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Chapter Title: External Debt, Budget Deficits, and Inflation

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It helps avoid dramatic unemployment. But incomes policy by itself is not enough. Without careful fiscal policy, the disinflation is not viable. With a boom, price stability is very temporary. Moreover, incomes policy is difficult to implement in a neutral fashion. In 1964 wage repression was part of the price for disinflation. In 1986 there was a redistribution from firms to workers implicit in the rise in real wages. But firms were able to react to defend themselves and, in the process, made the price freeze an increasingly costly option.

The second lesson concerns indexation. Indexation in the presence of supply shocks is a source of inflation propagation. But it also dampens the shocks. An economy with long adjustment periods has an inflation process that is protected against rapid acceleration. Indexation of assets reinforces the element of stability. In the 1964 episode, indexation was reinforced and broadened. In 1986, by contrast, it was eliminated altogether and replaced by a wage-adjustment trigger without a cap. The threat of setting off the *escala movel* led to efforts to purge the price index at a significant cost to credibility. Financial assets were indexed to the short-term interest rate in November because expectations had turned adverse. Such setting led to a highly volatile atmosphere in which inflationary expectations easily became the driving mechanism for actual inflation. The sharp deceleration of inflation in mid-1986 was thus replaced by an explosion of prices at the beginning of 1987.

The third lesson concerns the debt overhang. In 1964 it was irrelevant. In 1986 it was prominent. There was much less margin for maneuver in order to finance government deficits in a noninflationary fashion. There was less import capacity to make up for domestic shortages or to make long-term investment and technological updating attractive. There was no ability—even with initially abundant international reserves—to use the international accounts to compensate for internal excess demand. The death knell of the Cruzado Plan was, not surprisingly, sounded by the moratorium on external interest payments.

5 External Debt, Budget Deficits, and Inflation

In January 1987 Brazil faced an external debt of $103 billion, amounting to more than one-third of GDP. Debt service requirements remained onerous, and a precarious trade balance was on the verge of provoking a moratorium. The inflation front did not look any better. Table 5.1 shows the numbers for

Table 5.1 **The Brazilian External Debt, 1984–86 (in billions of U.S. dollars and percentages)**

	1984	1985	1986[P]
Total	102	105	103
Registered	91	96	95
Nonregistered	11	9	6
Medium- and long-term debt with:			
Foreign commercial banks		60	59
Brazilian banks abroad		8	7
Others		28	28
External debt/GDP ratio (%)	48	48	40

Source: Banco Central do Brasil, *Brasil Programa Economico,* November 1986.
[P]Preliminary.

the external debt, and figure 5.1 indicates recent behavior of the inflation rate.

As we discussed in chapter 4, the Cruzado Plan had stopped inflation cold in March 1986, and during the next six months inflation remained low. But less than a year later, inflation exploded again. In June 1987 Brazil faced an annualized inflation rate of 800 percent, twice as large an inflation as when the plan was implemented. Policymakers had emphasized inertia in contracts and expectations as the most important component of inflation. They had thus chosen a shock treatment centered around a rigid price freeze, while paying insufficient attention to the need for fiscal restraint. Their failure forces us to look more closely into fundamentals.

In this chapter we argue that foreign debt and inflation in Brazil are related problems originating from the same source. We analyze the relations among the budget deficit, interest rates, domestic and foreign debt, and inflation. We start with a brief description of the Brazilian financial market, and then look at alternative measures of the budget deficit and discuss whether classic seignorage models can fit the Brazilian inflationary process. Having examined the nature of these large budget deficits, and having argued, in the subsequent section, that classic money-goods models do not explain inflation in Brazil, we establish the importance of the financial market in the analysis of inflation in Brazil. We then develop a seignorage model for an open economy with a financial market. We show that the enforced switch from external to domestic deficit finance has pushed both real interest rates and inflation upward.

5.1 The Financial Market

Brazil has a complex financial system. Financial reform was a key element in the stabilization of the mid-sixties. In the 1950s and early 1960s,

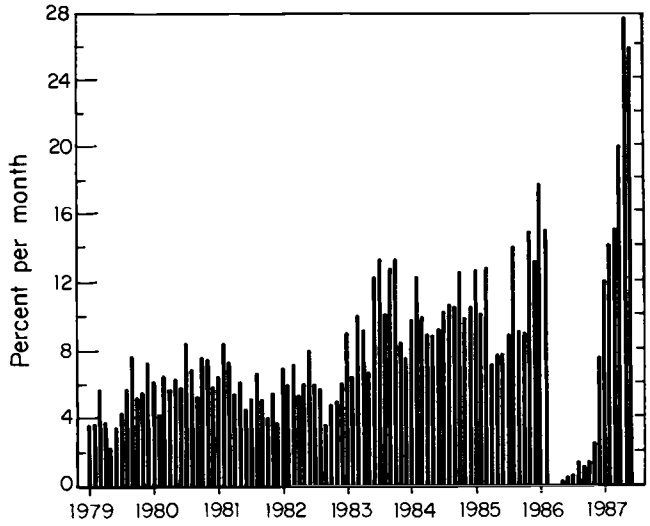

Fig. 5.1 Monthly inflation rate in Brazil, January 1979–June 1987 (wholesale prices, internal supply)

price controls on public services, sectoral subsidies, and inadequate tax collection contributed to a growing budget deficit, almost exclusively financed by monetary expansion. Interest rate restrictions, combined with inflation, limited financial savings and made interest-bearing money substitutes scarce. Long-term financing was available only in limited quantities from government banks at negative real interest rates.

