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DEPARTMENT OF ECONOMICS

MONEY, CREDIT AND EXPENDITURE IN MAURITIUS: A SIMPLE MACRO-MODEL

by

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ABSTRACT

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This study develops a small scale econometric model to explain the influence of credit on nominal spending in the Mauritian economy. First, the portfolio behaviour of economic agents is examined as this determines bank deposits. These deposits, in turn, affect the volume of credit given by commercial banks. Banks' behaviour itself in respect of reserves holdings, another determinant of bank credit, is then investigated. Finally, the influence of all major sources of credit including total credit given by commercial banks is studied.

The theoretical model is formulated against the background of recent economic developments in Mauritius and considerations from monetary economics. Econometric techniques are used in searching for preferred specifications of the behavioural equations, systems estimation and validating the model.

CHAPTER ONE

INTRODUCTION

Macro-models are constructed for different purposes and in accordance with different views on the factors most likely to influence the aggregate actions of economic agents. A well-specified model throws light on the crucial inter-relationships that exist in an economy and helps to avoid an excessive reliance on impressionistic judgements in policy formulation and macro-economic forecasting. Thus a large number of macro-models have been developed for both industrial and developing economies especially during the last two decades. In addition, the cost of model-building has been reduced by advances in econometric techniques and computer technology. However, modelling efforts in Mauritius have not been marked despite a growing concern since the mid-1970's for the problems and potentials of macro-economic policy.

The purpose of this dissertation has been to construct, estimate and validate a small-scale econometric model of Mauritius with a focus on the linkages between the financial and real sectors of the economy. More specifically, the role of money and credit in influencing aggregate spending and, ultimately, nominal income was investigated. This, in turn, has called for a detailed study of the portfolio behaviour of economic agents in respect of holdings of money balances in the form of notes and coins, demand deposits and quasi-money, i.e. savings and time deposits. The factors influencing banks' holdings of reserves were also examined as these, together with deposits, influence a substantial portion of total credit that goes into nominal spending. Finally, special attention was given to the relative influences of different forms of credit on aggregate

expenditure in the economy.

The construction of a useful and adequate econometric model involves broad historical and theoretical considerations as well as the application of rigorous data-based criteria in the selection procedure. The dissertation is therefore organised as follows. Chapter two sets out the background to the model by reviewing important economic developments during the sample period and indicating special features of the Mauritian economy. Chapter three examines some issues of direct relevance to the type of macro-model sought for in the research project. The full theoretical model is specified and its workings illustrated by a flow chart. Chapter four looks at the purely econometric aspects of the model by discussing the modelling strategy adopted, estimation techniques used and the diagnostic checks applied in selecting the final model. Estimation results and the diagnostic statistics are then presented. The validity of the model and its overall plausibility is assessed in some detail in chapter five. This involves first explaining the results presented in chapter four and examining the performance of the model in tracking the movement of its main endogenous variables. Thus simulation results are also shown and commented upon in chapter five. The final chapter, i.e. chapter six, contains concluding remarks followed by a statistical annex indicating the source of data and explaining briefly how quarterly series for a few variables were constructed from their respective annual of bi-annual figures.

CHAPTER TWO

RECENT ECONOMIC DEVELOPMENTS IN MAURITIUS

Mauritius is a small island country with a population slightly above one million and a per capita GNP estimated at SDR 1000 in 1985. The economy is dominated by sugar production though in recent years the importance of tourism and non-sugar manufacturing has accrued significantly. The island became politically independent from Britain in 1968 and since then it had had a chequered economic history.

First, the mid-1970's saw a period of rapid expansion. Real GDP growth rate averaged 10% for the period 1972-74. Essentially, this was a sugar-led growth following an upsurge in prices of sugar in the world market and generally good crops in Mauritius except for 1975. In addition, high sugar profits in the boom years led to more investment in non-sugar manufacturing and other sectors of the economy. The Export Processing Zone sector, which manufacturers exclusively for exports and defines a preferential status with regards to tax treatments rather than a specific area of the island, started to develop rapidly. The Government too embarked on ambitious development programs and raised its level of welfare expenditures. At a more general level, the boom triggered frequent and significant wage increases designed to compensate the rising cost of living and affect redistribution of income. However, the boom was not an unmixed blessing. Signs of an 'over-heated' economy surfaced in 1974 when imports doubled and inflation escalated to 20%. Still any gloomy prospect from 1974 onwards was dissipated when sugar prices in the world market reached unprecedented levels towards the end of the year. In 1975, however, sugar prices on the world market declined from the high levels prevailing in 1973 and 1974. The average price per metric

ton dropped from £385.9 in January, 1975 to £142.8 in June and levelled off at £152.8 in December. Worse still, the standing crop for 1975 was reduced by about 30% following cyclonic weather conditions early in the year. However, the downfall in prices and the reduced crop did not adversely affect export earnings in 1975 as the price of £260 per ton obtained for exports to the UK prior to 31st December, 1975 was agreed under a special arrangement at a time when there was a shortage of sugar in the UK. Receipts from sugar exports in 1975 were virtually the same as in 1974. Indeed, in December, 1975 the Government gave a further boost to wage increases by introducing a year-end one-month bonus to all public sector workers. On average the Government has been the largest employer accounting for some 30% of total employment. Its wage decisions assume formal lead in wage developments which, in addition, has been characterised by widespread and active collective bargaining. Thus boom conditions persisted throughout 1975 and very early 1976.

As the boom conditions receded in 1976 and it became difficult for the economy to re-adjust to situations of reduced resources, serious fiscal and Balance of Payments imbalances emerged. These were aggravated by unfavourable developments in the world economy culminating with the second oil price crisis of 1979. On the domestic front, the Government could not bring abrupt cuts on capital spending as some projects necessitated outlays over several years. Also projects with a high labour content were politically difficult to cut given an endemic unemployment problem linked partly to population pressures. Furthermore, the aspirations of a newly-independent nation could not be suppressed and the Government decided to maintain the pace of

development planning. As for its recurrent expenditures, the Government faced other dilemmas. Previous increases in wages and tax adjustments could not be reversed without a serious political outcry. On the other hand, the Government started to complement its wage policies in 1976 by subsidising the two basic staples, namely rice and flour in addition to potatoes, fertilisers and the water tariff rate. Later in the year, prior to the general elections, the Government announced the implementation of a policy of free secondary and university education. Eventually, this policy became operative in January, 1977. On the revenue side, higher inflows from import duties arising from both price and volume increases, were partly neutralised by a stagnation in sugar export taxes and a drop in income tax payments because of liberalised allowances. Thus the budgetary position deteriorated after the boom as both the scale and scope of public expenditures expanded and these were unmatched by additional revenues. As for Balance of Payments, the surpluses recorded in 1974 and 1975 turned into growing deficits. In 1978/79, the Balance of Payments deficit reached Rs 502 million and this was largely attributable to unrelenting growth in imports. To stem the deteriorating budgetary and Balance of Payments situations, the Government decided to implement a financial programme covering calendar year 1978 and this was supported by a first credit tranche stand-by arrangement with the IMF. In 1978/79 tighter fiscal measures were introduced to curb the import of non-essential items, encourage import-substitution and stimulate savings. In the meantime, the stance of monetary policy has become increasingly restrictive. A liquidity ratio of 25% was imposed for the first time in January, 1978 and this was raised to 30% one year later. In April, 1979, a 100

per cent cash payment was imposed for imports of low priority and central bank's approval was needed for utilisation of foreign suppliers' credit for such imports. Actually, suppliers' credit for luxury imports were to be extinguished in June, 1979. Earlier in May, 1979 the central bank re-oriented its refinancing policy and suspended automatic access to all its existing facilities. These measures, however, could not stop the drain on the country's foreign exchange reserves. By mid-1979 there was no sign of improvement in the overall economic situation and prospects were gloomy in the face of declining terms of trade and unabated world inflation fuelled by large increases in the price of petroleum products in that year. The causes of the fundamental disequilibrium in the Marutian economy then were well understood and the dangers of the Government's recourse to substantial borrowings especially from the central bank to maintain budgetary balance were appreciated. It was also felt that the correction of the external disequilibrium by drastic measures could not be delayed any further by continued recourse to foreign borrowings as this would simply be increasing the degree and cost of adjustment in future. In October, 1979 the IMF agreed to an economic and financial programme of adjustment under a stand-by arrangement. The stabilisation program aimed at bringing a balance between the demand for and the supply of resources and correct the Balance of Payments disequilibrium in the medium-term. Immediate measures taken in October 1979 included a devaluation of the Mauritian rupee by about 22.9% in SDR terms and the adoption of a restrictive budget, incomes and credit policies. The devaluation was to restore the profitability and external competitiveness of Mauritian exports and encourage import-substitution. As these

corrective measures were being initiated, the island was hit by severe cyclonic weather late in 1979 and early 1980. Consequently, the budgetary deficit for 1980/81 swelled on account of extensive reconstruction expenditures and the drop in Government revenue resulting from the reduced sugar crop. The performance criteria laid down by the IMF in October 1979 were re-negotiated and this leads to the final phase (1981-85) of the review of recent economic developments in Mauritius.

Although the period 1981-85 was marked by political instability, successive Governments agreed on the diagnosis of the problems facing the country and the tempo of the stabilization program was maintained with further support from the IMF. Strict demand management were continued and in addition some supply-side measures were introduced. The strategy of export-led growth was revitalised and various administrative bottlenecks removed to speed up industrial development. The structural problems of the sugar industry were closely examined and a Government authority was created early in 1985 to supervise the implementation of an 'action plan' designed to improve the long-run efficiency and profitability of sugar production. The public sector itself has been implementing some measures to improve its overall efficiency including that of its revenue-collecting departments. As the budgetary position improved towards the end of 1984, further measures aimed at increasing output were taken. In particular, the maximum income tax rate was reduced from 70% to 35% of taxable income. Monetary policy remained supportive to the adjustment programme and a ceiling was imposed on overall private sector credit. Government credit from the banking system has also been subject to IMF limits.

However, as from mid-1982 ceilings for individual banks are fixed on the basis of their involvement in lending to priority sectors and their deposit-mobilisation effort. Other steps were taken to enhance the role of banks in the financial intermediation process. Initially, the interest rate structure was rationalised and then liberalised to a large extent. In March, 1983 the cash ratio was reduced from 12% to 10% to improve the profitability of banks. In October, 1983 the Bank Rate was lowered from 12% to 11% in an effort to reduce the cost of credit and boost up investment in the growing sectors of the economy. As regards exchange rates, the authorities have always followed a pragmatic approach. For example, the rupee was de-linked from the £ and pegged to the SDR in January 1976 to minimise the destabilising effect of exchange rate changes on internal prices. The devaluations of October 1979 and September 1981 originated from the unsustainable imbalances in the economy after the sugar boom and, in a way, spread the burden of adjustment following the failures of import controls and other restrictive measures in arresting the drain on foreign exchange reserves. On 28th February, 1983 the rupee was unlinked from the SDR and linked instead to a basket of currencies more representative of the country's trade patterns. Inspite of two devaluations, relative price developments and appreciation of the SDR against most currencies other than the US$ has reversed some of the gain in competitiveness achieved by the second devaluation of September, 1981. Since the change in the basket in February, 1983, the implementation of a flexible exchange rate policy has restored the real effective rate to the level reached in September, 1981. Serious adjustment efforts coupled with improving conditions abroad meant better prospects for the

Mauritian economy. By the end of 1985, Mauritius had restored its financial stability and, as explained later, resumed strong growth based on exports.

Having discussed the historical path of the economy in broad terms, it may now be important to examine in some detail the trend in the key variables of the model. This is done in the following two sub-sections, in line with the objective of the dissertation to investigate the linkages between the real and the financial sectors of the Mauritian economy.

The Real Sector

GDP data have been revised from 1976 onwards and are strictly not comparable with earlier data. Table II.a indicates the trend in nominal GDP, nominal spending and the resource gap as reflected by the value of net exports and non-factor services. Real growth rates are in the last row of the table. The negative growth rates for 1975 and 1980 reflect the impact of unfavourable weather conditions which reduced sugar output significantly. Sugar is grown on 90% of arable land and in a normal crop year sugar output may be expected to reach 700,000 metric tons. The cutting season is in the third quarter and the bulk of Mauritian sugar is exported to the EEC under the Sugar Protocol with ACP countries agreed in 1975. This Protocol guarantees Mauritius a quota of 500,000 tons of white sugar equivalent and on average account for 40% of the annual total allocated to ACP countries by the EEC. A certain element of export stability has thus been ensured by Mauritius being signatory to the Sugar Protocol with the EEC. The price for the EEC quota is re-negotiated annually and in

1982 it implied a subsidy of about 35% of estimated exports. Also Mauritius enjoys a very small share (1.1%) of the total US import quota on sugar at a price slightly higher than the EEC price. On average up to 130,000 tons are left to be disposed of on the free market under the International Sugar Agreement. But prices in this free market have remained depressed in recent years partly on account of demand shifts away from goods containing sugar and competition from artificial sweeteners. One estimate puts the free market price at around half the average cost of the world's most efficient producers. At home, the large sugar estates with factories have been facing serious problems often of a structural nature but which they associate mainly to an excessive burden of the tax levied on sugar exports. On the other hand, the Government derives a large share of its revenue from the sugar export tax and considers the EEC price to be a 'political' one obtained by its efforts. A Commission of Enquiry was appointed in 1982 to examine all problems of the sugar industry and make recommendations. Following the publication of two dissent reports by the Commission, the Government took matters in hand and formulated early in 1985 an 'Action Plan' for the most vital sector of the economy. Some concessions were granted in the sugar export tax and a long-term re-structuring of the industry is envisaged with massive support from the World Bank. The other single crop of some importance in Mauritius is tea, although it ranks far below sugar. Tea production increased by 80% during 1980-84 reflecting a combination of factors including a brief boom in international tea prices. But the need for diversification was recognised in the early 1970's. Since then tourism and manufacturing have been regarded

as the leading growth sectors in Mauritius and the best hopes for reducing the high levels of unemployment. Non-sugar manufacturing now accounts for 15% of total value-added compared with 10% in 1976 and its contribution to total employment reached 27.5% in 1985 against 15% in 1976. Furthermore, manufactured exports accounted for 43% of total exports in 1984 as compared to 24% in 1976. This trend is largely reflective of the strong performance of the EPZ sector which grew in 1983 and 1984 by 9.3 per cent and 20.9 per cent, respectively. The present boom in EPZ activities resulted from economic recovery in the US and European markets, an imporved international competitiveness of the Mauritian economy, an aggressive export promotion drive and increased private investment. In 1982 non-manufacturing output actually declined by 1.2% after having expanded rapidly during the period 1972-79.

As regards the utilisation of resources in the economy, the trend over the last 10 years reveals some undesirable developments in the post-sugar boom period and an emerging improvement as from 1980 when drastic corrective measures were taken. The ratio of aggregate consumption expenditures to nominal GDP, which had fallen to 64% during the peak sugar boom year of 1974, rose to an average of 81 % in 1977-79. In the following two years affected by poor sugar harvests, i.e. 1980 and 1981 the ratio was even higher at 90% and 86%, respectively. However, the ratio declined gradually as from 1982 and was projected at 80.5% in 1985. The trend in the components of aggregate nominal spending and the resource gap are also shown in Table II.a.

