

Brazilian Inflation from 1980 to 1993: Causes, Consequences and Dynamics

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Abstract. This article focuses on Brazilian inflation: its causes, consequences and dynamics from 1980 to 1993. We argue that the main economic cause of the Brazilian inflation was the excessive growth of money, in turn caused by too high budget deficits. Oil and exchange rate shocks also played a role, together with the greater dependence of the Central Bank of Brazil on the government. We measure the degree of Central Bank independence by the variable 'turnover' of Central Bank governors defined as the number of months in office. The effect of this variable on inflation is found to be highly significant and positive.

Inflation in Brazil has been very high by the standards of industrialised and even developing countries since the 1960s. It averaged 44.6 per cent per year in the 1960s, 20.9 per cent in 1970-4, 46.5 per cent in 1975-9, 148 per cent in 1980-4 and an astonishing 707.4 per cent in 1985-9. In the first six months of 1994 it hovered on a monthly basis between 38 per cent and 55 per cent totalling 6,100 per cent in the 12 months ending in June. During the 1980s and early 1990s there was no lack of attempts to stabilise inflation. Since 1986 four unsuccessful plans were implemented to try to control inflation (the Cruzado Plan in February 1986, the Bresser Plan in June 1987, the Summer Plan in January 1989 and the Collor Plan in March 1990), but to no avail. The plans had the effect of reducing inflation for a while, but after a time span stretching from a few to six months it always accelerated again. They seem to have increased the variability of inflation and to have led to its overshooting with respect to the path one would have observed without the plans. The plans had in general the tendency to suppress the inflationary phenomenon by means of wage and price freezes and by suspending indexation, rather than attacking its fundamental causes: high budget deficits and their monetary financing. Under such circumstances it is not surprising that, once the wage and price freezes had become unsustainable, suppressed inflation became again manifest in its full force. The variability of inflation was therefore particularly high in the second half of the 1980s and early 1990s. For instance in 1985 inflation was 235 per cent. It dropped to 65 per cent in 1986 (Cruzado Plan of February 1986); to jump again to an all time yearly high of 4,126 per cent in 1987. In 1989, despite the Summer Plan, it reached

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1,783 per cent. In the 12 months ending in June 1994 it was 6,100 per cent (Fig. 1).

On 1st July 1994, with the presidential election scheduled for October, the government launched a new plan, the Plano Real. It introduced a new currency (the *real*), it abolished the previous crawling peg with the US dollar, it fixed maximum limits on the issue of the new currency and this was preceded by some limited measures of fiscal adjustment. The exchange rate of the *real* with the US dollar was initially fixed at 1:1, but it was soon left to float as the foreign exchange market pressures for its appreciation were too strong. In early December 1994, the *real* had appreciated by about 20 per cent with respect to the US dollar. In the last six months of 1994 inflation was brought down to 1.5–2 per cent per month from 40 per cent per month before July 1994. The plan found political support in favour of the low inflation among the part of the population which is less protected against inflation and President Fernando Henrique Cardoso (1995–6), who is the architect of the Plano Real, seems committed to low inflation.

These high inflation rates and especially their high variability raise the question of their effects on the distribution of income and on their overall costs. While inflation in Brazil never reached the peaks of the German hyperinflation of the early 1920s (over 10,000 per cent in the year ending November 1923), we feel that the inflationary deadweight costs must have been enormous and the effects on the distribution of income very perverse – despite the relatively high sophistication of the Brazilian

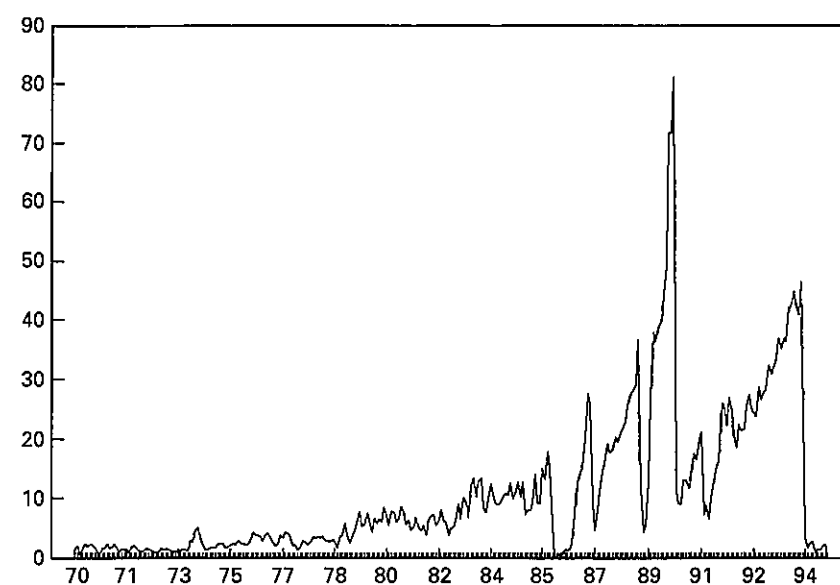


Fig. 1. Brazil: Inflation (Monthly percentage change).

financial system and the very low transaction cost of transferring funds from interest-bearing financial assets (which fully hedge against inflation and often yield a high positive real interest rate) to checking accounts which do not pay interest. Brazil's economic growth, which was very high in the sixties and seventies (6.8 per cent from 1965–73 and 7.9 per cent from 1973–80), slowed down considerably to 3.5 per cent per year on average in the period 1981–6, largely as a result of the external debt problem of the country. However, in the late 1980s and early 1990s, Brazil's dismal performance (average real GDP growth rate of 0.46 per cent from 1987 to 1992) must be related to the very high and variable inflation rates, which brought about deadweight losses and uncertainty. If this assumption is right, the end of hyperinflation will soon imply the return of very high real growth rates for Brazil.

This article focuses on Brazilian inflation, its causes, consequences and dynamics from 1980 to 1993. We argue that the main economic cause of Brazilian inflation was the excessive growth of money, in turn caused by too high budget deficits. Oil and exchange rate shocks also played a role, together with the growing lack of autonomy of the Central Bank of Brazil. We measure the degree of Central Bank independence by the variable 'turnover' of Central Bank governors defined as the inverse of the number of months in office. The effect of this variable on inflation is found to be highly significant and positive. The above view is not incompatible with the hypothesis that the rate of growth of money was maintained high in order to maximise government revenues from inflation. Models of inflationary finance are thus very appropriate to understand the Brazilian propensity to inflate.

The principal conclusion of the present article is that Brazil might gain a lot if it had a fully independent Central Bank and most importantly if it made price stability the sole legal responsibility of the Central Bank. The 1994 Plano Real was a step in the right direction to stabilise inflation; fiscal measures were taken and monetary growth and inflation were reduced considerably, but the monetary constitution has been changed only marginally. However, changing the monetary constitution only gradually and partially in the direction of greater autonomy of the Central Bank may not be the best way to solve the credibility problem of an inflation-prone country like Brazil.

This article is divided into four sections. The first one analyses three structural/institutional aspects of the Brazilian economy which are relevant for inflation, namely: the degree of independence of the Central Bank of Brazil and its changes through time; the size of bank liabilities, government liabilities and financial markets in relation to GDP; and the

degree of openness of the Brazilian economy. The second section tries to explain the persistence of Brazilian inflation and its tendency to accelerate until mid-1994 by analysing who gained and who lost from inflation. In the third section we present a very simple model of inflation in which monetary policy is the main driving force behind inflation (the quantity theory) but supply shocks (oil and agricultural supply), inertial factors and the 'turnover' of Central Bank governors are also important. In turn, money growth is caused by budget deficits, balance of payments surpluses and lagged inflation. The fourth section contains the estimates of two equations of the model: the reaction function of Brazilian monetary authorities and the reduced form equation for inflation. The estimated reaction function supports what Spinelli calls the 'fiscal dominance hypothesis' of inflation;¹ the inflation equation confirms the validity of the quantity theory of money, amended to take into account oil and exchange rate shocks and the increasing lack of credibility of Brazilian monetary authorities, measured by the turnover of Central Bank governors. In addition, there is no evidence that inertia played a significant role in the dynamics of Brazilian inflation, at least for the 1980s. The last section provides our conclusions.

Some structural/institutional characteristics of the Brazilian economy which are relevant for inflation

There are three structural/institutional aspects of the Brazilian economy which are important to explain inflation: (a) the degree of independence of the Central Bank of Brazil and its changes through time; (b) the size of bank liabilities, government liabilities and financial markets in relation to GDP; and (c) the degree of openness of the Brazilian economy. The relevance of point (a) for inflation is evident; point (b) is important as a larger financial market makes the non-monetary financing of large budget deficits easier; finally, the more open an economy, the greater the incentive on the part of exporting and importing firms and of the government to pursue a policy of stable nominal exchange rates. We compare these three structural/institutional aspects of the Brazilian economy with those of Italy because within the group of industrialised countries Italy experienced high inflation in the 1970s and the degree of Central Bank independence underwent dramatic changes after the mid-1970s.