The 1965 stabilization program initiated reforms which shaped the financial system during the 1970s. Those reforms introduced assets subject to monetary correction (indexation of the principal) and compulsory savings. The government made monetary policy the responsibility of the newly created National Monetary Council, started the Central Bank, and established the Housing Finance System headed by the National Housing Bank. Monetary authority was divided between the Bank of Brazil and the Central Bank. Their combined responsibilities still extend far beyond conventional central banking: the Central Bank manages development funds and programs, while the Bank of Brazil is the largest commercial bank in the country and the main supplier of rural credit.

Following the above reforms, extensive financial deepening occurred. Financial assets rose from 23 percent of GDP in 1965 to 60 in 1985. The share of indexed assets, particularly savings accounts and compulsory savings, increased continuously, while external borrowing came to play an important role. After the first oil shock, capital inflows were encouraged, and credit subsidies and federal debt issue increased dramatically. The Central Bank acted as a financial intermediary with a negative spread,

lending cheaply and borrowing at high rates. It seems likely that some portion of the considerable part of the agricultural credit known to be diverted from its intended applications found its way, directly and indirectly, through financial institutions into the holding of government debt.

The years from 1975 through 1983 were characterized by heavy reliance on foreign borrowing, proliferation of subsidized credit lines, and increasing dispersion of interest rates. Rising economic stress after 1975 changed the size and composition of the financial system, although its broad structure, which dated from the reforms of the second half of the 1960s, persisted until the reforms of 1986. Figure 5.2 shows the share of main financial assets in M4.

The Cruzado Plan substantially deindexed the financial system while retaining the indexation of savings deposits by a new correction index. But the OTN (Treasury Bill), which was frozen on February 1986 for one year, was revalued on March 1987 and subsequently, more frequently. Mini-devaluations were also reintroduced at the end of 1986, and the consumer price index is to be used to revalue balance sheet assets and liabilities. To a substantial extent, Brazil is back to the pre-Cruzado indexed economy, with even shorter adjustment periods.

Table 5.2 shows the main financial assets, yields, and taxation prevailing in March 1987. Brazilian financial instruments fall into four categories:

(1) those indexed by the consumer price index or by the new public debt instrument, the LBC (Central Bank notes), introduced in June 1986. These indexed instruments are mainly savings deposits and, increasingly, time deposits;
(2) assets with pre-fixed nominal yields, mostly sixty- and ninety-day time deposits;
(3) outstanding OTN-indexed bonds;

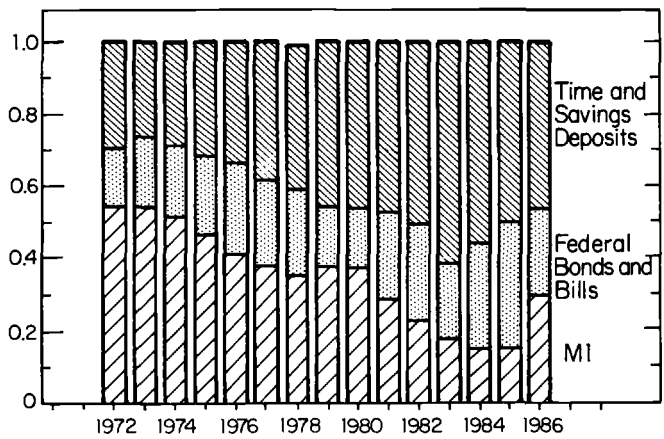

Fig. 5.2 Main financial assets share in M4

Table 5.2 **Main Financial Assets, Yields, and Taxation at the Beginning of 1987**

Asset	Yield	Taxation
Letra do Banco Central (LBC)	Rate of return set by government at "INPC inflation" with 15-day lag.	No tax on interest, 40% tax on capital gains at source.
Cadernetas de Poupanca	Principal corrected at LBC + 0.5% per month interest rate. Minimal holding periods: individuals, 1 month; companies, 3 months.	No tax for individual holders. Some fiscal benefits. Companies taxed via profits.
Certificado de Deposito Bancario (CDB) with post-fixed yield	Corrected by LBC plus market interest rate. Minimum term 60 days.	Income tax on interest: 35% if holder identified, 45% otherwise. Forty percent tax on capital gains.
Certificado de Deposito Bancario (CDB) with pre-fixed yield	Market-determined nominal rate (60 or 90 days).	"Reference" rate sets correction for tax purposes, tax rates same as yield for "post-fixed" CDB.
Obrigaco do Tesouro Nacional (OTN)	OTN correction (now same as LBC) plus fixed interest of 4–8%, depending on term.	Income tax 40% on interest, 35% on capital gains above LBC correction.
Letra do Tesouro Nacional (LTN)	Market-determined discount.	Same as for CDB with pre-fixed yield.
Letras de Cambio	Market-determined interest rate.	Same as for LTN.
Short-term assets held for less than 28 days	Market yield.	Forty percent income tax on total yield. No extra taxes on capital gains.
FGTS*	Corrected by LBC plus fixed interest rate.	No tax.
PIS/PASEP**	Corrected by LBC plus interest, depending on profitability of investment.	No tax.

