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INFLATION IN BRAZIL

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Octubre 1992
N° 87

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Conclusions and Policy Recommendations

Brazil has a highly sophisticated financial market, developed out of the need of participants to defend themselves against the frequent inflationary shocks to which the economy is being subject. The main characteristics of this market have been the high degree of indexation of most transactions and the extremely short maturity for most operations (overnight in most cases).

During the hyperinflation (February 1990) the ratio of the narrow monetary Base to the wider monetary aggregate M4 stood at just 5%, indicating the very low degree of monetary control that the monetary authorities could possibly exercise. Just for comparison, Argentina as of May 1991 has a value for this ratio of 52%, while Peru has it at 63%. The basic difference is that these last two countries are quite dollarized and, as a consequence when inflation hits, the financial system contracts evenly and the ratio Base to M4 is not sharply reduced. In Brazil, indexation has prevented dollarization. In consequence, when inflation hits, the market shifts from those sources of liquidity that pay the inflation tax (those linked to the narrow base) to those that do not pay it as they are indexed; in consequence we do observe a fall in demand for narrow base as a consequence of the shift to other indexed financial alternatives that are included in M4.

After the implementation of the Collor I plan, when the degree of financial intermediation was sharply reduced through the freeze of most interest earning assets, the ratio of Base to M4 rose to 25% and since then it has again fallen to about 17%. Plan Collor II attempted to regain monetary control by intervening in the financial markets through several regulations such as the straight prohibition of both indexation and the overnight money market. The economic team that implemented this plan resigned after only three months and it is now difficult to predict what will be the direction to be taken by the new authorities.

The fact that traditionally in Brazil the narrow monetary base is but the vertex of huge financial pyramid would suggest that there is a very weak link between this aggregate that the Central Bank can control and the relevant, and much wider, liquidity aggregates. This fact is supported by the empirical evidence in Section II showing a very weak link between the narrow monetary base and all monetary aggregates (from M1 up to M4) that could be of any relevance for the determination of the price level.

*/This paper was written between January and May 1991.

The workings of the Brazilian financial markets imply that to a great extent aggregate liquidity in the economy is quite independent from Central Bank policy (due to a wide variety of causes like indexation, overnight markets, sudden portfolio shifts and low reserve requirements). In this context, attempts to control the price level through the indirect control of liquidity by means of the narrow monetary base may prove to be a losing battle.

From the above perspective, Brazil could gain by adopting a fixed exchange rate regime, where the link from the exchange rate to the price level is likely to be much more direct than the actual link derived from the control of the monetary base.

Fixing the exchange rate may prove, however, a difficult task under the current institutional arrangements in Brazil where the Central Bank is subject to any type of political pressures to finance federal and local deficits. Credibility in the permanence of the exchange rate value is crucial for the success of this system and this could be attained through two sets of measures:

(1) At the flow level, fiscal balance must be attained so as to insure that there are no pressures on reserves derived from the financing of current deficits. However, fiscal balances may change from one day to the next, especially if the institutions to finance them are still present (like a Central Bank with powers to issue currency and then devalue) and therefore the current attainment of fiscal surpluses may not prove to be enough to guarantee the market's credibility in the new currency and this should be reflected in the lack of long term financial transactions and a high risk premium in interest rates.

(2) The best way to obtain the credibility in the new currency is to back it with facts (Reserves) and not promises of future fiscal surplus that are only a necessary but not sufficient condition for credibility. In this respect we recommend separating the regulatory role of the Central Bank from that of issuing Base Money and fixing its value of exchange. This last two functions could be best served through the creation of a Currency Board with a Charter stipulating that it can only print currency in exchange for foreign exchange at a fixed exchange rate (also determined by the Charter). The 100% potential convertibility between the narrow monetary base and foreign exchange will be the most credible guarantee to the maintenance of the level of the exchange rate. The level of the exchange rate at which the Currency Board will permanently operate will crucially depend on the ratio between the sight obligations of the Central Bank that will now be assumed by the Currency Board and the amount of **liquid** foreign exchange reserves available to capitalize initially the Board so that the ratio between its reserves and its liabilities is at least unity.

To summarize the previous argument we may say that the attainment of fiscal balance is an absolutely necessary but perhaps not a sufficient condition for stability under the current institutional setup in Brazil. The tendency towards endogeneity of the money supply suggests the convenience of resorting to a fixed exchange rate system implemented through a Currency Board under 100% reserve backing that would provide the required market's credibility in the new system.

The inability of the monetary authorities to announce credible monetary targets is best exemplified by the announcements made last May about targets for the second semester of 1990: 18.6% expansion for Currency and 9.1% expansion for M1. The actual rates of expansion duuring the semester where 120% for currency and 116% for M1. Between the months of May and August of 1990, the narrow monetary Base fell by 20% while the wide monetary aggregate M4 actually increased by 50%, providing the best example of the obvious difficulties for the Central Bank of regulating aggregate liquidity by means of the variables under its direct control (such as the narrow base).

Regression analysis with time series data for the decade of the 80's shows that the widest monetary aggregate (M4) is the one best related to the price level. In fact our results show that the link between monetary aggregates and inflation improves as the aggregate becomes wider. This result shows in a variety of tests ranging from straight regressions of inflation on past rates of change in the monetary aggregates to tests of goodness of fit of demands for the different aggregates and finally to causality tests of the Granger type.

Since the Central Bank does not control directly the monetary aggregates (M1 through M4) but just the Monetary Base (of which there are two versions: the narrow Base and the expanded Base including Federal Debt Titles outstanding) we have also tried to test about the ability of the BCB to exert any degree of control over the monetary aggregates through the alternatives measures of the monetary Base. As mentioned before, our empirical results show the narrow monetary Base to be quite unrelated to any of the standard monetary aggregates. The expanded Base is related to all of the aggregates that include the stock of Federal Debt Titles (M2 through M4), the relation becoming slightly better as the aggregate becomes wider.

In the empirical analysis we have tried to separate the effects that the several experiences of price controls during the decade may have had on the structural relation between money and prices. We have included price control dummies in the causality analysis for the plans Cruzado, Bresser and Verano. In all cases the dummies came out as contributing negatively to inflation during those periods, as it would be expected due to the application of price controls.

An important factor that comes out from the analysis is that of a mutual causality relation between money and prices: past rates of change in prices do have an effect current rates of monetary expansion, particularly in the wider monetary aggregates that include the stock of Federal Debt Titles. This comes as no surprise after we recognize that the lack of fiscal surplus implied that most of the accrued interest on public debt was normally paid by issuing more debt. In practice this means that public debt tends to grow at a rate at least equal to the nominal rate of interest. Since the interest rate includes inflationary expectations that on average tend to be quite correct, we do observe debt, and therefore the monetary aggregates that include it, to grow in proportion to the rate of inflation.

The above discussion takes us to the crucial problem of the means and purpose of exercising monetary control. Under a floating exchange rate system, the Central Bank should control some monetary aggregate in order to provide a numeraire to the economic system. The obvious target would be to control the aggregate more closely related to the price level. Our results show this aggregate to be M4 which is most related to the expanded monetary Base. It is, however, very likely that the Central Bank will not have the elements to control the expanded monetary base (it may change the composition of the expanded Base between cash or Titles, but not the overall level).

The above fact, which is not surprising, points out to the crucial problem of inflation in Brazil: it has a fiscal origin. To reduce the expanded Monetary Base the Treasury will have to run surpluses to produce the genuine resources with which to repurchase the Federal Debt Titles in the Market. Our analysis indicates that repurchasing Federal Debt Titles by printing new money (narrow Base) will not change anything of significance insofar as inflation is concerned, as the relevant variable which is the Expanded Monetary Base will remain unchanged.

The Primary Fiscal Surplus of the first quarter of 1991 stands as the worst in any quarter of the Collor presidency (Table 3, page 27). Apparently most of the efforts of the fight against inflation under Plan Collor I were put at freezing liquidity through measures that closely resemble a confiscation of financial assets. In the second stage of the plan (Collor II) more direct measures of intervention were adopted such as price and exchange rate controls, straight prohibitions on indexation or overnight investments, etc. During all of this last year the financial measures completely obscured any shadow of fiscal adjustment and the crude reality is that the overall primary surplus of the Treasury reached a mere 74 million dollars per month during the first three months of 1991. This simply means that the Treasury is not producing any income with which to serve its huge internal debt (Federal and State debt titles now Federalized plus the frozen Cruzados that should be freed after this coming September) and external debt. Fiscal adjustment is still lacking in Brazil and at this stage we feel it will have to come hand in hand with a deep monetary reform along the lines of full convertibility discussed above.

The last but perhaps most crucial impediment to stability we will mention here is the extremely high degree of public debt outstanding. The level of public debt, external and internal, and including the stock of frozen cruzados to be returned after next September, impose a serious constraint on the credibility of any reasonable monetary or exchange rate target that could possibly be announced. We feel that in the context of an all out fiscal adjustment authorities should only keep outstanding the amount of public debt that can really be normally served. Since nowadays the amount outstanding clearly exceeds the possibilities of any normal rate of service, it is obvious that the market value of the debt would fall if it were not for the implicit promise of the Central Bank to issue currency to support the value of the public debt. This implicit (sometimes explicit) promise transfers the problem of the insolvency of the state to the national currency and generates the conditions of monetary instability that are usually experienced. We feel the Central Bank should be taken totally out of the business of supporting the outstanding public debt (as it would if the Currency Board alternative is instrumented) and concentrate in achieving the objective of administering a useful national currency. This means that the market value of the outstanding public debt will fall in value to the present discounted value of the expected future primary surpluses that can be devoted to service the outstanding debt **and nothing more.**

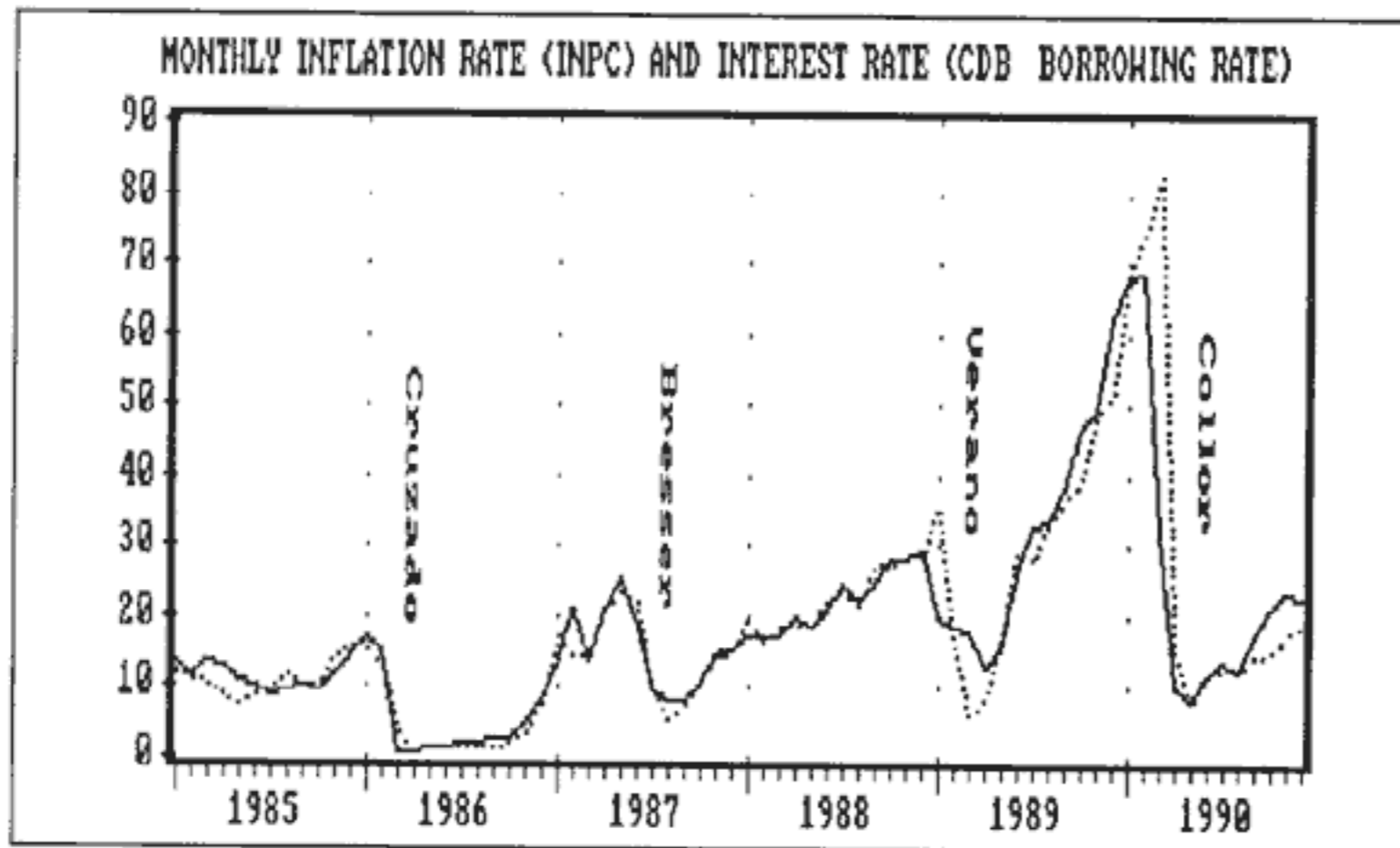
INFLATION IN BRAZIL

Introduction

Among the high inflation latin-american countries, Brazil, together with Chile have developed sophisticated systems of indexation in financial markets. In Chile, that has observed a conservative fiscal behavior, indexation has precluded the often observed phenomenon of the dollarization of the economy, while allowing for a growing capital market with relatively stable real returns and inflation. Brazil, on the contrary, has had a systemic tendency towards fiscal imbalance that resulted in ever growing pressures on the indexed financial markets of the continued government borrowing. In such a context, the indexation of the financial markets helped in preventing the shift of portfolios towards foreign assets but also provided the required accommodation for all financial variables to automatically follow the path of inflation. Indexation coupled with fiscal imbalance is a dangerous mix that could result in dangerous inflationary outbursts, as the Brazilian experience clearly indicates.

Since 1988, with few exemptions, Brazil has experienced nominal interest rates and inflation rates in the two digits range, at a monthly level. The high nominal interest rates are the result of the high inflation rates and a very small (on average) real interest component, as can be appreciated in Figure 1.

Figure 1



The purpose of this paper is to analyze the monetary and financial aspects of inflation in Brazil. We shall concentrate on the factors determining supply and demand for money, as well as all the other substitutes available in the highly sophisticated financial market. The end objective of the analysis is to determine which is the monetary aggregate that the monetary authorities should aim at controlling in order to affect inflation.

Section I presents the major recent macroeconomic trends and discusses the implications of the latest privatization efforts, particularly with regards to its potential monetary and fiscal effects. Section II describes the mechanics of the financial markets and the money supply process with special emphasis on the structure prevailing since the reforms of early 1990 (Plan Collor). Section III presents an econometric analysis of causality between the alternative money demand concepts, interest rates and inflation, and derives the policy implications.

--I--

Macroeconomic Trends During the 1980's

The decade of the 80's has shown Brazil in a gradual process of courting with a hyperinflation that finally arrived around 1989 and does not show signs of having been totally eliminated.

