

Standard Errors in parenthesis. Critical values of 2.65, -1.95, and -1.62 for 1%, 5%, and 10% confidence intervals respectively[43].

***Table 16*: Dickey-Fuller Wald Test**

$$B_t = \alpha + \rho B_{t-1} + u_t$$

α	-0.002
	(2.124)
B_{t-1}	0.744
	(0.178)

Wald Test: $H_0: \alpha = 0$ and $\rho = 1$

F-Stat	1.02

Standard Errors in parenthesis. Critical values of 5.18 (T=25) and 4.12 (T=25) for 1% and 5% confidence intervals respectively[44].

[43] MacKinnon (1991) implemented a larger set of replications and estimated response surface regressions which permit the calculation of critical values for any sample size. The ADF tests were carried based on his critical values.

[44] Hamilton (1994), appendix B.

***Table 17*: SubSamples: Stationarity of the Discounted Debt**

$$\Delta B_t = \gamma_0 B_{t-1} + \sum_{j=1}^{2} \gamma_j \Delta B_{t-j} + \varepsilon_t$$

Sample 1966-1980	(1)	(2)
B_{t-1}	-0.151	-0.190
	(0.091)	(0.108)
ΔB_{t-1}	0.241	0.227
	(0.269)	(0.290)
ΔB_{t-2}		0.123
		(0.339)
ADF Stat	-1.65	-1.76
PP Stat	-1.72	-1.72
Sample 1981-1996		
B_{t-1}	-0.319	-0.222
	(0.188)	(0.203)
ΔB_{t-1}	0.241	0.210
	(0.260)	(0.258)
ΔB_{t-2}		-0.329
		(0.282)
ADF Stat	-1.70	-1.09
PP Stat	-1.70	-1.44

Standard Errors in parenthesis. Critical values are:
Sample 1966-80: -2.78 (1%), -1.97 (5%), and -1.63 (10%);
Sample 1981-96: -2.72 (1%), -1.96 (5%), and -1.63 (10%).

***Table 18*: KPSS Stationarity Test**

$$\hat{\eta}_\mu = T^{-2} \frac{\sum_{t=1}^{T} S_t^2}{s^2(l)}$$

l = 0	0.032
l = 1	0.018
l = 2	0.012
l = 3	0.006
l = 4	0.004
l = 8	0.004
η_μ critical values	0.463 (5%)
	0.347 (10%)

Upper tail critical values, level stationarity, KPSS (1992), p.156.

Appendix B: Description of the Brazilian Government Securities

Securities Issued by the Brazilian Treasury

	Security	Earnings	Maturity	First Issue	Last Issue
ORTN	Indexed National Treasury Obligation	Indexed to inflation rate	2 years[1]	1964	6/1994
LTN	National Treasury Bill	Pre-fixed (sold at discount)	90,180 and 360 days	8/1970	still issued[2]
LFT	Treasury Financial Bill	"overnight" rate	Not specified, unlimited	1/1988	5/1996
BTN	National Treasury Bond	Indexed to exchange rate	1 or 2 years	8/1989	still issued
NTN-B	National Treasury Bond Serie B	Indexed to General Price index + 6%p.a. paid at maturity	2 or 5 years	11/1991	Still issued
NTN-C	National Treasury Bond Serie C	Indexed to IGP + 6%p.a. paid every six months	15 to 24 months	11/1991	Still issued
NTN-D	National Treasury Bond Serie D	Indexed to US$ exchange rate in freemarket + 6%p.a. paid at maturity	2 to 5 years	11/1991	still issued

1. 1 year (5/1985); maximum of 6 months (12/1985); nominal value constant from 3/1986 to 3/1987.
2. Issued interrupted during high inflation periods, 10/1988- 4/1990 and 2/1991- 10/1993.

Special Securities Issued by the Treasury

	Security	Earnings	Maturity	First issue
LTNE	National Treasury Special Bill	indexed to inflation rate	Perpetuity	12/1987[1]
OTN Fiscal	Fiscal National Treasury Obligation	indexed to US$ exchange rate	3 months	6/1988
BTNF	Fiscal National Treasury Bond	indexed to inflation rate	Daily	6/1989
BTNE	National Treasury Special Bond	BTNF + 6% p.a.	12 installments starting in 9/1991	3/1990
NTN-A	National Treasury Note Serie A	indexed to GPI or exchange rate + 6% p.a.	Max of 25 years	10/1991
NTN-L	National Treasury Note Serie B	5% p.a.	2 years	4/1993
NTN-M	National Treasury Note Serie M	indexed to US$ + Libor + .875% p.a paid every 6 months	15 years (nominative and inegotiable)	4/1994