*Fundo de Garantia por Tempo de Servico.

**Programa de Integracao Social.

(4) dollar-indexed instruments. These are either five-year OTNs with an exchange correction, or dollar-indexed deposits unofficially offered by some commercial banks, or dollars traded on the parallel (black) market.

Federal bonds and bills, which were practically nonexistent in 1965, represented more than 30 percent of financial assets by 1985. The debt of the public sector grew to more than 50 percent of GDP in 1985, as the government relied more and more on debt creation to finance the budget deficit.

5.2 The Budget Deficit

Not only was fiscal consolidation during the 1986 stabilization program difficult because of the size of the debt, but policymakers also made no

honest effort to correct the deficit. Some among them argued that Brazilian inflation was different from that elsewhere and that the budget deficit did not have a role in it; inflation was purely inertial and all that was needed to stop it was a price freeze and some formulae to recalculate wages, rents, and future installments. Others denied the existence of the problem by putting numbers together that would show a negligible budget deficit.

Table 5.3 shows alternative measures for the budget.[1] When inflation rises or abruptly falls, different budget concepts are strongly affected. The borrowing requirement of the public sector (PSBR), which moves dramatically with inflation because of the inflationary component of interest payments, is a faulty indicator. Rather, a preferable measure is the size of the budget deficit corrected for inflation.

In 1982 the budget deficit, corrected for inflation of the consolidated public sector, exceeded 8 percent of the domestic product. An agreement with the IMF (whose staff calculated the PSBR as 15.8 percent of domestic product in 1982) was reached in December of that year. The following year inflation, rather than decelerating, more than doubled. The public sector deficit exceeded its targets regularly, not merely because it was hard to control expenditures and increase tax receipts but also owing to rapidly growing internal and external interest payments.

There was a large increase in the budget deficit as a percentage of GDP in 1983 for two major reasons. First, in contrast with historically large and positive growth rates, output fell during 1983 by 3.2 percent. Second, interest paid on government bonds included compensation for the 30 percent devaluation of February because the return on these bonds had been linked to the rate of exchange depreciation. As shown in table 5.4, the domestic cost, corrected for inflation, of servicing the external debt greatly increased during 1983.

Figures for the budget deficit are available up to 1985, and all of them, except perhaps for those under the "operational deficit" column (see table

Table 5.3 **Different Measures of the Budget Deficit as a Share of GDP**

Year	Increase in Total Debt/GDP	Deficit Corrected for Inflation/GDP	FGV measure[a]/GDP	PSBR[b]/GDP	Operational Deficit[c]/GDP
1982	25.9	8.4	3.7	15.8	6.6
1983	60.5	15.2	4.1	19.9	3.0
1984	60.9	4.6	4.7	23.3	2.7
1985	64.6	6.1	n.a.	27.8	4.3
1986	22.9	3.5	n.a.	11.2	3.6

Source: Cardoso and Reis (1986) and Banco Central do Brasil, *Brasil: Programa Economico*, February 1987.

[a]Calculated on a cash-flow basis, excluding the monetary authorities' deficit.

[b]Public Sector Borrowing Requirement, calculated on accrual basis, excluding the monetary authorities' deficit.

[c]Subtracts monetary correction from PSBR.

Table 5.4 **Domestic Cost Rate of the External Debt Service in Brazil, 1982–85 (in percentages)**

Year	Interest Rate Paid on the External Debt	Inflation Rate During the Year	Devaluation Rate During the Year	Real Rate of the Domestic Cost of the External Debt Service
1982	13.02	95	93	11.9
1983	10.04	155	221	38.5
1984	10.20	221	220	9.9
1985	10.00	226	236	13.4

Sources: *Conjuntura Econômica* and *Boletim do Banco Central.*

5.3, col. 5), indicate the existence of large deficits. In particular, nominal borrowing requirements for the public sector continuously increase until 1985.

The question to be taken up in the next section concerns whether increasing inflation in Brazil can be explained by these growing budget deficits.

5.3 Seignorage Models of Inflation

The observation that high and lasting inflation rates always involve monetary expansion has led to the study of situations that give rise to monetary expansions. The most common argument links money printing to the financing of government deficits. The link may be obvious, such as money issued to finance a war, or more roundabout, for example, involving an exchange rate collapse.