Table II.a: National Accounts of Mauritius

(Rs million)

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985*
Nominal GDP	1,332	1,643	2,125	4,035	4,336	4,704	5,442	6,258	7,640	8,697	10,209	11,750	12,773	14,295	16,050
	(10.7)	(23.3)	(29.3)	(89.9)	(7.5)	(8.5)	(15.7)	(15.0)	(22.1)	(13.8)	(17.4)	(15.1)	(8.7)	(11.9)	(12.3)
Nominal Spending of which:	1,320	1,588	2,110	3,816	4,296	5,028	6,021	7,030	8,538	9,589	11,277	12,055	12,819	14,695	16,100
	(10.0)	(20.3)	(32.9)	(80.8)	(12,6)	(17.0)	(19.7)	(16.7)	(21.5)	(12.3)	(17.6)	(6.9)	(6.3)	(14.6)	(9.6)
Private consumption	954	1,140	1,395	2,447	2,752	2,956	3,658	4,249	5,144	6,562	7,277	8,301	8,886	9,869	10,980
Public consumption	182	219	235	344	427	575	733	858	1,009	1,224	1,422	1,624	1,706	1,835	1,940
Investment (Private & Public)	184	299	480	750	1,138	1,335	1,510	1,770	1,965	2,028	2,240	2,100	2,300	2,560	2,910
Net Export of Goods and non-factor services	12	55	15	219	40	-324	-579	-772	-898	-892	-1,068	-330	-46	-400	-50
% Growth of Real GDP	4.5	8.0	11.8	9.2	0.2	16.2	7.0	4.0	3.6	-10.1	6.4	5.8	0.4	4.2	5.5

*Provisional

Note: (1) Data from 1976 onwards are based on the new SNA series and are not strictly comparable with earlier data.

(2) Figures in brackets are percentage changes over the previous years.

The Financial Sector

Mauritius is a highly monetised economy with a fair number of well-developed financial institutions. These include the central bank, twelve commercial banks with branches spread over the island and a wide variety of financial and quasi-financial institutions. The banking system dominates the financial sector as banks' deposits constitute the public's main financial assets. However, in recent years the importance of non-bank financial intermediaries has accrued partly reflecting the setting up in 1978 of the National Pension Fund and the indirect effects of credit controls on commercial banks. In general the major non-bank financial institutions provide medium and long-term loans and act as additional investment avenues for savings. Their investments in Government securities increased significantly as from 1978 and relate mainly to the Government-owned State Insurance Corporation of Mauritius and the National Pension Fund. The Development Bank of Mauritius has been providing the bulk of development finance and continues to play an active role in the industrial development of the country. The two largest local banks, one private and one state-owned, have subsidiaries which also accept deposits from the public and lend medium or long-term. But the activities of these subsidiaries are not encompassed in the consolidated accounts of the banking system. Also, as expected, many non-bank institutions are linked with the sugar industry. Two of these institutions, namely the Sugar Insurance Fund Board and the Sugar Industry Pension Fund own considerable assets including fixed deposits at commercial banks. In particular, the Sugar Insurance Fund Board re-insures abroad and on occasions the inflow of re-

insurance claims has been reflected in temporary holdings of bank deposits. The largest commercial bank itself has extensive and well-established links with the sugar industry while the involvement of the other eleven banks in sugar financing especially of the large estates with factories has remained limited. Most of the non-bank institutions including the twenty life and general assurance companies that operate in Mauritius hold considerable amounts of deposits with commercial banks thus providing a strong unifying element in the financial structure. The Post Office Savings Bank is another growing non-bank institution with special appeal to small savers because of its attractive monthly prize draws. The ratio of total deposits to GDP in Mauritius is comparable with that of many developed countries and the ratio of currency to total money is among the lowest in the African region.

Understandably, Mauritius does not have a widespread unorganised sector nor faces the sort of financial dualism that characterised many under-developed countries. Activities in the underground economy may be largely associated with tax evasion. The sale of anonymous bearer bonds in 1982/83 in an attempt to mop out 'black money' elicited a very poor response. In fact the ratio of deposit money to total money is very high confirming the strong links between the formal and informal financial sectors of the economy. Lastly, the Government has announced its intention to set up a Stock Exchange and speed up other financial reforms in line with the needs of fast growing economy.

Charts I.a and I.b show the trend in the major credit and monetary aggregates over the period 1972(1) to 1985(2). Broadly, the

rate of monetary expansion has been in line with nominal GDP. In addition, the rate of monetary expansion slowed down in recent years in contrast to the rapid expansion experienced in the mid 1970's. Obviously the contractionary impact on monetary growth came from the Balance of Payments deficits experienced throughout the whole period after the sugar boom. On the other hand, expansion of credit to the Government, which averaged 25% in 1980-84, accounted for the bulk of monetary growth in recent years. Recent developments also point to a marked change in the composition of broad money, with M1 rising at a much lower pace than quasi-money. The composition of M1 itself has changed with the public economising on currency holdings especially after the first devaluation. The charts also show that monetary and credit developments in Mauritius are characterised by some seasonality arising from both internal and external sources.

Lastly, it is important to comment briefly on the enhanced role of monetary policy in small open island economies like Mauritius. In the immediate years after Independence, monetary policy was basically expansionary and assumed a more or less developmental role in channelling resources to savings and investment. As signs of 'overheating' appeared in the economy during the sugar boom, the emphasis of monetary policy shifted quickly to demand management. This was reported in the Bank of Mauritius Annual Report for 1973 as follows:

> "The year 1973 marks the beginning of a new phase of monetary policy. The first phase consisted of the expansionary monetary policy pursued by the Bank since towards the end of 1969. In 1972, however, the Bank became concerned about the significant rise in credit, in money supply and in prices. That is why the previous Annual Report (1972) anticipated, as it were, the inception of a monetary policy of 'restrained credit expansion' which forms the second phase".

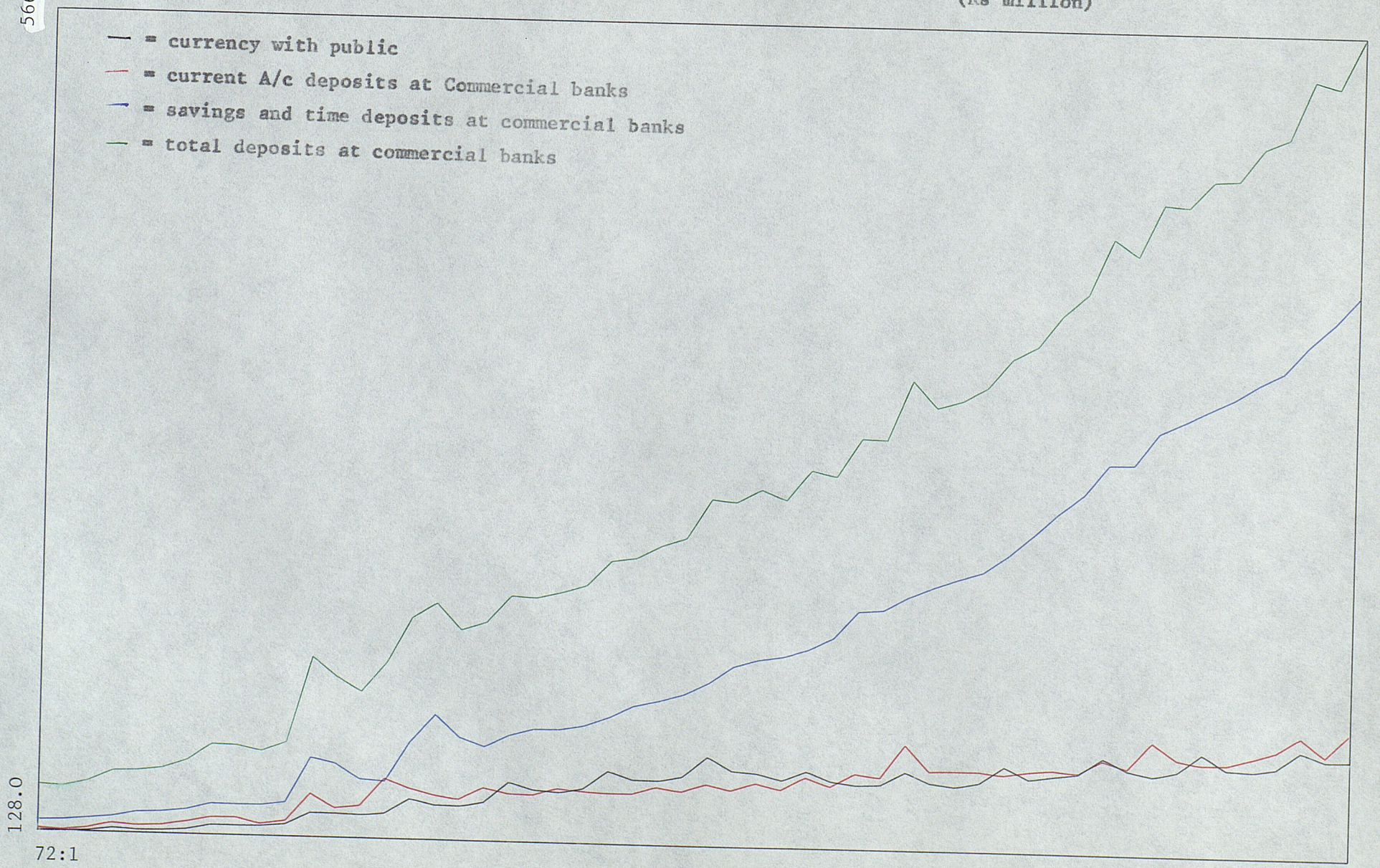
However, in the second phase, the developmental element was not neglected completely as the central bank always stressed on commercial banks the need to satisfy the credit requirements of the productive sectors first. On other occasions the central bank stepped in whenever bottlenecks occurred and even operates forward exchange rate cover for exporters. The drop in the Bank Rate in 1983 was aimed at stimulating investment and growth of the economy.

Also, for the purpose of containing demand pressures the central bank has acted on credit rather than money. In fact, in an open economy like Mauritius, the Balance of Payments itself becomes an additional source of money supply. Under such circumstances, the banking system does not have any direct control over the nominal supply of money, which becomes an endogenous variable of the system. What the banking system can do, is to regulate domestic credit, that is, one of the sources of money supply. The monetary instruments widely used reflect this reality. These have included the setting up of reserves and liquid assets observed by banks, imposition of ceilings on commercial banks' credit to the private sector including specific ceilings on credit to traders, limitations on commercial banks' access to central bank credit and varying the level of interest rates. In contrast, credit policy played a minor role in respect of Government credit owing to the thin non-bank market for Government stocks. For the most part the banking system takes an accommodating stance in respect of credit to the Government.

CHART II.a: Trend in Components of Money

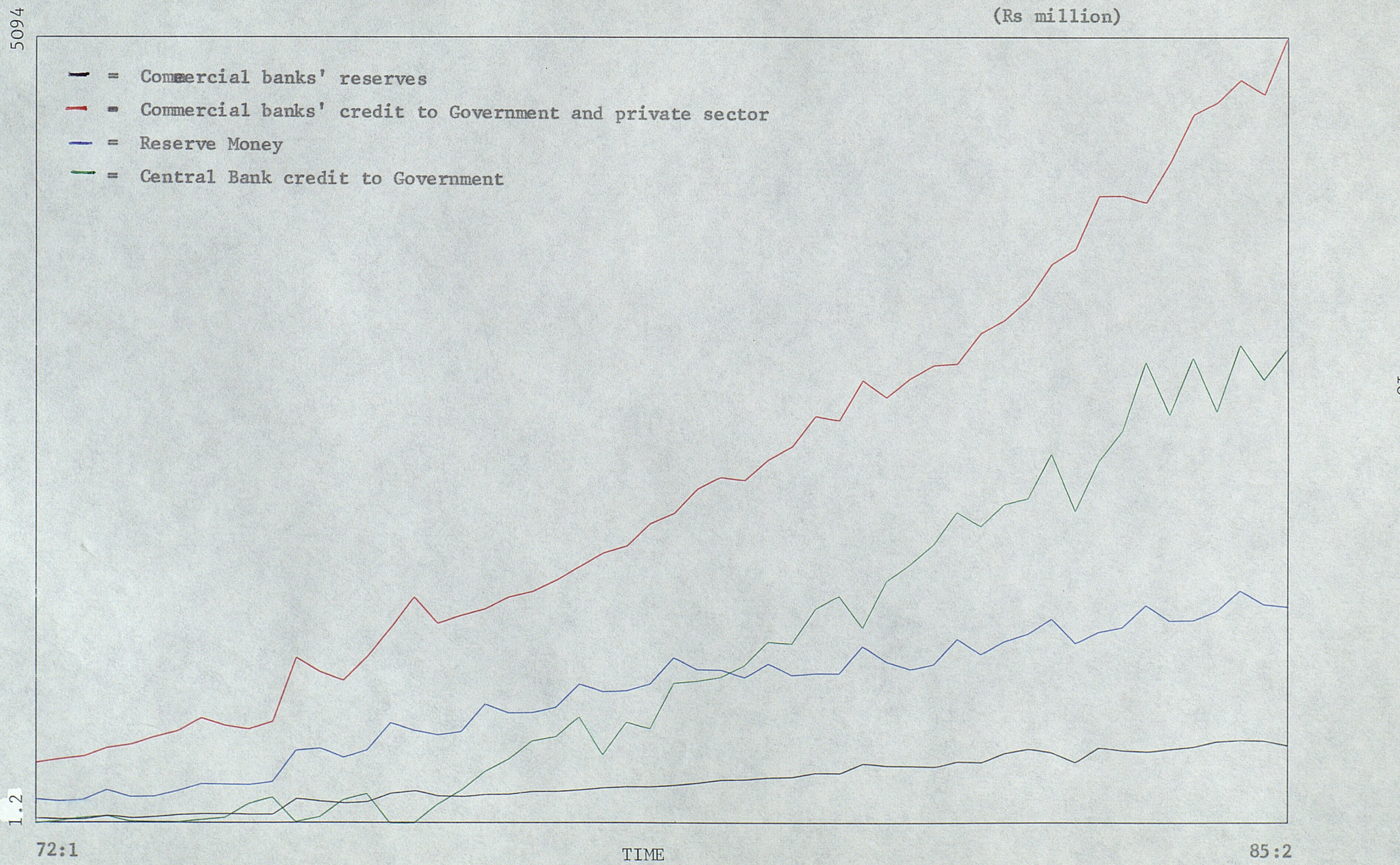
5668

(Rs million)



17

CHART II.b: Trends in Some Monetary and Credit Aggregates



CHAPTER THREE

THEORETICAL SPECIFICATION OF MODEL

The theoretical framework of the model derives from important developments in monetary economics especially those relating to money demand functions and the transmission channels of monetary policy. These developments are reviewed briefly before the theoretical model is set up.

The money demand function normally specified includes income as the scale variable and one interest rate or the inflation rate as representative opportunity costs associated with holding money. It is expressed in real terms and often imbedded in a stock adjustment framework which allows money to adjust gradually to its demand. However, some controversies still persist about the most relevant explanatory variables in different economies and the way these variables should be entered in the money demand functions. First, the choice between permanent or expected income and current measured income presents some problems. The transactions view of money which treats it as a buffer stock suggests including both expected and transitory incomes as explanatory variables on the grounds that transitory changes in income will not be allocated between consumption and various assets (including money) in the same way as the expected component (Darby, 1972). This suggests that current measured income which implicitly assumes the same coefficient to both the expected and unexpected components of income may not be fully appropriate. Another more difficult problem relates to the choice between output or real income, under various available definitions, as the basic scale variable. Here one notes that GDP may be the best measure of real income but not necessarily the best proxy for domestic expenditures. The most

appropriate measure of real income can only be determined empirically as it depends on who holds the money and for what purpose. In the case of some under-developed economies, the choice of an income measure will have to reflect further the effects of changing degrees of monetisation and financial depth on the measured demand for money. Both processes tend to raise the demand for money with monetisation increasing primarily the use of currency in the initial stage and financial deepening the use of bank deposits.

Other unresolved controversies surround the price or inflation index. Deflating nominal money balances converts them into their claim on resources and the deflator should therefore relate to all monetised transactions. In practice, such a 'global' deflator does not exist. A separate issue is the choice of the inflation measure with which to quantify the opportunity cost of holding money relative to the yield on goods. This requires an appropriate estimation of expected inflation rate and again the choice of a price index whose rate of change is most relevant to money demand. In countries with well-developed money and capital markets, the nominal yield on financial assets available as alternatives to money are the best measures of the opportunity costs of holding money. Such rates already embody economic agents' objective measure of inflationary expectations over the period represented by the maturity of the assets involved. This, on the other hand, is rarely true in economies where money and capital markets are thin or where financial repression prevails. In these economies, durable goods inventories and consumption are typically the most important alternatives to holding money and the rate of inflation becomes the most relevant, in addition to being empirically most convenient, measure of money's opportunity costs.