¹ See Franco Spinelli, and Michele Fratianni, *Storia Monetaria d'Italia* (Milan, 1991), and Carlo Favero and Franco Spinelli, 'Deficits, Money Growth and Inflation in Italy: 1865-1990', Working paper no. 279, Queen Mary and Westfield College, University of London, October 1992.

The Monetary Constitution of Brazil: a brief history

In the last two decades, we have witnessed the downfall of the monetary regime established in 1964-7. At that time, Roberto Campos and Octavio Gouvea de Bulhões conducted far-reaching monetary and fiscal reforms. An autonomous Central Bank was set up with powers to conduct monetary policy. Its board of governors could not be fired. To assure a better coordination between the fiscal and monetary policies, a National Monetary Council was also established, presided over by the Finance Minister with the members of the Central Bank having the majority vote.² Therefore, the monetary authority had a strong say on policy affairs at that time. As a matter of fact, the Central Bank's governor voted against many of the Ministry of Finance's measures.

However, soon after Campos and Bulhões left in 1967, the Central Bank governor had a confrontation with the military government and he was removed. In 1971, the Government ordered the Central Bank to finance *automatically* the public deficit.³ There was no more need to make provisions in the public budget to pay interest on debt which was financed either by issuing money or public debt. That left the door open to imprudent fiscal policies. In 1974, the constitution of the Monetary Council was changed to give the Ministry of Finance an overwhelming control over the Central Bank.⁴ Nevertheless, inflationary targets had been successfully achieved until the first oil shock in 1973 because of the lasting effects of the Campos-Bulhões institutional reforms: as the budget deficits were small and the economy was growing, the deficits were easily financed without resorting to excessive monetary expansion.

The expansion of public investment during the 1970s and early 1980s made it extremely difficult to control public expenditure and, as a result, the federal government had to resort to printing money to finance itself. Once there was no monetary authority to impose fiscal discipline, monetary policy followed fiscal policy passively.

During the 1980s, the Central Bank financed the Treasury on a daily basis. As inflation rose, the private sector demand for those financial instruments that allowed only a partial protection from inflationary erosion declined. On the other hand, the increasing public borrowing requirements forced the Central Bank to roll over the public debt daily and finance those financial institutions which lacked reserves to carry over their holdings of public bonds. The Central Bank made repurchase agreements with the financial institutions thanks to which, if a financial

² See Law no. 4,595 of 31 December 1964.

³ See Complementary Law no. 12 of 8 November 1971.

⁴ See Law no. 6,045 of 15 May 1974.

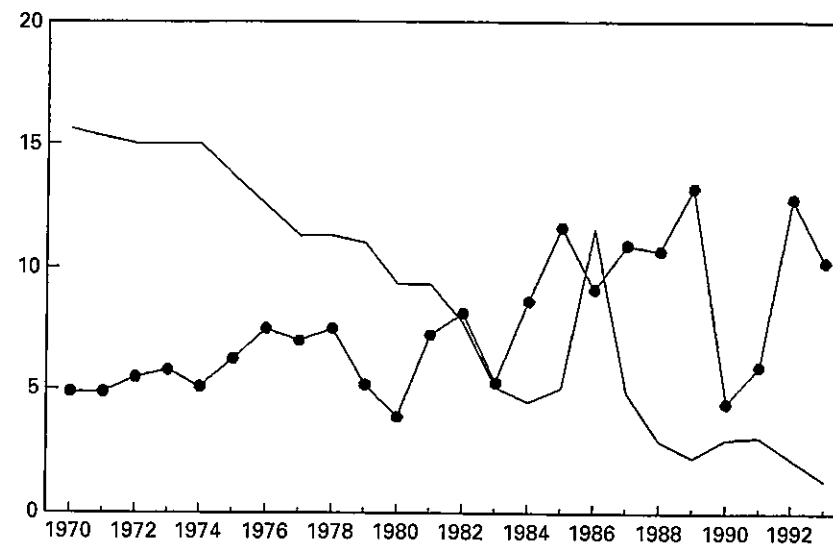


Fig. 2. Brazil: Money and public debt (as percentage of GDP); —, M₁; ●, domestic public debt.

intermediary could not finance its portfolio of treasury bills, the Central Bank automatically bought it back. This mechanism amounted to an instantaneous monetisation of the public debt. Money became completely endogenous.

As financial institutions could transform treasury bills into currency and *vice versa* without any significant risk of capital loss and the administrative costs were low owing to the use of computers, the public debt acquired such a high degree of liquidity that it could be considered money for all practical purposes. In addition, the development of checking deposits backed up by treasury bills paying daily interest and allowing instantaneous convertibility into currency became widespread. The holdings of M₁ fell from 15.6 percentage points of GDP in 1970 to 2.4 percentage points in 1992 and the domestic holdings of public debt increased from 5 to 14 per cent of GDP during the same period (Fig. 2). The holdings of monetary base fell further to 0.8 per cent of GDP in March 1993 and those of M₁ to a mere 1.3 per cent of GDP.⁵

This institutional framework turned out to be very unstable. The situation was aggravated by the confiscation of a fraction of government securities on the part of the government upon the announcement of each stabilisation plan.⁶ These measures brought about distrust in treasury bills and demand shifted towards other assets, forcing the government to

⁵ By way of comparison, in Germany the real stock of monetary base was about 1 per cent of GDP at the peak of hyperinflation in November 1923.

⁶ The actual loss of capital due to changes in indexation rules was estimated in 1991 to be 70 per cent of its real face value since 1980.

finance more of the deficit by money creation and leading to large increases in the risk premium on treasury bills demanded by the public that further aggravated the deficit.

Another institutional feature making monetary control difficult in Brazil is that there are still up to this day *de facto* two central banks: the Central Bank of Brazil, the institution issuing currency and supervising commercial banks since 1965, and the Banco do Brasil, a large government-owned commercial and development bank, which was performing the functions of government agent up to the creation of the Central Bank in 1965. From 1979 to 1986 the Banco do Brasil had unlimited access to the Central Bank's credit, much like the government, through the so-called 'movement account'. In March 1986 the access to the Central Bank's credit on the part of the Banco do Brasil was legally limited to the sum approved by the Secretary of the Treasury, but the issues of currency on behalf of the Banco do Brasil continued on a large scale.⁷ It is not surprising that, under the institutional setting described above, of passive monetary financing of government budget deficits and of development expenditures by the Banco do Brasil and the Central Bank of Brazil, inflation became very high and variable after the mid-1980s.

Finally, the 1994 Plano Real brought about some changes in the Brazilian monetary constitution. After a long preparatory phase that included the introduction of a new index (URV) to coordinate the transition to a new currency, the government finally passed in June 1994 a decree creating a new monetary system which comprises both a reorganisation of the monetary authorities and rules for issuing the new currency.⁸ However, the government opted to maintain too many degrees of freedom for monetary policy and has as a consequence weakened the credibility of the monetary reform. As we argue below, the decree could be amended to strengthen its credibility and the control over the money supply. The main points of the reform are:⁹

(a) the National Congress will establish the limits of currency issue, the National Monetary Council will supervise and the Central Bank will carry out monetary policy;

(b) the National Monetary Council will have the number of its members reduced to three: the Minister of Finance (Head of the Council), the Minister of Planning, and the Governor of the Central Bank;

(c) a Committee of Money and Credit is created to advise the National

⁷ See Francis A. Lees, James M. Botts and Rubens Penha Cysne, *Banking and Financial Deepening in Brazil* (London, 1990).

⁸ *Medida Provisória* no. 542 of 30 June 1994.

⁹ For a more detailed discussion of the monetary reform, see Marcio Ronci, 'In Search of a Monetary Constitution for Brazil', in Carlos Langoni, James Ferrer and Marcio Ronci (eds.), *The Quest for Monetary Stability* (Washington, 1995), chapter 7.

Monetary Council and coordinate monetary and fiscal policies. This Committee will be composed of the Central Bank Governor, the President of the Securities and Exchange Commission, the Secretaries of the Treasury and Economic Policy of the Ministry of Finance and three Deputy Directors of the Central Bank;

(d) the Central Bank will submit at the end of each quarter to the Economic Committee of the Senate the monetary programme for the following quarter with the estimated growth of the monetary aggregates that will assure monetary stability. The Central Bank Governor will also send to the Minister of Finance, the President of the Republic, the Presidents of the Congress and the Senate quarterly reports on the execution of the monetary programme, the issue of reals and economic developments;

(e) the law established the limits for the new currency issues between 1 July 1994 and 31 March 1995. Issues of reals should not surpass R\$7,500 million by 30 September 1994, R\$8,500 million by December 31 1994 and R\$9,500 million by March 31 1995. The National Monetary Council was allowed to adjust these targets by up to 20 per cent;

(f) part of the large stock of international reserves accumulated in the last years by Brazil will be allocated to provide convertibility to the new currency and the exchange rate between the real and the US dollar was to be set at R\$1 per US\$1 for an indefinite time. However, the National Monetary Council can change the parity between the real and the US dollar whenever it finds it appropriate.