A story that could be told for Brazil in the 1980s would start with a government with a large external debt. When foreign capital inflows suddenly cease, this government is forced to extract from the private sector the foreign exchange resources it needs, and does so either by money creation or increased domestic debt. On the other hand, to force the private sector to produce the trade surplus and the needed foreign exchange, the exchange rate needs to be greatly depreciated. The devaluation further increases the cost of the debt service in domestic currency, causing additional increases in government expenditure and money creation.

Inflationary deficit finance inevitably leads to two types of vicious circles. First, if government prices are adjusted with delays and income taxes are collected on the basis of incomes earned one year before, higher inflation itself increases the budget deficit, inducing even larger increases in money. Second, the share of the inflation tax in output is inversely related to velocity. Since velocity increases with inflation, increasing budget deficits will require further increases in money creation once velocity responds to increasing inflation rates.

Unfortunately, financing government expenditure through debt creation seems equally unattractive, especially when real interest rates are high and exceed the domestic growth rate. The rapidly growing stock of debt becomes

a major source of expenditure and makes deficit reduction more difficult in future years. External debt brings with it the additional burden of debt service in foreign currency.

Table 5.5 presents the size of the deficit and the source of finance. Until 1984, and particularly in 1983, the increase in the budget deficit was financed primarily by an increase in the total debt, both domestic and external.

As shown in figure 5.3, money growth in 1983 was approximately the same as in previous years, while inflation jumped to twice its previous level. The Brazilian monetary experience of 1983 provides one of those classic counterexamples to Milton Friedman's claim that every inflation acceleration in history has been preceded by a monetary expansion. Money growth lagged behind inflation until the last quarter of 1984. Inflation seemed to enjoy a life of its own. A committed monetarist might be willing to argue that this was due to velocity adjustments: inflation accelerated due to the expectation of faster money growth in the future, even though current money growth was slow relative to the inflation rate. These expectations might have been fueled by the sight of an enlarged debt and the prospect of increasing interest payments.

More eclectic economists would argue that the monetarist explanation is not convincing. To account for the dynamics of inflation, we must take into consideration the pervasive indexation schemes that have existed in Brazil and their effect on inflation inertia. This was the subject of the last chapter. Here we simply mention important supply shocks that took place during the period under scrutiny. Recall that a large devaluation in February 1983 followed the 30 percent devaluation of December 1979, that prices and interest rates administered by the government were corrected for past inflation, and that subsidies to oil and wheat consumption were cut at the same time as the mini-devaluations were accelerated.

All these inflationary pressures were worsened by a crop failure in 1983. Add to that the exchange and bond indexation scheme and one is not surprised how easily the inflationary shocks spread, leading to inflation rates

Table 5.5 **Budget Deficit Share in GDP and Budget Finance in Brazil, 1982–85 (in percentages)**

Year	Change in the Real Base/GDP	Inflation Tax on the Real Base/GDP	Seignorage/GDP	Increase in Real Net Debt (net of the base)/ GDP	Budget Deficit Corrected for Inflation/GDP
1982	−0.4	2.3	1.9	6.5	8.4
1983	−1.3	2.8	1.5	13.7	15.2
1984	0.3	2.0	2.3	2.3	4.6
1985	−0.4	2.1	1.7	4.4	6.1
1986	0.9	2.7	3.6	−0.1	3.5

Sources: Banco Central do Brasil, *Brasil: Programa Economico,* August 1986, and *Conjuntura Econômica.*

Note: For the calculation of the budget deficit share corrected for inflation, see appendix 2 to this chapter.

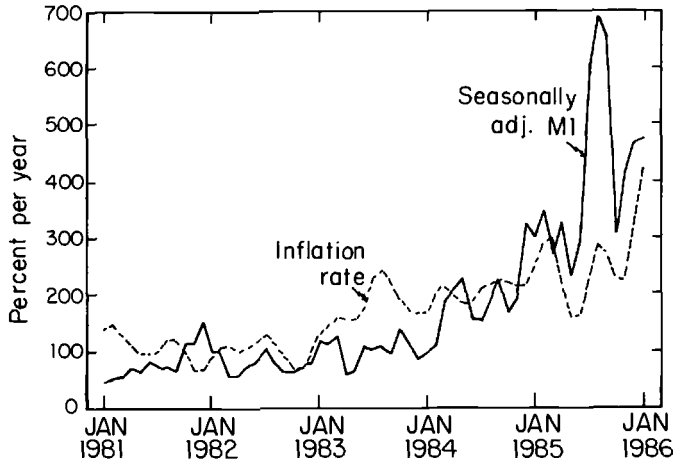

Fig. 5.3 Inflation and money growth (three-month moving average)

of 200 percent. The restrictive monetary policy of 1982 and 1983 resulted in high interest rates, recession, and unemployment, but left the inflation rate unchanged. By 1984 the government had gone back to its traditional accommodating monetary policy. As the money growth rate converged on the inflation rate, economic activity began to recover, in part helped by export growth.