Then a price index of durable goods would be most appropriate in calculating the relevant inflation rate on the grounds that as mainly such goods are held in wealth portfolios it is their yield that matters. An alternative view considers the decline in a unit of money's purchasing power, i.e. the inflation tax on holding money as most relevant. This would suggest using money's price deflator for calculating the rate of inflation. This broader index would also include the price behaviour of non-durables which may be consumed as cash holdings are reduced as a result of the inflation tax. Other difficulties may arise in converting a chosen index into an appropriate measure of expected inflation. The prices the public is willing to pay for fixed yield assets reflect expectations about the change in the value of these assets or simply the inflation rates during the maturity periods. Notes and coins, however, has no holding period as it is a sight asset. Consequently, the rate of inflation most relevant for money demand is that which the public thinks is underway currently or prevails on average over the period to which data observations refer. As expectations are not observable, some proxy must be constructed. The most common approach has been to assume that expectations are formed adaptively. Some researchers have simply used the actual rate of inflation in the previous period on the assumption that expectations are static. Still others have used the current rate of inflation, assuming it to be an unbiased reflection of rationally formed expectation.

Guided partly by the issues raised above, empirical work on money demand functions in LDCs increased significantly in the late 1960's and the 1970's. Generally, these studies fall into two categories: one dealing with individual countries and the other with

a group of countries. Studies in the first category have tended to take a conventional approach to money demand estimation, relating some measure of real money balances to a set of relevant explanatory variables and with possibly some adjustment being made for money market disequilibrium in the short-run. In some cases tremendous ingenuity has been displayed in adapting money demand estimates to the particular characteristics and experiences of individual countries (Bleger, 1978 and Fry, 1976). Estimation has proceeded from linear regression to more recent applications of non-linear and simultaneous equation techniques (Fry, 1978 and Wong, 1977). The second group of studies have concentrated more on the influence of monetary structures, often through studying the determination of the velocity of circulation rather than estimating the money demand functions directly (Ezehiel, H. and Adekunle, J.,1969 and Park, Y.C., 1970). In the very early 1980's one conclusion reached by Coats and Khatkate (1980) was that

> "the poor but improving quality of data in most LDCs requires ingenuity and simplicity of approach but appropriately modified demand functions of some general type typically used in developed countries seem to work well in many LDCs".

Other issues of relevance to the model relate to the channels through which monetary impulses are transmitted to the real sector. In the Keynesian income-expenditure model a change in money supply given a stable interest-elastic demand for money function alters the interest rate so as to equate the demand for money with the changed level of money supply. The change in the interest rate then affects investment expenditures which, in turn, affect equilibrium income directly or indirectly through the multiplier. Other economists

have emphasised net private wealth as an important factor influencing expenditures. They argue that changes in the real quantity of money or real balances could affect economic activity even without a change in the interest rate as the stock of money constitutes a component of the net wealth of the public. For example, an individual's excess demand for a commodity depends on the relative prices with which he is confronted in the market and the real value of his initial endowment which includes money as well as commodities. It follows that, other things being the same, an increase in the public's net wealth, of which money is part, would increase the amount of spending of the public (D. Patinkin, 1965). The wealth effect thus provides an explanation of the substitution between money on the one hand and real expenditures on the other, which seems to be lacking in the Keynesian liquidity preference approach. Although evidence from empirical work on the real balance effect or more broadly the wealth effect on both consumption and demand for money has been on the positive side, one serious problem remains, namely multi-collinearity arising from the inclusion of both income and wealth variables in the same equation. Other economists have extended the wealth effect to include a change in the market value of equities and Government securities held by the public. Ceteris paribus a change in the market values of equities or Government securities increases the amount of expenditure of the public (F. de Leeuw and E.M. Gramlich, 1969).

Another approach in monetary analysis has concentrated on the 'credit-rationing channel'. It is argued that because of imperfections in financial markets not a single rate of interest would equilibrate supply and demand. Interest rates are often determined by institutional

factors and Government ceilings imposed on some of them. Furthermore, the deposit flows of financial intermediaries cannot be predicted accurately nor can their asset compositions be changed easily in the short-run. Under these circumstances, financial intermediaries ration credit by various non-price means. In periods of credit restraint commercial banks have no possible rationing for risk-free customers while for others rationing will depend on their risk characteristics. Thus there is a tendency that a higher degree of credit restraint would result, at least in the beginning, in the reduction of loans from commercial banks to small, risky firms or individuals rather than large established corporations. The expenditures of small firms or individuals would be reduced even though changes in the interest rates do not occur. However, the small firms may then seek access to other non-bank sources of finance including trade credit from the large firms. As demand for their credit rises, the large firms must obtain additional funds in either the capital markets or from commercial banks. Eventually, as overall credit becomes less available, there would be a rise in interest rates, if the rates can change, or a general decrease in expenditures, other things being the same. In situations where interest rates are fixed, trade credit is not available and capital markets or other financial institutions are absent, a limited availability or rationing of loan funds would be directly transmitted to the real sector in the form of reduced expenditures by business firms and individuals.

The portfolio balance approach is more comprehensive in that it treats money as one among a wide array of real and financial assets.

The approach has been adopted by both quantity theorists and non-quantity theorists. To the non-quantity theorists monetary policy operates primarily through changes in the market prices of equities (Tobin, 1969). This view may be illustrated by considering the effects of a reduction in commercial banks' reserves requirements. This releases additional funds to the banks which will demand a larger proportion of loans and securities such as Government bonds, other fixed interest coupons and low risk obligations in their asset holdings, while creating more demand deposits. As banks increase their holdings of these assets, upward pressures are exerted on their prices and interest rates are driven down. Consequently, banks and other asset holders will look further afield for substitutes such as higher-risk fixed coupon obligations. The prices of these obligations will also be bid up by the increased demand. In general financial assets become more expensive relative to non-financial assets such as equities, real property, consumer durables, etc. This situation provides an incentive for individuals and enterprises to acquire non-financial assets in order to adjust their actual portfolios to the desired ones. The ultimate effect is to raise prices of non-financial assets thus stimulating an increase in demand for current productive services, both for producing new capital goods and for purchasing current services. The monetary impulse is therefore spread from financial markets to the markets for goods and services. In this framework, as stressed by Tobin, there is no unique role played by money among all financial assets. Also portfolio preferences or asset demand functions of banks, individuals and enterprises can change due to changes in their expectations, estimates of risks,

attitudes towards risk etc. Thus, in the non-quantity approach the impact of monetary policy cannot be captured in any single exogenous or intermediate variables such as money supply or some market interest rates. They are at best "imperfect and derivative" indicators of monetary policy (Tobin and Brainard, 1963).

Modern quantity theorists agree that monetary impulses are transmitted to the real economy through a portfolio adjustment process which operates on a wide array of assets, but to them the crucial distinction is between the banking system and the rest of the economy rather than the whole financial sector and the real sector. They emphasize relationships within simple models unlike the non-quantity theorists who prefer to investigate the effects of monetary policy via large structural models. Quantity theorists argue that movements in money supply are the best reliable measure of the thrust of monetary impulses as well as the primary determinants of changes in total spending. They consider that the rates of interest which affect investment decisions in the non-quantity theorist framework are the implicit yields and not the observable market prices. Furthermore, the market rates are influenced by the expected rate of inflation and hence do not reflect closely the productivities of capital. In their opinion even the most complex structural model cannot adequately and accurately capture the actual monetary influences on the economy. Thus in their research strategy, the quantity theorists prefer to pursue some simple but crucial relationships which would allow the prediction of economic activity from some policy controllable variable such as the quantity of money, regardless of the chain of causation.

The characteristics which exist in developing countries or small economies like Mauritius do not preculde the existence of the transmission processes outlined above. The relative importance of individual channels, however, may be different than in financially more developed economies and will have to be assessed empirically. A priori the credit-rationing channel is likely to be significant in economies where interest rates have generally been pegged and quantitative credit control has been a major monetary policy instrument. In these circumstances Wong (1977) argues that observed interest rates are unlikely to be the linkage variables between the holding of alternative assets and hence the availability rather than the cost of credit is more likely to affect demand. As regards the substitution effect, the emphasis in LDCs has to be between money and real assets because of the lack of variety of other financial assets. Lastly, to the extent that an increase in the stock of money balances is regarded as an increase in wealth and assuming no simultaneous increase in prices, monetary policy will affect consumption and investment, irrespective of the type of economy being investigated.

The small-scale dynamic model of the Mauritian economy developed in the dissertation has been formulated against the broad background of theoretical ideas and empirical issues discussed earlier in this section. Essentially, the model comprises five stochastic equations determining real demand for notes and coins (RNC), real demand deposits at commercial banks (RCA), real private sector time and savings deposits at commercial banks (RQM), nominal banks' reserves (BS) and aggregate nominal spending in the economy (NS). Four identities, i.e. for total deposits held at banks (TD), commercial banks' credit

to the Government and the private sector (CT), reserve money (MØ) and nominal aggregate income (Y), complete the model. The role of money and credit in influencing nominal spending is basic to the model and this introduces a quantity theorist or monetarist bias.

The components of real money balances, namely RNC, RCA and RQM are specified as functions of real GDP, the rate of inflation and the rate of interest on 3-month time deposits. In addition to reflecting opportunity costs, the rate of interest in the RNC and RCA equations is expected to capture any strong substitution effects between 'active' and 'idle' balances especially after 1981 when the share of M1 in total money started to decline continuously. As pointed out earlier the substitution between real assets and money is expected to be strong in economies where the capital market is thin and this justifies including the rate of inflation in the money demand equations. The role of real GDP as the scale variable is easy to understand especially in an economy that has witnessed a few dramatic changes in growth rates over a relatively short period of time.

Nominal bank reserves are influenced directly by the volume of total deposits at commercial banks and the reserves requirements ratio. The rediscount rate and the general refinancing policy of the central bank may also have some influence on holdings of reserves by banks. However, modelling behaviour of banks in respect of reserves' holdings presents special difficulties which will be discussed later.

The nominal spending equation contains explanatory variables which provide the crucial linkages between the real and the financial sectors. These variables include, first, total commercial banks' credit (i.e. credit to both public and private sectors), non-commercial

bank credit to the Government (i.e. central bank credit to the Government and non-bank investment in Treasury Bills) and a proxy for Government outstanding foreign liabilities. Ideally, one would like to encompass other items of domestic credit such as non-bank lending to the private sector and possibly foreign debt of the private sector. But this is not possible in the absence of reliable and consistent series.

All functions in the model are formulated in logarithmic forms linear in the parameters. In addition, the interest rate and the inflation rate variables are not entered in the equations in terms of their direct logarithms. Rather the logarithms of unity plus these variables have been used. Mathematically, a log-linear form of equation constrains the elasticity (short-run and long-run) of the demand for money with respect to each explanatory variable to be constant and thus independent of the level of the variables. However, in the case of the inflation or interest rate variables, it is perhaps less likely that a doubling of the rate from 1% to 2% will have the same proportionate effect on the demand for money as will a doubling from 10% to 20%. The use of the logarithms of unity plus the inflation rate or the interest rate, as mentioned above, constrains the respective elasticities to vary directly with the rates. Among other features of the model, first the economy's dependence on foreign trade is recognised by treating exports, imports and their respective prices as exogenous. Second, the domestic inflation rate is assumed to be exogenous. In Mauritius, imports account for an estimated 60% of the CPI basket and domestic price movements are dominated by the trend in import prices. Furthermore, prices have been influenced partly by the Government's policy towards food subsidies and the application

of extensive price controls until the end of 1985. Lastly, in view of past monetary policy practice and that only recently have steps been taken to liberalise the interest rate structure, interest rates are assumed to be exogenous to the model.

Using the prefix L to the variables to denote natural logarithms of the respective variables and neglecting dynamic considerations for the time being, the theoretical specification of the full model is as follows:

i) LRNC = f (LRY, LP, Lr)

ii) LRCA = f (LRY, LP, Lr)

iii) LRQM = f (LRY, LP, Lr)

iv) LBS = f (LTD, LRT, LRD)

v) LNS = f (KT, LNCTm LF)

vi) TD = CA + QM + GD

vii) CT = TD - BS + R1

viii) MØ = NC + BS + R2

ix) Y = NS + XMV

The left-hand side endogenous variables are re-defined below for completeness. The letters R wherever they occur indicate that the variables defined below are in real terms, deflated by the CPI index. For example, LRCA and LRY refer to the logarithms of real current account deposits and real GDP, respectively.

Endogenous Variables:

NC = Notes and coins with the public

CA = Private sector current account deposits at commercial banks

QM = Private sector savings and time deposits at commercial banks

BS = Nominal banks' reserves, i.e. cash in hand plus balances of the Bank of Mauritius

NS = Aggregate Nominal Spending which also includes expenditures on imports

TD = Total deposits held at commerical banks. i.e. CA and QM plus Government deposits

CT = Commercial banks' credit to the Government and the private sector

MØ = Monetary base or reserve money

Y = Nominal GDP

Predetermined Variables

P = the rate of inflation as measured by the % change in the average CPI for two successive quarters

r = Unity plus the rate of interest payable on 3-month fixed deposits at commercial banks

RT = reserves requirements ratio applicable on total deposits i.e. TD

RD = rediscount rate for export bills

NCT = a non-commercial banks debt aggregate made up of central bank credit to the Government inclusive of investment in Government securities and non-bank investments in Treasury Bills.

F = An aggregate measure of Government external debt. It includes long-term or medium-term loans from international development institutions, foreign governments on the Euro-dollar market in addition to short-term borrowings and liabilities to the IMF

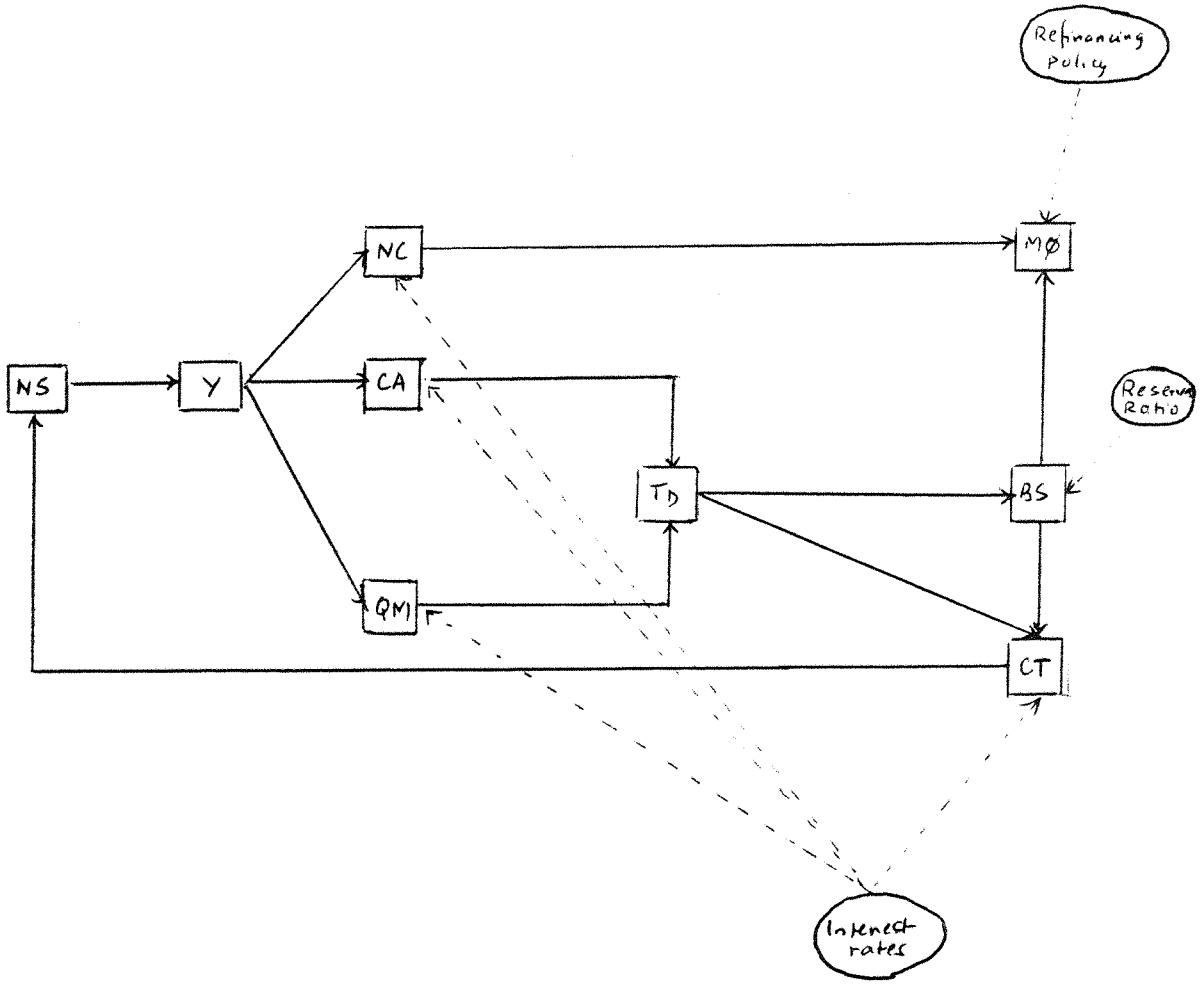
GD = Government deposits at commercial banks

R1, R2 = Residuals to complete the identities where they appear

XMV = Essentially, the trade balance i.e. exports less imports plus any residual items to complete the identity.

