

An Empirical Study of the Demand for Money in Uganda

Master of Arts (Economics) Thesis

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Certification

The undersigned certifies that he has read and hereby recommends for acceptance by the University of Malawi the thesis entitled: “**An Empirical Study of the Demand for Money in Uganda**”, submitted in partial fulfilment of the requirements for the award of a degree of Master of Arts (Economics) by the University of Malawi.

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Nonetheless, am solely responsible for any errors and omissions in this study.

Dedication

I dedicate this work to my parents for the love and moral support without which this work would have not been a successful. My God Bless you.

Abstract

In this study, the demand for real money M1 and M2 is estimated for Uganda covering the period 1980-2004 on a quarterly basis. The modelling takes place within the framework of the ordinary least squares (OLS) single equation estimation method. The choice of this single equation estimation technique was because it is simple to use and it has been widely used with good results. To estimate the demand for money, two-equation error-correction models are constructed which contain the short-run dynamics and long-run economic equilibrium. It was found that, money demand was cointegrated with its determinants implying that M1 and M2 monetary aggregates are useful tools for long-run intermediate targeting of monetary policy. Also it was established that a stable money demand exists for both M1 and M2 monetary aggregates. In the long-run equilibrium of real M1, M2, the estimated income elasticity of money is close to unity while in the short-run equilibrium the income elasticity is less than unity.

The study established that, real GDP, real exchange rate, currency-money ratio, return on physical capital, 91-day treasury bill rate and inflation rate are important in explaining the demand for money in Uganda. All the hypotheses that were set out could not be rejected except in five cases. First, the inflation rate variable was found to be stationary and it was therefore concluded that it is not a long-run determinant of real money demand. Second, the real exchange rate was found to be only a long-run determinant of money demand. Third, interest rate was found to be positively related to real money demand. Fourth, the investment ratio assumed unexpected positive sign both in the long-run and short-run implying that, the money demand model followed the MacKinnon hypothesis of positive relationship between money balances and investment suggesting that interest rates have not been adequate enough to stimulate investment following liberalisation of the financial sector. Finally, the results of the study also suggest that financial liberalisation and changes in political regimes did not have a significant impact on demand for real money balances in Uganda.

The implications from our findings are first, the need for continuity of reform programs in the liberalisation of interest rates, it also calls for an appropriate monetary action such as keeping positive interest rates, strict money growth and exchange rate stability. Second, the monetary authority will need to couch their policy objectives and directions, that is, they will need to couch their policy objectives increasingly in terms of monetary aggregates.

Keywords: money demand, cointegration, error correction model, elasticity, monetary policy, Uganda.

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List of abbreviations

AERC	African Economic Research Consortium
ADF	Augmented Dickey-Fuller
BOU	Bank of Uganda
BSM	Buffer Stock Model
CPI	Consumer Price Index
ERP	Economic Recovery Program
ECM	Error Correction Model
IFS	International Finance Statistics
IMF	International Monetary Fund
GDP	Gross Domestic Product
GNP	Gross National Product
GDI	Gross Domestic Investment
GOU	Government Of Uganda
UBOS	Uganda Bureau of Statistics
SDR	Special Drawing Rights
MFEP	Ministry of Finance and Economic Planning
FSAP	Financial Sector Adjustment Program
NNP	Net National Product
U.shs	Uganda Shilling
LDCs	Low developed Countries
PAM	Partial Adjustment Models

CHAPTER ONE

Introduction

1.0 Background

The demand for money function creates a background for reviewing the effectiveness of monetary policy management as an important issue in terms of the overall macroeconomic stability. Goldfeld and Sichel (1990) state that the demand for money is a critical component in the formulation of monetary policy and that a stable demand for money function has long been perceived as a pre-requisite for the use of monetary aggregates in the conduct of policy.

The formulation of an optimum monetary policy to achieve the economic objectives of full employment, rapid economic growth, price stability and balance of payment equilibrium would be simple and straight forward if policy makers knew completely and precisely how monetary aggregates and money market conditions are related in the economy. But there are problems of trade-offs and conflicts that exist among policy objectives making macroeconomic management a difficult exercise. For example, in the short run an attempt to achieve rapid economic growth is likely to generate inflationary pressure and consequently have an adverse effect on the balance of payment situation of a country. In order to minimise these conflicts among policy objectives and achieve desired policy targets, the monetary authority can manipulate variables that are under its direct control to effect change indirectly in other policy variables to arrive at its ultimate goal.

Therefore, after deciding on the targets of gross domestic product (GDP) growth, employment and inflation, the monetary authority chooses a set of variables to 'aim at' called intermediate targets such as M1, M2, interest rate that have a direct impact on investment and output. The intermediate targets, however, are controlled indirectly through operating targets (treasury bill rate, free reserves and monetary base) in order to induce certain changes in ultimate target variables.

The conduct of monetary policy in Uganda has focused mainly on promoting price stability to support the broad macroeconomic objectives. For instance, the 2004/05 real GDP growth was projected at 6% and underlying inflation was expected to turn out at 4%. In order to attain this objective, Bank of Uganda (BOU) was to limit growth in broad money (M2) to about 13.4%; the overall fiscal deficit, excluding grants was to be maintained at around 10.6% of GDP while

external current account deficit was projected to widen to 12% of GDP reflecting strong growth in imports. Credit to the private sector was to increase by 5%. Through open market operations treasury bills were to be used for mopping up excess liquidity and reducing upward pressure on the exchange rate (BOU Annual Report, 2003/04). Therefore, Broad money (M2) remains the operational target of the Bank of Uganda.

1.1 The Structure of the Financial Sector

The financial sector in Uganda is still relatively small and underdeveloped with the money and capital markets being extremely thin and the banking sector is the main financial intermediary. As is the case with most developing economies, the Ugandan financial sector is made up of formal and informal sectors.

In the 1970s and the 1980s there was preferential allocation of foreign exchange and credit to sectors in terms of priority. The formal sector encompasses the central bank, 13 licensed commercial banks, 9 credit institutions, 14 insurance companies, 13 development institutions, 3 building societies and a postal savings bank (BOU Reports). However, the financial sector performance and safety are improving due to enhanced supervision of banks and consolidation in financial institutions.