During the last decade inflation shows a gradually increasing trend, broken by successive stabilization attempts; Planes Cruzado, Bresser, Verano and Collor being the best known of the series of stabilization plans. The heterodox plan Cruzado allowed for a temporary restraint on inflation with some GDP growth but set the basis for the resulting hyperinflation by generating a situation of repressed inflation coupled with an ever growing government debt as a result of the continued fiscal deficits.

As inflation settled as a permanent way of life, society learned how to live with it. Rather than going after the fiscal deficits that fueled the process, Brazilians developed highly advanced indexation mechanisms in both the financial and real markets. The indexation process was even fostered by the government that at times generated mandatory indexes for indexation with the aim of controlling inflation by controlling the index actually used by economic agents. When price controls or the use of official indexes for indexation were abandoned, the framework for indexation remained intact. Private sector indicators substituted for the officially supplied indexes. The government was forced to index its debt and could not any longer resort to sudden devaluations as a mechanism to melt down its own debt in order to solve its pressing financial problems.

During most of 1989 inflation settled at levels ranging between 30 and 50% per month while the real interest rate paid on commercial banks certificates of deposits (CDB with 60 days maturity) reached 40% for the whole year. Such a real interest rate was also paid by the ever growing stock of public debt whose service become the major cause for expansion in the stock of liquid financial assets that fueled the inflation process. The stock of Federal Financial Public Debt (FFPD) rose from an initial level of about one half of the stock of M1 (Cash plus Demand Deposits of the Public) in 1980 to more than 9 times the stock of M1 in January 1990, as it can be appreciated in Figure 2. During 1989 alone, the real stock of FFPD rose by 23% while the real stock of M1 fell by 42%. Rapidly growing public debt coupled with fast demonetization can be an explosive mix, particularly in a year of general elections.

Figure 2

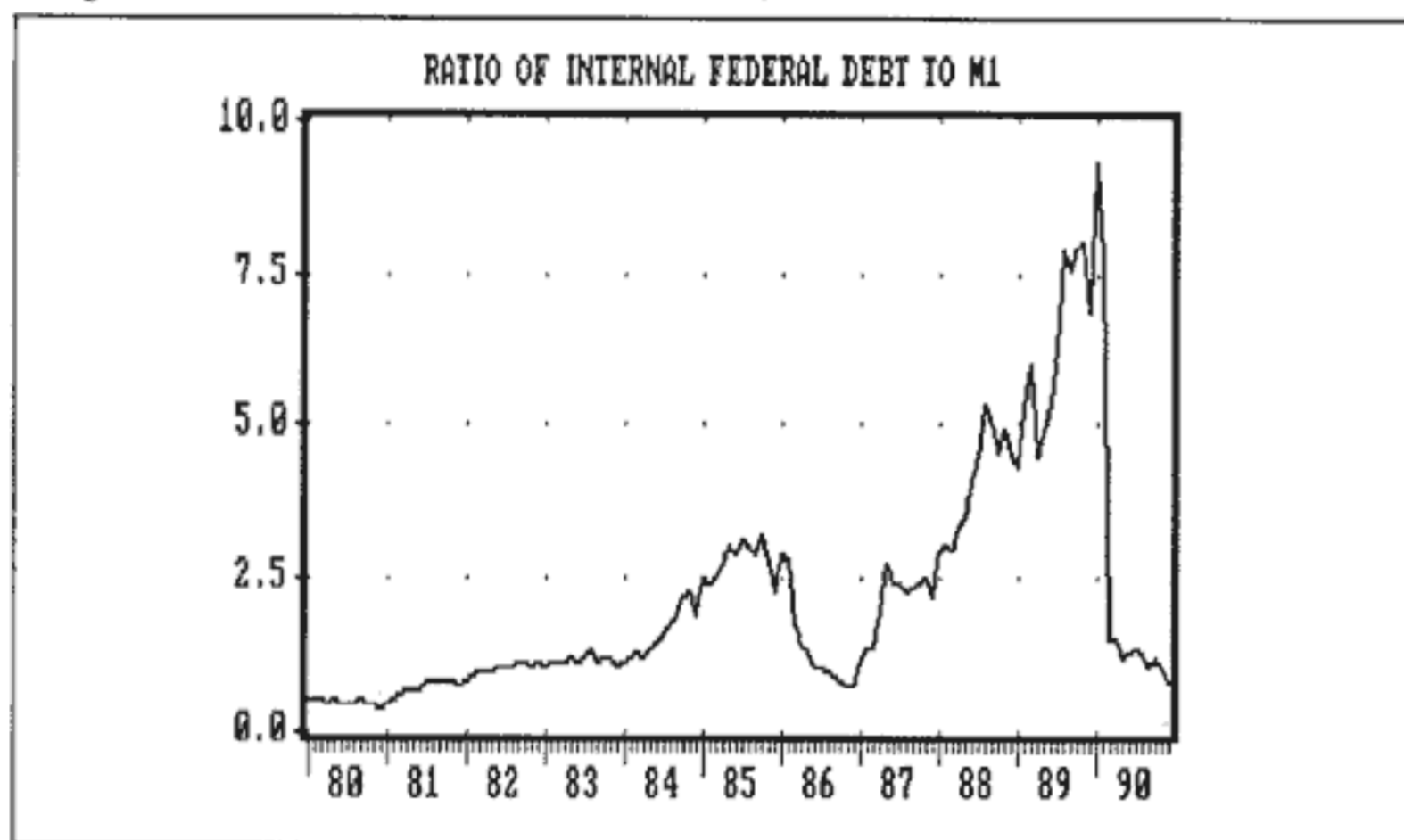
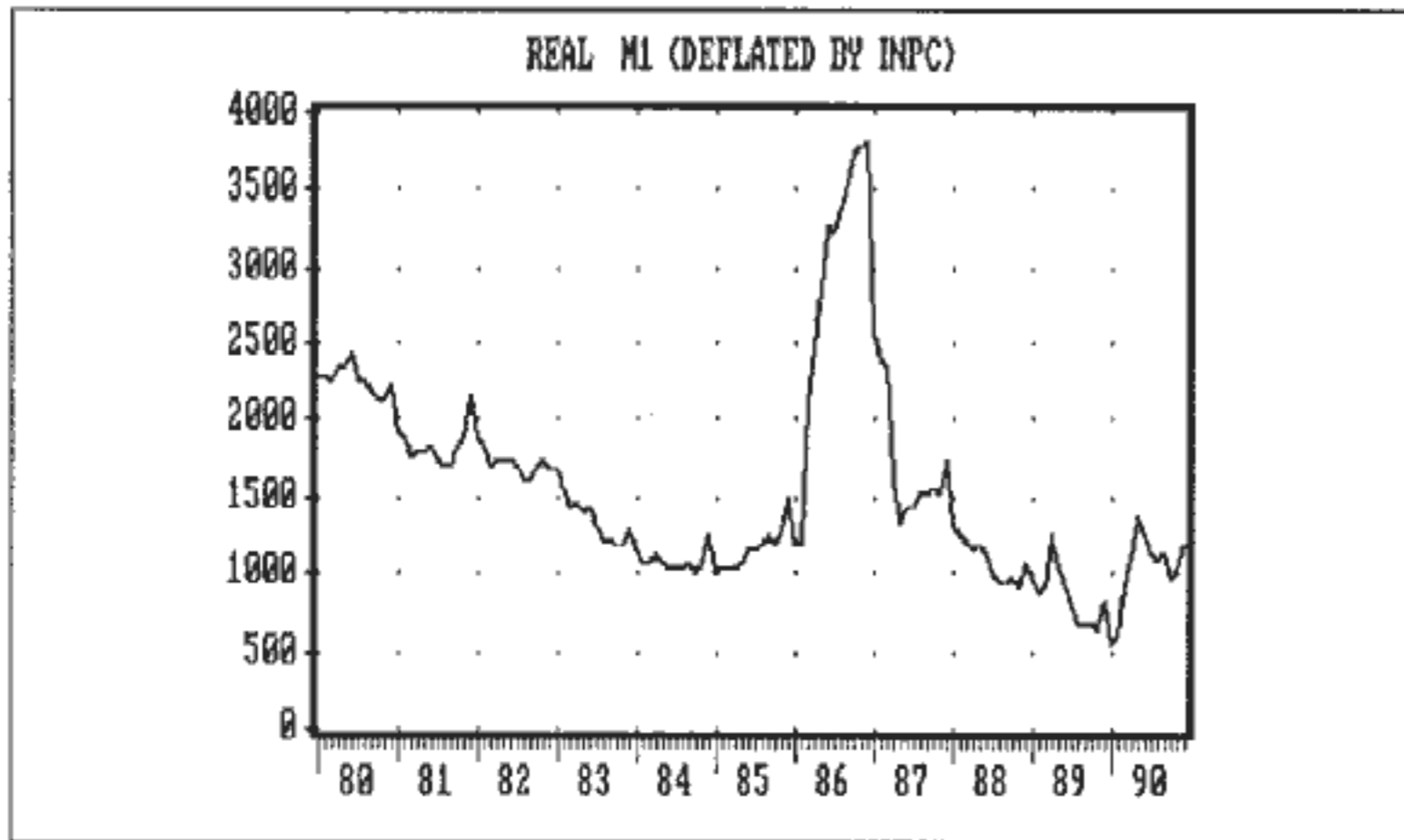


Figure 3



The time path of real M1 --Figure 3-- shows a gradual but persistent trend of fall. Such downward trend is drastically reversed during the Cruzado Plan thanks to the price freeze coupled with continued money creation. After the failure of the Cruzado Plan, it is easy to observe in Figure 3 that real M1 returns back to the level it should have had as predicted by the trend of the previous years: **the price freeze and the heterodox policies followed in those two years only delayed what would be the inevitable outcome of the economy in the absence of fiscal adjustment.**

After the failed experience of Plan Verano in the second quarter of 1989, inflation raises steadily from the 27% reached in July 1989 to the maximum of 73% in February 1990. The economy was in open hyperinflation as President Collor took office in March 1990. The package of measures announced on March 15, 1990 has come to be known as Plan Collor (later followed by the short lived Plan Collor II in February 1991).

The Plan Collor

Plan Collor was an ambitious set of measures aimed at solving the structural problems of the Brazilian economy within the context of free markets. Basically the plan stood on four basic pillars:

(i) Mandatory freeze on approximately 70% of all financial holdings for a period of 18 months, during which they will be paid indexation plus 6% annual interest (no service, however, until September 1991). The Cruzado Novo was replaced by the Cruzado on a one-to-one basis. However, all frozen financial holdings were to remain denominated in Cr.N. until the time of conversion.

(ii) Privatization plan through which the government intends to reverse the growing trend of statization and government interference in economic activity.

(iii) Contrary to other stabilization plans, the government this time does not resort to wage, price or exchange rate controls. The exchange rate for commercial transaction is allowed to float and a free market for tourist transactions is allowed (with the parallel market rate rapidly converging to the level of the tourist rate).

(iv) The government started a strict control of expenditures on a cash basis and stopped payments on the foreign debt to commercial banks as well as payments on a significant fraction of debts with the local government suppliers. These measures produced an initial breath on the Treasury's finances although certainly cannot be considered as a permanent solution. The financial air gained was further broadened by the mandatory 18 months period of grace on the service of the stock of frozen Cr.Novos.

We now describe in detail the mechanics of the instrumental aspects of the privatization process as they have aspects of relevance to the analysis of the money supply process. We shall also address in this section the issue of the fiscal consistency of the Plan Collor particularly in the light of the need to repay the frozen CR.N. Novos after September 1991.

The Privatization Plan

The Brazilian Denationalization Plan (BDP), announced in March 1990, was formally implemented by Decrees No.99463 and 99464 of August 16, 1990 that provide the reglamentation for the initial Law of April 16, mandating the BDP. The privatization process will be under the authority of the Privatization Committee formed by about 40 representatives of different sectors. Executive authority lies in the National Development Bank (BNDS) whose President also heads the Privatization Committee.

In a first stage the BDP call for privatization of about 21 public enterprises, mostly associated with the steel, petrochemical and fertilizing sectors. No firms in the public services sector are contemplated in this initial stage.

The basic tool of privatization will be the sale of shares of the firms to the private sector who will therefore take control of the enterprises. There are a series of preliminary steps through which the firms are valued by consulting firms, minimum prices are set and shares are issued with which we need not be concerned here (see the report on the BDP by Pinheiro Neto- Advogados describing in detail all the legal and instrumental aspects of the BDP).

It has been estimated that the net worth of the firms to be privatized in the first stage could be around a figure of about 18-20 billion dollars. Such an estimate is, however, highly speculative as the firms have not yet been formally valued by the consulting firms and there are major problems regarding, for example, the valuation of those firms debts. The firms from the steel sector to be privatized have an external debt of the order of 12 billion dollars, a fact that makes obvious that the net value of the privatization will crucially depend on the settlements to be reached with the creditors of those firms.

Although privatizations were planned initially to start in March 1991, we have been told there is little chance that any privatization of significance could be done until at least September. The assets of most of the enterprises to be privatized have been placed as collateral for external debts with foreign commercial banks. In fact, not only has the government stopped all payments on the external debt with the foreign creditors, but it has not started any conversations with them regarding the possibility of obtaining a waiver on the external debts these firms have with the Banks. Without such a waiver it is fair to say that the privatization effort is bound to failure as nobody would pay anything on a set of enterprises with a mortgage of external debt that most likely exceeds the total value of gross assets. The Bank's Committee, on the other hand, is unlikely to yield on such a waiver without at least trying to obtain a global settlement on the rest of the government external debt, a process that is bound to take time.

One of the key ideas of the privatization process is to sell the public enterprises in exchange for outstanding government financial debt. The mechanisms for the debt/equity swaps have not yet been set out but final definitions are expected soon, probably in February 1991. As of January, the types of financial paper being discussed as candidates for being accepted as payment in the privatizations are the following:

(1) **The stock of Cr.Novos frozen until September 1991** when they will start to be repaid in twelve monthly installments including principal and accumulated interest plus indexation. The frozen Cr.N. earn indexation by BTN fiscal plus 6% annual. As of January 1991, the value of this stock is of 27 billion dollars and grows at the rate of BTN plus 6% annual. This stock, in and of itself is larger than the estimated total value of the firms to be privatized. There are millions of holders of frozen Cr.N. and these are not transferable. The BDP allows for special funds to be organized by financial institutions where the public can deposit the frozen Cr.N. for the specific purpose of making joint bids (with the rest of the depositors in the fund) in the privatization auctions. The alternative to the holders of Cr.N. is to wait until September 1991 and to start receiving the 12 monthly quotas that would amount to about 2.2 billion dollars each.

It is estimated that if privatizations do not start soon, as September approaches the public would prefer to wait to get his frozen Cr.N. converted into liquid Cruzeiros rather than making an uncertain investment in a public enterprise. Since the authorities are mostly interested in the frozen CR.N. being invested into the privatization rather than being converted into liquid cash, it is highly likely that measures will be taken to reduce the expected value of the Cruzeiros that will be received in exchange for the Cr.N. after the crucial date of September 1991 in order to induce the public to bid in the privatization auctions. However, if September comes without any privatization still implemented, authorities will face the perspective of having to start issuing the equivalent of about 2.2 billion dollars in Cruzeiros per month and risk a new hyperinflation or, alternatively, adopt new measures to again reduce the liquidity of these frozen funds (such as equating them with the Privatization Certificates).