Two aspects of the monetary reform of June 1994 merit attention. First, there are a number of actors in charge of monetary policy: the President of the Republic, the Minister of Finance (Head of the Monetary Council), and the Congress. Therefore, the authority in charge of monetary policy is dispersed among agents who may at times have different interests, conflicting with monetary stability. In this respect, Ciampi's remark on the first condition for a stable currency is pertinent: 'the power to create money should be completely independent from the agents determining expenditures'.¹⁰ Secondly, on the rules limiting currency issues, the law does not establish automatic adjustments in monetary targets in case the Central Bank misses them and monetary targets can be changed each quarter. To be effective, targets should be set for a period longer than a fiscal year, otherwise the Congress may be tempted to change them to accommodate fiscal deficit outruns in the course of the year.

¹⁰ Carlo Azeglio Ciampi was Governor of the Bank of Italy from 1979 to 1993. See John B. Goodman, *Monetary Sovereignty: The Politics of Central Banking in Western Europe* (Ithaca and London, 1992), pp. 170, and Franco Spinelli and Michele Fratianni, *Storia Monetaria d'Italia* (Milan, 1991).

Table 1. Turnover of Central Bank Governors

Brazil	Italy
Denio Nogueira (1964-7)	Luigi Einaudi (1945-8)
Ruy Leme (1968)	Donato Menichella (1948-60)
Ernane Galvêas (1968-74)	Guido Carli (1960-75)
Paulo Lira (1975-8)	Paolo Baffi (1975-9)
Carlos Geraldo Langoni (1979-81)	Carlo Azeglio Ciampi (1979-93)
Afonso Celso Pastore (1982-4)	Antonio Fazio (1993-)
Antônio Carlos Lemgruber (March 1985-August 1985)	
Fernão Carlos Bracher (April 1985-February 1987)	
Francisco Roberto Gros (February 1987-April 1987)	
Fernando Milliet de Oliveira (May 1987-March 1988)	
Elmo de Araujo Camões (March 1988-June 1989)	
Wadico Waldir Bucchi (October 1989-March 1990)	
Ibrahim Eris (March 1990-March 1991)	
Francisco Roberto Gros (April 1991-September 1992)	
Gustavo Loyola (October 1992-January 1993)	
Paulo Cesar Ximenes (January 1993-September 1993)	
Pedro Malan (September 1993-January 1995)	
Pérsio Arida (January 1995-March 1995)	
Gustavo Loyola (May 1995-)	

Source: Central Banking Directory, (London, 1993) and Central Bank of Brazil.

The historical evidence presented in this section suggests that the degree of autonomy of the Central Bank is an important factor to explain how the Brazilian propensity to inflate changed through time and why it differed substantially from the Italian one. Using the turnover of Central Bank governors as a proxy for the institutional independence of the central bank, we verify that the situation has deteriorated a great deal (see Table 1): there were 12 governors in Brazil compared to only one governor in Italy during the 1979-93 period. Table 2 compares the monetary constitutions of Brazil and Italy. As explained above, the monetary constitution of Brazil did not change significantly after the monetary reform of 1 July 1994. More important changes occurred in recent years in the Italian monetary constitution under the pressure of the Maastricht Treaty setting the conditions for the participation in the European Monetary Union.

Table 2. *Comparing the Monetary Constitutions of Brazil and Italy*

Brazil	Italy
The Central Bank does not have statutory responsibility to stabilise prices.	The Central Bank does not have statutory responsibility to stabilise prices nor does it announce an inflation objective.
Governor can be dismissed at any time and has a ministerial status.	Governor cannot be dismissed and has a lifetime mandate.
Governor is appointed by the President of the Republic and approved by the Senate.	Governor is proposed by the Bank's Board, approved by the Council of Ministers and nominated by the President of the Republic.
Although the 1988 Constitution prohibits the Central Bank's financing the government, the Bank financed the public deficit on a daily basis. Since 1 July 1994, a ceiling is set by Parliament on the growth of currency.	Staff is well prepared. The Bank has one of the best research departments in Europe. The Bank provides the government with economic advice.
	Apart from the 1960-75 period, the Bank has been dominated by economists who regard control of money and stable prices as important, but not the only functions of the Bank.
	The Bank is not compelled to finance government deficits since the 'divorce' in 1981. It has been free to determine the discount rate since 1992. It has been free within limits to change reserve requirements since 1994. The large overdraft facility of the Treasury at the Bank was abolished in 1994.

However, changes in the monetary constitution seem only gradually to affect the outcome of inflation. In addition, a fully independent central bank is not a necessary (nor sufficient) condition for low inflation, as shown by the fact that inflationary targets had been successfully achieved until 1973, despite the lack of independence of the Central Bank, because budget deficits were small and easily financed without resorting to excessive monetary expansion. After 1973, the wage indexation mechanism and supply shocks have played a role in propagating inflation in Brazil in the absence of a thoroughly independent monetary authority able to resist the monetary financing of budget deficits.

The 1994 Plano Real was a step in the right direction to stabilise the economy. Fiscal measures were taken and monetary growth and inflation were reduced considerably, but the monetary constitution has been changed only marginally. The reform of the monetary constitution to commit the Central Bank to low inflation may facilitate the short-run adjustment and, more importantly, assure monetary stability in the medium- and long-term. However, the independence of the Central Bank of Brazil is still very limited, while the monetary constitution of Italy has recently undergone substantial changes that have strengthened the Central Bank's capability to control inflation. Changing the monetary constitution only gradually and partially in the direction of greater autonomy of the Central Bank, as Italy did, may not be the best way to solve the credibility problem of an inflation-prone country like Brazil. Brazil might gain a lot if it had a fully independent Central Bank and most importantly if it made price stability the sole legal responsibility of the Central Bank.

The depth, breath and resiliency of Brazilian financial markets

Two necessary but not sufficient conditions for the non-monetary financing of large budget deficits are the existence of a large and developed financial market and a government policy that creates rather than destroys confidence. The Brazilian financial market is very small. According to an estimate of the Central Bank of Brazil, the ratio of financial assets to GDP averaged 34.4 per cent of GDP from 1971 to 1979 and 33 per cent from 1980 to 1987.¹¹ No clear trend is discernible until 1989, when the ratio fell sharply, as inflation accelerated from 1,038 per cent in 1988 to 1,783 per cent in 1989. M_1 fell from 4.9 per cent of GDP in 1987 to 1.3 per cent in March 1993 (Table 3); the stock of federal, state and municipal bonds fell from 12.8 per cent of GDP in 1987 to 6.6 per cent in March 1993 despite the very high real interest rates, because the public lost its confidence in the government after President Collor (1990-3) froze in 1990 a large fraction of outstanding government securities and holders had lost about 80 per cent of the real value of their holdings by the time the frozen assets were freed (see penultimate column of Table 3). Furthermore, it is estimated that true GDP in Brazil may be substantially higher than the official measures because of a large hidden economy. The ratios reported in Table 3 may therefore be overestimated.

Table 4 shows that in Italy the size of the financial market is at present at least seven times the Brazilian one in relation to GDP and that it was many times larger than at present in Brazil even during the gold standard period at the end of the last century (about 100 per cent of GDP and four times as large as in Brazil today). In 1991, M_2 amounted still to about 70

¹¹ See Lees et al., *Banking and Financial Deepening in Brazil*, Table 5.4, p. 123.

Table 3. Brazil: Monetary base, money supply and financial assets in relation to GDP¹

End of period	Monetary base	M ₁	Financial investment fund	Federal bonds and bills	State and municipal securities	Special earnings deposits	M ₂	Savings deposits	M ₃	Private securities	M ₄	Financial assets frozen at the Central Bank ²	Financial assets
December 1987	2.4	4.9	—	10.9	1.9	—	17.7	10.5	28.1	4.9	33.0	—	33.0
December 1988	1.5	2.9	—	10.7	1.4	—	13.0	10.8	23.8	4.1	29.9	—	29.9
December 1989	1.1	1.7	—	10.2	2.0	—	13.9	5.4	19.3	2.7	22.0	—	22.0
December 1990	2.1	3.3	—	2.6	1.2	—	7.1	3.1	10.2	3.5	13.7	6.3	20.1
December 1991	1.4	2.4	2.3	1.8	1.1	0.9	8.4	3.6	12.0	3.9	15.9	2.8	18.7
December 1992	1.2	1.9	2.3	4.3	2.3	1.5	12.2	4.4	16.6	7.9	24.5	—	24.5
March 1993	0.8	1.3	2.2	4.4	2.2	1.3	11.5	4.4	15.9	7.6	23.5	—	23.5

Source: Central Bank of Brazil.