The informal economy in Uganda is still large with about 43% of Gross National Investment (ICC, 2005). The M2/GDP ratio is just about 9%, compared with 40% for Kenya and 35% for Tanzania (Kararach, 2001). The portfolio of available financial assets is very limited, with nearly all the assets held consisting of liabilities of government, Bank of Uganda and commercial banks. The only diversification worth mentioning is the Treasury bill market, which has active weekly auctions, although the commercial banks still hold more than 80% of the outstanding bills. However, considerable effort has been put to expand the formal financial sector, through the expansion of rural banks and micro-finance institutions.

The informal sector consists of a wide range of saving circles, moneylenders who are traders, well-to-do farmers, shopkeepers and in some cases rural government employees. Although reliable recorded information on the informal financial sub-sector is lacking, the sector is very active in the rural as well as the urban areas of the country. It is an important source of credit for the numerous small traders who have neither their own savings nor the necessary collateral required to borrow from the banks.

1.1.1 Developments in Financial Sector in Uganda

Over the last few years the banking industry has been strengthened, through the tightening prudential regulations on the banking system, increased frequency of on-site inspections and surveillance and improvement of supervision methodology. The minimum unimpaired paid up capital requirement for commercial banks was increased to 2 billion Uganda shillings in January 2000 and 4 billion Uganda shilling by January 2003, while Credit institutions are required to have a minimum of 1 Billion shilling. The enhanced capital is intended to provide a cushion for losses and act as a safeguard to depositors' funds. Most banks have successfully fulfilled these requirements. The enforcement of prudential regulations has also been improved, notably with the closure of insolvent banks in 1998, 1999 and 2001, although there have been slippages recently (GOU, 2001/02).

There has also been an improvement in the financial depth of the economy. As measured by the ratio M2/GDP, financial depth increased from 12.7% in September 2000 to 13.4% in September 2001. In addition, the non-performing assets as a ratio of total outstanding loans have declined from 50% in June 1995 to 8% in September 2001. In an attempt to increase efficiency and reduce transaction risk in the financial sector, an electronic cheque clearing system was inaugurated at the end of fiscal year 2001/02. This new system will reduce the amount of time it takes to clear a cheque from four working days to two.

Also the authorities are yet to pass the Financial Institutions Bill and the Micro-Finance Deposit-Taking Institutions Bill, and to establish the legal framework and monitoring structures for anti-money laundering and anti-terrorism financing.

Considerable effort has been made in the empirical literature for both the developed and developing countries to determine the factors that affect the long-run demand for money and assess the stability of the relationship between these factors and various monetary aggregates [see Ericsson (1998) for a recent review of the main empirical and methodological issues]. In the case of Uganda, some studies such as Atingi-Ego and Matthew (1996), Kateregga (1993), Henstridge (1999) Katarikawe and Ssebudde (1999), Nachega (2001) and Kararach (2001), have attempted to identify the key macroeconomic variables that determine the demand for money, with almost only the study by Nachega (2001) and Kararach (2001) focusing on a broader monetary aggregate such as M2 and the stability of the estimated coefficients. Furthermore, these studies have ignored the impact of physical capital on money balances, and also the extent

to which change in political regimes and social crisis have affected the demand for money by economic agents in Uganda.

Also since independence 9-October-1962, Uganda has been characterised by political and social crisis up to date, replacement of one government by another and the changes in economic orientation and policy all these have had an impact on the behaviour of economic agents. Such past economic conditions make it hard for policy makers to infer much about the likely long-run behaviour of the demand for money.

Accordingly it is of particular interest to re-examine the nature and factors that influence the money demand function, given the recent exceptionally strong performance of the economy. Therefore, the study attempts to establish whether or not money balances complements physical capital formation. Second, if a change in political regime has any impact on the behaviour of economic agents as far as money holding is concerned and lastly, it will also test the stability of the money demand function in Uganda.

1.2 Statement of the Problem

For the past decade Uganda has adopted some of the structural adjustment programs and one of the targets of the program was the highly repressed financial sector. Financial liberalisation among other things calls for the formulation and implementation of a sound monetary policy.

However, there has been considerable debate regarding the viability of implementing financial liberalisation policies that are intended to abolish institutional nominal interest rates held below their equilibrium level, in order to raise savings, investment and growth. The theoretical background of such policy recommendation, which have in fact constituted policy practice in low developed countries, is found in the theories developed by McKinnon (1973) and Shaw (1973). The implementation of financial liberalisation has generated a lot of concern given the fact that it has been accompanied by rising interest rates, unstable exchange rates and bank failures.

Therefore, from this end it would be important to test the suitability and appropriateness of the McKinnon model for the analysis of money demand in Uganda where money and capital markets are still thin and fragmented, money and physical capital are complementary to each other, and where if the return on physical capital increases economic agents are likely to increase their money balances.

The question is: does the money demand follow the classical approach that there is a negative relationship between investment and money balances or the McKinnon complementarity of positive relationship between investment and money balances?

There are three reasons why now is a particularly good time to re-visit the money demand relationship in Uganda. First, is the failure of existing empirical work to capture the impact of physical capital on money balances since money and capital markets are still underdeveloped in Uganda. Second, is that the historical span of data is now sufficient to allow for a comprehensive analysis of the dynamic effects in the demand for money function while simultaneously allowing for the underlying equilibrium in the data. The analysis of both the long-run and short-run considerations ensures that further analysis of the demand for money remains necessary. Third, is that past economic and political conditions have made it hard for the policy makers to infer much about the likely long-run behaviour of the money demand after liberalisation.

Therefore, the motivation of this study is the desire to investigate the key determinants of demand for money in Uganda, its behaviour and stability; and whether if there is any instability in the function it casts doubt on the usefulness of the function to provide guidance to policy makers.

1.3 Objectives of the Study

The main objective of the study is to examine whether any behavioural changes in the money demand function did in fact take place due to the structural reforms in the Ugandan economy.

The specific objectives of the study are to;

- (i) investigate the determinants of money demand in Uganda.
- (ii) investigate the stability of the money demand function.
- (iii) investigate whether narrow definition of money (M1) or broad definition of money (M2) is more relevant to demand for money in Uganda.