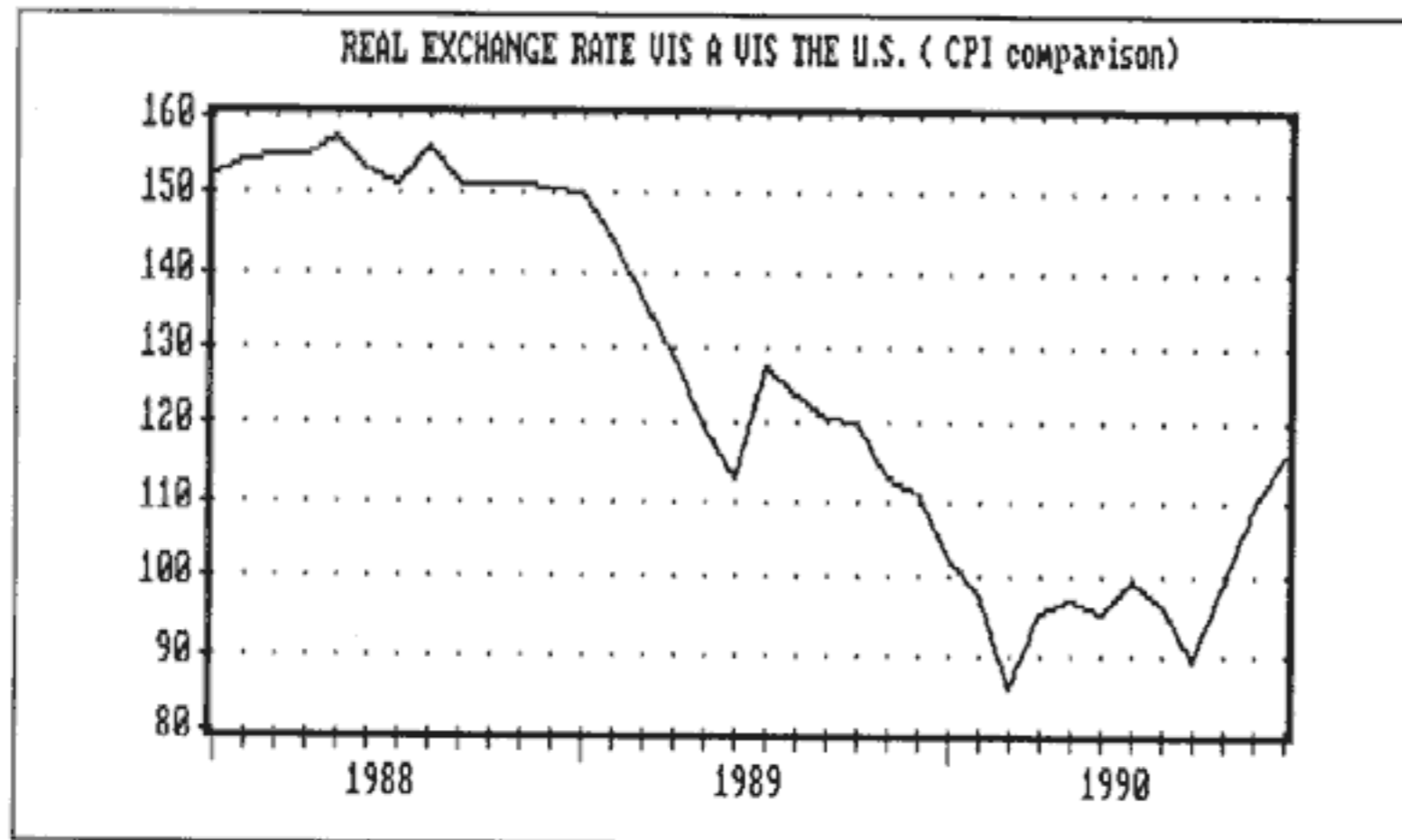
(2) **External Debt with Commercial Banks.** This debt amounts to about 43 billion dollars plus 7 billion in arrears. It trades actually at about 25% of par value, although a higher price should be expected if significant debt-equity swaps are to be implemented.

(3) **Certificates of Privatization (PC)** established by the Plan Collor. They are the result of a compulsory acquisition by financial enterprises of an amount of PC up to a portion of their net worth (8%). The Privatization Certificates so purchased could be exchanged only for stock of the firms being privatized at the auctions to be established. It was established that the total purchase of PC's should be made in 12 monthly installments with the provision that if no privatizations were started after three months, the payments could be stopped until the privatizations started. It was also established that after the auctions started, the remaining PC's would gradually start to diminish their indexation clause as an incentive for the holders to bid for the firms being privatized (however, until the time of the first auction, the PC's already issued will yield BTN plus 6% annual).

Purchases of PC's started in July 1990 and stopped in September 1990 as no enterprise was yet being offered for privatization. Payments have not resumed as of February 1991. The amount of PC's issued was the equivalent to 164 million dollars during July, 158 million in August and 156 million in September, for a total of 478 million dollars. Since then, the dollar value has probably fallen, as the PC's are indexed to the BTN fiscal that follows the CPI while the currency has experienced a substantial real revaluation, as can be appreciated from Figure 4 (the real exchange rate, however, still remains substantially below the historical average for the decade: as of December 1990 it had a value of 81 compared with the average of 100 for the whole of the 1980's). The total amount of PC's to be issued if privatizations are actually started is estimated at around 3 billion dollars.

(4) **Debt with government suppliers** that has remained unserviced since March 1990. This debt is in the process of being renegotiated. In a first stage the debt would be consolidated into a single instrument and in a second stage this new instrument could be presented at the privatization auctions in exchange for stocks of public enterprises. There are no serious estimates as of the final amount of this debt after consolidation, but a very rough estimate would put it at around 10 billion dollars.

Figure 4



Except for the bids in Cruzeiros (the legal tender) and the Privatization Certificates that are to be accepted at par, the relative prices between the three other types of debts (CR.Novos, Suppliers' debt and external debt) still have to be determined before the auctions can actually be made. Otherwise it would be impossible to compare offers made in different specie such as in Cr.N. and in titles of external debt. Since they are not negotiable, at least until September, there is no way to know for sure if the Cr.N. may have an equilibrium market value below par due to the low interest rate it yields plus the risk that they may not actually be paid back. If the equilibrium market price of the Cr.N. were to be below par, but they were to be accepted at par in the auctions, it would be preferable to make the offers in Cr.N. rather than in Cruzeiros or any other instruments that were to be taken at market value.

In conclusion, there are 5 different species that could be accepted at the privatization auctions, of which two are to be accepted at par and the other three will have to have their price settled before the auctions. If the price of one of the species were to be set at a level below that which would be the equilibrium market price, there would be an implicit subsidy for making the auctions in that particular type of specie.

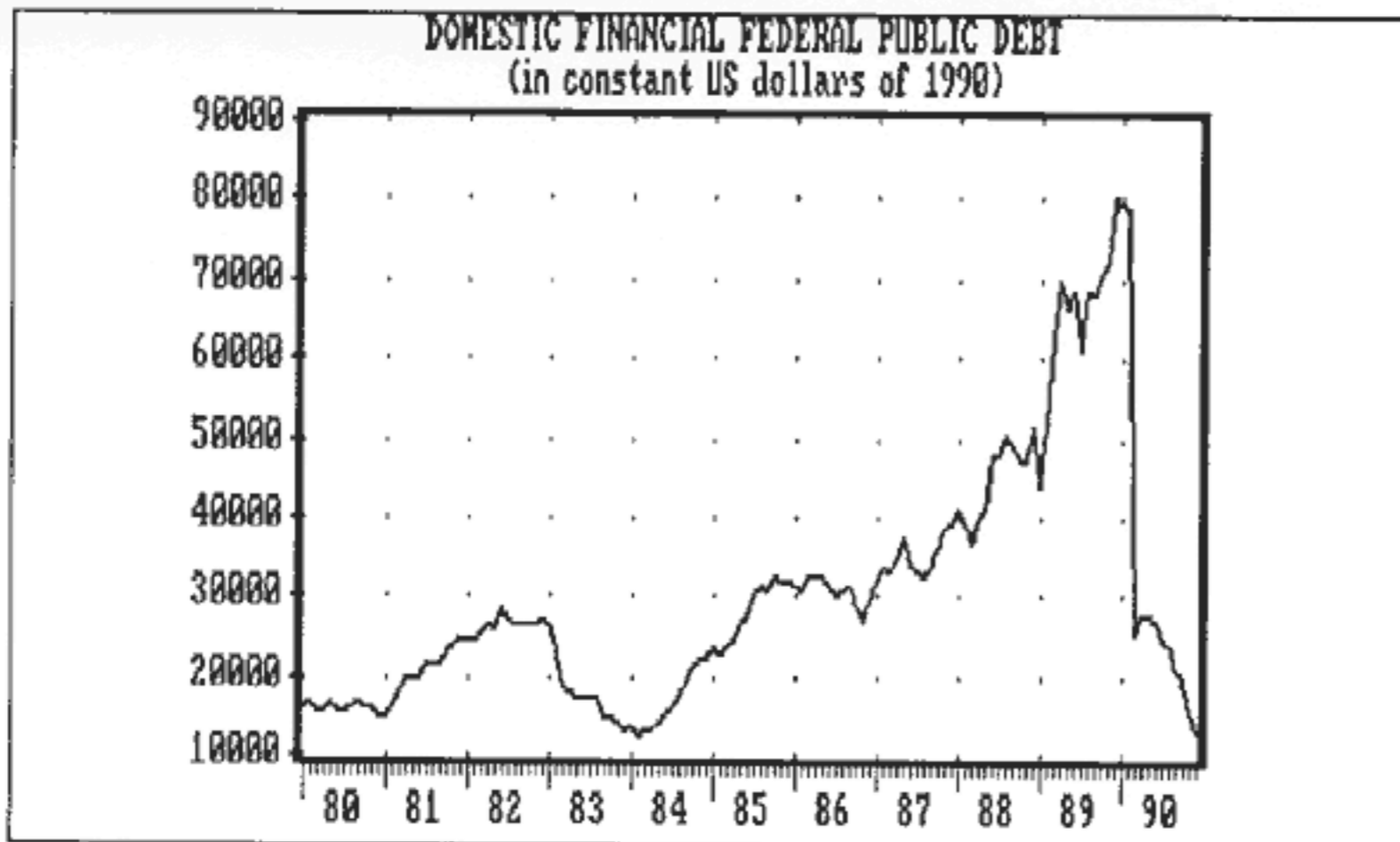
We feel that if the Cruzado Novo is accepted at par in the privatization auctions to be done before September 1991--as it seems it will be the case-- it will tend to displace the other debt instruments, provided the others are accepted at prices close to their free market values (as they must since they are transferable and nobody will bid with an asset valued at less than the market value). On the other hand, if the possibility of the convertibility of the Cruzado Novo after September is held with a large degree of certainty, the public may choose to hold to the frozen Cr.N. in order to have them exchanged for liquid Cruzeiros after September. Under such circumstances, we can foresee pressures to equate the frozen Cr.N. to the Privatization Certificates or some alternative aiming at reducing their liquidity.

The Financial Freeze and the Fiscal Balance

During 1989, the value of the outstanding stock of Internal Financial Public Debt (not including the public debt held by the Central Bank) rose from \$40 to \$76 billion dollars. For that same year, the compound real interest rate on Bank's Certificates of Deposit was 40%. Assuming Federal Public debt paid about the same rate as the Bank's CofD, the gross increase of \$36 billion incorporates real interest costs of about \$16 billion. The rest of the 20 billion can be accounted for the substantial real appreciation that took place (that raised the dollar value of the Cruzado assets) and the financing of the public deficit.

Figure 5 shows the time path of the real stock of financial public debt privately held, measured in constant dollars of 1990. As shown, from Jan. 1984 to Jan. 1990, the debt grew at the astonishing annual compound rate of 34.3% in real dollars!. As the debt grew, it became more difficult to roll it over in the market, as the Treasury did not have the primary surplus to pay even for the real interest due. The higher interest rate required to refinance the debt implied that it was due to grow even faster when the new interest service came due. As this happened the roll-over of the outstanding debt became increasingly more difficult and an alternative to increasing the interest rate paid was to increase the liquidity of the new debt issues by shortening its maturity or resorting to indexing the principal to the short run market interest rate or the inflation rate.

Figure 5



Gradually the terms in which the debt was issued shifted from stipulating a fixed nominal interest rate to being indexed to a price level (the BTN: Bonos do Tesoro Nacional) and then to the market's overnight interest rate (the LFT: Letras do Financiamento do Tesoro). The LFT became the most widely held public debt title by the time of the implementation of the Collor plan, with average maturity of about 24 months and paying the market's overnight interest rate. This implied that the total value of the LFT stock was indexed to the daily interest rate in the money market, a highly distabilizing situation for a country already at the verge of hyperinflation. As the market would get nervous, the interest rate would rise and immediately the stock of outstanding public debt would raise in the same proportion, putting additional pressure in the financial markets.

High inflation and the resulting fall in money balances stimulated the market's search for alternatives forms of remunerated liquidity. The LFT's provided a good hedge against interest rate changes but were not liquid enough to make them attractive to small investors. Banks started capturing overnight deposits from the public in money market funds and used those funds to purchase LFT of a much longer maturity. Short run money market funds were also created that received deposits with a maturity of 21 days and used the proceeds also to buy LFT or bank's Certificates of Deposits.

Overnight deposits and Short run money market funds clearly compete in liquidity with the traditional liquid monetary assets (currency and demand deposits) except they additionally pay interest. This additional supply of liquid assets further put fuel into the inflation process, generating a financial system where the market could basically generate its own supply of liquid assets (the demand for monetary base was practically kept at a minimum thanks to the creation of liquid assets through overnight swap operations not subject to legal reserve requirements).

The financial system became like an inverted pyramid with two vertices: (i) the monetary base, providing for the secondary expansion of demand deposits and to a lesser degree of the savings accounts deposits (in this case the reserve requirements are very low and often are not complied with) and (ii) the federal public debt that, after intermediation, becomes the counterpart for the overnight and money market funds.

In the government's view, the country had entered into a vicious circle of high debt with high real interest rates from where it was not possible to leave because of the lack of the required fiscal surplus with which to repurchase the debt. The solution laid in selling government assets in exchange for the outstanding debt. This would help reducing interest rates and restoring normality to financial markets and inflation. But privatization would take more time than what the outgoing hyperinflation would allow for. Therefore, the Plan resorted to a mandatory freeze on all financial assets for a period of 18 months. It was expected that after those months there would be enough public firms in condition to be exchanged for a substantial part of the now excessive stock of outstanding public debt. During the transition, the real interest rates on the frozen financial assets was set at 6% annual and the principal was also indexed to the BTN index that closely follows CPI inflation (except for the initial month when there was a loss of about 15%).