In order to demonstrate the workings of the model, the main characteristics of the system are represented in a flow diagram (Chart III.a).

Chart III.a: Flow Diagram of Model



Some policy variables affecting flows in the model have been circled in the chart above. For expository purposes, a rise in the level of interest rates is considered. First, this exerts a direct contractionary influence on credit given by banks and nominal spending gets reduced. Assuming no change in the trade balance or the price level, real income falls. The drop in real income induces declines in total deposits of banks as well as in notes and coins. On the other hand, rising interest rates increases quasi-money leading to an expansion in bank reserves and ultimately a rise in credit. Thus the system adjusts simultaneously in order to bring about a macro-economic equilibrium.

CHAPTER FOUR

ECONOMETRIC MODELLING AND RESULTS

Although some of the issues in monetary economics discussed in the last chapter helped in formulating the theoretical model, one has to note that in general economics provides little guidance about the dynamics of the processes generating the data. On the other hand, estimating a purely static theory-based model or one with strong priors on the operating lag structures may lead to considerably mis-specification arising from unnecessary restrictions on the data (Hendry, 1980). It is therefore important to adopt a modelling strategy which uses, in addition to considerations of theoretical plausibility, good data-based criteria.

As an overall strategy, preferred specifications for individual stochastic equations were obtained first before setting up the whole model. Estimation in the search for preferred specifications proceeded by ordinary Least Squares. Systems method, namely Instrumental Variables/Two Stage Least Squares was then applied to the stochastic equations within the model to allow for endogeneity of some endogenous variables and hence, consistent estimates. Finally, static and dynamic simulations were conducted to check the validity of the estimated model or whether further improvement in model performance was possible. This approach is a standard practice in applied econometrics but the methodology of "general to specific modelling of dynamic econometric relationships" followed in the search for final specifications of individual equations needs to be elaborated. The search started with a general or unrestricted specification with several lags in the variables including the dependent ones and simplifications were sought within this general formulation. In

the first simplification variables with statistically insignificant coefficients (normally with t-statistics less than unity) were dropped. In situations where a problem of 'overfit' was suspected, a t-ratio of 0.5 was used to obtain a more sensible 'general' model. Besides providing a good characterisation of the data-generation process, the final simplification was examined for its theoretical plausibility in terms of sign and size of the estimates as well as sensible dynamics when some priors did exist. The validity of the restrictions imposed by the simplification process was tested by looking for any significant fall in the value of the logarithms of the likelihood function. This methodology has been discussed in Mizon (1977) and Hendry and Mizon (1978). In addition, most diagnostic checks summarised in Hendry and Ericson (1983) were made on the preferred specification for individual equations. These data-based checks essentially ensure that the fit of preferred specification does not deviate from the historical data systematically (absence of serial auto correlation) or heterogeneously (absence of residual heteroscedasticity). Besides the Durbin-Watson statistic for first-order autocorrelation, which in any case is biased towards 2 in specifications with lagged dependent variables, Lagrangean Multiplier tests were used to check for the presence of fourth and eigth order autocorrelations. Reasonably flat residual correlograms were also looked for. The presence of heteroscedasticity was tested by the first-order ARCH statistic (Engle, 1982) and the resulting fit of squared residuals to their values lagged one quarter was useful in selecting appropriate dummy variables. Lastly, good econometric practice also demands that each equation be examined to check that it is acceptable on grounds of

intertemporal stability. The Chow F-test was called upon to verify that the parameter vectors do not differ significantly between identifiable historical episodes within the sample period.

The final preferred specifications for individual equations and the four identities mentioned in section III form a model containing nine endogenous variables and 47 pre-determined variables. The equations in the simultaneous system were estimated by the method of instrumental variables, using all pre-determined variables as instruments. A check for the validity of the instruments, i.e. instruments independent of errors, was also considered. Using all pre-determined variables as instruments means that the instrumental variables estimates are the same as those obtained by two stage least squares. Furthermore, where one equation involves only pre-determined variables the system method estimates are equivalent to those obtained by ordinary least squares applied to the preferred specification.

Data on variables are seasonally unadjusted and, therefore, seasonal dummies were used in the search procedures. Other dummies suggested by exogenous events or the results of the ARCH test were introduced where appropriate. Diagnostic checks similar to those applied in the ordinary least squares specification search exercises were made for the equations estimated by systems method. However, Box-Pierce Q-Statistics were used instead of the Lagrangean Multiplier tests in view of the large number of instruments. The Q-statistics are designed to pick up departures from randomness indicated by the first four and first eight residual autocorrelations. An enhanced version of the TSP package available at Southampton University was used for all estimations and diagnostic checks. Table IV.a summarises the

goodness-of-fit statistics and other diagnostics for the preferred equations obtained by ordinary least squares. Remaining tables IV.b to IV.g relate to results from the systems estimation.

Table IV.a: Summary Statistics and Diagnostic Checks (OLS)

	Equations				
	Real Notes and Coins RNC	Real Current A/C Deposits RCA	Real Time and Savings Deps RQM	Nominal Banks Reserves BR	Nominal Aggregate Spending NS
$\bar{R}^2$	0.98	0.85	0.97	0.99	0.99
DW(1)	1.96	2.02	2,07	1.96	2.13
ε_1	4.69 (9.94)	6.67 (9.49)	5.19 (9.49)	20.25 (9.49)	3.30 (9.49)
ε_2	7.86 (15.51)	7.03 (15.51)	9.96 (15.51)	16.33 (15.51)	14.73 (15.51)
ε_3	0.49 (3.84)	0.09 (3.84)	1.32 (3.84)	0.97 (3.84)	0.17 (3.84)
η_1	0.50 (3.12)	0.36 (2.29)	0.45 (2.27)	0.32 (2.21)	0.70 (2.25)

Note:

1) All variables are expressed in logarithmic forms

2) Critical values are given in parentheses (5% level of significance)

3 i) ε_1 Lagrangean Multiplier test statistic for fourth order autocorrelation approximately distributed χ^2_4 on the null

ii) ε_2 Lagrangean Multiplier test statistic for eighth order autocorrelation approximately distributed χ^2_8 on the null

iii) ε_3 Engle's first-order ARCH statistic, approximately distributed χ^2_1 on the null

iv) η_1 = Chow F-test for parameter constancy. Sample of 54 was divided between 46 and 8 quarters.

Table IV.b: Summary Statistics and Diagnostic Checks (2SLS/IV)

	Equations				
	Real Notes and Coins	Real Current A/C Deposits	Real Time and Savings Deps	Nominal Banks Reserves	Nominal Aggregate Spending
$\bar{R}^2$	0.98	0.85	0.97	0.99	0.99
DW(1)	1.98	2.01	2.07	1.96	2.14
ε_1	4.08 (9.49)	5.26 (9.49)	4.06 (9.49)	6.58 (9.49)	1.54 (9.49)
ε_2	11.10 (15.51)	9.89 (15.51)	9.83 (15.51)	8.03 15.51)	5.53 15.51)
ε_3	0.56 (3.84)	0.10 (3.84)	1.33 (3.84)	1.01 (3.84)	0.25 (3.84)
ε_4*	34.77	32.93	31.99	42.28	35.31
η_1	0.04 (2.25)	0.25 (2.29)	0.30 (2.27)	-0.38 (2.21)	0.62 (2.25)

* Statistics are below critical values

Note: 1) All variables are expressed in logarithmic forms

2) Critical values are given in parentheses

3 i) ε_1: Box-Pierce Q-statistics for first four residual autocorrelations, approximately distributed χ^2_4 on the null

ii) ε_2: Box-Pierce Q-statistics for first eight residual autocorrelations, approximately distributed χ^2_8 on the null

iii) ε_3: Engle's First-order ARCH statistic, approximately distributed χ^2 on the null.

iv) ε_4: χ^2 test for validity of instruments, i.e. instrumental variables independent of errors.

v) η_1: Chow F-test for parameters constancy. Sample of 54 divided between 46 and 8 quarters.

Table IV.c: Estimates of Real Notes and Coins (RNC) Equation: 1972(1) to 1985(2).

Definition of variables

	Constant	-0.531	(-2.11)
Real notes and coins lagged 1 quarter	RNC(-1)	0.452	(5.08)
Real notes and coins lagged 3 quarters	RNC(-3)	0.181	(2.80)
Real notes and coins lagged 4 quarters	RNC(-4)	0.183	(1.57)
Current Real GDP	RY	0.091	(1.59)
Real GDP lagged 1 quarter	RY(-1)	0.060	(1.29)
Real GDP lagged 2 quarters	RY(-2)	0.113	(2.24)
Current rate of inflation	P	-1.452	(7.56)
Rate of inflation lagged 1 quarter	P(-1)	-0.913	(-3.42)
Rate of inflation lagged 2 quarters	P(-2)	-0.484	(-1.68)
Current rate of interest on 3-month deposits	r	-1.491	(-2.39)
Rate of interest on 3-month deposits lagged 4 quarters	r(-4)	-2.017	(-3.09)
Dummy for 1st devaluation, 1 for 4th quarter 1979, -1 for 1980(1)	DUM1	-0.051	(-1.73)
Seasonal dummy for 4th quarter of the calendar year	DUM2	0.149	(4.64)

Note: 1) t-statistics are in parentheses

2) All variables except the dummies are expressed in logarithmic forms

3) As explained in Section III, the logarithms of the inflation and interest rate variables in the RNC, RCA and RQM equations actually refer to the logarithms of 1 plus these respective variables.

Table IV.d: Estimates of Real Current Account Deposits (RCA) Equation: 1972(1) to 1985 (2).

Definition of variables			
	Constant	0.006	(0.01)
Real Current A/c Deposits Lagged 3 Quarters	RCA(-3)	0.207	(1.95)
Real Current A/c Deposits lagged 4 quarters	RCA(-4)	0.310	(2.86)
Current Real GDP	RY	0.113	(1.01)
Real GDP lagged 1 quarter	RY(-1)	-0.141	(-1.14)
Real GDP lagged 3 quarters	RY(-3)	0.486	(4.23)
Current rate of inflation	P	-3.306	(-5.59)
Rate of inflation lagged 2 quarters	P(-2)	1.790	(2.35)
Rate of inflation lagged 3 quarters	P(-3)	-2.848	(-3.53)
Current rate of interest on 3-month deposit	r	-3.858	(-1.57)
Rate of interest on 3-month depost lagged 1 quarter	r(-1)	6.829	(2.31)
Rate of interest on 3-month deposit lagged 3 quarters	r(-3)	-6.960	(-3.95)
Dummy to reflect a huge temporary rise in demand deposits associated with receipt of re-insurance claims from abroad. 1 for 1980(4), zero elsewhere.	DUM1	0.685	(5.30)
Dummy to reflect huge increases in demand arising from advance receipts of sugar export proceeds not yet disbursed to planters or delays in paying sugar insurance claims. 1 when such increases were recorded, zero elsewhere.	DUM2	0.142	(3.71)
Sugar boom dummy. 1 for period of boom, zero elsewhere	DUM3	0.195	(4.47)
2nd Devaluation dummy. 1 for 1981(3), zero elsewhere	DUM4	0.145	(2.16)
Seasonal dummy for 3rd quarter of the calendar year	DUM5	-0.097	(-2.54)
Seasonal dummy for 4th quarter of the calendar year	DUM6	0.099	(2.77)

Note: 1) t-statistics are in parentheses

2) All variables except dummies are expressed in logarithmic form.

Table IV.e: Estimates of Real Savings and Time Deposits Equation (RQM): 1972(1) to 1985(2).

Definition of variables:

	Constant	-1.058	(-2.40)
Real savings and time deposits lagged one quarter	RQM(-1)	0.558	(5.17)
Real savings and time deposits lagged two quarters	RQM(-2)	-0.383	(-3.63)
Real savings and time deposits lagged four quarters	RQM(-4)	0.39	(5.71)
Real GDP lagged one quarter	RY(-1)	0.179	(2.10)
Real GDP lagged two quarters	RY(-2)	0.123	(1.26)
Real GDP lagged four quarters	RY(-4)	0.258	(2.58)
Current rate of inflation	P	-1.221	(-3.40)
Rate of inflation lagged one quarter	P(-1)	-1.164	(-2.38)
Rate of inflation lagged two quarters	P(-2)	0.550	(1.10)
Rate of inflation lagged three quarters	P(-3)	-1.320	(-2.92)
Rate of interest on 3-month deposits lagged 1 quarter	r(-1)	2.305	(1.59)
Rate of interest on 3-month deposits lagged 3 quarters	r(-3)	-3.772	(-1.49)
Rate of interest on 3-month deposits lagged 4 quarters	r(-4)	3.665	(1.83)
Seasonal dummy for 3rd quarter of the calendar year	SD3	-0.035	(-1.21)
Seasonal dummy for 4th quarter of the calendar year	SD4	0.074	(2.62)

Note: 1) t-statistics are in parentheses

2) All variables except dummies are expressed in logarithmic forms.

Table IV.f: Estimates of Nominal Banks' Reserves (BS)

Equation: 1972(1) to 1985(2).

Definition of variables.

	Constant	0.005	(0.02)
Bank reserves lagged 1 quarter	BS(-1)	-0.179	(-1.70)
Bank reserves lagged 2 quarters	BS(-2)	-0.176	(-1.94)
Bank reserves lagged 3 quarters	BS(-3)	0.380	(3.81)
Current total nominal deposits at commercial banks	TD	1.278	(6.83)
Total nominal deposits at banks lagged 1 quarter	TD(-1)	0.345	(1.28)
Total nominal deposits at banks lagged 3 quarters	TD(-3)	-0.681	(-3.52)
Reserves Requirements Ratio	RT	0.869	(5.90)
Dummy to capture situation of huge excess reserves in 1974(4). 1 for that quarter, -1 for following quarter	DUM1	0.173	(1.66)
Dummy to capture situation of huge shortage of reserves in the last quarter of the sample. -1 for quarter before 1985(2), 1 for 1985(2)	DUM2	-0.086	(-1.55)

Note: 1) t-statistics are in parentheses

2) All variables except dummies are in logarithmic forms.

Table IV.g: Estimates of Aggregate Nominal Spending (NS) Equation: 1972(1) to 1985(2).

Definition of variables.