1.4 Hypotheses of the study

The hypotheses of the study include the following:

- (i) Income, interest rate, inflation, exchange rate, return on capital, financial innovation and changes in political regimes have no explanatory power on the real demand for money holding.
- (ii) Demand for money is not a stable function.
- (iii) Narrow money (M1) and broad money (M2) are not relevant variables for demand for money in Uganda.

1.5 Significance of the study

Uganda is still under going through a series of economic reforms therefore making it necessary to estimate the elasticity of the demand for money for policy purposes. Most of these reforms like liberalisation of markets have called for the formulation and implementation of sound monetary policy. Thus, information on the behaviour and stability of the money demand function is of great importance to monetary authorities.

The study will contribute to knowledge that can be used in formulating better macroeconomic policies given a situation characterised by thin money and capital markets, because of the understanding of the nature of the response of money balances to the return on physical capital. This is important in designing appropriate monetary policies for macroeconomic management. It will act as a source of reference for public policy makers because, it will enhance on the empirical literature on the demand for money in Uganda and other developing countries, indicating where the gaps exist and identify areas for further research.

1.6 Organisation of the study

This study is organised in six chapters. Chapter two is a review of the economic and monetary developments in Uganda. Chapter three presents a review of selected theoretical and empirical works on demand for money. It also contains an overview of the literature. Chapter four, deals with the methodology, that is, model specification, estimation techniques as well as an analysis of empirical results. Chapter five is the presentation and interpretation of the empirical findings. Chapter six concludes the paper and draws the policy implications on the basis of the findings. It also contains the limitations of the study.

CHAPTER TWO

Economic and Monetary Developments in Uganda

2.1 The Ugandan Economy

Since independence in 1962, Uganda started to move away from a colonial-style economy with a currency board, fiscal restraint and significant primary exports towards actively promoting import-substitution industries through the assembly of a control regime, which featured monopoly export marketing board, a fixed official exchange rate and a fixed interest rate. The Uganda Shilling commenced circulation in 1966 and was managed by the newly created Bank of Uganda. Despite economic stability and growth, the 1960s saw a degradation of political stability. The then Prime Minister, Milton Obote, re-wrote the constitution in 1966 gathering for himself more of the trappings of office, including making himself Head of State.

But dependence on the army for power culminated into a military coup lead by Idi Amin in 1971, it was until 1979 that this notorious military rule was overthrown. During this regime there was gradual stagnation. However, receipts from the 1976/77 coffee boom helped to prop up the Amin regime, but with a rapid deterioration in income, the fiscal position and increased inflation followed.

After the overthrow of Idi Amin's military government elections were held and Obote won a disputed election and succeeded a barely cohesive set of interim government. Again reliant on the army, he was driven out by a military coup in 1985. In January 1986, Yoweri Museveni's National Resistance Army took Kampala. The National Resistance Movement (NRM) government has remained in power following a series of presidential and parliamentary elections under the new constitution in 1996 (Henstridge, 1999).

After the Obote II regime, Uganda was in an economic crisis evidenced in many sectors of the economy. The country's GDP declined by 30% and its Gross investment and the Industrial output also declined sharply as equipment, spare parts, and raw materials became scarce. Quarterly inflation doubled. High inflation was a consequence of fiscal deficit financed by seigniorage; exchange rate was fixed and most interest rates controlled. The decline in investment preceded the decline in GDP by several years, as foreign ethnic groups, particularly the East African Indians, ceased to maintain their assets in Uganda. Fearing nationalization in general and expropriation in particular, private entrepreneurs avoided making any investment in the country. It was only in 1982 that investments increased again, but only to two-thirds of its former value.

In 1981, the government signed a stand-by arrangement with the International Monetary Fund (IMF) aimed at restoring macroeconomic stability and eliminating the distortion in the key markets. This program included, among other things, exchange rate flexibility, quantitative targets for the overall budget deficit, net credit to the government and money growth. From 1981 to 1983, the country experienced a welcome of 17.3% growth rate but most of this success occurred in the agricultural sector with little progress being made in manufacturing and other productive sectors.

Despite a recovery of real GDP growth in 1981/82-1983/84, political uncertainty and the intensification of the civil war caused the stabilisation program to collapse in early 1984 which led to negative growth rates of 4.2% in 1984, 1.5 % in 1985, and 2.3% percent in 1986 (see, Atingi-Ego, 1998).

Throughout these years of political uncertainty, coffee production by smallholders farmers continued to dominate the economy, providing the best hope for national recovery and economic development. As international coffee prices fluctuated, however, Uganda's overall GDP suffered despite consistent production. The unstable political and economic situation was worsened further by two coups in two years (1985 and 1986). This worsened the balance of payments, foreign exchange constraints and generally budgetary discipline. Equally, the operation of the formal financial sector became inefficient and the informal sector grew considerably (Atingi-Ego, 1998).

This economic decline, again, seemed to end, and in 1987 GDP rose to 4.5% above the 1986 level although in September 1987, the government could not maintain its budgetary stance and decided to monetise its deficits. This marked Uganda's first sign of economic growth in four years, as security improved in the south and west and factories increased production after years of stagnation. This modest rate of growth increased in 1988, when GDP expansion measured 7.2%, with substantial improvements in the manufacturing sector. In 1989 falling world market prices for coffee reduced growth to 6.6%, and a further decline to 3.4% growth occurred in 1990, in part because of drought, low coffee prices, and a decline in manufacturing output (see GOU, 1989/1990).