Most of the financial public debt outstanding as of 1990 was not held directly by the public but was rather intermediated by financial institutions through the overnight money market and short run funds. Therefore, much of the debt was "compromised" as collateral for the extremely liquid liabilities of the financial institutions. It was therefore impossible to freeze the assets of the financial institutions without also freezing their liabilities. The step taken was to freeze all the liabilities of the financial institutions rather than only those that had public debt as a counterpart. This may have been due partly to difficulties of instrumentation, but most likely to the desire to sharply reduce outstanding liquidity of the economy in order to obtain a quick improvement on the inflation front.

The freeze on financial assets was implemented together with a change in the denomination of the currency. The Cruzado Novo (Cr.N.) was replaced by the Cruzeiro at a one to one rate (just a change of name). The frozen assets are to remain denominated in Cr.N. until the time at which they will be converted into Cruzeiros at the one to one rate (conversion to start in September 1991 in 12 monthly quotas including principal plus accrued interest at the rate of BTN plus 6%).

The frozen liabilities of the financial institutions were changed to the order of the Central Bank of Brazil (BCB) in an account called VOB (Values to the order of the Central Bank). At the same time, the financial institutions had to deposit a similar amount at the BCB: partly this was made up with the 80% of the frozen LFT's they had in their portfolios and the rest should be made up by selling other assets. At the Central Bank, a liability account denominated #6110 pooled all the deposits made by the financial institutions as counterpart of their frozen deposits in CR.N. Novos in the VOB account. The value of the account #6110 at the BCB, therefore, represents the amount of resources deposited at the BCB that are to be returned to the public after September 1991. In practice, however, the amount due to the public as shown in the VOB account (or rather by the sum of the VOB accounts of all financial institutions) is larger than the amount deposited in the account #6110. The reason is that the Savings and Loans (Mortgage Credit institutions) were borrowing short with the Passbooks (Cuadernetas de Poupanca) and lending very long mortgages; therefore, they had no liquid assets to transfer to the Central Bank in the account #6110. As of December 31, 1990, 4.7 trillion Cruzeiros are due to the BCB on account of an equivalent amount of frozen Cr.N. but only 3.56 trillion Cr. have been deposited at the account #6110.

At the prevailing commercial exchange rate of December 1990, the dollar value of the stock of frozen Cr.N. that will have to be returned after September 1991 is of \$27536 million. Out this total, however, only 20788 have been deposited at the account #6110 by the financial institutions. The remaining \$7 billion dollars are mainly due by the Savings and Loans institutions.

The deposits at the account #6110 grow on account of indexation by BTN plus the 6% real interest and fall to the extent that permanently authorities are allowing for the unfreezing of funds for "special" cases.

Table 1 shows the total amount of frozen CR.N. novos (VOB), the amount that has been defrozen (DEFR), the net amount due (VOB net), and finally the actual amount deposited by the financial institutions at the account #6110.

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TABLE 1

STATE OF ACCOUNTS FOR THE FROZEN CR.NOVOS
(Trillions of Cruzeiros)

	VOB	DEFR	VOBnet	#6110
March 1990	2.17	0.21	1.96	1.81
April	3.18	0.71	2.47	1.62
May	3.50	1.35	2.15	1.29
June	3.74	1.41	2.33	1.67
July	3.94	1.42	2.52	1.76
August	4.16	1.43	2.73	1.91
September	4.46	1.43	3.03	2.19
October	4.94	1.44	3.50	2.54
November	5.54	1.45	4.09	3.00
December	6.21	1.50	4.71	3.56

VOB: Current Value of the initial stock of frozen Cr.Novos.

DEFR: Amount already returned (prematurely) to owners.

VOBnet: Current value of actual amount due of Cr.N.

#6110:counterpart deposits made by financial institutions at the BCB.

Source: BCB

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As of December 31,1990, the value of the stock of frozen Cr.N. is of Cr.4.7 trillion, equivalent to \$27.5 billion U.S.dollars. Assuming the real exchange rate to remain constant, the remaining real interest due will take this amount to a value of around \$28 billion by September. This last amount is more than twice the amount of 13.3 billion dollars of remaining public debt titles in the market (as of Dec.31,outside of the BCB).

We can now make some very simple calculations to get a feeling about what could be the potential impact of the rescue of the \$28 billion in Cr.N.under different assumptions regarding the way the repayment takes place:

(i) The best alternative is obviously that all the Cr.N. are rescued against stocks of the privatized public enterprises. This alternative has very little chance of taking place given the observed delays in the privatization process. It has larger chances of being feasible if the Cr.N. are equalized to the Privatization Certificates and therefore be made good only for bidding at the privatization auctions. Needless to say this last alternative is bound to have a very high political cost and may imply a tampering with property rights that might further endanger the working of the financial markets.

(ii) The worst alternative is that all of the \$28 billion are rescued issuing new Monetary Base (MB). As of December the stock of the MB was equivalent to \$9.5 billion dollars. At a monthly rate of repayment of about 2.33 billion, the MB would grow by an additional 24.5% monthly during those 12 months. Since such monetization would clearly be out of the feasible range, the only possible outcome is for inflation to raise at an additional 24.5% monthly in order to generate the required additional inflation tax. However, inflation is already around 20% monthly and therefore the risk of a new hyperinflation would become more than a certainty in this case.

(iii) The total stock of Cr.N. is converted into new public debt instruments. The difference with the previous alternative lies in whether the government is able to generate primary surpluses large enough to serve the real interest on this incremental debt. Otherwise, very soon the market will be flooded with public debt that will eventually substitute for money with the same or worst inflationary effects than if the original debt had been settled directly by printing money (see Sargent and Wallace on the "Unpleasant Monetarist Arithmetics"). For the reasons that follow we assign very little chance of success to this alternative unless sharp changes in the way public finances are conducted do take place.

The public finances under the Plan Collor

Table 2 shows the cash revenues and expenses of the Treasury during 1990. The expenses do not include any interest on the frozen public debt or on the external debt with commercial banks. The figures are shown in current US dollars at the prevailing commercial exchange rate in order to facilitate comparison.

TABLE 2

FINANCIAL OPERATIONS OF THE TREASURY (Cash Basis)
(Millions of U\$S)

	REVENUES	EXPENSES	SURPLUS
January 1990	4042	10620	-6578
February	3608	8606	-4998
March	9695	11277	-1582
April	7468	4479	2989
May	10961	8311	2650
June	4876	4571	305
July	4899	4710	189
August	4975	4788	187
September	4793	4618	175
October	4802	4765	37
November	4081	4068	13
December	4332	4309	23
AVGE. July/Dec	4647	4543	104

SOURCE: Departamento Do Tesoro: Demonstrativo da Execucao Financiera do Tesouro Nacional

It is clear that the fiscal adjustment after March 1990 had two clearly differentiated stages. In the first stage, April and May, the unsustainable deficits of the first quarter of the year are reversed thanks to a series of extraordinary measures that were not to be sustained in the following months. The second stage, starting in June, marks the beginning of the fiscal deterioration under the plan. It is fair to say that the fiscal surplus has deteriorated in each successive month after the original surplus of almost three billion dollars was reached in April (with the exemption of December when there was a trivial increase). From \$3 billion surplus in April, followed by a \$2.6 billion surplus in May, the surplus settles at a more reasonable \$300 million in June and since then it has gradually fallen to a bare \$13 million in November and \$23 million in December.

In the second semester of 1990, revenues and expenses settle at highly stable levels averaging \$4647 and \$4543 million U\$S for an average cash surplus of \$104 millions per month, equivalent to \$1248 million per year. It should be noted that the \$1.2 billion dollar surplus does not include provisions for the service of "any interest or amortization on suppliers debt of about \$10 billion U\$S, external debt of \$40 billion U\$S and the stock of \$27 billion of frozen Cr.N..

It should also be mentioned that, in spite of the Treasury running a fiscal surplus during the second semester of 1990 at an equivalent annual rate of \$1.2 billion, the perspectives for the resumption of anything close to regular service of the government debt remain grim (as of January 1991). During that semester, the real interest rate on CDB (time deposits) run at the annualized rate of 43%. At a more optimistic rate of 20% real annual, the service of just the frozen CR.N. would require a cash surplus of 5.6 billion, still a far cry from the annual rate of just \$1.2 billion reached in the second semester, but still feasible under a serious fiscal adjustment effort. Of course, the assumption of a 20% real rate as cost for the refinancing of the frozen CR assumes that a serious adjustment does take place, otherwise the rate would be at least the actual 43% per year, or even raising as the crucial date of September approaches.

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The Menu of Financial Assets Available Under the Collor Plan

During the period of implementation of the Collor I Plan and for many years before, Brazilian financial markets have been characterized by the overwhelming weight that is played by government debt instruments and the extremely short maturity with which most operations are conducted.

The first thing that shocks the foreign observer is the extremely high degree of indexation in the financial markets. No less than six price indexes are regularly constructed and daily announced in financial newspapers. There is even a daily futures market for price indexes where one can hedge against fluctuations in the price level (as measured by the BTN Index described below).

Among the most widely used indexes is the BTNfiscal, nowadays an accounting unit that is indexed to the IRVF (Index for the adjustment of fiscal obligations). Previously, the BTN was an indexed bond of the Treasury that did adjust to the IRVF. The BTN as a bond was discontinued but the index of its 'would be' market value continued widely in use for indexation of financial and commercial transactions. For example, as of January 15, 1991, the BTNfiscal had a value of 112,1399 Cruzeiros, equivalent to \$0.6112 dollars at the commercial exchange rate; in January its value was increasing at the daily rate of 0.6770% (per working day). The IRVF is based in a three cities sample of the wider index INPC covering nine cities (INPC: National Consumer Price Index), both indexes being produced by the National Statistics Bureau. In all our calculations for obtaining real variables we have used the INPC; this index is also the one used at the Research Department of the Central Bank. Other price indexes used are the ones constructed by the Fundacion Getulio Vargas and the one made by the Brazilian Institute of Geography and Statistics (IPC-IBGE).

Another peculiar characteristic of the Brazilian financial market is that in many instances the interest rates are quoted on the basis of a 22 working days month. For example, a monthly nominal interest rate of 40% for overnight deposits would really mean a daily rate of $40/22\% = 0.01818$ and if left during the 30 days of the month it would earn interest only during the 22 working days for a total of $(1.01818)^{22} = 1.486$, equivalent to 48.6%.

We now proceed to describe the available set of instruments in the financial market as of January 1991, all of them possible candidates for alternative measures of the stock of liquidity in the economy relevant for the determination of the inflation process.

(1) Cash

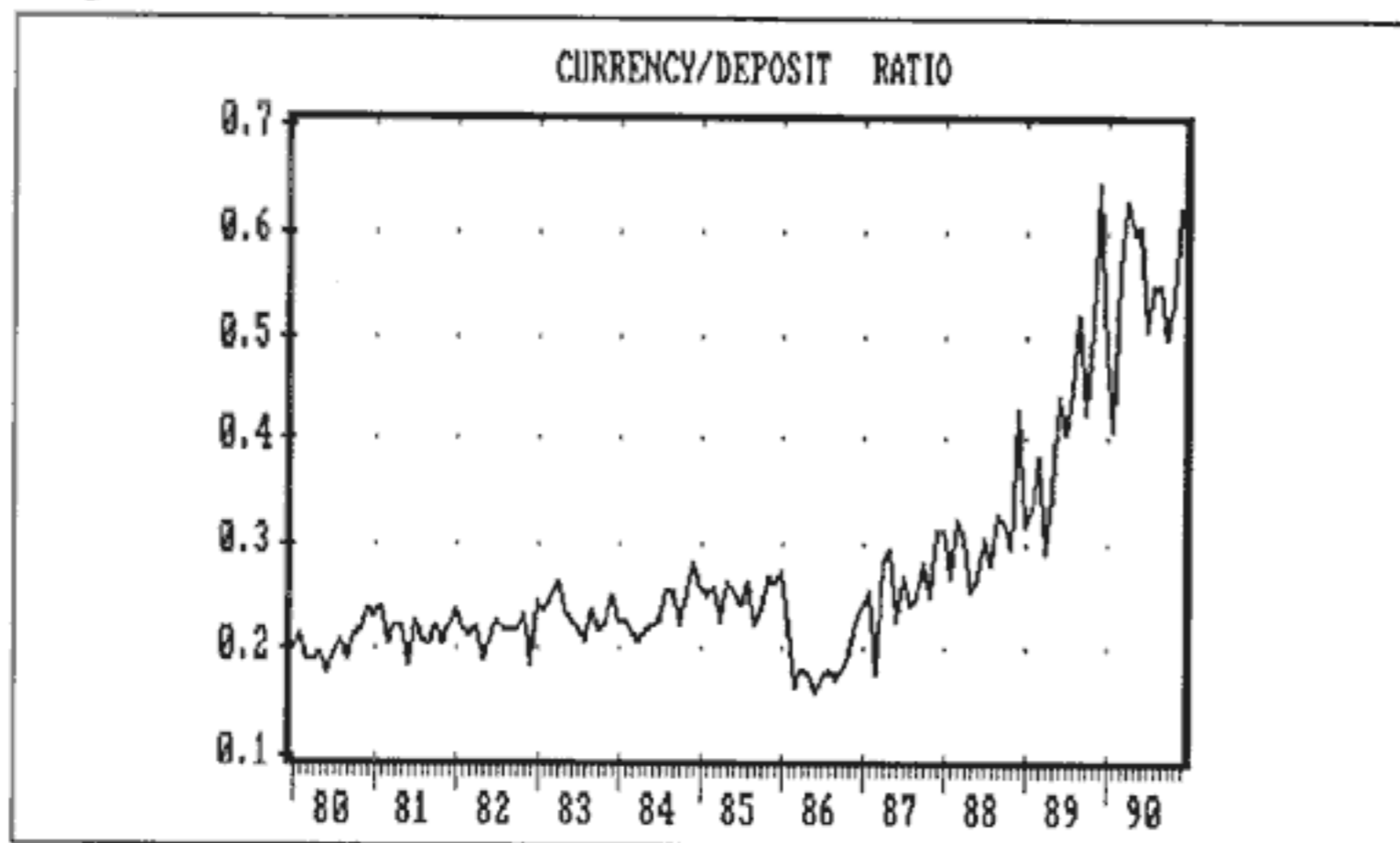
The legal tender since March 1990 is the Cruzeiro. However, there are still in circulation notes and coins in Cruzados Novos and a few bills in Cruzeiros. The frozen deposits under the Plan Collor are still denominated in Cruzados Novos and will become Cruzeiros only after their gradual liberation after September 1991. Holdings of currency were the only financial assets exempted from the freeze of the Collor Plan. Immediately after the implementation of the freeze of about 80% of all other financial holdings, the public drastically changed the composition of the remaining 20% in favor of currency that almost doubled in real terms during March alone.

(2) Demand Deposits

Bank's sight deposits are subject to a reserve requirement by the BCB that ranges from 30% to 45% depending on the size and location of the institution. Reserves deposited at the BCB do not earn any interest or indexation and are, together with currency, the basis for the inflation tax, as they are the only non-interest earning liabilities of the Central Bank. An additional restriction on the use of the funds captured with demand deposits is that 25% of the amount must be lent for Rural Credit Operations at a rate of BTN plus 9% annual.