	Constant	0.969	(2.71)
Aggregate nominal spending lagged 1 quarter	NS(-1)	0.354	(3.32)
Aggregate nominal spending lagged 2 quarters	NS(-2)	0.455	(3.99)
Current banks' credit to the public sector and private sector	CT	-0.575	(-3.03)
Bank credit to public and private sector lagged 1 quarter	CT(-1)	0.256	(1.33)
Bank credit to public and private sector lagged 3 quarters	CT(-3)	0.400	(2.20)
Central bank credit to Govt. plus non-bank investment in TBs lagged 1 quarter	NCT(-1)	-0.034	(-1.68)
Central bank credit to Govt. plus non-bank investment in TBs lagged 2 quarters	NCT(-2)	0.067	(3.73)
Central bank credit to Govt. plus non-bank investment in TBs lagged 3 quarters	NCT(-3)	-0.038	(-1.96)
Central bank credit to Govt. plus non-bank investment in TBs lagged 4 quarters	NCT(-4)	0.063	(3.95)
Aggregate for external debt of Govt. lagged 3 quarters	F(-3)	-0.408	(-3.35)
Aggregate for external debt of Govt. lagged 4 quarters	F(-4)	0.355	(3.03)
1st devaluation dummy, 1 for 1979(4), -1 for 1980(1)	DUM1	0.107	(1.81)
Sugar boom dummy, 1 for period of boom, 0 elsewhere.	DUM2	0.070	(1.80)

Note: 1) t-statistics are in parentheses

2) All variables except dummies are in logarithmic forms.

3) TBS = Treasury Bills

Table IV.h: Long-run elasticities

Dependent Variable	Long-run elasticities of dependent variables with respect to: Real Income (Y)	Inflation (1+P)	Interest Rate (1+r)	Total Deposits (TD)	Reserves Ratio (RT)	Credit Aggregate 1 (CT)	Credit Aggregate 2 (NCT)	Public External Debt Aggregate (F)
RNC	1.45	15.48	19.07	-	-	-	-	-
RCA	0.95	9.04	8.26	-	-	-	-	-
RQM	1.01	7.25	12.86	-	-	-	-	-
BS	-	-	-	0.97	0.87	-	-	-
NS	-	-	-	-	-	0.42	0.30	0.28

CHAPTER FIVE

DISCUSSION OF RESULTS AND MODEL PERFORMANCE

An examination of whether the model reaches an acceptable standard of performance is carried in two steps. First, results for individual equations are appraised in some detail. Overall model performance is then assessed from results of both dynamic and static simulations.

Individual Equations

(a) Notes and Coins

Results for this equation are good from the point of view of size or sign of parameter estimates and goodness of fit statistics. As expected the response of real currency demand to increases in real GDP is positive in both the short-run and in the long-run. Also the substitution effect between currency and real assets is strong as revealed by the high significance of the inflation rate variable. Another substitution effect exists between notes and coins and quasi-money especially in the long run. Both the inflation rate and the interest rate variables have high negative coefficients confirming theoretical priors about their dominance in money demand functions for economies with under-developed money or capital markets. Results also establish an important seasonal rise in demand for currency in the fourth quarter. Besides reflecting an increase in trading activities in December, the strong rise in Mauritius is also influenced by a tradition of payments of end-of -year bonuses and gratuities started primarily during the sugar boom in the mid 1970's. The growth of nominal currency with the public slowed considerably in 1980 immediately after the first devaluation. Nominal currency with public dropped from a monthly average of Rs 697 million in 1979 to Rs 659 million

in 1980 and then rose to Rs 682.1 million in 1981. The devaluation itself led to a sudden spurt in domestic prices given the high importance of imports in the CPI basket. Consequently, demand for currency in real terms dropped temporarily before picking up after the sudden price effect of the devaluation has receded. 1980 was also a cyclone-affected year during which a negative real GDP growth rate of 10.1% was recorded. This may explain the slow down in the expansion of nominal currency but for real currency demand the sudden price effect of the devaluation was more dominant. Another consideration may relate to the fact that the first devaluation of October 1979 was accompanied by even more restrictive monetary measures including the re-introduction of credit ceilings after a temporary suspension. This, in turn, might have induced a slight economy in the use of available money balances as some economic agents tried to depend more on money lenders in the unorganised money market to meet target expenditures. In any case, the slow down in the growth of the public's holdings of currency in 1980 was well captured by the first devaluation dummy.

(b) Current Account Deposits

Modelling demand for real current account deposits posed certain problems as shown by the worse $\bar{R}^2$ of 0.85 for that particular equation. $\bar{R}^2$ for all other equations in the model exceeded 0.97. Part of the problems are revealed by the trend in ownership of demand deposits shown in Table V.a.

Movements in demand deposits of the 'personal and professional' sector are more likely to be influenced by the economic variables

discussed in section III. However, the share of this sector in total demand deposits averaged only some 40% during the period 1973-1985 and has been on a general decline especially after 1980. On the other hand, share of sectors like 'financial institutions' has gone up significantly. In general, demand deposits in accounts other than 'personal and professional' have been characterised by some irregular movements. This explains the presence of several dummies including two seasonals in the final equation. In the end an adequate specification was obtained as shown by good results for the diagnostic checks.

In the long-run, increases in real income affect current account deposits positively while a negative influence was exerted by both rising inflation and interest rates. To some extent the same type of substitution effects observed in connection with currency held by the public operate on demand deposits kept with banks. Lately some banks have offered savings deposits accounts with cheques thus inducing a more direct type of substitution between demand deposits and quasi-money. This enhanced the significance of the interest rate in the demand deposits equation.

Relevant dummies for inclusion in the demand deposits equation were suggested by a careful analysis of the trend in ownership of deposits and by abrupt movements in the level of overall demand deposits. First, payments of insurance claims by the Sugar Insurance Fund Board and occasional advance receipts of sugar export proceeds especially in the last two years brought significant temporary increases in demand deposits at the end of certain quarters. A dummy variable to capture such increases is highly significant and is

correctly signed. On another occasion in the last quarter of 1980 the level of demand deposits recorded a sudden significant expansion. As reported on page 9 of the Bank of Mauritius Quarterly Review Volume XII, that increase reflected largely temporary holding of sugar re-insurance claims from abroad as demand deposits with one commercial bank. Actually, the level of demand deposits went up by Rs 234 million or 32.5% during the second half of 1980. A dummy for this temporary increase was found to be very significant with the right sign. Next, the significance of the sugar boom dummy in the demand deposits equation is, in a way, predictable. As inflows of sugar proceeds increased massively during the boom, the economy was flushed with liquidity and current account deposits were inflated pending quick investment opportunities or the purchase of durable goods. Another positive impact on demand deposits was derived from the second devaluation. A dummy for that exchange rate adjustment was significant and positive largely reflecting increase in deposits of holders categorised under 'Other Industries and Manufacturers'. These include mainly export industries or local industries relying heavily on imported raw materials. Their deposits increased by about 40% between March, 1981 and March, 1982 which includes the devaluation month of September, 1981. Prior to that the level of deposits under 'Other Industries and Manufacturers' virtually stagnated.

Regarding the seasonals, it is observed that the 3rd quarter dummy is negatively signed while that for the fourth quarter has a positive sign. Both are very significant in influencing demand deposits. Mauritius does not have a compulsory P.A.Y.E. system for income tax payments though wage earners have an option of paying on a monthly

Table V.a: Ownership of Demand Deposits - 1973-1985.

(Rs millions)

	As End of March:												
	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
TOTAL	187.1	275.7	374.3	489.6	500.5	529.0	575.1	623.2	759.4	779.3	854.3	869.6	957.2
Of which:													
Sugar	20.5	55.2	62.4	92.2	53.0	47.0	19.5	46.9	50.3	25.7	46.0	56.0	48.6
Other industries and manufacturers	10.3	10.5	29.1	26.2	20.4	29.6	30.3	32.5	35.5	50.5	52.0	46.2	72.4
Business and Trade	23.2	33.3	38.6	51.7	60.9	69.0	71.8	81.7	78.2	97.3	78.6	71.5	77.4
Financial Institutions	35.0 (18.7)	41.7 (15.1)	49.2 (13.1)	58.1 (11.9)	66.2 (13.2)	83.3 (15.7)	131.0 (22.8)	143.9 (23.1)	203.7 (26.8)	228.8 (29.4)	267.7 (31.3)	279.3 (32.1)	289.0 (30.2)
Government	8.6	15.7	16.6	31.0	37.1	42.2	61.9	27.9	73.2	59.4	92.8	74.7	102.6
Personal and Professional	82.7 (44.2)	107.1 (38.8)	168.0 (44.8)	213.7 (43.6)	242.0 (48.4)	230.6 (43.6)	243.1 (42.3)	272.6 (43.7)	288.5 (40.0)	297.9 (38.2)	291.2 (34.1)	317.3 (36.5)	325.8 (34.0)

Note: 1) Government includes mainly semi-Government institutions.

2) Figures in parentheses are percentage shares in total deposits.

basis. A substantial amount of income tax payments are effected wholly or partly in September when returns are submitted. The tendency in the past few years has been to pay the tax by cheque and this explains why accounts, replenished before the 30th September, are reduced on the last day of that month. Thus a seasonal fall in demand deposits normally occurs in the third quarter. A significant positive seasonal dummy for the last quarter reflects accrued inflows of sugar export proceeds and the temporary increases associated with end-of-year bonus or gratuities.

Savings and time deposits at Commercial Banks

Practically all savings deposits are held by the 'personal and professional' sector whose corresponding share in total time deposits works out to an average of 50% over the sample period. Still the holding of time deposits by non-bank financial institutions or semi-Governmental bodies is quite significant and subject to some irregular movements. For example, the share of 'personal and professional' sector in the increase of total time deposits of Rs 250 million during the year ended March, 1985 was insignificant while the bulk of the increase was accounted for by non-bank financial institutions. However, in general, the share of the 'personal and professional' sector in total time deposits has been rising and accounts for an average of 75% of total outstanding time deposits at commercial banks. This implies that the type of problems encountered in the demand deposits equation would be less in the quasi-money specification. Indeed, the variation in quasi-money is well explained by the explanatory variables. The $\bar{R}^2$ is high and other diagnostic statistics reasonably good.

The effect of real GDP on quasi-money is positive though it operates with a longer lag than in the notes and coins or demand deposits equation. This is quite understandable as agents' savings decisions are made after all expenditures or outlays have been made. The inflation variable is very significant pointing to strong substitution effects between quasi-money and real assets such as real estates or consumer durables. In fact the inflation variable dominates the quasi-money equation and the interest rate variable became more significant and positive only in the long-run. Variability in interest rates became important in Mauritius after 1976 and although a liberalised interest rate structure exists as from November 1981 the central bank still imposes a floor rate for savings deposits to protect the interest of depositors.

The bulk of sugar export proceeds for a standing crop are received in the second half of the calendar year and these flows have a positive seasonal impact on quasi-money in the last two quarters. Employment in the sugar industry rises during the harvest time and this adds to the seasonal rise in quasi-money. The dummy for the 4th quarter is very significant reflecting the positive influence on quasi-money arising from the receipts of end-of-the-year bonuses etc.

Bank Reserves

In general banks' reserves are made up of a very large required portion determined mechanically by the volume of current deposits and the reserves requirements ratios. The remaining smaller portions reflect situations of excess or shortage of reserves and fluctuate widely. It is precisely these fluctuations which bring additional

difficulties in modelling banks' behaviour in respect of reserves holdings.

Still results shown in Table V.b are satisfactory. The presence of heteroscedasticity was eliminated by the introduction of separate dummies to capture two situations of large excess and shortage of reserves, respectively. The only source of concern remains the presence of high fourth and eighth order autocorrelations indicated by the Lagrangean Multiplier tests in Table IV.a. However, Q-statistics for the first four and eight autocorrelations in both the OLS and systems method estimation are below critical values. In addition, simulation results confirm the good fit of the chosen specification in a systems framework.

The magnitude and sign of the estimated coefficients are in accordance to priors, namely strong positive influences from current deposits and the reserves requirements ratio. The equally strong presence of lagged reserves variables and lagged deposits in the equation indicate important corrective actions on the part of banks after situations of excess or shortage of reserves. But the long-run direction of corrective actions is unpredicatable given wide fluctuations arising from situations of excess or shortage of reserves. In fact results show that in the long-run lagged banks' reserves exert a slight positive influence on current reserves holdings.

Theoretically, one would expect the rediscount rate or the overall re-financing policy of the central bank to affect reserves holdings of banks. The rediscount rate was found to be insignificant and was dropped in the final specification. A shift dummy was used to capture the effect of tighter refinance policy as from February

1974, namely the imposition of a penal rate on borrowings from the central bank in excess of prescribed limits but this did not have a significant influence on banks reserves either. Likewise, the effect from the suspension of automatic access to all credit facilities from the central bank for nearly a year in 1979/80 was found to be negligible. In fact this suspension occurred when demand for private sector credit was very low and the operation of credit ceilings was temporarily abandoned. Earlier in January 1978 the Bank of Mauritius adopted an extended concept of credit and decided to include re-discounted bills as part of private sector credit given by banks. The operation of credit ceilings then compelled banks to exercise some restraint in the utilisation of rediscount facilities of the central bank but no emerging effects on holdings of reserves was observed as revealed by a dummy introduced to capture the effect of this definitional change. On other occasions the central bank operated special lines of credit to help commercial banks tide over tight situations arising from delays in the receipt of sugar export proceeds or other unforeseeen difficult circumstances. Also, though the eligibility of sugar export bills for re-discount at the central bank was suspended in 1975 and only non-sugar export bills have since been accepted for re-discounting, the volume of the latter increased significantly in recent years. It would therefore appear that the central banks' refinancing policy inclusive of its important discretionary element did not provide sufficient leverage in influencing banks' reserves. Actually that policy served to neutralise possible seasonal effects in holding of bank reserves as one would expect in an economy like Mauritius where demand for credit is itself strongly seasonal.

On the other hand, banks have run short of reserves on occasions when their investments in Government securities or lending to private sector showed dramatic increases. This would point to an element of volatility in holding of reserves as shortages might have been incurred for specific purposes on a temporary, if not daily, basis. Individually or collectively, banks might have seized on opportunities to invest heavily in Treasury Bills or Government Stocks thus running short of reserves temporarily or have really faced tight liquidity shortages on account of delays in repayments of overdrafts or loans. The lack of investment avenues or the operation of credit ceilings would support this type of behaviour by banks. Lastly, separate dummies introduced to capture two situations, one of large excess and the other of large shortage of reserves were slightly significant and have the right signs. Still banks' behaviour in respect of reserves holding remains complex and a better specification would involve further detailed investigations. It is intended to carry out such investigations at a later stage.

Nominal spending

The estimation results for the aggregate nominal spending equation are reasonably good though two of the explanatory variables were aggregates constructed specially to preserve degrees of freedom and there was a problem of coverage in that private sector external debt and most non-bank lending to the private sector were omitted from the regression because of lack of consistent data. Commercial bank credit to the private sector and the Government were deliberately lumped together to provide a crucial credit variable endogenous to the model.

However, central bank credit to Government and non-bank investments in Treasury Bills were aggregated to avoid too many explanatory variables which would have led to overfit of the regression. The same reasoning applies in aggregating medium-term or longer-term public external debt and a good proxy for the Government's remaining foreign liabilities, namely 'other liabilities' of the Bank of Mauritius.

In the long-run, the three aggregate explanatory variables mentioned above are all significant in explaining variations in total spending in the economy. The $\bar{R}^2$ is high and all diagnostic checks on the selected specification are good. Total credit from commercial banks has a positive impact on nominal spending but the long-run elasticity of this credit aggregate appears to be on the low side. One explanation lies in the possibility of a 'crowding out' effect on commercial banks arising from a growing share of central bank credit to Government in overall domestic credit. During the periods following the boom and up to 1983, the share of central bank credit to Government in total domestic credit rose continuously and has dropped only in the last two years. This 'crowding out' effect has been more marked on occasions when IMF limits on domestic credit were imposed as performance criteria under various stand-by arrangements. Also, the imposition of ceilings on private sector credit extended by commercial banks would imply that the private sector itself was 'crowded out' by the Government during a large part of the sample period and this could have accrued the importance of non-bank credit in influencing nominal spending. The largest commercial bank itself has an affiliated finance corporation whose medium-term lending increased substantially during the last ten years. Commercial banks

are involved mainly in financing working capital requirements while major non-bank institutions especially the Development Bank of Mauritius provided the bulk of longer-term finance. Lastly a complete squeeze on traders' credit (a sub-ceiling on credit to traders fixed in 1973 was unrevised by mid-1985) might have forced traders to rely more on suppliers' credit and the informal sector besides evolving their own self-finance mechanisms.