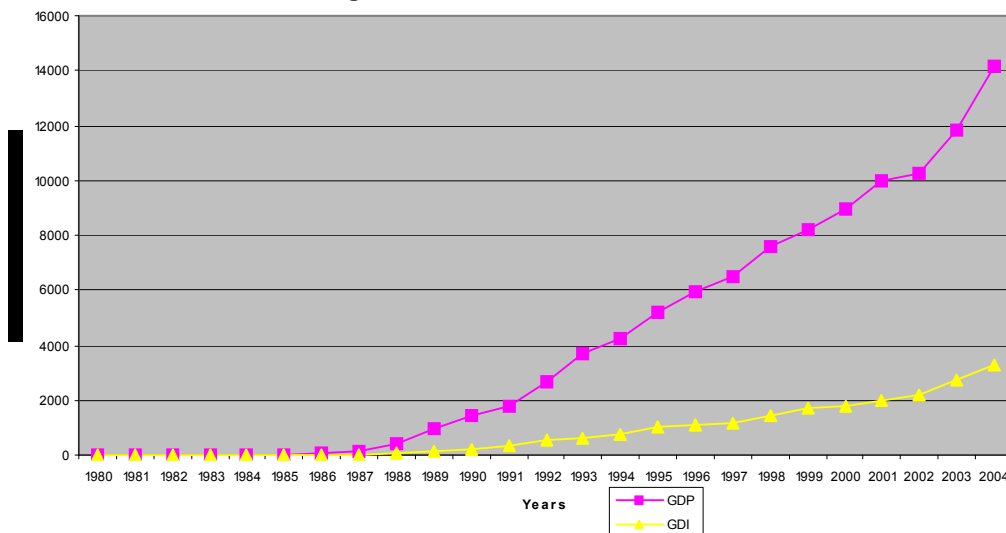
The economic environment was unstable in Uganda from 1986 to 1998. The velocity of money circulation was considerably unstable rising from 7.7% in 1981 to 128% in 1997. With the liberalization of the economy, financial disintermediation, rather than deepening, occurred.

Domestic credit fell overall in 1993 by 8% and in 1995, by 47.3%, even though claims on the private sector rose and on central government fell. This contrasts with the early 1980s when a large share of domestic credit went to central government.

The 1990s became the period of reform in Uganda designed as to remove market rigidities in the economy in general, and the financial sector in particular. In Kararach (2001), the Financial Sector Adjustment Program (FSAP) was introduced in 1992 whereby the sector became deregulated and the growth of financial institutions facilitated. In early 1990's inflation reduced drastically and brought under control, annual inflation averaged 45.3% and 8% during 1988-92 and 1993-1997 respectively.

However, since 1990 Uganda has been providing a competitive incentive regime for private investors. To spear head the development of the industrial sector, the Uganda Investment Authority (UIA) was established in January 1991 by an act of parliament. This agency was supposed to be business oriented whose mission was to make a significant contribution to economic development by stimulating private sector development, promote exports and creating sustainable employment (Investment code, 1991). Since then GDP and planned investment for Uganda has been improving, but with the largest portion from the agriculture sector.

Figure 1:Trends in GDP and GDI



According to the Uganda yearly economic review (2000), nearly 2000 enterprises (36% foreign and 26% joint venture) of various sizes committed over US\$ 2 Billion in actual investment into Uganda for projects including Agro-processing, manufacturing, energy, tourism, fisheries and many others.

2.2 Interest rate regimes in Uganda from 1980-2004

The lack of well-developed equity markets in Uganda makes firms highly dependent on bank credit and typically firms borrow to purchase investment goods and working capital.

In Uganda, the financial policy, which has been adopted for a long time, has been that of restricted interest rate. This restriction fixes limits on the deposit and lending rate across the board for all banks.

From 1970, the monetary authority determined the interest rates. The Bank of Uganda had the power to legislate and determine the interest rate chargeable by commercial banks. The rates of interest in Uganda have been low for a number of reasons: (Kahwa, 1995).

- The first reason relates to the role of Uganda's Agriculture sector where over 50% of the Uganda's GDP comes from. Over 50% of the population earns a living from agriculture. Low interest rate would enhance its activities while high interest rate would imply a failure of the Agriculture sector to obtain credit, and therefore thwarting its activities
- The second reason stems from the suspicion that free market charge exorbitant rates that are harmful to small borrowers.
- The third stem from the belief that without low interest rate, investment would not be adequate to accelerate growth. This can be related to the Keynesian postulation, which advocates for low interest rate
- High rates are inflationary through their effect on costs.
- It was an attempt to regulate the monopoly power of the Uganda banking system, which is highly concentrated.

Since 1986, the interest rate policy in Uganda changed to allow for the establishment of a positive real interest rate. Three interest rate policy regimes have been experienced in Uganda according to (Kihangire *et-al*,1995);

The period May 1987 to March 1989 was characterised by a passive regime during which interest rates were announced on budget day and they remained unchanged during the course of the financial year except for a few interventions. From April 1989 to April 1992 Uganda pursued an inflation led interest rate regime, where by interest rates on annual savings were kept at 4% points above the annual inflation rate for the previous three months.

Period November 1992 first liberalisations policy, the Treasury bill rate was proxied as the market rulings interest rate and bank interest rates were required to be within a specific interval

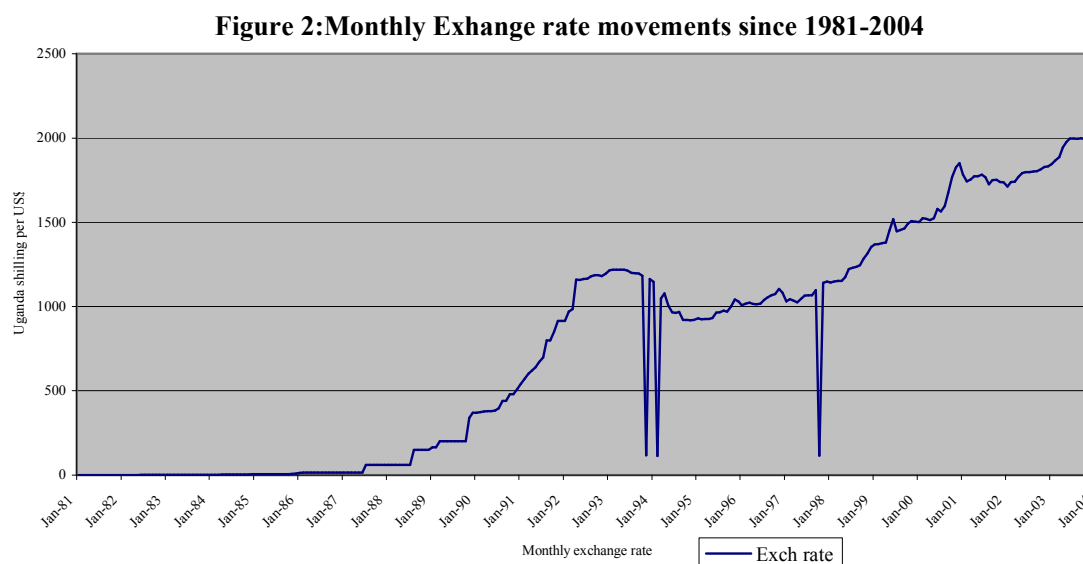
around the 91-day Treasury-bill rate, which was determined in the primary auction market. The interest rates were there after decontrolled by adopting a policy of freeing some and linking others to a reference rate (annualised discount rate on treasury bills).