Up to mid-1985, the fact that inflation was holding at the 1984 rates was interpreted as a confirmation of the theory that, in the absence of shocks and in a context of thorough indexation, inflation sustains itself through inertia. As a matter of fact, there were shocks during 1985 but these were counterbalanced by price controls and by public sector price increases that were lower than the general inflation rate. The inflation explosion in August, November, and December of 1985 aroused the suspicion that something was very wrong with the inertialists' explanation.

5.4 Can Money-Financed Budget Deficits Explain Inflation in Brazil?

Seignorage models consist of a combination of two equations. The first one shows the seignorage share in output (or, in other words, the share in output of the budget deficit financed by money creation) as equal to money growth divided by velocity, which is assumed to be a positive function of the inflation rate. The second one makes inflation equal to money growth. If increasing money-financed budget deficits are to explain the ever increasing inflation between 1979 and 1985, one would expect seignorage as a share of GDP to rise. This did not happen. Between 1970 and 1985, seignorage as a share of GDP is fairly constant at around 2 percent. Seignorage models as an

explanation for inflation in Brazil can thus be dismissed on the grounds that seignorage as a share of GDP shows absolutely no correlation with inflation (figure 5.4).

The money-goods model of monetarism is inappropriate to the Brazilian economy because it fails to account for changes in deficits not financed by money creation. The model predicts that seignorage requirements drive the system. But the Brazilian experience has to be interpreted in the light of the institutional reality of financial markets and growing external debt.

There is yet another reason why a more complete model is necessary to account for inflation in Brazil. This concerns the dynamics of inflation. Fully flexible prices permit equality, at all times, between seignorage adjusted for growth and the inflation tax on the monetary base.[2] But the Brazilian data rule out this possibility. Figure 5.5 shows that an increase in inflation increases the inflation tax but also increases velocity and reduces seignorage.

Ruling out full price flexibility, different assumptions about price dynamics yield unattractive models of seignorage. The reason is that money holders are assumed to acquire disequilibrium levels of real balances to satisfy needs of the monetary authorities. A more appropriate solution is to introduce financial markets into the model. In the next section we sketch a seignorage model that does exactly that.

5.5 A Seignorage Model for the Open Economy with a Financial Market

Consider an economy in which the current account is financed either by commercial loans or by changes in foreign reserves. All external borrowing

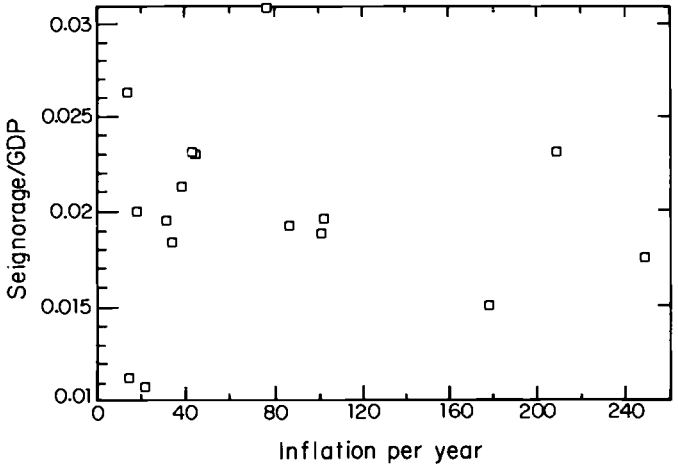

Fig. 5.4 Seignorage in Brazil, 1970–85

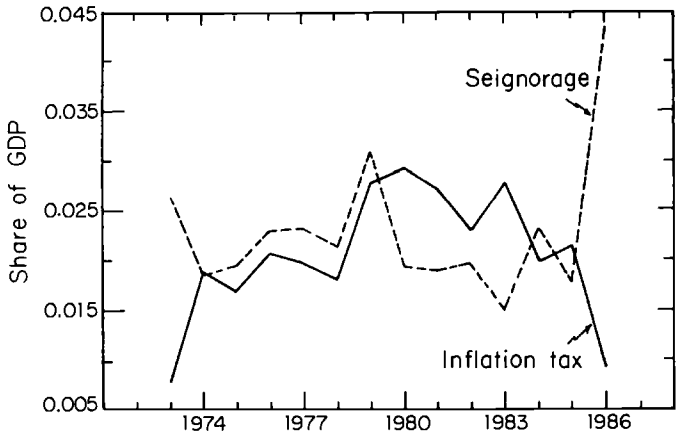

Fig. 5.5 Seignorage and inflation tax in Brazil, 1973–86

is done by the public sector. The government finances the budget deficit by borrowing abroad and by creating both money and domestic debt. We can combine the government budget constraint and the balance of payments equation to obtain an equation for the growth rate of the real money base:

$$\mu = a/h - \Pi \tag{5.1}$$

where h stands for the real monetary base, μ is its growth rate, Π stands for inflation, and a represents the sum of the domestic component of the budget deficit financed by money creation plus the noninterest current account. Equation (5.1) is derived in appendix 1 at the end of this chapter.