Central bank credit to the Government and non-bank investment in Treasury Bills exerted a long-run positive influence on nominal spending. This would reflect a relatively high importance of the public sector in the economy. Again, the long-run elasticity is rather low, partly because of a growing importance of other non-bank resources in financing development expenditures or capital spending of the Government. In fact, foreign grants or long-term soft loans from international institutions have been channelled directly to Government agencies or through the Development Bank of Mauritius so that some of the spending effects arising from variations in central bank credit to Government and non-bank investment in Treasury Bills have been dominated. In addition, non-bank credit to the Government in the form of non-bank investments in Treasury Bills became significant only after 1978 and is channelled mainly from two Government-owned institutions, namely the State Insurance Corporation of Mauritius and the National Pension Fund.

The long-run effect of external public debt is slightly negative and difficult to justify. Such borrowings have often been incurred ex-post to tide over foreign exchange shortages after periods of unrelented growth in imports or unexpected declines in export proceeds.

These borrowings became significant after 1978 and have often been contracted to finance budgetary deficits on occasions when domestic sources of finance were limited. In a way the relatively higher positive influence of the credit variable including central bank credit to Government and non-bank investments in Treasury Bills would explain the low significance of the external debt variable. The timing of repayments at specific dates financed by increases in domestic credit from the central bank or commercial banks and the growing importance of non-bank finance as from 1978 would also operate in minimising the impact of the foreign debt variable used in the model.

A dummy to capture the effect of the sugar boom on nominal spending was found to be quite significant with the correct sign. Imports almost doubled in 1974 at the peak of the boom and expenditures in virtually all sectors of the economy went up. The second dummy to capture the effect of the first devaluation on aggregate expenditure was equally important and reflected mainly a price effect on the value of imports. The effect of the second devaluation in 1981 was less marked and insignificant because the volume of imports was already on the decline.

The long-run elasticities with respect to the explanatory variables in the five behavioural equations have also been calculated (Table IV.h). Besides the comments made in earlier discussions of the estimation results for individual equations, one interesting observation relates to the income elasticities for the components of money. The figures imply that a rise in income will, in the long-run, be reflected in holdings of notes and coins to a greater extent than in holdings of demand deposits. This is by no means unusual

for an economy where the market for non-bank financial assets is thin and the public have good access to banks for quick withdrawals from savings accounts. Still the income elasticity of real notes and coins seems to be on the high side. One of the main reasons for expecting income elasticity of demand for money to exceed one in a less developed country is that the process of monetisation proceeds with growth in income. The income elasticities of real demand deposits and quasi-money confirm the highly monetised structure of the Mauritian economy.

Simulations

The short-comings of simulation as a method of model evaluation have been pointed out by Hendry and Richard (1982). A. Pagan (1986) notes that "nothing new can be learned about model adequacy that was already available from an analysis of ordinary residuals". However, simulation statistics oriented towards the operational characteristics of the model can still be useful. Static simulations in which historically observed values of the lagged endogenous vairables are used can help in identifying structural characteristics of the model which have been incorrectly specified. In contrast, under the dynamic simulation procedure the lagged endogenous variables are generated by the model and a comparison of the simulated values of the endogenous variables with their actual values would provide a rigid test for the reliability of the model. By allowing the lagged endogenous variables to be determined within the model dynamic simulation helps to identify misspecification of the lag structures and provides a test for the stability of the estimated model. Dynamic simulation results for the nine endogenous variables of the model are shown

in charts V.a to V.i. Summary statistics from both static and dynamic simulations are indicated in Tables V.b and V.c.

As shown in the charts, the model is able to duplicate the turning points reasonably well. Good performance was confirmed further by Theil Statistics for dynamic simulations shown in Table V.b. Theil's inequality coefficient (U) shows close tracking performance for all endogenous variables. The bias proportion of U is excellent for seven endogenous variables and fairly good for notes and coins and reserve money. Thus no systematic bias that would have warranted a revision of the model was present. The variance proportion of U shows the ability of the model to replicate the degree of variability in the variable of interest. A high value for this proportion would imply that the actual series has fluctuated considerably while the simulated series showed little fluctuations or vice-versa. Again results shown in Tables V.b and V.c are excellent. The last Theil statistic, namely the covariance proportion measures what may be called unsystematic error, i.e. it represents the remaining error after deviations from average values and average variabilities have been accounted for. Since it is unreasonable to expect predictions that are perfectly correlated with actual outcomes, this component of U is less worrisome. In practice, a covariance proportion of U close to unity is the target and in this context results are again excellent. On the basis of the Theil statistics it would appear that little improvement in model performance was possible.

The descriptive indicators shown in the second and third columns of the summary tables V.b and V.c provide another quick means of assessing model performance. A value of 0.2 for the ratio of RMSE to standard deviation confirms satisfactory model performance.

The ratio for all endogenous variables of the model are well below this figure.

Table V.b: Static Simulations - 1972(1) - 1985(2)

Variable	RMSE	Mean % Absolute Error	RMSE* Standard Deviation	THEIL STATISTICS			
				Inequality Coefficient	Error due to Bias	Error due to Different Variation	Error due to Different Covariance
Notes & Coins NC	16.42	2.38	0.06	0.00	0.00	0.00	0.99
Demand Deposits (CA)	35.93	5.20	0.14	0.00	0.00	0.00	0.99
Quasi-Money (QM)	84.22	4.09	0.07	0.00	0.00	0.00	0.99
Bank Reserves (BD)	16.19	6.82	0.10	0.00	0.00	0.00	0.99
Nominal Spending (NS)	139.15	5.81	0.13	0.00	0.00	0.00	0.99
Total deposits at banks (TD)	86.09	3.20	0.06	0.00	0.00	0.00	0.99
Banks' credit to Govt. and Private sector (CT)	79.09	3.06	0.06	0.00	0.00	0.00	0.99
Reserve Money (MØ)	23.65	2.40	0.06	0.00	0.00	0.00	0.99
Nominal Income (Y)	139.15	6.01	0.13	0.00	0.00	0.00	0.99

* RMSE/(Std.Deviation) is defined as $\sqrt{\Sigma(x_i-\hat{x})^2/\Sigma(x_i-\bar{x})^2}$ where x_i is the actual value of a variable, $\hat{x}_i$ is the simulated value and $\bar{x}$ is the mean of x.

Table V.c: Dynamic Simulations 1972(1) - 1985(2)

Variable	RMSE	Mean % Absolute Error	RMSE * Standard Deviation	THEIL STATISTICS			
				Inequality Coefficient	Error due to Bias	Error due to Different Variation	Error due to Different Covariance
NC	15.96	2.36	0.06	0.00	0.02	0.03	0.94
CA	36.99	5.32	0.14	0.00	0.00	0.00	0.99
QM	99.81	5.02	0.08	0.00	0.00	0.00	0.99
BD	23.00	8.37	0.14	0.00	0.00	0.01	0.99
NS	127.45	6.36	0.12	0.00	0.00	0.00	0.99
TD	101.97	3.73	0.07	0.00	0.00	0.00	0.99
CT	86.67	3.29	0.06	0.00	0.00	0.00	0.99
MØ	31.60	2.86	0.08	0.00	0.01	0.00	0.99
Y	127.44	6.58	0.12	0.00	0.00	0.00	0.99

* RMSE/(Std. Deviation) is defined as $\sqrt{\Sigma(x_i-\hat{x})^2/\Sigma(x_i-\bar{x})^2}$ where x_i is the actual value of a variable, $\hat{x}_i$ is the simulated value and $\bar{x}$ is the mean of x.