The reference was used to set the maximum leading rate for agriculture and development bank and the minimum interest on overdraft account and interest on demand deposits were phased completely and have since the been determined by market forces. With full liberalisation in June 1994 the link with the Treasury bill was removed.

Reserve requirements beginning 1987, commercial banks were required to hold 10% of deposits as statutory reserve in un-remunerated accounts. This policy held till 1993 when these requirements were reduced to 8% of demand deposits and 7% of time deposit. This was to safeguard the interest of depositors but later it had been employed as an instrument of monetary policy.

2.3 Exchange rate regimes

In an attempt to assess the exchange rate regimes of Uganda, this study focuses on the period from 1980. This is mainly because of lack of information and data on earlier periods.



During the period before 1981, Uganda maintained a fixed exchange rate, where the shilling was pegged to the US\$ at a rate of U.shs 7.1428 per US\$. However, due to the volatility in the US\$

in the period 1971 to 1975, the peg was further changed to a special Drawing Right (SDR), the rate was fixed at U.shs 9.66 per SDRs¹ and it remained in force up to 1981.

This fixed exchange rate faced a lot of problems, for instance, the oil shock in the early 1970s, which dramatically changed the terms of trade. Most of the developing economies embarked on swift policy reforms while on the other hand, policy reforms in most economies particularly Uganda were weak. This weak response resulted in an overvalued exchange rate, chronic shortages of foreign exchange (in 1980, the level of foreign fund position was U.S \$ 16.8 million compared to U.S\$ 31.1 million in 1994), and the emergence of parallel foreign exchange (Kibanda) market.

In May 1981, a financial programme with the assistance of the IMF was launched and among its objective was to restore confidence in the shilling and at the beginning of June 1981, a managed float of the exchange rate was introduced. This led to the removal of the peg on the shilling.

In August 1982, dual exchange rate was introduced to improve the allocation of foreign exchange and to promote non-traditional exports. In this dual exchange rate system, two windows were created to replace the float. Window one (W1) was basically for financing priority imports like industrial raw materials, spare parts, machinery, seeds and fertilizers and a lower exchange rate applied. The exchange rate was determined daily by a money market committee. The rest of the transactions were conducted at the window two (W2) rate, which was determined by weekly auction and it reflected supply and demand conditions for foreign exchange.

At the establishment of the dual rate at W1 was U.shs 99.16, while that at W2 was U.shs 300 per US\$. By May 1984, the two rates were merged. The rate stood at U.shs 292.29 and U.shs 326.37 per US\$ in W1 and W2 respectively. As a result, the shilling depreciated fast both in the official and parallel exchange rate markets. Between June 1984 and June 1985 the exchange rose from U.shs307 to U.shs 600 per US\$(more than a 95% depreciation) in a year. This auction system was abandoned in February 1986 at a rate of U.shs 1,480 per US\$ (GOU, 1985/86).

In May 1987, government launched an economic rehabilitation and adjustment programme, aimed at stabilising the economy and achieving economic recovery. The major distinguishing feature in the programme was the currency reform under which all outstanding currency and

¹ Special Drawing Right (SDR) also referred to as “paper money” as defined by Salvatore (1990) are international reserves created in the books of IMF and distributed to member nations according to their importance in international trade.

bank deposit were converted into new Uganda shilling at a rate of 100 old shilling to one new shilling, plus a conversion tax of 30%. Thereafter, the shilling was devalued five times putting the rate at U.sh 370 per U.S\$ by November 1989. According to Abuka (1992), for the period 1980-1989 one third of Uganda's imports were financed by parallel market forex.

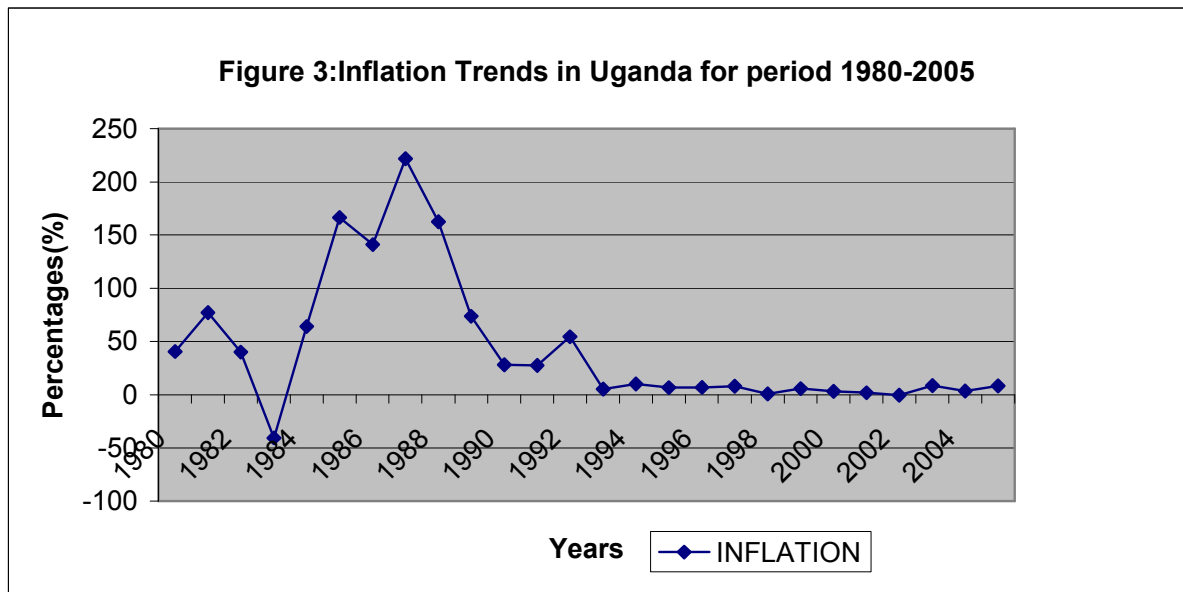
The most fundamental change to have taken place in Uganda's exchange rate policy was that of July 1990 when government liberalised the foreign exchange market that led to the establishment of foreign exchange bureaux. At the interception of the policy a total of U.S\$ 2.14 million was purchased by the forex bureau. The figure rose to US\$ 48.51 million in September and B.O.U premium reduced from 44.86% in July 1990 to 0.4% by December 1994 (GOU 1994/95).