The next question concerns the inflation dynamics. The nominal interest rate adjusts to clear the money market at all times. We also assume that there is inflation inertia: inflation increases whenever the level of activity exceeds full employment, that is, whenever the actual real interest rate, $i - \Pi$, defined by goods and money market equilibrium, is below the full-employment real interest rate, r:

$$\dot{\Pi} = \sigma[r(G,TB) - (i - \Pi] \tag{5.2}$$

where G and TB represent, respectively, permanent government expenditure and the trade surplus.

The model described by equations (5.1) and (5.2) is represented graphically in figure 5.6, where we also show the adjustment path for an increase in government expenditure financed by money creation. A larger budget deficit financed by money creation shifts the schedule ($\mu = 0$) to the right. Increased government expenditure requires a higher full-employment real interest rate, thus shifting ($\dot{\Pi} = 0$) to the left. The economy moves with

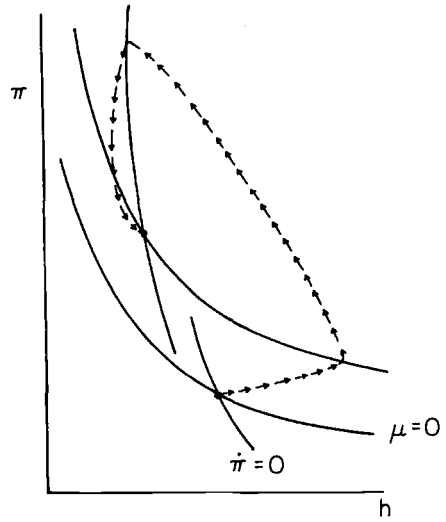

Fig. 5.6 A money-financed increase in government expenditures

oscillations from the initial low-inflation equilibrium to the new equilibrium with a higher inflation rate and smaller real money balances. As money increases, the nominal interest rate falls and so does the real interest rate, stimulating activity and pushing up the inflation rate. Gradually, inflation catches up with money growth and then exceeds it, reducing real cash balances and increasing the real interest rate.

This story seems appropriate to the trajectory of the post–Cruzado Plan data, but it certainly does not fit the period of increasing inflation between 1979 and 1985, which requires a different explanation. Figure 5.7 shows the adjustment of inflation and real balances within the same basic model, but now with unchanged seignorage and rising equilibrium real interest rates. Seignorage is unchanged as long as the increased sum of budget deficits and noninterest current account surpluses does not get monetized but rather is financed by larger domestic debt. The increase in the equilibrium real interest rate can be attributed to crowding out, either as a result of growing government expenditure financed by debt or due to increased trade surpluses required to finance interest payments on the foreign debt.

Consider a situation where a balance of payments crisis, such as the halting of capital inflows at the end of 1982, requires a real devaluation, which induces a growing trade surplus. Monetary targets imposed by the IMF program bring about a change in domestic government finance from money to debt. The sum of the budget deficit and noninterest current account

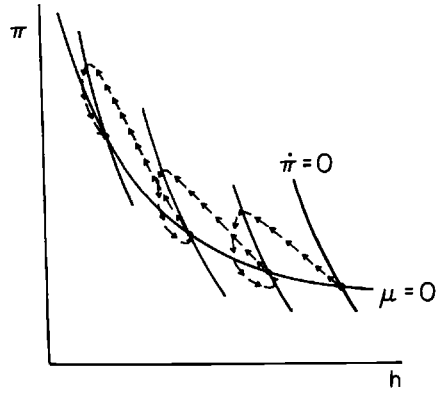

Fig. 5.7 Successive increases in the full-employment real interest rate

financed by money creation is thus left unchanged. The higher real exchange rate and trade surplus are counterbalanced by a higher equilibrium real interest rate.

How does the system move from one low-inflation equilibrium to another with higher inflation? The higher real exchange rate brings about increased activity in the tradable goods sector, thus raising demand and inflation. As inflation increases and money growth lags behind, the real interest rate increases. The economy adjusts in a cyclical fashion.

Figure 5.7 shows a leftward-looping pattern of adjustment for inflation and real balances, induced by successive increases of the equilibrium real interest rate. This matches the Brazilian data in figure 5.8 extremely well. Figure 3.2 (chap. 3) confirms the upward trend of real interest rates in the years between 1979 and 1985.

5.6 Concluding Remarks

Between 1979 and 1985, Brazilian inflation doubled three different times. From 45 percent in mid-1979, it jumped to 100 percent in 1980–82, and then to 200 percent in 1983–84. At the end of 1985 and the beginning of 1986, the annualized inflation rate grew to 400 percent. The Brazilian inflationary process cannot be explained, as we argued above, simply by reference to increasing budget deficits financed by money creation. This does not mean that Brazilian budget deficits were not large or that they did not have an important role in sustaining inflation. But such a process has to be understood in the light of changing sources for financing the budget and the economy. The inflation acceleration between 1979 and 1985 is linked to the switch from external to domestic finance and to the progressively larger trade surpluses that pushed up interest rates and inflation.