CHART V.a: Dynamic Simulation for Notes and Coins with Public

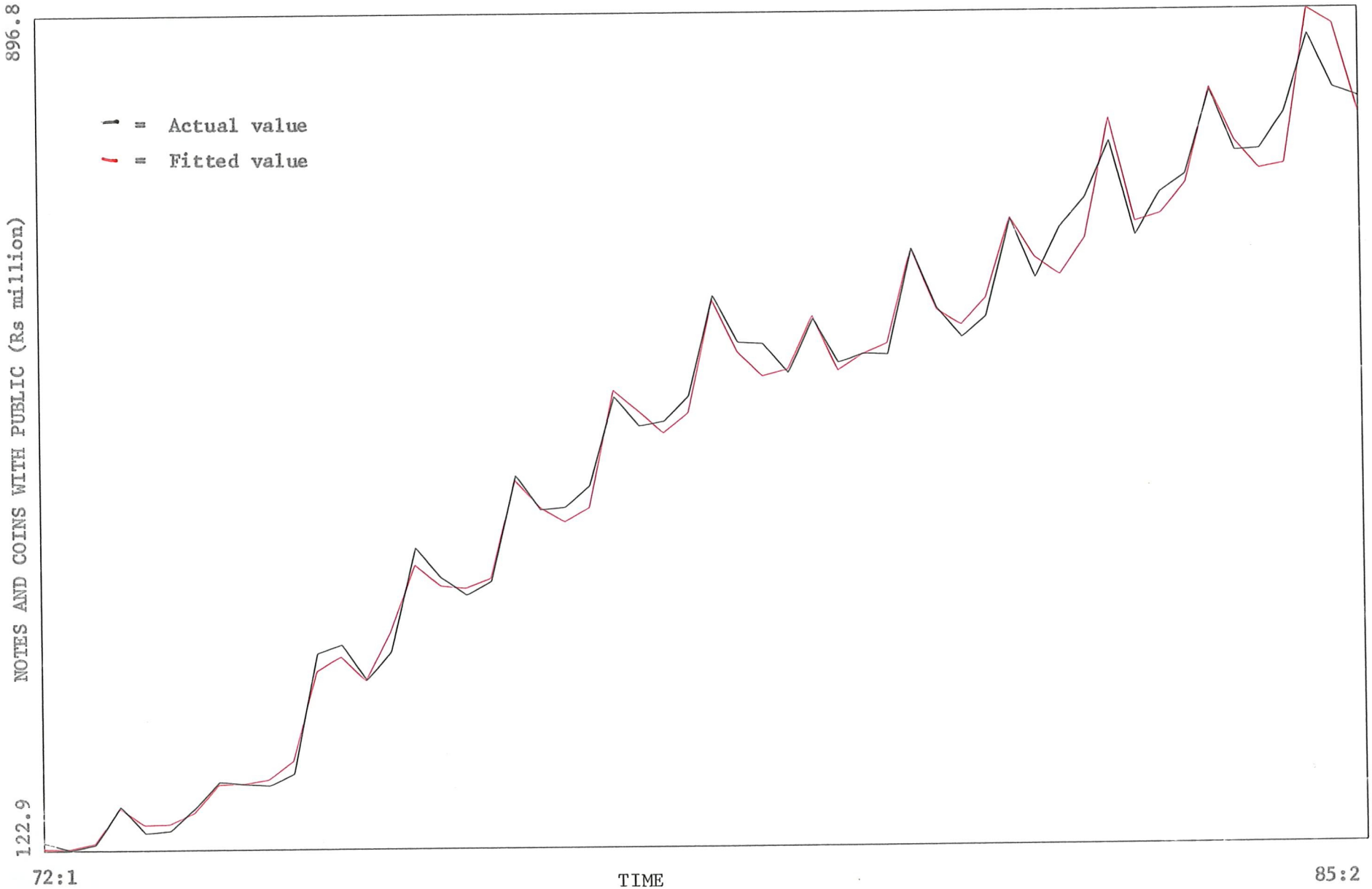


CHART V.b: Dynamic Simulation for Current Account Deposits

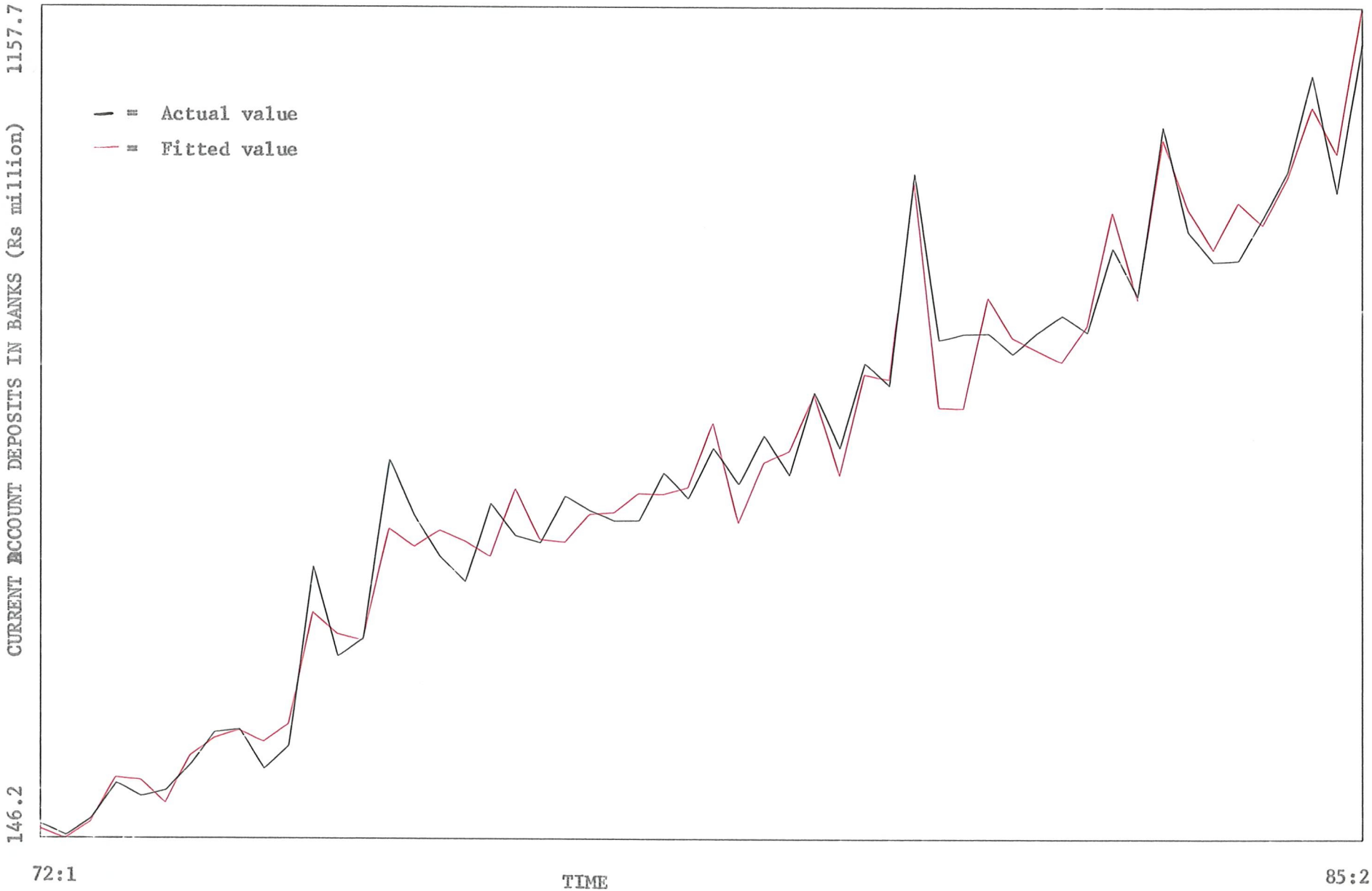


CHART V.c: Dynamic Simulation for Private Sector Savings and Time Deposits

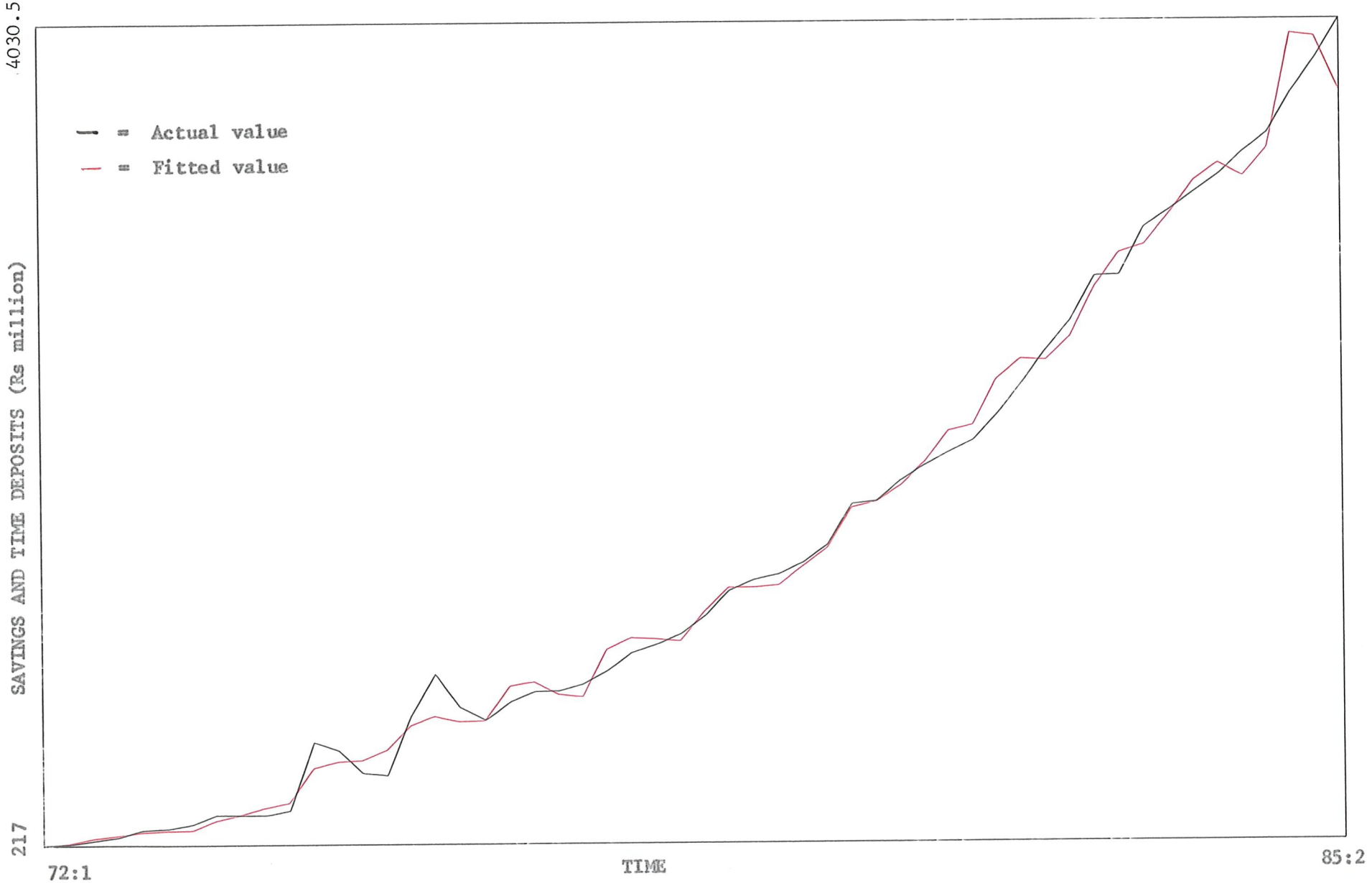


Chart V.d: Dynamic Simulation for Commercial Banks' Reserves

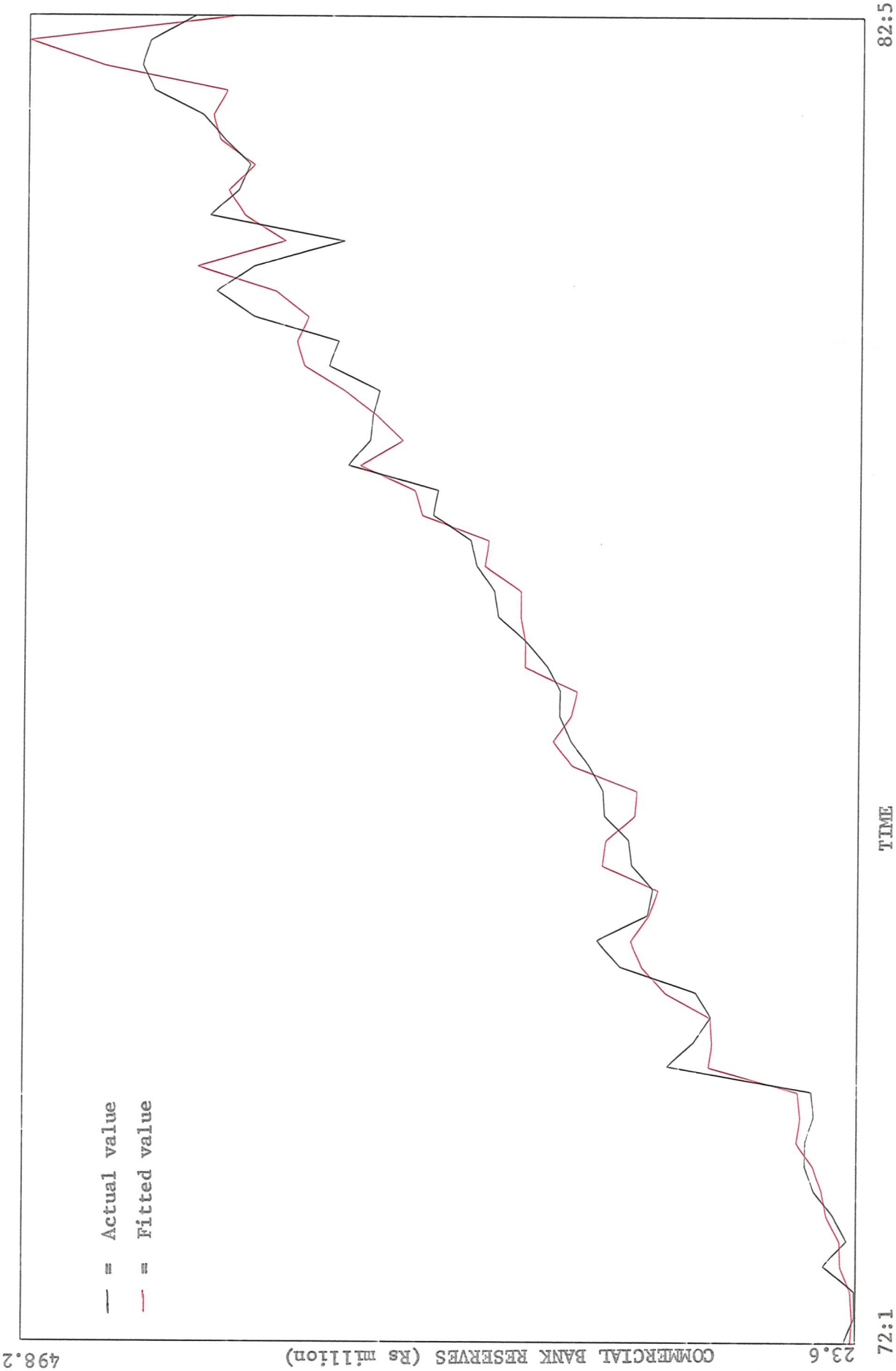


CHART V.e: Dynamic Simulation for Aggregate Nominal Spending

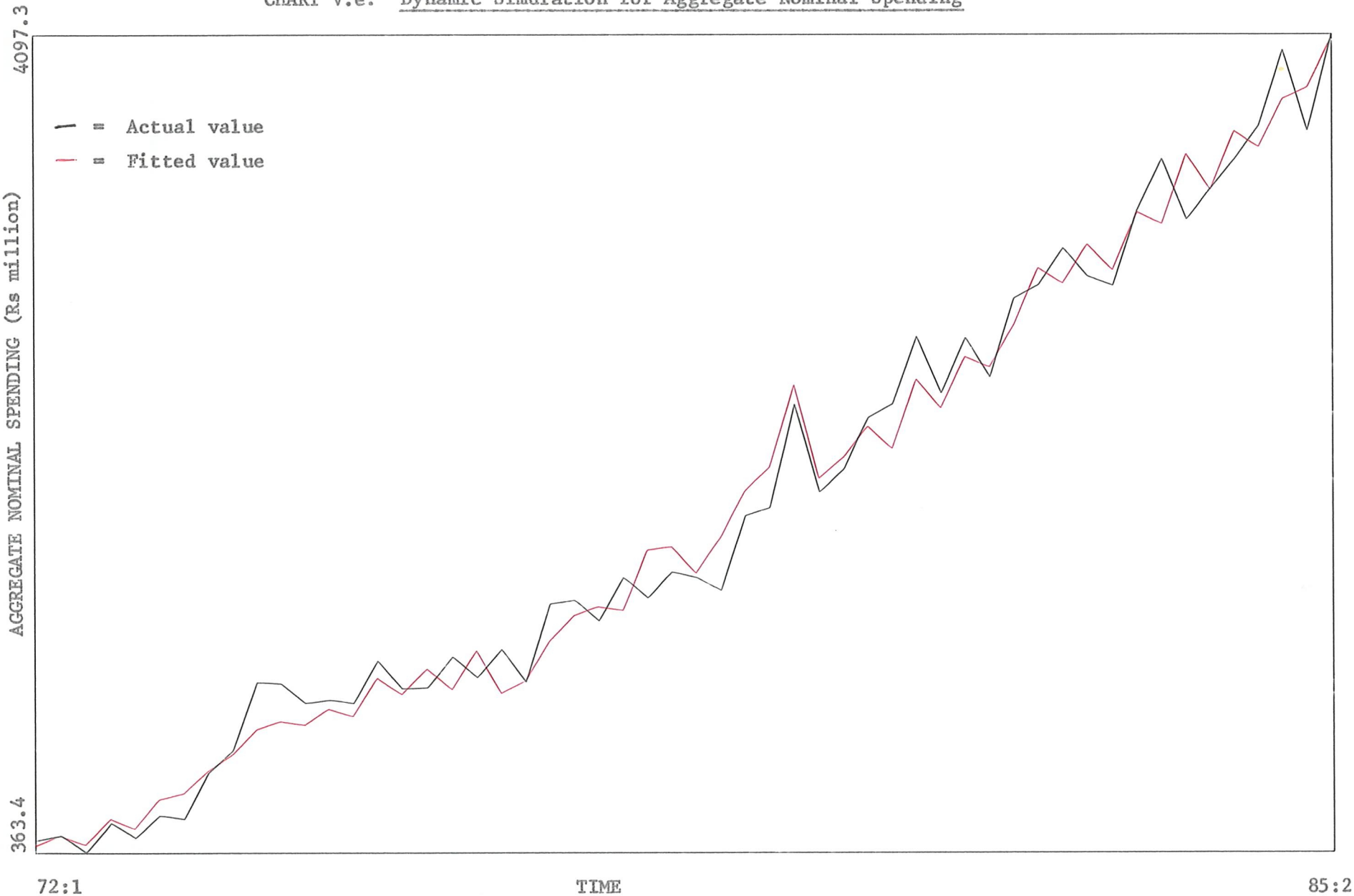


CHART V.f: Dynamic Simulation for Total Deposits Held at Commercial Banks

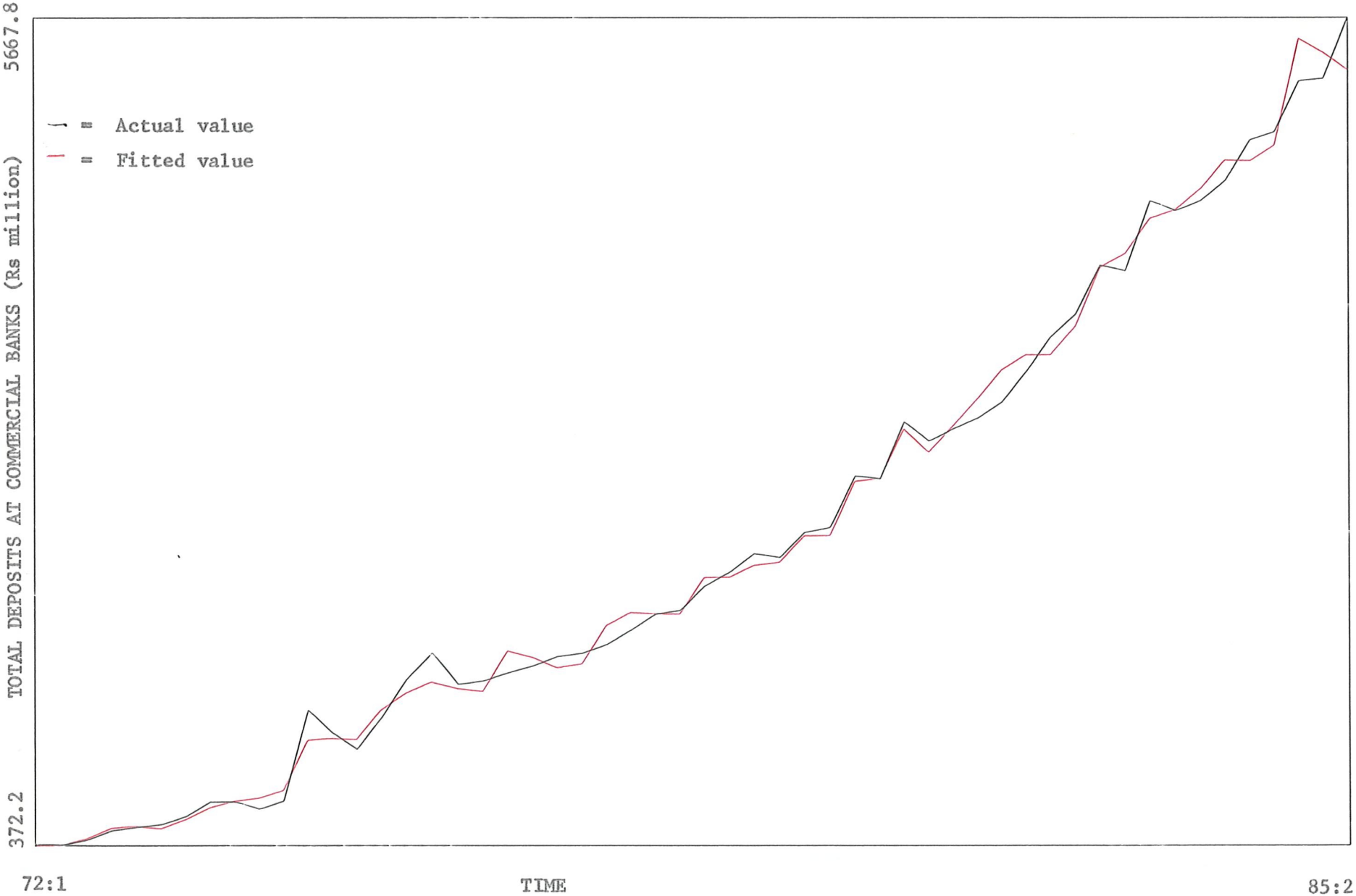


CHART V.g: Dynamic Simulation for Commercial Banks' Credit to Government and Private Sector