During the period of coffee boom, that is, 1994/95, the shilling had been overvalued, the real effective exchange rate depreciated by 23% in 1993/94, then by 2% in 1995/96 and 5.5% the following year. This presented accumulative appreciation of 24% from June 1993 and in April 1999 the Bank of Uganda was forced to intervene with sales of about U.S\$ 26 million and by May B.O.U sold U.S\$10million. However, the real effective exchange rate depreciated by a similar magnitude between June 1997 and December 1998 (Background to the Budget 1999/2000).

The Bank of Uganda has continued to maintain its presence in the Inter-bank foreign exchange market (IFEM) under the sterilisation and intervention strategy to mop up excess liquidity generated by government expenditure and to instil order in the market. For instance it subsequently intervened to sale forex in the IFEM during the fourth quarter of 2003/04 and it amounted to U.S\$69.9 million compared to a net sale of foreign exchange of U.S\$7.7 million posted in the preceding quarter.

2.4 Inflation in Uganda 1980-2004

In practice, inflation is normally measured by the change in the consumer price index (CPI) that is, the average of the basket of goods and services consumed by a representative household. In Uganda, the CPI for six major towns of Kampala, Mbale, Jinja, Masaka, Gulu, and Mbarara is calculated every week.



It can be noticed that there was inflationary pressure in Uganda during the period 1979-1980. This was due to supply pressure, supply of transport services was constrained by poor road conditions and inadequate vehicles. Increase in prices of petroleum products during 1974-1979 oil shocks also affected the general price level in the economy (Rudaheranwa, 1995).

Break down in production during the period of political instability 1972-1986 constrained supply of most consumer goods. This war was supplemented by foreign exchange shortages that would be used to supplement domestic supply.

In the period prior to the financial reform program in 1987, Uganda was characterised by high inflation rate of about 280% in 1988, (Musinguzi *et.al*, 1994). This high rate resulted into negative real interest rates, this inhibited the financial intermediation process and thus undermined the efficient performance of financial institutions in Uganda. This constrained the available funds in the banking sector

Empirical findings of Elbadow (1990) and Rudaherenwa (1995) show that the other main causes of liquidity injection in Uganda's economy prior to the Economic Recovery Program (ERP) in 1986 is the financing of the government deficit. This was mainly by borrowing from the central bank. After the ERP the policy was to reduce monetary growth and the main cause of inflation was the depreciation in nominal exchange rate, increase in world prices of tradable and changes in demand and supply conditions for non-tradable.

Early 1992, there was prolonged drought across the whole country until March 1992. This reduced crop production causing food prices to increase. Also, the event of bad weather

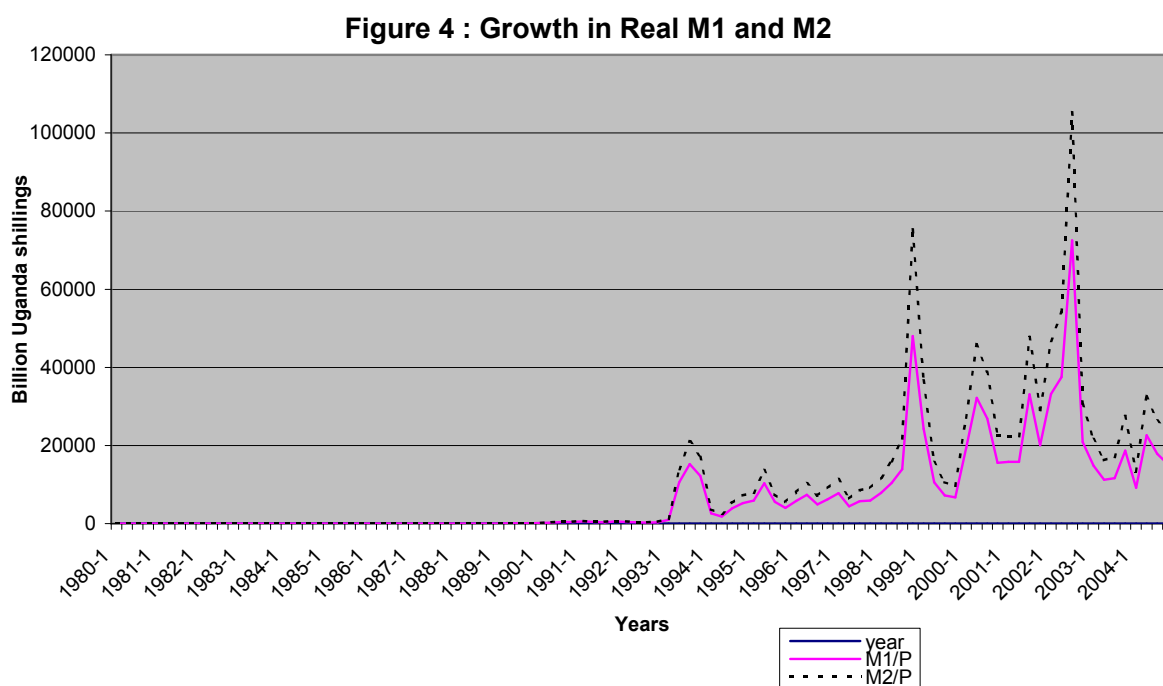
conditions containing the El Niño since 1992. Food production and transport were severely contained and inflation began to be mainly driven by food items. At the beginning of the year, the annual headline inflation rate declined steadily from 10.4% in June to 6% in October. However, at the beginning of November, increases in food crop prices pushed the inflation rate back to double digit averaging to 10% through to 28% February in 1998 (GOU, 1998/99).