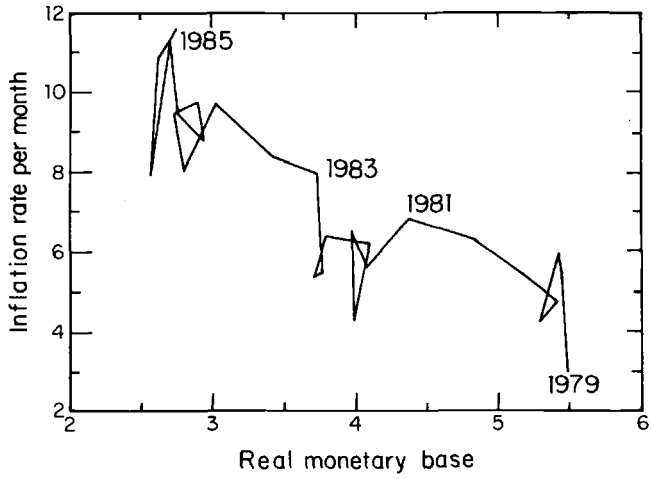

Fig. 5.8 Inflation and real monetary base (quarterly average)

The Cruzado Plan failed to pay attention to this aspect of the debt problem. Larger deficits were experienced and were financed by monetary expansion. At the same time, excess demand required a higher real interest rate to compensate. This combination led to a classic inflationary finance situation which could have been avoided by reducing the excess demand (by increased taxation) and by improved conditions of finance. Debt relief would have permitted smaller trade surpluses for interest service and would have provided a buffer against resumption of higher inflation rates.

Appendix 1: A Model of Seignorage

The government budget constraint is defined as:

$$(A.1) \qquad (G_t - T_t) + i_t B_{t-1} + i_t^* E_t D_{t-1} = (K_t - K_{t-1}) + (B_t - B_{t-1}) + E_t(D_t - D_{t-1})$$

where:

$G_t - T_t$ = the nonfinancial component of the budget deficit;
$i_t B_{t-1}$ = interest payments on domestic debt;
$i_t^* E_t D_{t-1}$ = interest payments on the external debt; E is the exchange rate;
$B_t - B_{t-1}$ = domestic borrowing;
$D_t - D_{t-1}$ = external borrowing;
$K_t - K_{t-1}$ = domestic credit creation, equal to the change in the monetary base, H, minus the change in foreign reserves, F:

(A.2) $$K_t - K_{t-1} = (H_t - H_{t-1}) - E_t(F_t - F_{t-1}).$$

Consider now the balance of payments under the assumption that only the government borrows abroad:

(A.3) $$F_t - F_{t-1} = NX_t - i_t^* D_{t-1} + (D_t - D_{t-1})$$

where NX_t = the noninterest current account. We also define:

$\Pi_t = (P_t/P_{t-1}) - 1$ as the inflation rate;

$j_t = (E_t/E_{t-1}) - 1$ as the devaluation rate;

$1 + i_t = (1 + r_t)(1 + \Pi_t)$ as the relation between nominal and real domestic interest rates.

We substitute (A.2) and (A.3) in (A.1) and use the definitions above to obtain (A.4), where R = the real exchange rate:

(A.4) $(G_t - T_t) + r_t(B_{t-1}/P_{t-1}) + R_t NX_t$

domestic deficit corrected for inflation + noninterest current account

$= (H_t - H_{t-1})/P_t + [(B_t/P_t) - (B_{t-1}/P_{t-1})]$

real seignorage + increase in the real domestic debt

= creation of real paper at home

Observe that as long as the current account does not deteriorate with a real devaluation, a real devaluation must be financed by a reduction in the domestic deficit, an increase in domestic debt, or by money creation. We can rewrite (A.4) as:

(A.5) $$a_t = (H_t - H_{t-1})/P_t$$

where:

$$a_t = (G_t - T_t) + r_t(B_{t-1}/P_{t-1}) - [(B_t/P_t) - (B_{t-1}/P_{t-1})] + R_t NX_t.$$

We multiply the right-hand side of (A.5) by $H_t H_{t-1}/H_t H_{t-1}$, thus obtaining:

(A.6) $$a_t = h_t \cdot \Phi_t$$

where $h_t = H_t/P_t$, and $\Phi_t = z_t/(1 + z_t)$, having defined z as the growth rate of the monetary base. We also define the growth rate of the real monetary base as: $\mu = \Phi - \Pi$, obtaining:

(5.1) $$\mu = a/h - \Pi$$

Appendix 2: Calculating the Budget Deficit

Recall the budget constraint defined in appendix 1 as (A.1):

$$(G_t - T_t) + i_t B_{t-1} + i_t^* E_t D_{t-1} = (K_t - K_{t-1}) + (B_t - B_{t-1}) + E_t (D_t - D_{t-1})$$