Notes: (1) Financial Aggregates: End of period data; (2) Federal Bonds and Bills frozen as a result of the 1990 Collor Plan.

Table 4. Italy: monetary base, money supply and government debt in relation to GDP, 1870-1991

Period	Monetary base (1)	M ₂ (2)	Total public debt (3)	Public debt outside of Central Bank (4)	M ₂ + public debt outside of Central Bank (5)
1870	22.9	28.7	111.6	—	—
1913	15.5	58.1	88.6	—	—
1970	20.0	74.6	34.2	24.1	98.7
1980	16.6	79.1	54.9	41.2	120.3
1991	15.0	69.6	103.4	91.5	161.1

Sources: Spinellin and Fratianni, *Storia Monetaria d'Italia* (Milan, 1991) for the gold standard years; Bank of Italy for the post-war period.

per cent of GDP and M₂ plus government bonds outstanding to 161 per cent of GDP (last column of Table 4). The figures reported in Table 4 exclude private securities, which are instead included in Brazilian M₄.

Brazilian financial markets have excelled in developing sophisticated means to cope with the desire of the public to hold a very low amount of non-interest bearing means of payments (rapid transfer services to move funds from interest yielding bank deposits and treasury bills to chequing accounts, the disproportionate development of cheques even for very small denomination payments, the use of credit cards). The welfare costs of these developments must be very large. In the following section, and in particular Table 7, we discuss the contribution of the disproportionate growth of the Brazilian banking sector to GDP.

As to the second necessary but not sufficient condition, confidence in government securities was badly shaken after the Collor freeze of 1990, as shown by the fall in the public's holdings of government securities despite the high real interest rates that the government was paying on them in the last years. The average maturity of domestically held Brazilian public debt is very short.

The degree of openness of Brazil and the usefulness of an exchange rate anchor

The degree of commercial openness of Brazil has been very low in the post World War II period and the tendency has been to decline through the decades. Imports of goods and services were only 5.5 per cent of GDP in 1991 and exports only 7.2 per cent (Table 5). However, a new policy of commercial opening started in February 1991 which led to a reduction of average tariffs on imports from 40 per cent in 1991 to 14 per cent in the second semester of 1993 and this will undoubtedly lead to an increase in these ratios. By way of comparison, in Italy the share of exports of goods and services, which was about the same as in Brazil in the early 1950s,

Table 5. *The degree of openness of the Brazilian economy and comparisons with Italy*

(Ratio of imports and exports of goods and services to GDP in selected years)

Period	Brazil		Italy	
	Imports	Exports	Imports	Exports
1950	7.6	9.2	9.9	9.0
1960	6.4	5.3	16.8	16.8
1970	7.5	7.0	18.7	18.8
1980	11.2	9.0	27.4	22.8
1990	5.5	7.2	19.7	19.2
1991	6.5	8.5	18.3	18.0

Sources: For Brazil: *Conjuntura Econômica*, Instituto Brasileiro de Economia, Fundação Getúlio Vargas, November 1993, vol. 47, no. 15; For Italy: *International Financial Statistics*, IMF, various issues.

reached 18 per cent in 1990. From 1950 to 1970 it had doubled in connection with the creation of the European Economic Community in 1958.

The higher the degree of commercial integration, the greater is the incentive for nominal exchange rate stability. Because in open economies the transmission from exchange rate depreciation to domestic inflation is very high and fast, governments have an incentive to peg the nominal exchange rate. This explains why the European Monetary System (EMS) was created in 1979 and why Italy had a strong incentive to bind the lira to the Deutsche Mark through the Exchange Rate Mechanism of the EMS. Even though the EMS has not always guaranteed real exchange rate stability, it has provided Italy, France and all higher inflation countries of the EMS with a useful nominal anchor for inflation. It has first made it easier for these countries to enact a restrictive monetary policy and in a second stage it has helped them by importing credibility from the German Bundesbank. There is evidence that this credibility effect started to be felt between 1983 and 1985, depending on the country.¹²

The nominal anchor provided by the EMS was particularly important in the early 1980s when, after about a decade of high inflation and high nominal and real exchange rate instability, it was felt that inflation had to be brought under control. Had Brazil been a more open economy, the incentive to peg the nominal exchange rate to the dollar would have been higher. Instead, apart from a short spell in the early 1980s, when the exchange rate depreciated by about 30 per cent in real terms, the Brazilian

¹² See Giuseppe Tullio and Marcio Ronci, 'Central Bank Autonomy, the Exchange Rate Constraint and Inflation: the case of Italy; 1970-1992', forthcoming, *Open Economies Review*, 1996 and in Paul De Grauwe, Stefano Micossi and Giuseppe Tullio (eds.), *Inflation and Wage Behaviour in the EMS* (Oxford, 1996).

government chose to index the nominal exchange rate to domestic inflation and to keep the real exchange rate more or less constant. Thus, in the absence of an independent central bank strongly committed to keeping inflation low, the Brazilian monetary system was left without a monetary anchor.

The gainers from inflation and the persistence of Brazilian inflation

When in the course of the 1980s inflation moved to higher levels as a result of the monetary financing of budget deficits, gainers from inflation realised how beneficial inflation was for them and as a result had little incentive to lobby for the control of inflation. The gainers were the government and the banking system which earned large inflation tax revenues, and large private corporations which have enjoyed and still enjoy a large degree of monopoly or oligopoly power and do not have to rely heavily on the banking system for loans to finance investment. They are relatively independent from commercial banks because large monopoly profits allow them to rely mainly on self-financing. Small and medium-sized firms were instead penalised by the very high real interest rates which have prevailed most of the time since 1986. For instance, at the end of 1993 real interest rates on interbank loans were about 30 per cent per year and those on bank loans probably higher. Thus, while the Brazilian industry, agriculture and service sectors are already heavily concentrated, one of the side effects of inflation may have been to increase the degree of concentration even more. Public corporations, being less efficient, rely less than large private ones on self-financing. However, their losses are covered either by the government budget or increasing indebtedness.

The losers are the poorer part of the population who do not have access to the banking system (over 50 per cent of the population) and have to rely on currency to make all the payments, and non-unionised workers who do not have formal wage indexation. The medium and large income groups use instead credit cards and cheques and keep demand deposits at a trivial level by using telephone or automatic transfer services from high interest yielding deposits to demand deposits.¹³

The gainers from inflation mentioned above may have contributed to the persistence of inflation in Brazil. In this connection, it is worth mentioning that strong labour unions are mainly interested in defending

¹³ It was estimated in 1989 that Brazil cleared about 7 billion cheques, 95 per cent of which were cleared in 24 hours. By comparison American Express processed on a world wide basis 28 million items a month, about the same number of cheques cleared in Brazil in a single day. During the high inflation period it was not unusual in Brazil to write cheques for less than the equivalent of two US dollars. See Lees et al., *Banking and Financial Deepening in Brazil*, p. 134.

Table 6. Brazil: Inflation tax revenues as a percentage of GDP

(Arithmetic averages)

Period	Annual inflation	Government	Commercial banks	Total
1947-50	8.9	1.2	0.7	1.9
1951-60	20.9	2.0	1.5	3.5
1961-70	43.5	3.0	2.2	5.2
1971-80	42.8	1.8	2.0	3.8
1981-85	172.9	2.1	2.5	4.6
1986	65.0	1.3	1.9	3.2
1987	415.8	3.3	3.4	6.7
1988	1037.6	3.5	3.1	6.6
1989	1782.9	4.4	2.4	6.7
1990	1476.6	3.4	1.9	5.3
1991	480.2	3.1	2.1	5.2
1992	1157.9	2.7	1.9	4.6

Sources: Francis A. Lees, James M. Botts and Rubens Penha Cysne, *Banking and Financial Deepening in Brazil* (London, 1990), table 2.6, pp. 38-39; and Cysne Rubens Penha, 'Imposto Inflacionário e Transferências Inflacionárias no Brasil', EPGE Ensaio Econômico, Fundação Getúlio Vargas, Rio de Janeiro, August 1993.

the income of the workers in the São Paulo region who already enjoy the highest wages in Brazil. They are as a consequence strong supporters of wage indexation rather than strong opponents of high inflation.

In what follows, we present data on government and commercial bank revenues from inflation (the inflation tax paid by the currency and deposit holders), and we develop our point that large private enterprises holding dominant positions in their markets have increased their profits.