On the other hand, demand conditions also explain the inflation rate in Uganda. Since ERP money supply continued to grow due to excessive capital in flow, revaluation losses, budget deficits and crop finance. These inflows were from IMF and World Bank and multilateral donors. During the period 1994-1995, Uganda experienced a coffee boom that its export earnings increased, which is said to have stabilised the monetary factor. Mbire (1992) identified domestic credit, which is determined by fiscal deficit and crop finance, as the major determinant of money supply.

The developments in inflation in Uganda as of now have been influenced firstly by, the long droughts; secondly by the inherent increase in international prices of crude oil coupled with hiked excise duty on petrol and diesel and thirdly by the increase in electricity tariffs for both domestic and industrial consumers (BOU Annual report, 2005).

Since a large component of Uganda's consumer price index is made up of non-tradable. It is equally true that changes in supply conditions of food items is the major cause of inflation at the moment. The current monetary policies objectives are to maintain price stability, market determined exchange rate, liberalisation of financial markets. This has been ascertained by frequent Bank of Uganda interventions.

2.5 Money Growth in Uganda since 1980-2004



It is evident that M2 is growing at higher rate than M1, and this is consistent with empirical literature, especially that time deposits expand faster than currency in circulation and demand deposits. Also from the above graph, it is evident that from 1993 we have some slight growth in both broad and narrow money and this could be attributed to financial liberalization of the economy and previous political instability that the economy was overcoming. The continued growth of broad and narrow money continue to be manifested sharply in 1998 and 2002.

CHAPTER THREE

Literature Review

The objective of this chapter is to review the theoretical and empirical studies on demand for money with a view to come up with an appropriate theoretical framework for the analysis of demand for money in Uganda.

3.1 The Theories of Money Demand

Money is a modern medium of exchange and a standard of unit in which prices and debts are expressed. It serves four major functions: medium of exchange, store of value, unit of account and a source of differed payments. The theoretical work by Sriram (1999) and Mishkin (1998) states that the demand for money is demand for real balances and is a function of scale variables² and a set of opportunity cost variables³. Individuals hold money for its purchasing power, so they do not take into consideration their nominal holdings. Therefore, with respect to the individual's behaviour, real money demand remains unchanged, when price level changes and all real variables, such as real income, the interest rate and the real wealth remain constant.

Individuals are free from "money illusion" if a change in the price level does not influence values of all real variables, leaving individual's real behaviour and real money demand unchanged. On the contrary, an individual whose real behaviour is affected by the changes in price level, when real variables values remain constant, will suffer from money illusion.

Irving Fisher considered money illusion to be an important factor in business cycle fluctuations, so he defined money illusion as a "failure to perceive that the dollar or any other unit of currency expands or shrinks in value." The modern developed theories of money demand have their formulation on the classical approach.

3.1.1 The classical approach on money demand function

According to the classical theory, all markets for goods continuously clear and relative prices are flexible that insures the equilibrium conditions. The economy is assumed to be in full employment level except for the transitory deviation as a result of real disturbances. In such an economy, the role of money is simple: it serves as a commodity whose unit is used in order to

² A measure of economic activity.

³ Indicates the foregone earnings by holding assets, which are alternative to money.

express prices and value, but whose own value remains unaffected by this role. It also serves as a medium of exchange. However, it does not influence the determinants of relative price, real interest rate, the equilibrium quantities of commodities, and thus aggregate real income. Money is neutral with no effect on real economic variables.

The concept of money holdings was developed in the quantity theory especially through the work of Pigou (1917). Earlier, Fisher (1911) gave the famous formulation of the quantity theory through the so-called *equation of exchange*. The quantity theory gives an explanation of a relationship between the quantity of money and price level. This relationship was developed in the classical equilibrium framework by two alternative but equivalent expressions.

The first one, called “Equation of exchange,” is associated with Irving Fisher and the second “Cambridge approach or cash balance approach” which is associated with the Cambridge University economists, especially A.C Pigou. Both paradigms are primarily concerned with money as a means of exchange and hence, they yield models of the transaction demand for money.

3.1.2 Irving Fisher’s Version of Quantity Theory Approach

The quantity theory of money is found in the work of the American economist Irving Fisher (1911). His theory is based upon the famous equation of exchange:

$$M_s V_t = P_t T \dots\dots\dots(1)$$

Hence, for the aggregate economy, the value of sales must equal the value of receipt. The value of sale must equal to the value of transaction (T) conducted over any time period multiplied by the average price (P_t) at which they take place. The value of purchase must equal to the amount of money in circulation (M_s) in the economy times the average number of times it changes hands over the same time period/velocity of circulation (V_t)

M_s the quantity of money is determined independently of any of the three other variables and at any given time can be taken as given the value of transactions, can also be taken as determined independently of the other variables in the identity. They believed output would correspond to the full employment level.

These considerations permit the identity to be transformed into a version of quantity theory of money. $\Delta V = \Delta T = 0$, $\Delta M_s = \Delta P = 0$. Implying that P would vary proportionately with any change in M_s .

$$M_d = M_s \quad M_d = \frac{1}{V} PT$$

$$M_d = kPT \dots\dots\dots(2)$$

That is, the demand for nominal money depends on the current value of the transaction to be conducted in the economy and equal to a constant fraction of those transactions.

3.1.3 Cash Balance Approach

As an alternative paradigm to the quantity theory approach to the demand for money, a group of classical economists in Cambridge, which included Pigou (1917) and Marshall (1923) were studying the same topic and developed the Cambridge approach.

In this cash balance approach the amount of money an individual holds depends on the convenience derived from holding it, the feeling of security that holding it gives, the expectations of the individual, the variety of opportunity cost involved in holding it and individual's total resources.

Therefore the problem of an individual is to balance out the different services available. However, while this approach sets out many of the influences acting on a person's demand for money, it does not go very far in analysing how these motives were interrelated or in discussing their relative importance. The principle determinant of people's taste for money holding is the fact that it is a convenient asset to have. The more transactions an individual has to undertake, the more he or she will want to hold money. However, an individual agent cannot hold all the money he or she wants, given that stock of cash cannot exceed total wealth.