Deflating (A.1) by P_t and using the definitions of Π, j, and r (app. 1), we can write the budget deficit corrected for inflation as:

(A.7) $$(G_t - T_t)/P_t + r_t(B_{t-1}/P_{t-1}) + \{[(1 + i_t^*)(1 + j_t)/(1 + \Pi_t)] - 1\}(D_{t-1}/P_{t-1})$$

$$= \text{budget deficit corrected for inflation} = BD_t$$
$$= [(K_t - K_{t-1})/P_t] + [(B_t/P_t) - (B_{t-1}/P_{t-1})] + [(R_t D_t) - (R_{t-1} D_{t-1})].$$

Using (A.2) and observing that:

$$(H_t - H_{t-1})/P_t = [H_t/P_t) - (H_{t-1}/P_{t-1})] + [(H_{t-1}/P_{t-1})(\Pi_t/1 + \Pi_t)],$$

we can write the budget deficit corrected for inflation:

(A.8) $$BD_t = b_t + d_t + h_t + infltax_t$$

where:

$b_t = B_t/P_t - B_{t-1}/P_{t-1}$ = increase in the real domestic debt;
$d_t = R_t D_t - R_{t-1} D_{t-1} - R_t(F_t - F_{t-1})$ = increase in the real external debt net of foreign reserves;
$h_t = H_t/P_t - H_{t-1}/P_{t-1}$ = increase in the real monetary base;
$infltax_t = (\Pi_t/1 + \Pi_t)(H_{t-1}/P_{t-1})$.

Table 5.5 in the text shows the share of the budget deficit, corrected for inflation, in GDP and its financing for the last four years. We next describe how those numbers were calculated. We use the information given in table 5A.1.

Table 5A.1 **Net Debt of the Public Sector (in millions of cruzados)**

	1981	1982	1983	1984	1985
1. Federal government and Central Bank	2,324	5,903	35,060	129,541	446,319
Domestic debt (including the base)	919	1,961	8,387	47,781	176,518
External debt	1,405	3,942	26,673	81,760	269,801
2. State and local government	1,325	3,570	11,530	38,655	152,789
Domestic debt	1,052	2,815	8,579	27,602	103,418
External debt	273	755	2,951	11,053	49,371
3. State enterprises	4,875	12,206	47,903	161,230	625,280
Domestic debt	1,824	4,832	16,839	54,335	214,550
External debt	3,051	7,374	31,064	106,895	410,730
Domestic debt	3,795	9,608	33,805	129,718	494,486
External debt	4,729	12,071	60,688	199,708	729,902
Total debt = (1) + (2) + (3)	8,524	21,679	94,493	329,426	1,224,388

Source: Banco Central do Brasil, *Brasil: Programa Economico*, August 1986, pp. 34–35.

To obtain the fraction of the budget financed by the increase in the real debt of the public sector, we first deflate the consolidated net debt of the public sector at the end of the year by the general price index at the end of the year. The difference between the real debt in two consecutive years divided by the real GDP is equal to the sum of columns 1 and 4 of table 5.5.

Observe in table 5.5 that the numbers for the inflation tax are different from the numbers one can calculate for seignorage, since seignorage also includes the changes in the real monetary base.

Adding columns 1, 2, and 4 of table 5.5, we obtain our measure of the share of the budget deficit, corrected for inflation, in GDP. We observe that our measure is different from other measures available for the share of the budget deficit in GDP, as shown in table 5.3.

We next explain why our measure in column 2 of table 5.3 is different from the "operational deficit" (OD) published by the Central Bank (col. 5, table 5.3). The OD is calculated by eliminating from the deficit defined as "borrowing requirement of the public sector" (PSBR) the actual payments of monetary correction. Even if the PSBR were an appropriate measure of the total borrowing requirements of the public sector in Brazil, the operational deficit would not be a proper measure of the budget deficit corrected for inflation for the following reason. The monetary correction index is not always equal to the inflation rate, and the difference between the two represents capital gains or losses for the public sector. Consider, for instance, a year such as 1983, during which the government sold domestic debt with a clause for monetary correction equal to the devaluation rate. There was a 30 percent devaluation in February, and the inflation rate that year was well below the monetary correction paid on the domestic debt. By excluding monetary corrections from interest payments rather than inflation, the Central Bank is leaving aside capital losses actually incurred by the public sector.

The next problem concerns the exclusion of the deficit of the monetary authorities from the PSBR. In Brazil, most subsidies are paid directly by the monetary authorities. Therefore, a concept that excludes the deficit of the monetary authorities underestimates the actual borrowing by the public sector. The Central Bank only started publishing data for the total debt of the public sector in January 1986, and a series for the period 1982–85 was then made available. The data for 1985, for instance, shows that the share of the increase in the total debt in GDP was 65 percent. In that same year, the data published for the PSBR share in GDP was 27 percent. The large difference comes from the fact that the concept of PSBR does not include the deficit of the monetary authorities. Our measure, by contrast, includes all expenditures by the public sector and takes into consideration the capital losses that the OD excludes.