The Currency/Deposits ratio has shown a clear upward trend as inflation has increased along the 1980's. During the first half of the 80's, when inflation was in the much lower level of one digit per month, the C/D ratio stood at about 0.2, as shown in Figure 6. During the second half of the 80's as inflation spiraled also did the C/D ratio that almost tripled in value to the level of around 0.6 as of 1990. This observation is the result of the fact that a majority of demand deposits is held by firms whereas individuals hold relatively more cash. In high inflation, firms are better positioned to avoid the inflation tax than individuals; in consequence the demand for demand deposits falls more than the demand for currency and we observe the C/D ratio to increase.

Figure 6



(3) Time Deposits (CDB)

Time deposits are transferable IOU's issued by banks in order to raise funds. They have an average maturity of 60 days and are denominated CDB (Certificate of Bank Deposit). Normally they are issued in large denomination at a fixed nominal interest rate and maturity. These CDB's are sold at market prices depending of the day's interest rate (that may be different from the rate at which the CDB is issued). Normally they are sold to other banks or money market funds who would fraction them for the small investors. The public can share in a fraction of a CDB for smaller amounts and even for very short periods of time. CDB are standard investment alternatives for the money market funds in addition to Federal and State debt and other financial assets. Banks also issue CDI (certificates of interbank borrowing) but these are only held by other banks in the interbank borrowing market.

There are no reserve requirements on CDB's. They can be issued at a fixed nominal interest rate (denominated "taxa prefixada", in the sense that the nominal interest rate is known from the start) or they could also be indexed. Indexation can be made by some measure of the market interest rate (the closing quotation for the overnight rate or the cut rate for the BCB daily auction of Bills) or by a price index; in either case the Bank may pay a premium over the indexation factor. The indexed obligations are denominated "taxa postfixada, in the sense that the nominal interest rate earned will only be known as maturity occurs).

(4) Savings Passbooks (Cuaderneta de Poupanca)

These are deposits made at Savings and Loans that use them exclusively for mortgage housing credit. The biggest S&L is the Caixa Federal (the National Mortgage Bank), publicly owned. The S&L deposits are subject to a 15% reserve requirement that is remunerated by the BCB at the rate of BTN plus 6% annual.

(5) Fixed Rent Funds (Fondos de Renda Fixa)

One of the two kinds of Money Market Funds (the other are the Short Run Funds described next). The investor buys shares in the Fund and the money is used to purchase interest earning assets (either prefixed or postfixed) as opposite to risky assets such as stocks or gold. Normally these funds acquire CDB's and Treasury Bills (called LTF) or Central Bank Bills (called BBC). The value of the share is the total value of the Fund's portfolio divided by the number of shares issued. The reward to the investor takes the form of capital gains on the price of the share between the day he makes the purchase and the day he gets out.

Deposits at the Fixed Rent Funds are nominative (non-transferable) and have a minimum maturity of 21 days. Early withdrawals are penalized by the loss of all adjustment in the price of the share from the purchase day on. The Funds (usually administered by Banks) are mandated by the BCB to invest at least 10% of their portfolio in Federal Debt Titles and there are no reserve requirements being imposed.

(6) Short Run Funds (Fondos de Corto Praco)

They also operate as a money market fund but have no withdrawal penalty other than paying the Tax on Financial Investments (falls on investments of maturity of less than 18 days at a decreasing rate that ranges from 40% of the interest on overnight up to zero for 18 days). These Funds are required to invest at least 70% of their portfolio in Federal Debt Titles. Typically, the Fund will invest the liquid funds in the overnight money market against swaps for Federal Debt.

(7) Overnight (Open Market)

This market performs large swaps operations with Federal Debt Titles or CDB. The typical operation for making a deposit there would be to purchase the equivalent amount of Debt titles from the open market agent with a repurchase agreement for the next day at a higher price. The capital gain realized after the repurchase is the equivalent of the interest earned. Deposits overnight may belong directly to the public or indirectly through the intermediation of the Money Market Funds.

(8) Federal Debt Titles

The total stock of Federal Debt issued by Dec.31,1990, stood at around 17.9 trillion cruzeiros (about 104 billion dollars). However, only 2.06 trillion were outstanding in the market (\$12 billion dollars), the rest being held by the Central Bank. The counterpart of the Federal Debt held by the BCB is the money it issued to purchase it or the interest plus indexation earned on the stocks held. From a practical point of view, all that we observe is that the BCB has financed the fiscal deficits through a triangular operation: the Treasury finances the deficit by selling its own debt in the market. Then the Central Bank accommodates the Treasury borrowing by printing money and repurchasing the debt titles from the market. In the end we observe that the fiscal deficit was financed by printing money. Sure enough, this operation results in the creation of a debt of the Treasury held at the Central Bank, but nobody expects it to be ever paid, as the BCB has no real profits.

Before the Collor Plan, the bulk of the Federal Debt was documented in the form of the LFT (Letra de Finaciamento de Tesoro). The LFT had a varying maturity with an average of two years) and the principal was indexed daily to the index constructed using the overnight money rate. This meant that an increase in the interest rate for just one day resulted in an increase of the value of all the outstanding stock of LFT.

In March 1990, 80% of the outstanding stock of Federal Debt (and all other financial assets denominated in Cr.N.) was subject to the freeze. In the case of debt titles that were backing deposits at financial intermediaries, 80% was to become frozen in CR.N. only on the day the deposit was due (this refers to the "operacoes compromissadas"). The debt titles that were held directly by their final owner ("operacoes finais") become converted into Cr.N. only at the day the title matured. Much of the titles held outside the BCB were held as Op.compromissadas with short run maturity and as a consequence 80% of them has already been converted into Cr.N. The debt titles held by the BCB are being converted, not into Cr.N. but into a new title called "BTN especial" that accrues BTN plus 6%. Part of the stock of BTN especial was acquired by the Central Bank with the debt titles that the banks were forced to deposit as counterpart of the frozen deposits (#6110); the rest corresponds to the titles the BCB already had in its portfolio.

As a consequence of the freeze, the stock of LFT outside of the BCB was reduced from 2.6 trillion in March to 0.745 trillion in April (the March figure is already free of the amounts frozen corresponding to operacoes compromissadas coming due during the last two weeks of March).

In May 1990 the Treasury decided to stop issuing the LFT with postfixed interest rate and changed to the LTN (Letra do Tesoro Nacional) with a prefixed nominal interest rate. As the LFT in the hands of the public (remaining from the 20% that was left unfrozen) came due, they were replaced by LTN. The BCB started conducting all its open market operations with LTN. The Treasury recognized the Central Bank the rate of return of the LFT on its portfolio of Federal Debt but asked the Bank to conduct open market operations with the LTN. This created some accounting problems related with the bearing of the frontal charge of nominal interest on the LTN vs. the indexed LFT that resulted in the BCB starting to issue its own short run bill, the BBC (Bono do Banco Central) to conduct the open market operations. The BBC started being issued in January 1991. The Central Bank issues BBC and exchanges them in the market for the outstanding LTN. The Central Bank therefore creates a new liability (the BBC) and acquires an asset (the LTN). Subsequently, the LTN is exchanged at the Treasury for an LFT as the BCB does not hold LTN in its portfolio.

The Modifications of the Collor II Plan

From October/November 1990 onwards, the fiscal situation starts to deteriorate rapidly, particularly among the large States and Municipalities. The overspending by the States was facilitated by the authorized liberation of frozen Cruzados for the purpose of paying taxes, a measure that induced debtors to quickly set their debts in amounts not observed before. Thank to this measure the States received the extra funds and quickly spent them. States also resorted to issuing debt that was intermediated by the State Banks who in turn were to receive automatic rediscounts from the Central Bank on account of the amounts unsold of these titles.

In the month of December 1990 alone, the Narrow Monetary Base grew by 58% as compared with a total accumulated growth of 11.1% during the previous six months (May/November). One of the significant factors explaining this unusual expansion was the granting of financial assistance to State Banks that were already under great financial stress. Other important factors for the observed monetary expansion was the purchase of Federal Debt Titles and of Reserves.

On January 31, 1991 a new economic package is announced that promises deep changes with respect to the previous basic framework. It is difficult for us to evaluate this new plan since short after three months of its announcement the whole economic team that was supposed to have designed it resigned and a new team was appointed led by Minister Marcilio Marques Moreira.

The most obvious objective of the new plan was to stop inflation through the recovery of effective monetary control by the monetary authorities. The fact is, however, that in addition to the financial measures that could aid to this former objective, the government also instrumented an immediate freeze on all prices and wages.

In the financial sector the most relevant measure was the suspension of all overnight operations and short term deposit funds and the creation of an interest rate index called the TR (Reference rate).

The TR was to be announced by the BCB during the first 8 working days of the month and is based on the rate paid by a sample of commercial banks on their Certificated of Deposits (CD's).

Several financial investments were to have their return tied to the TR index: first of all the stock of frozen Cruzados starts being remunerated at TR+6% annual, a rate that also starts to apply to all Savings Accounts. All Federal Bonds outstanding as well as Banks remunerated deposits at the Central Bank start paying a remuneration equal to TR. Free from the TR are the less than 90 days Bank's Certificates of Deposit that are allowed to pay a pre-fixed nominal rate (and the TR becomes the average of these rates).

Price indexation is forbidden in all contracts of less than one year term. Financial contracts of less than 90-days must be stipulated at a prefixed nominal rate. For more than 90-days maturity, the contract may be stipulated at TR plus a fixed spread.

The only short term investment alternative allowed is the new Fund of Financial Applications (Fundo de Aplicacoes Financeiras "FAF") that can be held by any authorized financial institution. The public may now choose between shares at this short run fund or in the pre-existing Fixed Rent Funds with a minimum maturity of 21 days.

The FAF has a required portfolio composition as follows;

- 43% in Federal Government Bonds or Deposits at the BCB, both paying TR.
- 44% in authorized State Bonds and private sector paper.
- 8% in the new Economic Development Titles (TDE) paying TR +12%. The funds from TDE will be used to finance private sector modernization programs.
- 3% in the new Social Development Fund ((FDS) to promote social investment projects and administered by the CEF.

All FAF withdrawals with a maturity of more than 23 working days will be exempted from the tax on financial operations. For the rest of maturities between 1 and 22 days there is a graduated scale of taxes ranging from a 45% tax (on the interest) for a 1 day withdrawal to 2.15% for a withdrawal after 22 days.

A crucial element in the Collor II Plan is an effort to get some improvement in the State finances and to solve the problem of the outstanding stock of State Bonds that ended up being financed through Central Bank rediscounts. States were forbidden to issue new bonds tied up to anticipated future receipts (emprestos de anticipacao da receitas).

In the absence of any Federal help it was clear that the market for State Bonds was about to collapse and this would have turned insolvent both the State Banks and the States themselves. States were invited to enter into individual "Agreements" (Acuerdos") with the Federal authorities in order to elaborate plans for the recovery of their finances through the implementation of adjustment plans. Under the agreements the Central Bank assumes responsibility for the floating state bonds that were being placed in the overnight market in fact converting them into a Central Bank Bond, but only for a maximum period of 180 days. After this trial period authorities expect that the states will have made the necessary fiscal adjustments so that their debt will be liberated from the Central Bank and they will have to resume placing it in the free market.

According to authorities, if after the 180 days a State has not made the necessary adjustments it will not be able to place the debt now freed by the BCB and the State Bank will be allowed to go broke.

On the fiscal front there were few relevant changes. Public sector utility prices were raised between 40% and 59% on January 31 and the intention was at instrumenting overall government savings by an additional 1.5% of GDP.

In spite of all the measures being adopted, the Monetary Base grew by 38% in February (first month of the new plan) and 11.7% in March. In spite of the price freeze the Consumer Price Index rose by 21.8% in February and close to 6% in March.

The Primary Surplus of the Treasury on a cash basis (measured in dollars at the official rate) was not able to reach the already depressed level of the last quarter of 1990. Table 3 shows the evolution of primary expenditures and receipts since 1990.

The first quarter of 1991 shows the worst fiscal result since President Collor took office in spite of the implementation of the new economic package. Notice that we are evaluating the fiscal performance on the basis of the primary surplus and therefore this worsening of the situation is independent from the service of the internal or external public debt as well as the high interest rates that may have been due to the dynamics of indexation.

TABLE 3

BRAZIL: PRIMARY SURPLUS SINCE 1990
(In millions of US dollars computed at the official)
(average monthly exchange rate)

	TOTAL REV. (1)	TOTAL EXP. (2)	INTEREST EXP. (3)	PRIMARY SURPLUS (4)	OFFICIAL EXCH. RATE (5)
	(In Billions of Cr.)			(In million Dollars)	
JAN.90	57.7	151.7	94.0	0	14.3
FEB	87.9	209.8	98.3	-968	24.4
MARCH	236.4	275.0	72.1	886	37.8
APRIL	363.5	218.0	3.8	3067	48.7
MAY	571.3	433.0	17.0	2980	52.1
JUNE	278.9	261.4	0.5	313	57.2
JULY	337.7	314.2	5.2	430	66.7
AUGUST	368.6	343.8	4.0	401	71.8
SET	374.2	349.2	16.6	550	75.6
OCT	456.1	452.6	17.8	224	95.0
NOV	516.2	514.6	28.6	239	126.5
DEC	687.5	683.6	30.1*	214	158.7
JAN.91	624.2	621.4	0.1	15	193.0
FEB.	701.0	699.4	12.4	63	221.0
MARCH	852.0	846.7	28.3	143	235.0

(4) = {(1)-(2)+(3)}/(5)

Source: Demonstrativo da Execucao Financiera do Tesouro Nacional, various issues.

*: Estimated

Basically the new Plan represented an attempt at reversing an already deteriorating trend of the economy because of lack of instrumenting the required corrections during the Collor I Plan. The tools chosen were those promising an easy and quick result: price controls and regulations. Little was done at the real side of the required adjustment: it just consisted in increases in public sector prices and promises of fiscal restraint for the future and agreements with States to solve their financial problem after six months. Meanwhile the public finances continued their deteriorating trend and inflation did not abate in spite of a price freeze.

Plan Collor II was short lived and marked the end of the first economic team of the Collor administration as Minister Zelia and most of her team resigned on May 2, 1990.

The Definitions and Recent Behavior of the Monetary Aggregates

A short measure of short run liquid assets in the Brazilian economy should include not only the conventional measures of cash and demand, time and savings deposits but also the very short term deposits made at the money market funds as well as in the overnight market (replaced by the FAF during the Collor II plan). The fact is, however, that there is no available time series data for capturing the amount of the deposits made at the money market funds or in the overnight market.

The way researchers have chosen going around the above problem is to try to estimate the deposits made at those markets by the value of the assets purchased with them. There are many assets purchased with the resources of the Money Market Funds (MMF) and the Overnight Open Market, but we are informed that by and large the overwhelming fraction is taken by the acquisition of Federal Debt paper and Bank's CDB. The fact is, however, that money market institutions also invest in private firms Debentures as well as in State Debt titles (mostly held by the corresponding state banks or the Funds they manage). Therefore, the sum of Federal debt titles held in the market is probably an underestimate of the total amount of deposits at the MMF and the Overnight market. In spite of the previous caveat, the accepted monetary aggregates actually in use in Brazil are constructed using the stock of Federal Debt held outside of the Central Bank as the proxy for all those deposits for which there is no direct measure.