Inflation tax revenues of the government and commercial banks

Table 6 reports data on inflation tax revenues of government and of commercial banks as a percentage of GDP. Total inflation tax revenues peaked in 1963 at 9 per cent of GDP of which 5.4 per cent accrued to the government and 3.6 per cent to commercial banks. For the period 1961-70 they amounted to 5.2 per cent per year on average of which 3 per cent accrued to the government. Despite the sharp drop in the base of the tax (the monetary base for the government and the stock of chequing deposits for commercial banks (see Figure 2 and Table 3), inflation tax revenues were higher on average in the 1986-92 period than before. After the peak collection of 6.6-6.7 per cent per year of GDP in the 1987-9 period, tax revenues fell to 4.6 per cent of GDP in 1992. It is not clear whether in 1992 the elasticity of inflation tax revenues to the tax (inflation) had become negative (i.e. whether the downward sloping section of the Laffer curve had been reached yet). However, it was clear already in

Table 7. Contribution of financial institutions to GDP

Period	Contribution to GDP (in per cent)
1970	5.4
1975	6.3
1980	7.9
1985	11.9
1990	11.1

Source: Brazilian National Accounts, IBGE.

1992-3 that the base of the inflation tax had become so low that the game of squeezing money users had reached its limits and that the welfare costs and the costs in terms of misallocations of resources and lost GDP were becoming too high. The monetary stabilisation was therefore very much needed.

It seems to us that the models of maximisation of inflation tax revenues explain some of the features of the high Brazilian inflation of the post-war period. This does not imply that the government aimed at high inflation policies deliberately. In fact, once inflation increases, the government realises the advantage of inflation and its interest in pursuing anti-inflationary policies diminishes. The government accepts inflation *ex-post*, it does not decide the level of inflation *ex-ante*. Models of inflationary finance are thus appropriate to understand the Brazilian propensity to inflate.

In general the inflation tax revenues of the government have been slightly higher than those of commercial banks. However, the revenues from the inflation tax accruing to commercial banks may underestimate the contribution of inflation to their profits, if they manage to increase the interest rate wedge between assets and liabilities when inflation goes up. Share prices of commercial banks in real terms have in fact been found to be positively related to inflation in Brazil.¹⁴ Although we do not have aggregate data on bank profits, there is some indirect evidence: the sectoral contribution of financial institutions to GDP increased from about 5 per cent in 1970 to about 11 per cent in 1990 (Table 7). Between 1990 and 1994, the number of banks and branches increased by 6.5 per cent and 8 per cent, respectively.¹⁵

¹⁴ See Novaes Walter Filho, 'Inflação e Preço de Ação de Bancos Comerciais', *Disertação de Mestrado*, Pontifícia Universidade Católica, Rio de Janeiro, July 1988.

¹⁵ See *Conjuntura Econômica*, October 1993, p. 3.

The Brazilian industrial structure by size of firms and the dependency on bank loans of small and medium-sized enterprises

Real interest rates were hovering around one per cent per month on average in 1987 and 1988 (Table 8). On an annual basis these real interest rates were extremely high at about 13 per cent. After 1988, except in the year 1990 when they were distorted by the Collor Plan and the freezing of treasury bills, they averaged 2 per cent per month or about 28 per cent on an annual basis. Monetary policy became quite expansionary in the first nine months of 1993 and as a result inflation accelerated from about 25 per cent in the second semester of 1992 to 37 per cent in September 1993 and the economy recorded a high rate of growth. In the fourth quarter of 1993 and in most of the first half of 1994 monetary policy became again restrictive as real interest rates returned to very high levels. According to some measures they were above three per cent on a monthly basis on average in the first quarter of 1994 and above 6 per cent in April–May 1994. The behaviour of the Central Bank in the course of 1993 shows that it reacted to the acceleration of inflation by raising real interest rates and by slowing down the rate of growth of money, as if it had as a target a given monthly inflation rate, which may change through time depending on the optimal rate of inflation needed to achieve maximum inflation tax revenues. We shall see in the next section that the Central Bank has been quite consistent in the 1980s and early 1990s in the way it reacted with a two-quarter lag to changes in inflation in the manner described above.

Real interest rates of the order of 28 per cent per year maintained for several years (except for short spells) must be very damaging for existing firms that have to borrow heavily to finance investment and working capital and for potential new entrants in any branch of activity – be it agriculture, industry or services. Since Brazilian economic sectors are very concentrated and large private corporations need to rely relatively less on bank loans and external borrowing than small and medium-sized firms, the policy of high real interest rates may have increased the degree of concentration of Brazilian industry or at least prevented its reduction. This is especially true for the 1989–July 1994 period, but it remains in part true also for the post-stabilisation period, as real interest rates have remained at very high levels. State enterprises, which are all large, do rely heavily on bank loans and their losses are more likely to be covered by the government budget. Therefore, the high real interest rate policy will not affect state enterprises' chances of survival to the same extent as it will affect the private firms' chances. Foreign multinationals, to the extent that they need external financing, can rely on borrowing in foreign currencies or capital injections from their parent companies.

Table 8. Brazil: Real Interest Rates on banks' certificates of deposits (CDB)

(Arithmetic averages of monthly data)

Year/quarter	Nominal rates	Inflation (IPC)	Real rates ¹	Monthly average for the year
1986				1.4
3	2.6	1.5	1.1	
4	5.9	4.2	1.6	
1987				1.1
1	16.5	15.1	1.2	
2	25.4	23.4	1.6	
3	5.0	5.0	0.8	
4	13.1	12.1	0.9	
1988				0.9
1	17.9	16.8	0.9	
2	19.7	18.9	0.7	
3	24.0	22.9	0.9	
4	29.0	27.7	1.0	
1989				2.1
1	18.9	24.0	-4.1	
2	18.2	14.0	3.7	
3	35.2	31.4	2.9	
4	52.5	44.1	5.8	
1990				-2.5
1	56.4	71.1	-8.6	
2	10.2	20.7	-8.7	
3	14.5	12.6	1.7	
4	22.5	16.1	5.5	
1991				2.1
1	15.3	16.1	-0.7	
2	11.6	8.4	3.0	
3	16.7	14.8	1.7	
4	29.9	24.6	4.3	
1992				2.1
1	27.9	24.1	3.1	
2	22.9	20.8	1.7	
3	27.0	24.9	1.7	
4	26.8	24.3	2.0	
1993				0.1
1	27.5	27.7	-0.2	
2	31.3	30.4	0.7	
3	34.0	34.2	-0.2	

Sources: Central Bank of Brazil, *Programa Econômico*, various issues. The interest rates and the rate of inflation are on a monthly basis. For October 1993 real rate: *Jornal do Brasil*, (Rio de Janeiro, Nov. 19, 1993).

Note: (1) Calculated as $r = [(1+i)/(1+\pi)] - 1$ where r = real rate, i = nominal rate and π the rate of inflation measured by the consumer price index (IPC) until the third quarter of 1990 and by the general price index (IGP) afterwards.

Table 9. *Self-financing and external borrowing of Brazilian firms: 1978-84*¹
(Annual averages)

	Self-financing as per cent of total sources of funds	Borrowing from third parties ² as per cent of total sources of funds
Foreign controlled firms (84)	80.7	2.0
Private national firms (799)	65.6	7.2
State enterprises (117)	41.4	22.3

Source: Francis A. Lees, James M. Botts and Rubens Penha Cysne, *Banking and Financial Deepening in Brazil* (London, 1990), table 11.7, pp. 330-331.

Notes: (1) Number of firms in parentheses; (2) Excluding share issues.

Unfortunately, reliable data on self-financing and bank financing of Brazilian enterprises by size of firms do not exist. Taking the sample of the 100 largest private Brazilian corporations, in 1992 external debt amounted to 37 per cent of sales for the first 10 and 42 per cent for the 10 ranking from the 91st to the 100th position.¹⁶ However, this difference of five percentage points may be too small to be significant and the 91st to the 100th firm still too large to represent the universe of the small and medium-sized firms.

As an additional piece of incomplete evidence we report in Table 9 the self-financing and the borrowing from third parties of three groups of firms as a percentage of total sources of funds (internal and external, including share issues): foreign-controlled, private national and state-controlled firms. The period is 1978-84. For the sample of foreign-controlled firms, which contains data on 84 of them, one can assume that the average firm size is larger than for the 799 firms in the sample of private national firms in the 1978-84 period. The degree of self-financing was on average significantly smaller for the group of private national firms (66 per cent) than for the group of foreign-controlled firms (81 per cent). In addition, the borrowing from third parties (bank loans and issues of bonds) was almost four times as large for the sample of private national firms. State enterprises rely much less on self-financing (41 per cent) and borrow much more than the other two groups of firms. However, very high real interest rates affect them less than private firms since they have a less binding budget constraint.