1. Last issued in 08/1993.

Securities Issued by the Brazilian Central Bank

	Security	Earnings	Maturity	First Issue
LBC	Central Bank Bill	Average "overnight" rate	Flexible (Max of 1 year)	5/1986
BBC	Central Bank Bond	Pre-fixed (sold at discount)	Min of 28 days	8/1991
NBC	Central Bank Note	Indexed to US$ exchange rate	Max of 1 year	1/1991
LBCE	Central Bank Special Note	Average "overnight" rate	Flexible	1994

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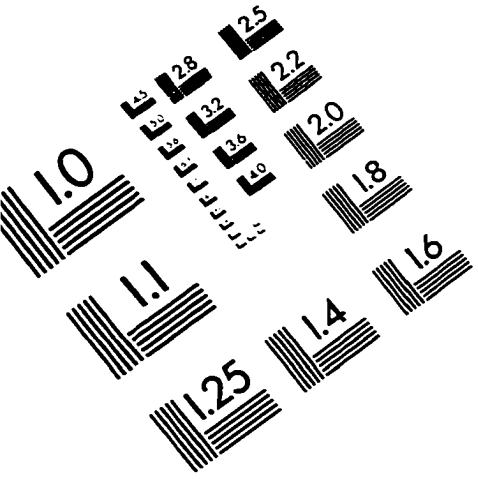
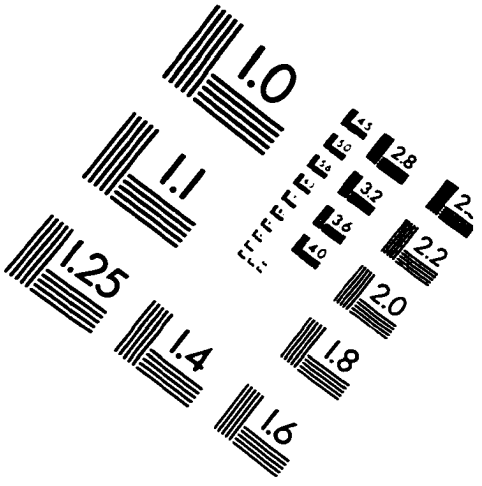
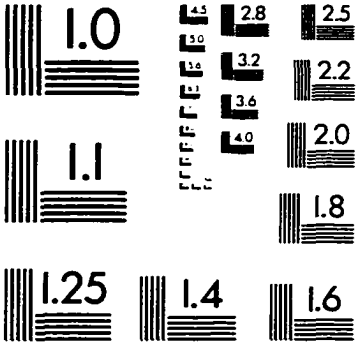
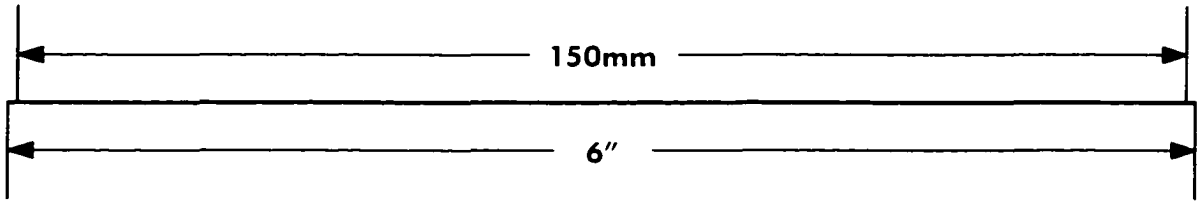
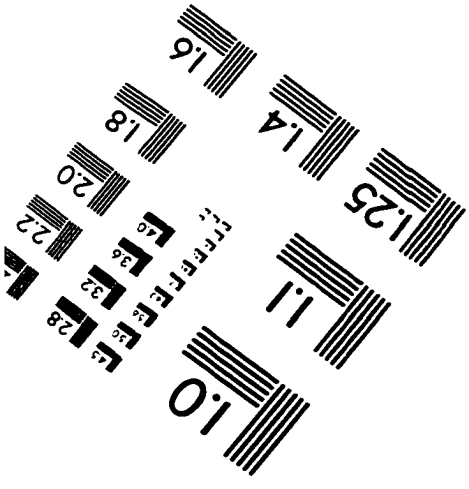
IMAGE EVALUATION
TEST TARGET (QA-3)

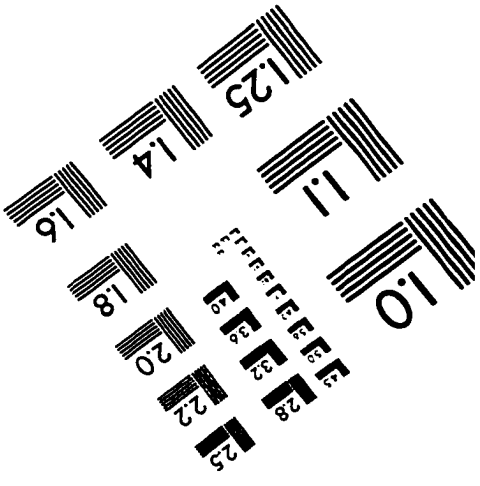












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