The monetary aggregates actually in use are the following:

- (1) M1 : Currency in hands of the Public plus Demand Deposits at Commercial Banks. This is the most liquid of the aggregates.
- (2) M2 : Second in order of liquidity, equals M1 plus the stock of Federal Debt held outside of the BCB.
- (3) M3 : Equals M2 plus deposits at the S&L (Cuadernetas de Poupanca).
- (4) M4 : Equals M3 plus the stock of CBDs issued.

Since July 1988, the time series of monetary aggregates constructed by the BCB distinguish on the one hand the stocks of Federal debt titles and CBDs held as collateral for deposits or swaps and on the other the stocks held against the own capital of the financial institution. In the later case, the stocks of debt or CBD's are not considered as part of the monetary aggregates as they would not be backing deposits. For all time series before July 1988, the monetary series did incorporate all of the outstanding stocks of Federal Debt (outside of the BCB) or of CBD's issued. In order to avoid the problem of the non-homogeneity of the time series we shall conduct all our econometric analysis using data from 1980 up to June 1988 for which the series uniformly incorporate all stocks held by financial institutions as money. We would have liked to work with the corrected series but unfortunately the data is not available except for the short period after July 1988, a period that anyway is not good for doing econometric analysis because of the sharp disturbances that took place as a consequence of the hyperinflation.

The monetary authorities have direct control over two monetary aggregates: the monetary base and the stock of short run Federal Debt held in the market as counterpart for money market deposits. It is debatable whether the stock of Federal debt should be included into a wider concept of Monetary Base, as it was done by including it into the monetary aggregates. Obviously, if Federal debt is included into the monetary concept and is not included into the Base concept, there will be little association between both. A simple swap by the Central Bank of Base for Federal Debt would change the Base but probably would leave unchanged the wider monetary aggregates such as M2 and up.

In testing for the degree of control of the BCB over different monetary aggregates, we have used all the available series with and without including the stock of Federal Debt held outside of the BCB. Similar alternative measures are also used in the next Section in studying the relation between the behavior of the monetary aggregates and inflation.

Tables 4a and 4b show the behavior of the different aggregates since 1988. All figures have been put into millions of U\$S dollars in order to facilitate comparisons (using the commercial exchange rate also shown in the last column).

TABLE 4a

FINANCIAL ASSETS HOLDINGS
(In billions of Dollars)

	Cash Total	Bank Dep.	Monetary Base	Cash in Public	Demand Deposits	M1	Fed. Debt (Public)
1988							
Jan.	3.36	3.14	6.50	3.03	9.62	12.65	32.64
Febr.	2.84	2.53	5.37	2.43	8.33	10.76	32.43
March	2.75	2.56	5.31	2.36	7.89	10.25	30.77
April	2.68	2.87	5.55	2.38	7.54	9.93	31.62
May	2.48	2.71	5.19	2.11	7.53	9.65	33.07
June	2.40	2.50	4.90	2.01	7.59	9.60	33.35
July	2.37	2.06	4.44	2.02	6.99	9.01	33.49
Aug.	2.15	1.75	3.90	1.83	6.25	8.08	34.10
Sept.	2.13	1.72	3.85	1.87	6.06	7.93	32.37
Oct.	2.26	1.72	3.98	2.00	6.18	8.18	29.65
Nov.	2.22	1.62	3.85	1.88	6.15	8.03	29.93
Dec.	2.65	1.69	4.35	2.34	6.27	8.61	32.48
1989							
Jan.	2.64	1.67	4.30	2.29	6.26	8.55	30.95
Febr.	2.57	1.95	4.52	2.14	6.55	8.68	34.96
March	2.86	2.49	5.35	2.47	6.86	9.32	44.73
April	3.46	2.61	6.07	2.96	9.04	12.01	51.99
May	3.74	3.22	6.96	3.17	9.85	13.02	52.53
June	3.63	3.43	7.06	3.18	7.98	11.17	49.94
July	3.04	2.49	5.53	2.59	6.14	8.73	45.13
Aug.	2.76	2.10	4.86	2.30	5.37	7.67	47.60
Sept.	2.80	1.83	4.63	2.43	4.96	7.39	49.85
Oct.	2.70	1.70	4.40	2.32	5.00	7.32	50.94
Nov.	2.82	1.86	4.68	2.35	4.96	7.31	52.16
Dec.	3.55	2.05	5.59	3.15	5.30	8.45	53.91
1990							
Jan.	3.16	2.00	5.16	2.76	4.98	7.73	55.09
Febr.	2.83	1.82	4.66	2.24	5.15	7.39	54.07
March	4.60	1.79	6.40	3.81	7.37	11.19	27.54
April	6.54	3.11	9.65	5.70	9.54	15.25	13.59
May	8.04	6.36	14.39	7.23	11.83	19.06	18.47
June	8.32	7.08	15.39	7.61	12.62	20.23	19.21
July	6.92	5.09	12.01	6.33	11.39	17.71	17.49
Aug.	6.54	4.21	10.75	6.02	11.35	17.37	17.90
Sept.	7.21	4.05	11.26	6.61	12.03	18.64	17.36
Oct.	6.17	3.51	9.67	5.47	10.42	15.89	14.74
Nov.	5.22	2.68	7.90	4.57	8.81	13.38	13.01
Dec.	5.67	2.90	8.56	5.15	8.80	13.95	11.59

TABLE 4b

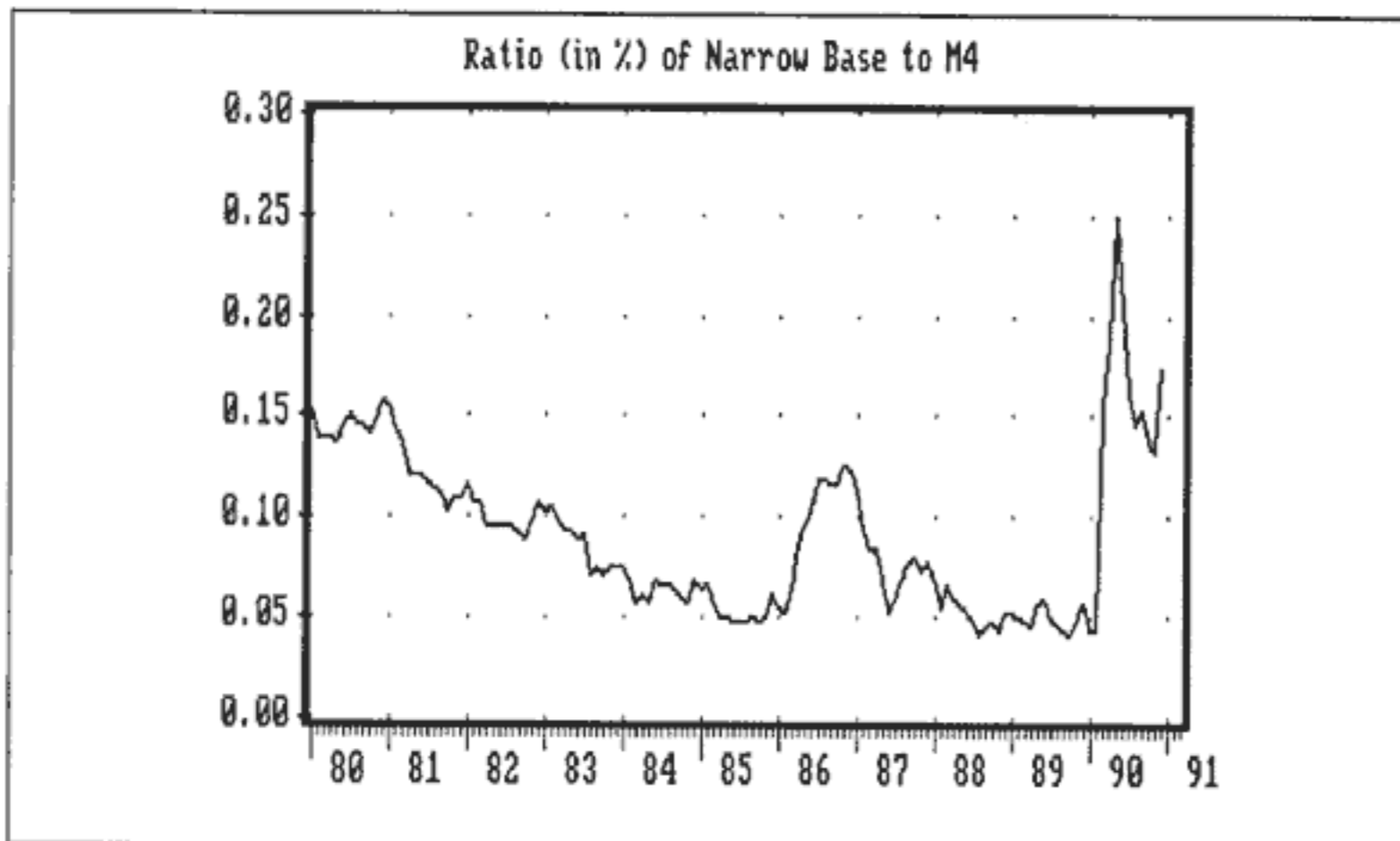
FINANCIAL ASSETS HOLDINGS
(In billions of Dollars)

	M2	Savings Dep.	M3	Time Dep. (CDB)	M4	Comm. Exch Rate
1988						
Jan.	45.29	30.88	76.17	13.29	89.46	0.08
Febr.	43.19	31.68	74.87	13.12	87.99	0.09
March	41.02	33.10	74.12	13.10	87.22	0.11
April	41.55	33.83	75.38	12.93	88.31	0.13
May	42.71	33.28	75.99	12.62	88.61	0.15
June	42.96	33.68	76.64	12.59	89.22	0.18
July	42.51	34.09	76.60	12.53	89.13	0.22
Aug.	42.18	34.10	76.29	12.59	88.88	0.27
Sept.	40.30	34.67	74.98	12.73	87.71	0.33
Oct.	37.83	34.29	72.12	12.49	84.62	0.41
Nov.	37.96	33.89	71.85	12.32	84.17	0.53
Dec.	41.09	34.20	75.30	13.21	88.50	0.67
1989						
Jan.	39.50	32.47	71.97	10.52	82.49	0.90
Febr.	43.64	36.31	79.95	7.97	87.92	1.00
March	54.05	44.05	98.09	7.69	105.78	1.00
April	63.99	51.42	115.41	8.35	123.76	1.02
May	65.55	52.69	118.24	9.69	127.92	1.10
June	61.11	46.78	107.89	10.85	118.74	1.34
July	53.86	38.09	91.95	9.58	101.53	1.91
Aug.	55.27	37.06	92.33	9.57	101.90	2.48
Sept.	57.23	35.88	93.11	9.88	102.99	3.27
Oct.	58.27	34.01	92.28	9.81	102.09	4.49
Nov.	59.47	32.22	91.69	10.22	101.91	6.25
Dec.	62.36	29.75	92.10	12.15	104.25	9.26
1990						
Jan.	62.83	28.11	90.94	13.15	104.09	14.3
Febr.	61.45	31.17	92.62	11.85	104.47	23.7
March	38.73	23.69	62.42	8.43	70.85	37.7
April	28.83	18.72	47.56	7.62	55.18	47.9
May	37.52	18.41	55.93	9.51	65.44	52.2
June	39.44	16.31	55.74	12.84	68.58	57.1
July	35.21	15.85	51.06	14.80	65.86	66.5
Aug.	35.26	17.61	52.87	16.50	69.37	71.8
Sept.	36.00	18.85	54.85	19.55	74.41	75.6
Oct.	30.64	16.89	47.53	19.20	66.73	95.2
Nov.	26.39	14.82	41.22	17.21	58.43	123.2
Dec.	25.54	13.76	39.30	15.53	54.83	154.6

The basic tool for monetary control are the open market operations of the Central Bank. Up to Dec.1990, the BCB conducted daily auctions (leilaos) of Treasury Bills (in LTN), the "primary auctions" on behalf of the Treasury, for the purpose of restructuring and rolling-over the outstanding stock ("primary auctions"), and the "secondary auctions" for conducting the open market operations.

The possibilities for the Central Bank of being able to control the monetary aggregates through open market operations are quite restricted. The Reserve Requirements are quite low for Demand Deposits (30-45% depending on the size and location of the institution), only 15% on Savings Deposits and zero for all money market funds and overnight operations that basically operate with swaps of Federal debt. While there may be some minimum demand for High Power Money derived from technical requirements for cash reserves at Banks, we feel these ratios may be extremely low and volatile in a sophisticated and extremely short run market as Brazil's where most of the money market operations are renewed daily by phone. It can be appreciated in Figure 7 that the ratio of the narrow monetary Base to the widest monetary aggregate (M4) has systematically fallen during the decade, reaching the bottom level at about 5% before the launching of the Collor I plan that raised this ratio to values close to 25%. The high degree of intermediation signaled by the low Base/M4 ratio is also a symptom of the high degree of instability and low degree of monetary control that can be exercised by the Central Bank.

Figure 7



In what follows we present an econometric analysis of the causality relation between the different monetary aggregates and the two alternative measures of the monetary base: the conventional base (currency plus bank's deposits at the BCB) and the expanded base that includes the stock of Federal Debt titles held outside of the Central Bank.

We have constructed the seasonally adjusted monthly rates of change of the monetary variables and related them to the current and past rates of change (also seasonally adjusted) of the alternative measures of monetary base. The period covered is from 1980-06 through 1988-06 (97 observations). The regressions are of the following form:

$$Y(t) = C + A*X(t) + A1*X(t-1) + A2*X(t-2) + A3*X(t-3)$$

During the period of analysis there were three economic plans that resorted to price controls: planes Cruzado, Bresser and Verano. It has been suggested to us that the use of price controls may have changed the Currency/Deposits ratio and therefore the value of the multiplier linking the Monetary Base and the Monetary Aggregates. In order to study those possible effects we have constructed dummy variables of the form:

D1=1 for March-August 1986, zero elsewhere, for the Cruzado Plan.

D2=1 for May-August 1987, zero elsewhere for the Brassier Plan.

D3=1 for January-March 1989, zero elsewhere for the Plan Verano.

The design of each dummy (the timing for the 1's) was suggested to us as the most likely period during which the price controls were really effective during each of the plans.

Rather than testing the dummies in each of the equations linking the alternative base measures with the alternative monetary aggregates, we have preferred to test the hypothesis of whether the price controls did have effects over the C/D ratio. As the regression in Table 5 below shows, is apparent that neither Dummy has a significant effect on the C/D ratio and therefore we have decided not to incorporate the dummies into the analysis of the money supply process. The dummies will, however, become a significant explanatory factor later on when we study the relation of causality between money and prices.

=====

TABLE 5

Effects of Price Controls on the Currency/Deposit Ratio

$$C/D = 0.399 - 0.02*D1 + 0.001*D2 - 0.01*D3$$

(2.01) (-0.8) (0.06) (-0.38)

AR(1) = 0.97 (17)

D-W.:2.55

R2.Adj.: 0.72

SAMPLE: Monthly from 1980.06 to 1989.12

Method of Estimation:OLS with an AR(1) correction.

=====

The coefficients A_i are estimated using a Polynomial Distributed Lag structure (PDL) and all regressions include an AR(1) process of correction for first order autocorrelation of residuals. The purpose of the analysis is to determine the extent of the relationship between the different monetary aggregates and the two alternative measures of monetary base.