The overall costs of the Brazilian inflation are difficult to quantify. The inflationary deadweight losses are related to diverting economic resources from the productive sector to the overgrown financial and government

¹⁶ Authors' calculation based on data published by *Gazeta Mercantil: Balanço Anual*, year 17, no. 17 (São Paulo, October 1993).

sectors, causing a less efficient economy; reducing the signalling function of the price system, generating a less efficient organisation of production; raising accounting costs; and fostering industrial concentration with a possible negative effect on competition. The fall in the investment rate (Fig. 3) and the virtual halt in the growth of GDP per capita (Fig. 4) during

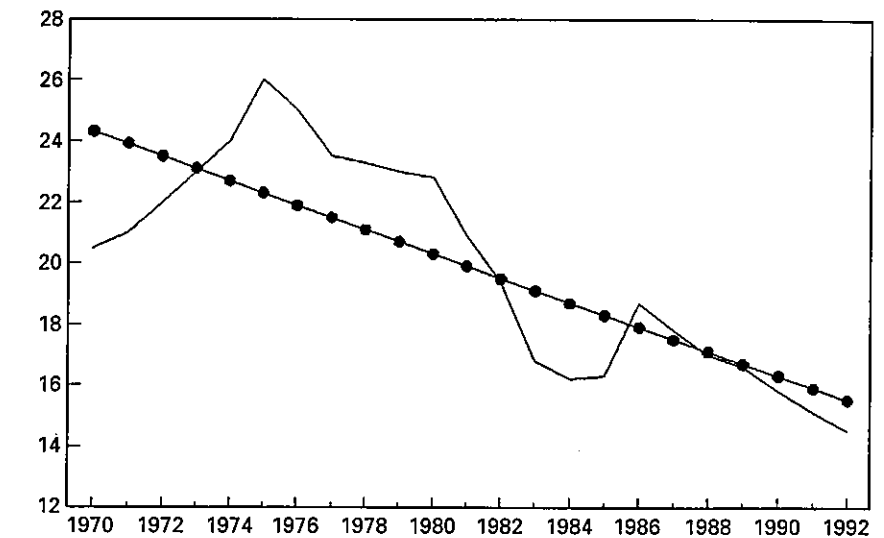


Fig. 3. Brazil: Gross fixed capital formation (As percentage of GDP); —, gross fixed capital; ●, Trend.

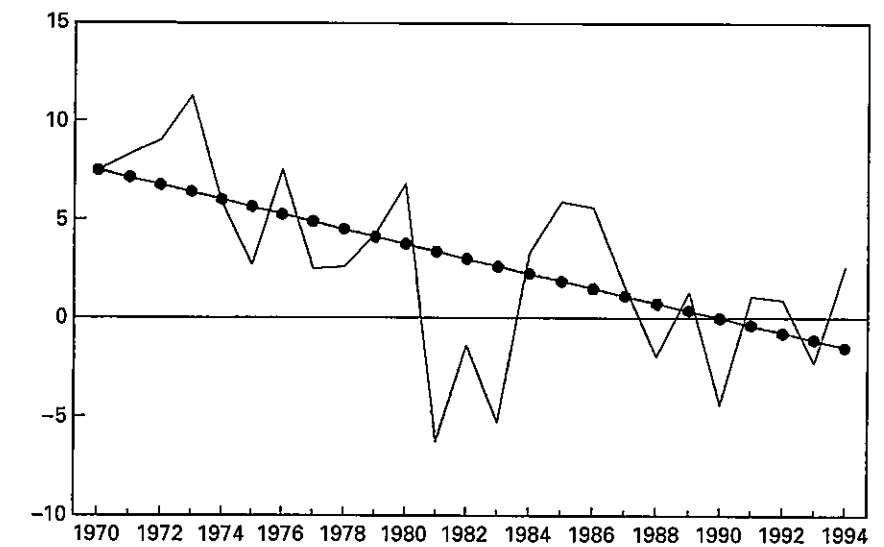


Fig. 4. Brazil: GDP per capita growth (Annual percentage change); —, GDP per capita; ●, Trend.

1983-93 must have been related to the uncertainty caused by the high and variable inflation rates. One is left with the impression that this inflation must have enormous costs for society as a whole and that a serious stabilisation programme should create the conditions for a very large once-and-for all jump in real GDP and higher growth thereafter. In the next section we present a two equation model of the Brazilian inflation, which we have tested using quarterly data for the 1980s and early 1990s.

A model of the Central Bank's reaction function and inflation

The money supply is not assumed to be exogenous. The Central Bank is assumed to react with a lag to the government budget deficit, past inflation, the development of external accounts (either the balance of payments or the current account) and the business cycle. Thus the reaction function of the Central Bank is given by:

$$Dm_t = c_0 + c_1 g_t + c_2 Dp_t + c_3 bopy_t + c_4 b_t, \quad (1)$$

where: Dm is the first difference of the logarithm of the stock of money, g is the nominal government budget deficit divided by GDP, Dp is the first difference of the logarithm of the price level, $bopy$ is the balance of payments or current account divided by GDP, and b is the output gap, measured as the percentage deviation from potential output.

The coefficient c_1 is assumed to be positive since the Central Bank monetises part of the budget deficit. Its size and significance will provide a test for the 'fiscal dominance' hypothesis of money growth. The idea behind introducing the external accounts into the reaction function is that when they are in surplus the Central Bank feels more relaxed about reducing interest rates and expanding money or more simply that it behaves passively by the 'rules of the game' and does not sterilise completely international reserve flows; c_3 is therefore assumed to be positive. As to the reaction to inflation and the business cycle the Central Bank can either behave in an accommodating way ($c_2, c_4 > 0$) or in a stabilising way ($c_2, c_4 < 0$).

We assume that inflation is determined by costs of production as well as aggregate demand, in particular monetary policy. For Brazil it has been shown that wage dynamics, indexation rules, oil and/or agricultural supply shocks and exchange rate shocks play an important role. In addition, monetary policy and velocity changes may be crucial in phases of high inflation as suggested by the quantity theory.¹⁷

¹⁷ For an interesting econometric study of Brazilian inflation, see Fernando de Holanda Barbosa and Paul McNelis, 'Indexation and inflationary inertia', *The World Bank Economic Review*, vol. 3, no. 3 (1990), pp. 339-57.

Equation (2) says that inflation is determined by the rate of growth of nominal wages corrected for productivity growth, the rate of change of the price of oil expressed in domestic currency, and supply shocks:

$$Dp_t = a_1 Dw_t + a_2(Dp^*oil_t + Ds_t) + u_t, \quad (2)$$

where: D is the first difference operator, p is the logarithm of the price level measured by the consumer price index, w is the logarithm of the nominal wage, p^*oil is the logarithm of the price of oil in US dollars, s is the logarithm of the exchange rate of the domestic currency with the US\$, and u represents other cost shocks like agricultural price, tax, cost of capital shocks and foreign inflation.

The Phillips curve is given by:

$$Dw_t = \sum_{i=1}^n a_{0,i} Dp_{t-i} + a_1 b_t, \quad (3)$$

where: b is the output gap, measured as the percentage deviation from potential output. We omit productivity of labour in the mark-up equation (2) and in the Phillips curve (3) because in the high inflation conditions of Brazil its variability is very low compared to the variability of monetary variables and also because of data problems. Philip Cagan omitted real GDP for the same reasons in his pioneering econometric study on money demand during hyperinflation.¹⁸ He turned out to be right, at least for the German hyperinflation of 1919-23, as shown by Tullio.¹⁹ The demand side of the economy is assumed to be influenced by the rate of growth of money, adjusted for changes in real GDP ('quantity theory of money'). One can, therefore, add the rate of growth of nominal money and of real GDP among the variables which influence inflation. Substituting (3) into (2) and taking into account the above mentioned variables influencing inflation from the demand side, one obtains the final equation for inflation:

$$Dp_t = b_0 + b_1 Dm_t - b_2 Dy_t + \sum_{i=1}^n b_{3,i} Dp_{t-i} + b_4 b_t + b_5 Dp^*oil_t + b_6 u_t + b_7 e_t, \quad (4)$$

where: m is the logarithm of the stock of money, e is the demand shock, y is the logarithm of real GDP, and where a constant term b_0 has been added and p^*oil is expressed in domestic currency ($p^*oil + s$).

¹⁸ See Philip Cagan, 'The monetary dynamics of hyperinflation', in Milton Friedman (ed.), *Studies in Quantity Theory of Money* (Chicago, 1956), pp. 25-117.

¹⁹ See Giuseppe Tullio, 'Inflation and Currency Depreciation in Germany 1920-23: a dynamic model of prices and the exchange rate', *Journal of Money, Credit and Banking*, May 1995, pp. 350-62.

All coefficients b_0 – b_7 are expected to be positive and most explanatory variables are expected to influence inflation with lags which we introduced explicitly in equations (2)–(4) only for inflation to simplify the notation. The significance of the coefficients of lagged inflation in equation (3) will provide an indirect test of the so-called ‘inertial hypothesis’ of inflation. The restriction $b_1 = 1$ will provide a test for the ‘quantity theory of money’ hypothesis. In the following section, we present estimates of the reaction function (1) and estimates of the inflation equation (4).