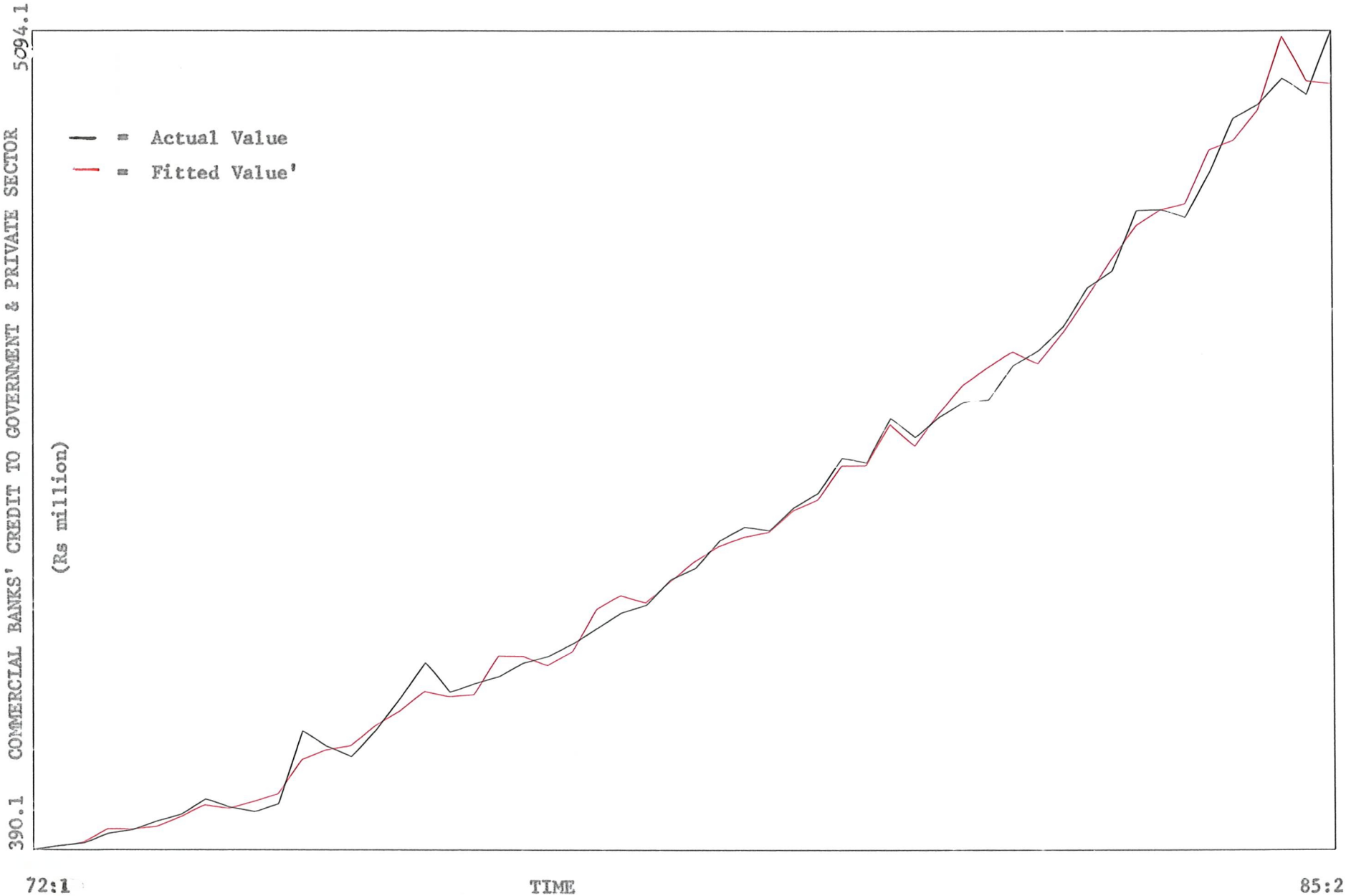


CHART V.h: Dynamic Simulation for Reserve Money

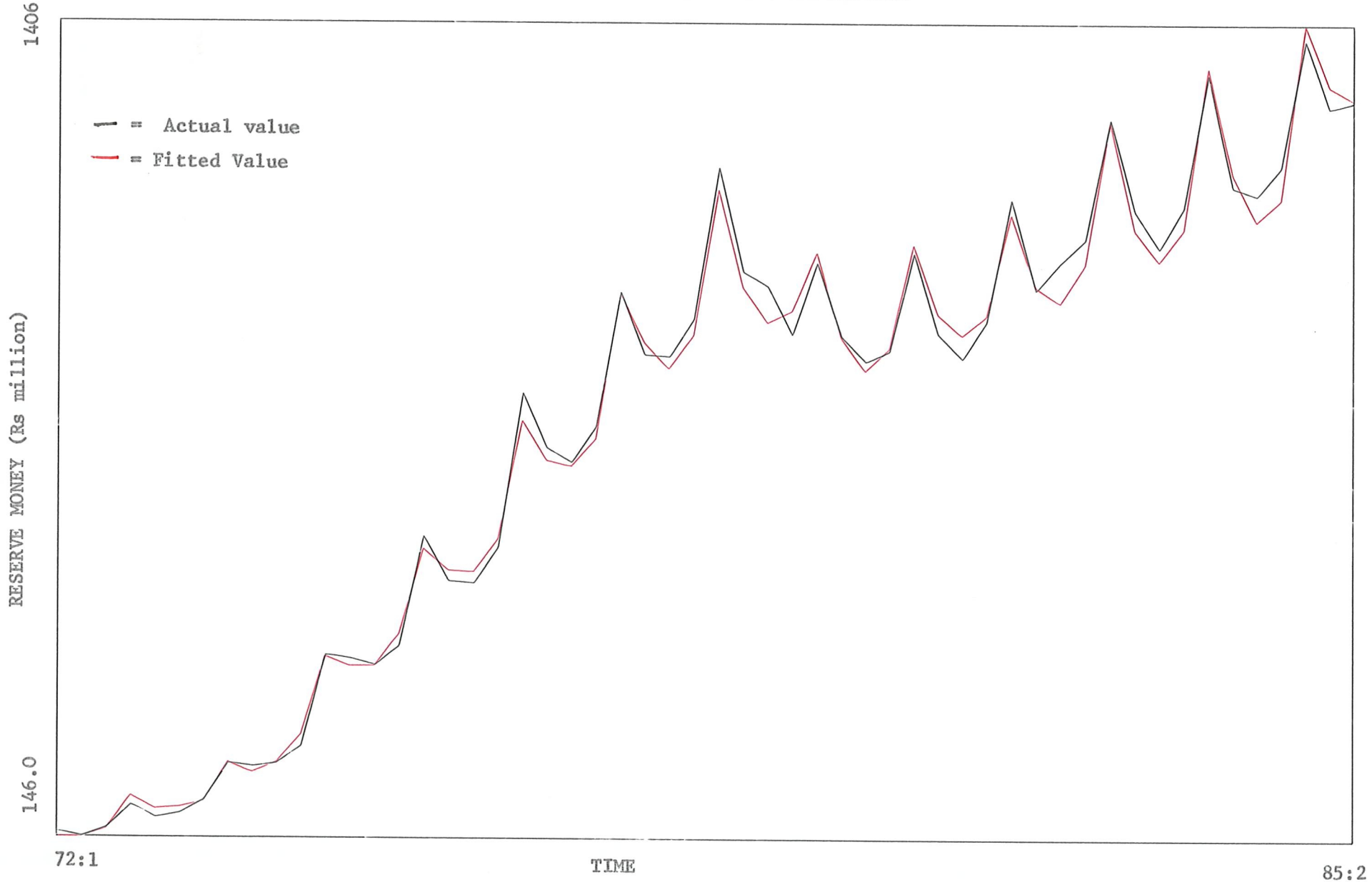
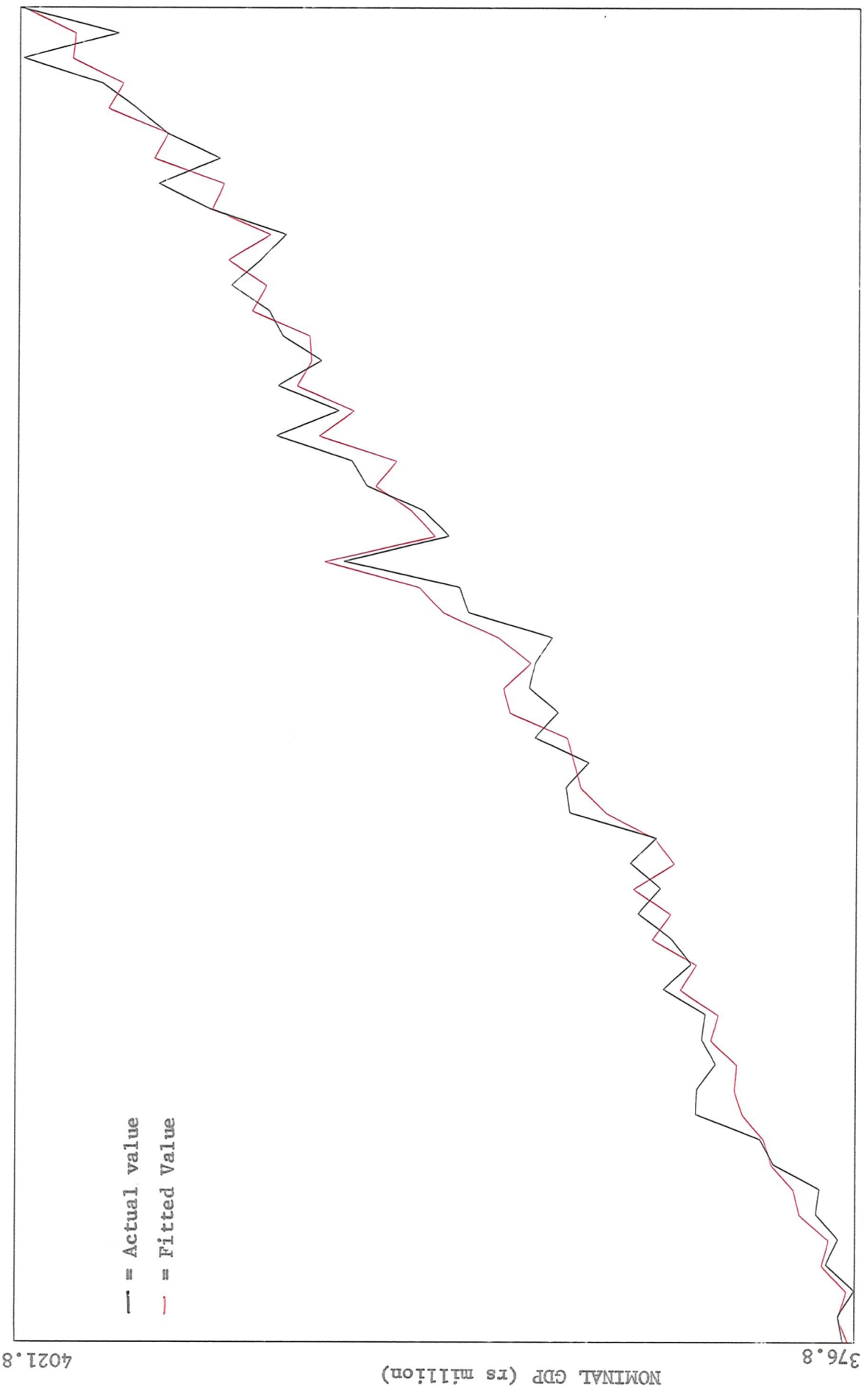


Chart V.i: DYNAMIC SIMULATION FOR NOMINAL GDP



CHAPTER SIX

CONCLUSION

The model developed in this dissertation performs well as shown by both static and dynamic simulations of its endogenous variables. Essentially, the effect of some major sources of credit on aggregate spending were quantified within a macro-economic framework. The role of credit given by commercial banks was emphasised and this has implied a detailed analysis of the behaviour of economic agents in respect of monetary assets and banks' behaviour itself in respect of reserves holdings. The following are major concluding remarks from the modelling exercise:

a) The two credit aggregates used in the model do have some significant influence on nominal spending in Mauritius. The long-run effect of credit to the Government and non-bank investment in Treasury Bills was stronger than that of total credit given by commercial banks. However, both credit aggregates have low long-run elasticities. This would indicate that other sources of credit not considered in the model because of lack of published data could also be significant in explaining aggregate expenditure. In particular, the spending effect of credit from large institutions like the Development Bank of Mauritius, the finance corporations associated with the two largest commercial banks, mortgage institutions, insurance companies, etc. will have to be investigated. Foreign grants to the Government and private sector external debt could also have some effect on nominal spending but this is not deemed significant at this stage. The implementation of tight monetary measures inclusive of quantitative controls on credit from the banking system have enhanced the role of non-bank financial intermediaries in recent years and this has important implications for macro-economic policy analysis.

b) Real GDP, deposit rates and inflation are all important in influencing portfolio behaviour in respect of monetary assets and ultimately credit. Substitution effects between M1 and quasi-money on one hand and between all components of money and real assets on the other hand, are strong in Mauritius. Though the three major components of money were examined separately, developments in the ownership of demand and time deposits, briefly referred to in the dissertation, would suggest a further disaggregated approach for money demand analysis in Mauritius. It is intended to adopt such an approach in further investiagtions at a later stage.

c) In view of its good performance, the model may be used for short-term forecasting. However, this is subject to the usual qualification that no abrupt change in the economic structure should occur during the forecasting period. Also in view of its small size the model may be updated easily and, hence, prove itself useful in situations where quick policy questions have to be answered. In any case, a knowledge of the macro-economic relationships highlighted in the model is crucial for a satisfactory integration of financial, fiscal and Balance of Payments planning.

d) The results obtained also show to what extent econometric efforts in certain developing countires are necessarily driven by institutions and data availability. This is a pragmatic reason for which the model has been kept small. The model may be among the first attempts for Mauritius and its operational value can be enhanced at a later stage by an improvement in the quality of some data used and a larger coverage for the sources of credit. Better still, it may be expanded into a disaggregated model to obtain more exact and subtle insights in the workings of the Mauritian economy.

STATISTICAL ANNEX

(i) Data sources

The data used in the dissertation were obtained from the following sources:

a) Bank of Mauritius

Annual Reports (various issues)

Quarterly Reviews (various issues)

b) Central Statistical Office - Mauritius

Annual and Bi-Annual Digest of Statistics (various issues)

c) International Monetary Fund

International Financial Statistics (various monthly issues)

International Financial Statistics Year Books (various issues)

(ii) Constructed series

a) GDP data

Only annual data are published for Mauritius. Quarterly series were constructed using quarterly imports as benchmarks i.e. the annual GDP was divided into four quarterly figures on the basis of the share of imports in a particular quarter to total imports for the year. Exports were also tried as benchmarks but the resulting GDP figures especially for the first and second quarters were not realistic. Other researchers have used the linear interpolation technique developed by Diz (1970) or similar statistical techniques. However, it was felt that such ad hoc approaches are inappropriate for Mauritius.

b) Nominal Spending

The above approach i.e. using imports as benchmarks was also applied to obtain quarterly nominal spending figures.

National accounts for Mauritius are now based on the UN Systems of National Accounts (SNA) and have been revised from 1976 onwards. Data prior to 1976 are obtainable from different sources but the International Financial Statistics Year Book 1983 seems to be more reliable and was therefore used.

c) External Public Debt

This aggregate variable contains a portion relating to longer-term debt of the Government, for which only figures at end June and December are published by the Central Statistical Office and the Bank of Mauritius. However, quarterly figures on foreign borrowings of the Government are available and were used as guidelines to derive longer-term external debt outstanding at the end of March and September. Also, as explained earlier, the short-term external debt of the Government and liabilities to the IMF were proxied by outstanding liabilities of the Bank of Mauritius, for which quarterly data are available.

(iii) Other Data Issues

a) Interest rates

The rate applicable on 3-month deposits was chosen as the most representative rate for the RNC, RCA and RQM equations. Its variations reflect those of other rates well. For latter quarters of the sample when a liberalised interest-rate policy was pursued, an average of the band rates for 3-month deposits was used.

b) Inflation Rate

Some empirical issues relating to the choice of the inflation rate were indicated earlier. The percentage change in the average CPI for two successive quarters was used as a measure of the inflation rate.

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