The regression results are presented in Tables 6a(using the conventional base) and 6b (using the expanded base) . It is clear that the best regressions are the ones explaining the wider monetary aggregates (from M2 onwards) with the expanded Monetary Base concept (BME, that also includes the Federal Debt).

The conventional monetary base(not including Federal Debt titles) is almost irrelevant for explaining the monetary aggregates. In some cases the rates of change in BM are **negatively** related to the rate of expansion of the monetary aggregates (cases of M3 and M4) and the R2 levels do not exceed 0.42 (in the case of M4). The only case were the sum of coefficients of BM is significantly different from zero is in the regression explaining the rate of change in M1, where the sum of lagged coefficients takes the value of 0.817 (with a T-value of 5.7).

The best results are obtained using the expanded monetary base and the monetary aggregates that include the stock of Federal Debt titles. Starting from M2, the narrowest one that yet included the stock of Federal Debt Titles), as more items are included into the monetary aggregate, the better the explanatory power of the regression, as measured by the Relative Forecast Error. As expected, the relation between the aggregates that do not include Federal Debt titles (M1, M3-T and M4-T) and the expanded monetary base is much weaker than with the aggregates that do include the debt titles. Notice, however, that the wide measure M4-T or M3-t that do not include Debt Titles are better related to the Expanded Base than the narrow aggregate M1.

We think the correct criteria for choosing the best regression among a set that includes different endogenous variables is the Relative Forecast Error (the reasons are presented later when discussing the money demand functions in Section III). According to this statistic, the best regression insofar as explaining the rate of change in the monetary aggregate is that of M4 being explained by the expanded monetary base. As we shall see later in the study, M4 is also the aggregate most related to inflation and the one with the most stable real demand according also to the RFE criteria. To be fair, however, we must say that the main differences found here are between aggregates that do or do not include the outstanding stock of Federal debt Titles. After that distinction is made, the differences between regressions for explaining the aggregates that do include the Titles are really quite small. In other words, the regressions for M4 are only marginally better than the regressions for the narrower M2.

TABLE 6a

RELATION BETWEEN MONETARY AGGREGATES
AND CONVENTIONAL MONETARY BASE

COEFFICIENT	DEPENDENT VARIABLE					
	M1	M2	M3	M4	M3-T	M4-T
Constant	1.4 (0.93)	8.1 (4.5)	10.4 (5.39)	10.2 (5.62)	8.37 (5.56)	9.35 (6.19)
SUM BM(t-i)	0.817 (5.70)	0.16 (1.02)	-0.071 (-0.47)	-0.039 (-0.29)	0.112 (0.82)	0.008 (0.06)
BM(t)	0.33 (3.8)	-0.01 (-0.27)	-0.08 (-1.6)	-0.06 (-1.3)	0.001 (0.02)	-0.029 (-0.6)
BM(t-1)	0.24 (5.4)	0.02 (0.48)	-0.039 (-1.0)	-0.026 (-0.76)	0.019 (0.50)	-0.008 (-0.25)
BM(t-2)	0.16 (3.75)	0.059 (1.44)	0.0039 (0.10)	0.007 (0.20)	0.036 (1.03)	0.012 (0.38)
BM(t-3)	0.077 (0.92)	0.097 (1.68)	0.047 (0.94)	0.041 (0.90)	0.052 (1.04)	0.033 (0.76)
AR(1)	-0.083 (-0.72)	0.493 (4.92)	0.671 (7.75)	0.69 (8.31)	0.43 (4.17)	0.59 (6.45)
Adj.R2	0.22	0.25	0.38	0.42	0.19	0.32
D-W.Stat.	2.04	2.22	2.31	2.23	2.13	2.18
F-Stat.	5.70	11.72	21.22	24.80	8.55	16.43
RFE	103%	56.7%	45.2%	41.4%	53.1%	42.6%

SAMPLE 1980.06-1988.06//97 OBSERVATIONS
ALL DATA ARE SEASONALLY ADJUSTED
ESTIMATION METHOD: OLS WITH A POLYNOMIAL
DISTRIBUTED LAG STRUCTURE ON BM(T-i)

RFE: Relative Forecast Error (S.E.of Regression as percentage of the Mean of Dependent Variable).

TABLE 6b

RELATION BETWEEN MONETARY AGGREGATES AND EXPANDED MONETARY BASE

COEFFICIENT	DEPENDENT VARIABLE					
	M1	M2	M3	M4	M3-T	M4-T
Constant	1.063 (0.46)	0.23 (0.44)	1.28 (2.1)	1.88 (2.67)	2.46 (2.39)	3.31 (3.21)
SUM BME(t-i)	0.774 (3.71)	0.931 (18.9)	0.840 (15.05)	0.77 (12.07)	0.697 (7.4)	0.606 (6.51)
BME(t)	0.14 (0.9)	0.55 (13.6)	0.52 (12.1)	0.52 (11.74)	0.249 (3.6)	0.26 (4.34)
BME(t-1)	0.17 (2.48)	0.339 (19.43)	0.31 (16.4)	0.30 (14.57)	0.199 (6.35)	0.189 (6.43)
BME(t-2)	0.208 (2.79)	0.126 (6.86)	0.106 (5.2)	0.083 (3.82)	0.149 (4.51)	0.113 (3.66)
BME(t-3)	0.23 (1.44)	-0.085 (-2.0)	-0.101 (-2.28)	-0.135 (-2.94)	0.099 (1.38)	0.0365 (0.57)
AR(1)	0.087 (0.80)	-0.25 (-2.5)	-0.006 (-0.063)	0.20 (1.96)	0.101 (0.97)	0.27 (2.76)
Adj.R2	0.127	0.76	0.75	0.75	0.41	0.48
D-W.Stat.	1.98	2.02	0.98	1.98	1.99	1.99
F-Stat.	5.69	106.2	98.11	101.29	23.62	31.04
RFE	110%	31.6%	28.7%	26.8%	45.3%	37.2%

SAMPLE 1980.06-1988.06//97 OBSERVATIONS
 ALL DATA ARE SEASONALLY ADJUSTED
 ESTIMATION METHOD: OLS WITH A POLYNOMIAL
 DISTRIBUTED LAG STRUCTURE ON BME(T-i)

Monetary Policy, Interest Rates and Inflation: Causality Analysis.

In this section we shall be concerned in studying the causality relation between monetary policy (measured by changes in the alternative measures of the monetary aggregates), interest rates (both nominal and real) and the inflation rate (captured by the CPI).

Table 7 shows the relation, at a monthly level, between the nominal interest rate on a 30-day basis and the CPI inflation rate on the same basis. Basically, this regression of the standard Fisher equation could not be more identical to the textbook version: the coefficient of inflation on the nominal interest rate is equal to unity and the constant indicates a reasonable value for the monthly level of the real interest rate (not significantly different from 1% per-month). The fact that the current inflation has an immediate and identical impact on nominal interest rates shows the extent and efficiency of the Brazilian indexation system in the financial markets.

The independence of real interest rates from the inflationary process is an advantage of the indexation practices. We can get additional evidence about this relation by computing the real interest rate as:

$$REAL = (1+CDB)/(1+INF) - 1 ,$$

where CDB is the 30 day nominal interest rate on bank's time deposits and regressing this variable on current inflation as shown in Table 8. The variable REAL is correlated with the current inflation rate and as the regression shows, there is no relation whatsoever between both variables, confirming the result of R-1 indicating the complete adjustment of nominal interest rates to current inflation.

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TABLE 7
Nominal Interest Rates and Inflation

$$NOMINT = 0.9605 + 0.999*INFL$$

(1.14) (23.4)

R2 Adj.:0.90
D-W Stat: 1.83
F Stat.:547
Sample Period: 85.01-89.12

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TABLE 8

Real Interest Rates and Inflation

$$\text{REAL} = 1.0805 - 0.0154 * \text{INFL}$$

(1.59) (-0.44)

R2 Adj.: -0.01
 D-W Stat: 1.79
 F Stat: 0.2

=====

The almost perfect correlation between nominal interest rates and inflation implies we can in practice use either variable in analyzing their relation with the monetary base. We have decided in what follows to use the inflation rate as the relevant variable for the analysis of causality but, for illustrative purposes we show some results of the relation between the expanded monetary base and both the nominal interest rate and inflation in Tables 9 and 10. It can be clearly appreciated by comparison of both regressions that the results do not differ significantly. A sustained 1% increase in the monthly rate of interest results in a 1.04 increase in the monthly rate of expansion of the expanded monetary base after three months and a 1.09% increase if the change is in the inflation rate. Neither coefficient (given by the sum of the PDL coefficients) differs significantly from unity, apparently confirming the absence of money illusion and the high degree of indexation in Brazil's financial system.

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TABLE 9: Expanded Monetary Base and Interest Rates

SMUBMA: Seasonally adjusted rate of change in the expanded monetary base.

CDB : Nominal Interest rate on 30 days time deposits.

$$\text{SMUBMA} = 0.1067 + 0.445 * \text{CDB}(t) + 0.322 * \text{CDB}(t-1) + 0.19 * \text{CDB}(t-2)$$

(0.08) (6.7) (14) (5.7)

$$+ 0.07 * \text{CDB}(T-3)$$

(0.9)

SUM of PDL on CDB Coefficients; 1.04 (14.78)

Adj.R2.: 0.85

D.W.: 1.89

F.Stat.; 154

Method of Estimation: OLS with a Linear PDL on CDB

SAMPLE: 1985.06 to 1989.12

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TABLE 10: Expanded Monetary Base and Inflation

$$\begin{aligned}
 \text{SMBMA} = & 0.1578 + 0.431 \cdot \text{INF}(t) + 0.325 \cdot \text{INF}(t-1) + 0.219 \cdot \text{INF}(t-2) \\
 & (0.11) \quad (6.85) \quad (13) \quad (6.7) \\
 & + 0.113 \cdot \text{INF}(t-3) \\
 & (1.56)
 \end{aligned}$$

SUM of PDL on CDB Coefficients: 1.09 (14.3)
 Adj.R2.: 0.81
 D.W.: 1.88
 F.Stat: 123
 Method of Estimation: OLS with a Linear PDL on INF
 SAMPLE: 1985.06 to 1989.12

=====

Given the high correlation between nominal interest rates and inflation and the results of Tables 9 and 10 indicating that they have similar effects on the base, from now on we shall conduct the analysis exclusively using the rate of inflation as the variable of analysis.

In order to assess causality between inflation and the different monetary aggregates, we have worked with the monthly rates of change in all variables and filtered all series with an AR(1,2) process to remove autocorrelation. Causality is studied by running regressions between the residuals of the current filtered (endogenous) variable and the lagged values of the residuals of the (exogenous) explanatory filtered variable. In such context, the variable X is said to cause Y if lagged values of the filtered series of X explain the current value of the filtered series of Y.

We have also included as possible explanatory variables the price controls Dummies that were defined previously. The reasons are quite obvious: in analyzing causality from money to prices we must allow for the fact that price controls may not allow prices to raise even though the monetary innovation would predict so. In this case the price controls Dummies should come out with a negative sign. When the endogenous variable is the filtered changes in the monetary aggregates we find a less clear case for a definite sign for the price control Dummies. If during the period considered by each dummy there was some peculiar behavior of the monetary aggregates, this will show in the coefficient of the Dummy. For example, if during the Plan Verano the money supply grew abnormally, the coefficient of the Dummy should come out as positive in the regression explaining the innovations in the money supply process.

It was obvious to us that in studying causality the most significant distinction is between those monetary aggregates that include the Federal Debt and those that do not. We have therefore restricted the analysis to four monetary aggregates: the narrow and the expanded monetary Base and the aggregates M1 and M4.

TABLE 11

CAUSALITY FROM MONEY TO PRICES
DEPENDENT VARIABLE : RESIDUALS FROM INFLATION

	(1)	(2)	(3)	(4)
	=====	=====	=====	=====
C	0.66 (1.6)	0.63 (1.5)	0.79 (1.9)	0.54 (1.4)
BASE(-1)	0.05 (1.6)			
BASE(-2)	-0.01			
BASEA(-1)	(-0.3)	0.07 (1.23)		
BASEA(-2)		0.02 (0.39)		
M1(-1)			0.057 (2.14)	
M1(-2)			0.042 (1.55)	
M4(-1)				0.191 (2.7)
M4(-2)				-0.01 (-0.2)
D1	-2.79 (-1.8)	-2.3 (-1.4)	-3.21 (-2.1)	-1.66 (-1.1)
D2	-4.5 (-2.4)	-4.28 (-2.2)	-4.27 (-2.3)	-4.47 (-2.4)
D3	-7.1 (-3.2)	-6.8 (-3.1)	-7.43 (-3.4)	-6.64 (-3.1)
R2 Adj.:	0.13	0.12	0.158	0.175
D.W.:	2.29	2.27	2.36	2.25
F-Stat.:	3.9	3.56	4.57	5.03

SAMPLE PERIOD: 1982.01 to 1989.12

All monetary variables are in terms of the residuals of equations of the form: Inc.% in M= C AR(1) AR(2) run for the period 1980.06 1989.12. The residuals for inflation are obtained with a similar regression for the period 1981.01 1989.12.

TABLE 12

CAUSALITY FROM PRICES TO MONEY

DEPENDENT VARIABLE: RESIDUALS FROM MONEY CHANGES

	BASE =====	BASEA =====	M1 =====	M4 =====
C	0.26 (0.2)	0.336 (0.53)	-0.81 (-0.4)	0.82 (1.3)
INF(-1)	0.01 (0.04)	0.632 (4.1)	0.48 (1.1)	0.54 (3.5)
INF(-2)	0.08 (0.24)	0.359 (2.28)	-0.08 (-0.17)	0.71 (4.6)
D1	1.30 (0.25)	-1.37 (-0.5)	5.95 (0.85)	-3.09 (-1.2)
D2	3.89 (0.62)	-2.8 (-0.9)	4.1 (0.49)	-0.97 (-0.3)
D3	-4.20 (-0.5)	3.04 (-0.8)	-5.0 (-0.5)	-2.84 (-0.8)

R2 Adj.:	-0.04	0.19	-0.02	0.28
D-W. STAT:	2.01	2.31	1.92	1.36
F-STAT.:	0.17	5.69	0.52	8.48

SAMPLE PERIOD: 1982.01 to 1989.12

All monetary variables are in terms of the residuals of equations of the form: Inc.% in M= C AR(1) AR(2) run for the period 1980.06 1989.12. The residuals for inflation are obtained with a similar regression for the period 1981.01 1989.12.

Tables 11 and 12 present the results of the analysis of causality. Several interesting results follow from these Tables. First of all we notice that the price control Dummies are negative and significant in almost all cases for the inflation regressions, indicating that the price controls had a significant impact in producing (artificially) low inflation rates. On the other hand, all of the price control Dummies are not significantly different from zero in all of the regressions explaining the monetary innovations. It follows there were no detected atypical changes in the money supply processes during those periods of price controls.

The narrow monetary Base and inflation do not show any causality between them (with one or two months lags). Neither does causality from the expanded base to inflation show up. However, the data show causality from one month lagged M1 and M4 to inflation. In the case of changes in M1 the coefficient is very small (0.057) but statistically different from zero at the 95% confidence level). The coefficient of innovations in lagged M4 is larger (0.19) and significant at the 99% level.