Empirical estimates of the reaction function and the inflation equation

The Central Bank's reaction function

The main hypothesis we want to test in this section is that monetary policy (and hence inflation) is dominated by fiscal policy (fiscal dominance model). In order to test this hypothesis we estimated a general version of the monetary authority reaction function (equation (1) of the previous section) with four lags for each variable and then simplified it using *F*-tests according to Hendry's method.^{20, 21} To avoid spurious regressions, we carried out also Dickey–Fuller tests for the existence of unit roots which showed that the variables of the reaction function were stationary. The sample period (in quarters) is 1981.3 or 1983.1 to 1993.1, depending on data availability. The endogenous variables used are alternatively the rate of change of the nominal monetary base (Dm_0), of M_1 (Dm_1) and of an extended monetary aggregate including securities issued by the federal, state and local governments, saving deposits and private securities (Dm_4). All the explanatory variables have been already defined in Section 4, except for *res2y* which is the ratio of the stock of convertible currencies of the Central Bank to GDP and is used instead of *bopy* in regressions (2), (3) and (4), and Q_1 , Q_2 and Q_3 which are seasonal dummies.²²

In Table 10, we present ordinary least square (OLS) estimates of equation (1). Regressions (1) and (2) are very satisfactory and well behaved.²³ The LM test indicates the absence of autocorrelation of the

²⁰ For an explanation of Hendry's method, see A. Banerjee, J. Dolado, John Galbraith and David Hendry, *Co-integration, error correction, and the econometric analysis of non-stationary data* (Oxford, 1993).

²¹ For previous estimates of a reaction function for Brazil, see Roberto Marcos da Silva Montesano, *Controle Monetário em Economia Aberta: O Caso Brasileiro no Período 1974–1982* (Rio de Janeiro, 1989).

²² We also performed Granger causality tests between the budget deficit, money growth and inflation. In general, we found that the deficit causes money growth and inflation.

²³ We also estimated equation (1) using instrumental variables to take into account the fact that some explanatory variables may have been endogenous. In particular, the nominal budget deficit may be endogenous because the interest payments on public debt are indexed to the past inflation and tax revenues depends on the business cycle.

Table 10. Brazil: Reaction function of monetary authorities

Number of regression... Definition of money ...	(Quarterly data: 1981.3 or 1983.1 to 1993.1)			
	(1) Dm_0	(2) Dm_0	(3) Dm_1	(4) Dm_4
Constant term				
$g(-1)$	0.19 (3.07)	0.09 (1.13)	0.08 (0.98)	0.16 (2.39)
$g(-2)$	0.70 (2.90)	0.83 (3.41)	0.85 (3.32)	1.22 (5.90)
$Dp(-2)$	1.52 (4.87)	1.44 (4.47)	1.27 (3.73)	-0.33 (-1.19)
<i>bopy</i>	-0.49 (-3.46)	-0.50 (-3.27)	-0.39 (-2.42)	-0.003 (-0.02)
<i>res2y</i>	1.03 (1.70)			
Q_1		0.81 (1.60)	0.69 (1.30)	0.87 (2.04)
Q_2		-0.33 (-5.11)	-0.31 (-3.92)	-0.10 (-1.50)
Q_3		-0.36 (-5.27)	-0.32 (-3.82)	-0.15 (-2.29)
Q_4		-0.26 (-3.69)	-0.24 (-2.82)	-0.01 (-0.18)
R^2	0.81	0.80	0.77	0.69
R^2 adjusted	0.77	0.76	0.73	0.62
S.E. of regression	0.16	0.17	0.18	0.14
D.W.	1.87	1.87	1.91	1.28
F. statistics	24.04	19.15	16.22	10.34
Number of observations	47	41	41	41
Period	81.3–93.1	83.1–93.1	83.1–93.1	83.1–93.1

Note: *t* – statistics are indicated in parentheses.

residuals, they are also normally distributed (Jarque-Bera test) and are not heteroskedastic (Arch-test). Chow forecast tests which break the sample in 89.4, 90.1 and 90.4 indicate stability of the estimated relationship. So does the Cusum test.²⁴

When Dm_1 or Dm_4 are used as dependent variables the results are less satisfactory (regressions (3) and (4)). This is especially the case for Dm_4 in regression (4) for which the residuals are autocorrelated and not normally distributed. From now on we shall therefore use mainly the monetary base as the relevant monetary aggregate for Brazil.

The coefficients of regression (1) imply that a 1 per cent increase in the ratio of the deficit to GDP leads within three quarters to an increase in the annualised growth of M_0 of 9.2 percentage points; they also imply that an increase in the balance of payments surplus leads to a relaxation of domestic monetary conditions. Finally, the negative and very significant coefficient of $Dp(-2)$ suggests that Brazilian monetary authorities have had during the sample period a policy of stabilising inflation by increasing interest rates and restricting credit conditions when inflation was increasing too much and relaxing credit conditions when it was dropping below certain levels. One such episode of inflation moving above a desired level and the monetary authorities restricting credit occurred in the fourth quarter of 1993 and was described in the above section (see also Table 8). This is not incompatible with a model of maximisation of the inflation tax revenue.

Reaction functions are in general quite unstable, as in most countries monetary and fiscal authorities change objectives or the weight of objectives frequently. However, monetary reaction functions for Dm_0 presented above for Brazil do not support this view. Despite the high and variable inflation rates, we manage to explain well the growth in monetary aggregates as a function of three objectives: (a) the financing of the government deficit; (b) a domestic inflation target; and (c) an external (balance of payments or international reserves) objective. In this respect,

In general, the instrumental variable estimates were very like the ordinary square estimates presented in Table 10. We decided to present only the ordinary least square (OLS) estimates because, although they yield biased and inconsistent estimators, Monte Carlo studies show that OLS estimates have relatively small variances compared with other estimation methods and in a small sample (which is the case) their smaller variances may more than offset their greater bias, so that they have smaller mean squared errors. See Ronald J. Wonnacott and Thomas M. Wonnacott, *Econometrics* (New York, 1970), p. 399.

²⁴ The results of these tests are not reported here, to save space. We did not perform recursive parameter estimates, because the number of observations was not large enough. We also performed Granger causality tests between the deficit, money growth and inflation. In general we found that the deficit causes money growth and inflation.

Table 11. Brazil: Estimates of the inflation equation
(Quarterly data; 1980.3-1993.1)

Number of regression... Definition of money...	(6) M_0	(7) M_0	(8) M_1
Constant term	0.09 (2.07)	0.10 (2.14)	0.11 (2.69)
Dm	0.40 (3.69)	0.44 (3.91)	0.54 (6.32)
$Dm(-1)$	0.28 (2.59)	0.17 (1.59)	0.18 (1.63)
$Dm(-2)$	—	—	-0.13 (-1.68)
$Drpoi(-1)$	0.30 (1.79)	0.36 (2.27)	0.28 (2.06)
Turnover	1.28 (3.65)	1.22 (3.08)	1.22 (3.60)
$h(-1)$	—	0.004 (0.70)	0.003 (0.65)
$Dp(-1)$	-0.001 (-0.006)	-0.005 (-0.03)	-0.003 (-0.02)
D_{86}	-0.32 (-2.31)	—	—
D_{90}	-0.31 (-2.72)	—	—
$D_{86.2}$	—	-0.48 (-2.67)	-0.47 (-3.04)
R^2	0.73	0.70	0.78
R^2 adjusted	0.69	0.65	0.75
s.e. of regression	0.16	0.17	0.15
D.W.	1.85	1.82	1.78
F. statistics	16.93	14.07	19.60
Number of observations	51	51	51

Note: t -statistics are indicated in parentheses.

the reaction function estimated for Brazil is surprisingly similar to the one estimated by the authors for Italy for the period 1970-92.²⁵

The inflation equation, 1980.3-1993.1

In Table 11, we present OLS estimates of equation (4), using quarterly data from 1980.3 to 1993.1.²⁶ We experimented both with the error correction and partial adjustment models, but the more simple equations shown in the table were much more satisfactory. To the explanatory variables given in equation (4) we added the variable 'turnover' of Central Bank governors defined as the inverse of the number of months in office of each Central Bank governor, obtained from Table 1. This variable is assumed to be negatively related to the credibility of the Central Bank and the government and hence positively related to inflation. Cukierman et al. found that within the less developed countries (LDCs) there is no relation

²⁵ For a similar reaction function estimated for Italy from 1970 to 1992, see G. Tullio and M. Ronci, 'Central Bank Autonomy, the Exchange Rate Constraint and Inflation: the case of Italy; 1970-1992'.

²⁶ We also estimated equation (4) using instrumental variables to take into account that some explanatory variables were endogenous. In general, the results were the same as the ordinary least square (OLS) estimates presented in Table 11. We decided to present only the OLS estimates for the same reasons as explained in note 23.

between inflation and legal independence; however, there is a strong positive association between inflation and Central Bank governors' turnover.²⁷ All variables except 'turnover' were lagged up to four quarters, before simplifying the regression using Hendry's method. We included seasonal dummies which turned out not to be significantly different from zero and were dropped. We also carried out Dickey-Fuller tests for the existence of unit roots which showed that the first differences were stationary to avoid spurious regressions.