The above results show that M4 is the aggregate that shows the most significant relation of causality on inflation according to the methodology chosen. The fact is, however, that causality between M4 and prices seems to be mutual: results in Table 12 show that inflation does cause M4 according to the criteria we have been following. Furthermore, the strength of the causality from prices to M4 seems to be much higher than the reverse we just saw above. The coefficient of lagged innovations of inflation on current innovations in M4 is 0.54 (as compared with only 0.19 for the causality from M4 to inflation); the two month lagged effect is even larger with the coefficient taking the value of 0.71. In both cases the coefficients of 1 and 2 period lagged innovations in M4 are significantly different from zero at the 99% confidence level.

The previous results should be carefully interpreted as they may be seen as indicating that and that the only viable alternative left may be price controls. The fact is that both money and prices are probably being moved together by another third variable, the fiscal disequilibrium. Prices raise in anticipation of the future money that will be printed because of the fiscal imbalance and in fact the monetary authorities are forced to print the money, either due to political pressures or to the automatic indexation clauses, at least with respect to the outstanding stock of government debt.

Our results are, nonetheless, of some interest. First they show that inflation does affect the expanded base and monetary aggregates and this may reinforce the inflationary process in a longer time frame. Second, they show that monetary innovations also do have a short run impact on inflation.

From a longer run perspective, money and prices are clearly correlated, although it is not possible to distinguish clear leads and lags in this relationship. This fact should not be a surprise as it is well known that with a fixed exchange rate, prices lead money and the opposite is valid with a floating exchange rate.

Under fixed exchange rates we expect public sector deficits to result in immediate losses of reserves as they are financed from the Central Bank. This is the standard operation described best in the "monetary approach to the balance of payments literature: as money is printed to finance the government, equal amounts come back to the Central Bank in exchange for Reserves. At this stage of the disequilibrium, neither prices nor money show movements in response to the accumulating deficits. At some point reserves reach some critical minimum and authorities must resort to devaluation. Only at this point the price level experiences a jump in response to the devaluation. After the devaluation and initial price increase, the reserve flow normally reverses sign (that was the purpose of the devaluation) and the money supply starts to increase. If there is some degree of exchange control in the economy it is also likely that the parallel exchange rate would have anticipated the devaluation in the official market and would have risen first.

The line of causality one would therefore expect under fixed exchange rate would be as follows:

Deficit ==> Reserve Losses==.Parallel Exch.Rate ==>Official Exch.Rate
==>Prices==>Reserve Gains==>Money

/*A detailed analysis of this line of causality under fixed exchange rates is presented in Rodriguez C.A. "A Stylized Model of the Devaluation-Inflation Spiral", IMF Staff Papers, March 1978.

On the other hand, after allowing for expectations to affect the demand for money, and therefore prices, it is possible for current inflation to increase in anticipation of a future increase in the money supply, giving the wrong impression that the price increase may have caused the future monetary expansion. When price controls are used for extended periods one may even find the unintuitive result that reductions in inflation are associated with large increases in the rate of monetary expansion, an obvious result of printing money with price controls that normally end up in a situation of repressed inflation and later price explosion.

The regressions in Table 13 show the medium run relation between money (measured by the broader concept of M4, in seasonally adjusted rates of change) and prices (monthly inflation rates). The regressions use a Polynomial Distributed Lag structure (linear with no restrictions) and shows that lagged rates of expansion of M4 are significant in explaining current inflation and that after 6 months the sum of the coefficients is exactly unity. However, as it is also shown, it is also the case that past rates of inflation explain current rates of money creation and that the sum of the lagged coefficients is also about unity after six months.

We have also included in the regressions the Dummy variables for capturing the effects of price controls. Of all three Dummies, only D1 (Plan Cruzado) comes out as significant in the inflation equation (giving close to 5% points less of inflation per month). In the money equation Dummy D3 (Plan Verano) comes out negative and significant.

The relation between rates of change in money and prices becomes weaker as more narrow monetary aggregates are considered. Using the rates of change in M3 instead of M4 yields a six month final effect on inflation of 1.034 as captured by the sum of the coefficients on lagged rates of change in M3. With M2 as explanatory variable, the sum of coefficients is only 0.84 and finally, when M1 is used, the sum of coefficients becomes negative and statistically insignificant (all of the explanatory power of the regression is given by the ARMA (1,1) process). Table 14 presents the summary of all the regression results between past rates of change in money and current inflation.

The above results seem to suggest that the broader monetary aggregate, being better related to prices in the theoretically expected way, should be the target whenever a floating exchange rate system is in use that requires the setting of monetary targets. Since we have also found that the broader monetary aggregate is best explained by the expanded monetary base, the recommendation that follows is to use the expanded monetary base to control the rate of growth of M4 in order to achieve the inflation target.

TABLE 13

MEDIUM RUN RELATION BETWEEN M4 AND PRICES

	INFLATION =====	DEPENDENT VARIABLE	SMU4 =====
C	0.342 (0.28)	C	0.384 (0.46)
SUM of SMU4 Coef.	1.014 (10.6)	SUM of INF Coef.	1.071 (16.6)

SMU4	0.405 (8.7)	INF	0.339 (12)
SMU4 (-1)	0.318 (10)	INF (-1)	0.277 (15)
SMU4 (-2)	0.231 (14)	INF (-2)	0.215 (19.9)
SMU4 (-3)	0.145 (10)	INF (-3)	0.153 (16.6)
SMU4 (-4)	0.058 (2.2)	INF (-4)	0.091 (5.9)
SMU4 (-5)	-0.028 (-0.6)	INF (-5)	0.028 (1.2)
SMU4 (-6)	-0.115 (-1.9)	INF (-6)	-0.033 (-1.0)
D1	-4.70 (-2.2)	D1	-0.036 (-0.02)
D2	-4.46 (-1.7)	D2	-2.42 (-1.2)
D3	-2.46 (-0.7)	D3	-6.64 (-2.7)

AR(1) :	0.53 (2.6)	AR(1)	---
MA(1) :	0.19 (1.06)	MA(1)	---

R2 Adj.:	0.83	R2 Adj.:	0.83
D.W.:	2.03	D.W.:	1.79
F-STAT.:	68.7	F-Stat.:	97.8

The rates of change in the monetary aggregate are seasonally adjusted. All regressions were estimated by OLS and correction ARMA(1,1). The lagged coefficients were estimated with a linear PDL with no restrictions.

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TABLE 14

Summary of results of PDL regressions of lagged rates of change in money on inflation

Endogenous variable: Monthly inflation rate in CPI

Exogenous variables: Rates of Change in:

	M1	M2	M3	M4	M4-TF	M3-TF
Sum of 6 month coefficients	-0.204	0.840	1.034	1.014	1.037	0.888
(T-value of sum)	(-1.09)	(6.27)	(9.91)	(10.6)	(7.5)	(4.7)
R2 Adj.	0.84	0.84	0.83	0.83	0.83	0.83
AR(1)	0.95	0.60	0.34	0.19	0.41	0.46
MA(1)	0.28	0.37	0.39	0.53	0.46	0.63

The rates of change in the monetary aggregates are seasonally adjusted. All regressions were estimated by OLS and correction ARMA(1,1). The lagged coefficients were estimated with a linear PDL with no restrictions.

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In order to further test the above conclusion regarding the convenience of stabilizing M4 as it is the aggregate most related to current inflation and to the expanded monetary base, we have also run standard money demand functions on the alternative monetary aggregates. These results are presented next.

Money Demand Functions

We have considered demand functions for six monetary aggregates, namely : M1, M2, M3, M4, M4-TF and M3-TF (TF is the stock of Federal Debt titles held outside of the Central Bank). As explanatory variables for the real money stocks we have considered the level of income (captured by the monthly indicator of industrial activity), the opportunity cost of holding money (captured by either the nominal interest rate on CDB or the inflation rate), and a first order moving average on the residuals. We have tried incorporating the lagged endogenous variable but the results were not better than those incorporating the MA process reported here.

Real money balances were constructed dividing the nominal monthly balances by the same month Consumer Price Index. The resulting series were then subject to seasonal adjustment using the TSP program as it was also done with the variable for the level of industrial activity. It did not seem necessary to subject either inflation or interest rates to seasonal adjustment.

The idea of doing the regressions is to choose the most stable demand for money for the purposes of conducting monetary policy. This requires to choose on the basis of explanatory power between regressions with different endogenous variables. In this case the R2 criteria is not useful since they refer to different populations. An example may help to illustrate the problem: assume that the variable real M1 happens to be virtually a constant over time except for some very minor random shocks that are impossible to explain. The R2 on the regression of any explanatory variable on M1 will be zero. On the other hand consider real M2 which fluctuates a lot and has huge random shocks of which the regression explains 50%. The R2 will be 50% and therefore higher than that of the regression on M1. However, we clearly prefer M1 as the aggregate for controlling inflation as it is almost linearly related to the price level. True, we explain nothing of the small Standard Deviation of the variable, but since it is so small it just does not matter. With M2 the standard error could be 80% of the mean and we explain 40% of it but there still is left a 40% unexplained after the regression.

It is clear from the above discussion that the R2 statistic is not useful for deciding between regressions with different endogenous variables. For this purpose a better statistic giving the right information is the Relative Forecast Error (RFE) for the regression, constructed as the ratio between the Standard Error of the regression and the mean of the dependent variable. The RFE captures best the measure of how much is left unexplained of the level of the endogenous variable and not just of the variations around its mean (as the R2 does).

In Tables 15a and 15b we report the regression results using alternatively the nominal interest rate on CDB or the inflation rate as measures for the opportunity cost of holding money.

TABLE 15a

MONEY DEMAND FUNCTIONS

VARIABLE	Dependent Variable (Logarithms of M_i/CPI)					
	M1	M2	M3	M4	M3-TF	M4-TF
C (T-Value)	-7.3 (-3.5)	1.28 (1.4)	4.60 (7.0)	5.44 (10)	2.17 (2.7)	4.17 (5.3)
CDB rate	-2.90 (-12)	-0.40 (-4.0)	-0.20 (3.1)	-0.40 (-6.8)	- 1.40 (-16)	-1.40 (-15)
LOG(PBI)	3.14 (7.2)	1.53 (8.1)	0.94 (6.8)	0.80 (7.4)	1.36 (8.1)	1.01 (6.1)
MA(1)	0.73 (4.7)	0.61 (4.2)	0.69 (5.2)	0.58 (4.1)	0.35 (2.6)	0.58 (4.0)
R2 Adj.	0.8	0.62	0.59	0.66	0.84	0.84
D-W Stat	1.80	1.96	1.85	1.98	1.99	1.93
S.D. Dep.Var.	0.47	0.14	0.10	0.089	0.20	0.20
Mean DEP.VAR.	7.22	8.55	9.05	9.23	8.43	8.74
Coef.of Variat.	6.5%	1.6%	1.1%	0.9%	2.3%	2.3%
S.E.of Regres.	0.21	0.089	0.065	0.051	0.079	0.079
Rel.Forc.Error	2.9%	1.04%	0.7%	0.55%	0.93%	0.90%

Sample Period: Monthly, 1985.01 1989.12

Method of Estimation : OLS

LSPBI is the seasonally adjusted series of industrial production.

All regressions were done using Ordinary Least Squares on the basis that our interest is not in obtaining the best estimates of the values of the coefficients but to find out the equation with the maximum predictive power. In any event, using instrumental variables does not alter the previous results in any significant way. For example, the regression using TSLQ for the M4 aggregate, presented in Table 16, yields coefficient estimates and overall performance that closely parallel those shown here using OLS.

TABLE 15b

MONEY DEMAND FUNCTIONS

Dependent Variable (Logarithms of M_i/CPI)

VARIABLE	M1	M2	M3	M4	M3-TF	M4-TF
C (T-Value)	-7.85 (-3.9)	1.37 (1.7)	4.75 (7.9)	5.47 (12.4)	1.97 (2.4)	3.88 (5.3)
INFL.Rate	-3.22 (-13.6)	-0.55 (-5.9)	-0.30 (-4.5)	-0.50 (-9.8)	-1.58 (-16.9)	-1.57 (-18)
LOG(SPBI)	3.26 (7.8)	1.52 (9.0)	0.91 (7.1)	0.80 (8.7)	1.40 (8.3)	1.06 (7.0)
MA(1)	0.77 (5.4)	0.61 (4.2)	0.71 (5.2)	0.64 (4.6)	0.44 (3.1)	0.65 (4.8)
=====						
R2 Adj.	0.82	0.67	0.62	0.74	0.84	0.87
D-W Stat	1.88	1.85	1.69	1.87	1.87	1.81
=====						
S.D. Dep.Var.	0.47	0.14	0.098	0.086	0.204	0.203
Mean DEP.VAR.	7.22	8.55	9.05	9.24	8.43	8.74
Coef.of Variat.	6.5%	1.6%	1.1%	0.9%	2.4%	2.3%
S.E.of Regres.	0.20	0.079	0.060	0.043	0.080	0.073
Rel.Forc.Error	2.7%	0.9%	0.66%	0.46%	0.94%	0.83%
=====						

Sample Period: Monthly, 1985.01 1989.12

Method of Estimation : OLS

LSPBI is the seasonally adjusted series of industrial production.

Table 16

Demand for Real M4 using TSLS estimation method

$$M4 = 5.94 + 0.705 * LSPBI - 0.41 * CDB$$

(11) (6.6) (-7.2)

where M4 stands for the Log. of real M4, and LSPBI is the seasonally adjusted log. of industrial production.

MA(1): 0.56 (3.9)

R2 Adj.: 0.66

D-W: 1.96

RFE: 0.51%

Period: 1885.03-1989.12

It follows from Tables 15a and 15b that the regressions using current inflation as the explanatory variable perform marginally better than those using the nominal interest rate. In both cases, however, the relative goodness of fit between the alternative monetary aggregates remains the same, as shown in Table 17 where the alternative monetary aggregates are placed in ascending order according to the value of the Relative Forecast Error"of the regression.

Table 17

Relative Forecast Error of money demand equations

Dependent Variable	Independent Variable	
	CDB	Inflation
M4	0.55%	0.47%
M3	0.70%	0.66%
M4-TF	0.90%	0.83%
M3-TF	0.95%	0.94%
M2	1.04%	0.93%
M1	2.90%	1.49%

Source: Data from Tables 15a and 15b.

In all regressions we find that correction for an MA(1) is enough to eliminate the need for any additional first order autocorrelation of residuals. The estimated coefficients are significantly different from zero at less than one percent level confidence level for all endogenous variables in all equations(except for the equation of M1 using the inflation rate). The coefficient values are in line with what could be theoretically expected (the income elasticity around unity, differing significantly only in the M1 equations, and the coefficient on the opportunity cost measure having a negative sign).

According to the criteria of minimizing the Relative Forecast Error, the regressions using the monetary aggregate M4 come out clearly as the best choice, independently of whether the opportunity cost is measured by the nominal interest rate or the inflation rate. The worst aggregate according to our criteria is M1 for which the RFE is a maximum for all cases.

Our recommendation is therefore that the Broad concept of the monetary Base be used to determine M4 which in turn is the aggregate best related to inflation. Second in the overall ranking would clearly come out M3, while M1 is the aggregate less related to any concept of Monetary Base and to inflation.