As the change in nominal price of oil expressed in domestic currency is too highly correlated with domestic inflation because the Brazilian currency followed a crawling-peg for most of the sample period, we used instead as a proxy for oil-price shocks Dr_{poil} , which is the rate of change of the real price of oil in domestic currency. D_{86} and D_{90} are two dummy variables reflecting once and for all shifts in the demand for money due to the wage and price freeze and improved inflationary expectations after the implementation of the Cruzado and Collor plans. The first one assumes a value of one in the second and third quarter of 1986 and zero otherwise and the second one the value of one in the second, third and fourth quarter of 1990. The rate of change of the real price of agricultural products was also included in the regression as a proxy for domestic agricultural supply shocks, but it never had a significant coefficient. Also the rate of change of the ratio of government expenditures to GDP was included as a proxy for tax-supply shocks, but with no success. The business cycle, the changes in real GDP, and lagged inflation always had insignificant coefficients and were therefore removed from the regressions. The insignificance of business cycle and real GDP coefficients may be explained by the fact that their variability was very low compared to the variability of monetary variables in the high inflation conditions of Brazil.

According to our estimates, the most important variables affecting Brazilian inflation are current and lagged money growth, oil shocks and the 'turnover' variable. The fact that lagged inflation never turned out to have a positive and significant coefficient deserves some explanation. In Brazil the theory that inflation had a strong inertial component has been very popular. In particular de Holanda Barbosa and McNelis (1990) show in a very interesting study that the degree of inertia changed through time with the legal changes relating to wage indexation clauses: the degree of inertia increased as indexation lags became shorter.²⁸ We were unable to

²⁷ See A. Cukierman, S. B. Webb and B. Neyapti, 'Measuring the independence of central banks and its effect on policy outcomes', *World Bank Economic Review*, vol. 6 (1992), pp. 353-98.

²⁸ The lags changed from annual to monthly in the last 30 years. See Holanda Barbosa and McNelis, 'Indexation and Inflationary inertia'.

find significant effects of lagged inflation, suggesting that the inertial theory has no empirical foundation, at least for the 1980s. However, Holanda Barbosa and McNelis's study covers the period 1963.1-1985.1, while ours the period 1980.3-1993.1. In addition, they use real money as an explanatory variable rather than nominal money as we do; thus, their results may be biased against the quantity theory and in favour of the inertial hypothesis.

There is evidence in favour of the 'quantity theory'. The null hypothesis that the sum of the coefficients of Dm_0 is equal to one in regressions (6)-(8) cannot be rejected at the five per cent significance level. It is, however, rejected at the one per cent level of significance (Wald-test). The explanatory power of the regressions is higher when M_1 is used as independent variable (regression (8)). The residuals of all three equations satisfy the standard tests for autocorrelation, normality and homoskedasticity. In addition the Cusum test indicates that the estimates of the inflation equation are stable. Chow forecast tests performed for equations (7) and (8), by breaking the sample period in 1990.4, confirm the hypothesis of no structural break after that date.

The estimates presented in Table 11 suggest that money is by far the main determinant of Brazilian inflation and that the lags are very short, as one would expect in such a high inflationary environment. The 'turnover' variable turns out to be very significant, confirming our analysis of the Brazilian monetary constitution and suggesting that Central Bank independence and the stability of governors do matter and influence in an important way expectations of inflation and inflation itself.²⁹ This result is in agreement with Cukierman et al.'s findings for LDCs. One could argue that current monetary growth may be caused by current inflation and that therefore the coefficients of Dm in the inflation equation are biased upwards. However, the estimates of the reaction function presented in Table 10 show that monetary growth in Brazil is explained very well by a few variables other than inflation and that, if anything, inflation influences monetary growth negatively with a two-quarter lag. In addition, Table 11 shows that when lagged money and lagged inflation appear together in the inflation equation, the significance of the coefficient of lagged inflation falls to zero, while the coefficient of lagged money remains significant, suggesting that the dynamics of monetary growth is of paramount importance for inflation.

²⁹ One may argue that high inflation could bring about a high 'turnover' of central bank governors. We carried out Granger-causality tests which showed that 'turnover' caused inflation and inflation did not cause 'turnover'.

Conclusions

The quantity theory of money (amended for supply shocks) explains very well Brazilian inflation in the 1980s and early 1990s, although we could not find support for the inertial hypothesis of inflation, at least for the 1980s. The degree of Central Bank independence, measured by the high significance of the variable 'turnover' of Central Bank governors, was an important factor in explaining Brazilian inflation.

Models of inflationary finance are appropriate to explain the persistence of inflation in Brazil until 1994. The attempt to keep the inflation tax revenues high in relation to GDP caused an acceleration of inflation, as the inflation tax base was vanishing. In Brazil money growth is strongly influenced by fiscal deficits throughout the period in the presence of a Central Bank which is highly dependent on the government (the fiscal dominance hypothesis). Despite the very high and variable inflation the estimated reaction functions are well behaved and stable.

There is a strong presumption that the costs of the inflationary policy have been very high for the country. We see no other reason for the negative growth of real GDP *per capita* in the eight years from 1986 to 1993 than the deadweight losses caused by the virtual disappearance of money and the uncertainty created by inflation. The accumulated costs may have amounted to 15–20 per cent of GDP and possibly more.

The efficiency of the Brazilian banking system in the automatic transfer of funds between various accounts and in processing an enormous amount of small denomination checks had probably a perverse effect, in the sense that it may have retarded stabilisation by reducing the welfare losses of inflation for a given stock of real M_1 .

Besides the lack of Central Bank independence and of government and Central Bank credibility, there are other two structural weaknesses which make the non-monetary financing of budget deficits difficult in Brazil: the thinness of Brazilian financial markets and the very small degree of openness of the economy. The latter makes the stability of the nominal exchange rate less important compared to what happens in very open economies.

As inflation in Brazil accelerated in the 1980s, the gainers from inflation (the government, commercial banks and big corporations) realised how profitable inflation was for them and hence must have resisted stabilisation. The high and accelerating inflation in Brazil and its persistence have therefore to be explained mainly in terms of institutional incentives for those who profit from inflation.

Brazil might gain a lot if it had a fully independent Central Bank and most importantly if it made price stability the sole legal responsibility of

the Central Bank. The 1994 Plano Real was a step in the right direction to stabilise inflation. Fiscal measures were taken and monetary growth and inflation were reduced considerably, but the monetary constitution has been changed only marginally. However, changing the monetary constitution only gradually and partially in the direction of greater autonomy of the Central Bank may not be the best way to solve the credibility problem of an inflation-prone country like Brazil.

Appendix – Description and sources of data

<i>bop</i>	Balance of payments in millions of US dollars. Source: <i>Conjuntura Econômica</i> , published by Fundação Getúlio Vargas, various issues.
<i>ca</i>	Current account in US\$ million. Source: <i>Conjuntura Econômica</i> .
<i>Def</i>	Government deficit in current prices. Source: <i>Brasil Programa Econômico</i> , published by the Central Bank of Brazil.
D_{86}	Dummy for Cruzado Plan equal to one in 1986.2 and 1986.3 and zero otherwise.
D_{90}	Dummy for Collor Plan equal to one in 1990.2–1990.4 and zero otherwise.
<i>EP</i>	Private market exchange rate. Source: <i>Conjuntura Econômica</i> .
<i>g</i>	DEF/YN.
<i>h</i>	(Real GDP – trend real GDP)/trend real GDP.
M_0	Monetary base, end of period. Source: Central Bank of Brazil.
M_1	Currency and checking deposits. Source: Central Bank of Brazil.
M_4	Extended money including financial investment funds, federal, state and municipal securities, special earning deposits and private securities. Source: Central Bank of Brazil (see also Table 3).
<i>p</i>	General price index equal to an average of consumer and wholesale prices. Source: <i>Conjuntura Econômica</i> .
<i>pa</i>	Agricultural price index. Source: <i>Conjuntura Econômica</i> .
<i>poil</i>	Price of oil in US dollars, converted into domestic currency at the private market exchange rate. Source: International Monetary Fund, <i>International Financial Statistics</i> (IFS).
<i>res1</i>	International reserves. Source: Central Bank of Brazil.
<i>res2</i>	Liquid international reserves. Source: Central Bank of Brazil.
<i>y</i>	Quarterly GDP at constant prices. Source: <i>Boletim Conjuntural</i> , published by IPEA (Instituto de Pesquisa Econômica e Aplicada), Rio de Janeiro.
YN	Quarterly GDP at current prices. Source: <i>Boletim Conjuntural</i> .

- turnover* Inverse of the number of months in office of Central Bank's governor (see Table 1).
- Dx First difference operator; lower case letters indicates logs or ratios (like g and h above). All percentage changes for Brazil are defined as changes with respect to the previous quarter for instance as $Dx = \log X - \log X(-1)$.