There are alternative ways of holding assets, and many of them offer advantage relative to money, for instance stocks and bonds yield an interest income that money does not. In addition to depending on the volume of transactions individuals may be planning to conduct and the nature of the markets in which they operate, the demand for money also varies with the level of wealth and opportunity cost of holding money.

Assuming for an individual the level of wealth, the volume of transactions, and the level of income move in a stable proportion to one another, then the demand for money in nominal terms is proportional to the nominal level of income for each individual and hence for the aggregate economy as well. Therefore; $M_d = kPY$ since $M_d = M_s$,

$$M_s = kPY = M_s V = kPY \text{ Where } V=1/k.....(3)$$

V in this case represents not the transaction velocity of circulation but rather income velocity.

The Cambridge economists view on the money demand function influenced both the Keynesian and the Monetarists theories and it is very important that the approach emphasised individual choice, but it did not point out the influence of interest rate on the demand for money.

3.2 Keynesian Liquidity Preference Theory

John Maynard Keynes's development of the cash balance approach to the problem of the demand for money now forms the basis of treatment of the subject in macroeconomics. Keynes (1930,1936) provided a more rigorous analysis of money demand, focusing on the motives of holding money: transaction, precautionary and speculative purposes. He introduced interest rates as another explanatory variable in influencing the demand for real balances. The money demand function was then represented as;

$$M^d/p = f(y, r) \dots\dots\dots(4)$$

Where the demand for real balances (M^d/p) is a function of real income (y) and nominal interest rate(r). The main proposition of his analysis is that when interest rates are very low, economic agents will expect a future increase in interest rate and a reduction on bond value thus preferring to hold money. Therefore, the aggregate demand for money becomes perfectly elastic with respect to the interest rate (liquidity trap), when interest rates are very low.

3.2.1 Post-Keynes Developments

A number of developments moved in several directions to explain the three motives for holding money. These models can be classified into three separate frameworks; transaction models, asset or portfolio and consumer demand theories.

The medium of exchange function leads to transaction models, the store of value function gives rise to the asset or portfolio models where money is held as part of individual's portfolio and the consumer demand theory approach considers the demand for money as a direct extension of the traditional theory of demand for any durable good.

3.2.2 Demand for Transaction Money

Baumol (1952) and Tobin (1956) independently developed similar demand for money models, which demonstrated that money balances held for transaction purposes are sensitive to the cost and benefit of holding money for transaction purpose. The benefit is the convenience; the cost of this convenience is the forgone interest they would receive had they left the money in an interest bearing account.

Interpreting the model more broadly, an individual can hold a portfolio of monetary assets (currency and checking account) and non-monetary assets (stocks and bonds). r can be treated as

the difference in return between monetary and non-monetary assets and b as the cost of transferring non-monetary asset into monetary assets, such as a brokerage fee.

The individual minimises the sum of brokerage cost and interest income forgone. This leads to a well-known “*square-root rule*” for transaction demand for money.

$$M_d/P = \sqrt{bY/2r} \dots\dots\dots(5)$$

Which states that the demand for real money balance M_d/P is directly proportion to the transactions cost b and real income Y , and inversely proportional to the interest rate, r .

If $b=0$, $M_d/P=0$ implying that without brokerage fees, money would not be held except at the instant at which it passes through the hands of the person selling bonds and buying goods. And if Baumol-Tobin model best described the real world then elasticity of money demand in response to income and interest rate must be 0.5 and -0.5 respectively.

3.2.3 Demand for Precautionary Money

The precautionary motive is a straightforward restatement of the Cambridge security motive. In this motive the demand for money arises because individuals are uncertain about their future payments. So the more money an individual holds, the less likely he or she is to incur the cost of liquidity. But the more money an individual holds, the more interest he or she is giving up. Therefore, the person optimises the amount of precautionary money to hold by carefully balancing the interest cost against the advantage of not being caught illiquid. As interest rate rises, the opportunity cost of holding precautionary money and the holdings of this money fall. The result of this model is similar to that of Baumol-Tobin analysis.

3.2.4 Demand for Speculative Money

This is demand for money in respect to the future level of rate of interest and this is an alternative explanation for Keynesian liquidity preference model. Tobin (1958) developed a model of the speculative demand for money. The idea was that individuals would always want to diversify their portfolio by holding both bonds and money, reducing the total amount of risk. That is why individuals may hold money as a store of value even if money has zero expected rate of return. However, Tobin’s attempt to understand whether individuals hold speculative money balances or not was only partly successful because there are assets that have no risk but earn a higher return than money. There it is still doubtful as to whether the speculative money balances exist.

3.2.5 Friedman' Restatement of Quantity Theory of Money

Friedman (1956) developed the demand for money within the context of the traditional microeconomic theories of consumer behaviour. Consumers hold money because it yields a utility that is the convenience of holding the means of payments rather than making frequent trips to the brokers and the risk losses on bonds. The demand for money should be the demand for real consumer goods and services, as opposed to their money value.

This demand for real balances should depend on the level of income, it should also depend on the expected return on other ways of holding assets such as bonds, equities, money or consumer durables much as the demand for one kind of good should depend on the price of other kinds.

Durable goods also serve as alternatives to money. As the price level rises, the value or purchasing power of stock of durable goods remains roughly constant as durable goods prices rise along with the general price index. On other hand, the purchasing power of money falls with increase in price so that an increase in the expected rate of inflation should cause a shift out of money and bonds and into consumer durables. The level of demand for real balances depends also on expected rate of inflation. Applying the portfolios choice theory he expressed the formula of demand for money as;

$$\frac{M_d}{P} = f(Y_p, r_b - r_m, r_e - r_m, P_e - r_m, w, h, u); \dots\dots\dots(6)$$

Where; Y_p is Friedman's measure of wealth, permanent income.

r_m is expected return on money,

r_b is the expected return on bonds,

r_e is the expected return on equity,

P_e is the expected changes in price level,

W is total wealth (human and non-human)

h is human wealth,

u is other factors.

Friedman's wealth variable includes both human and non-human since an individual may borrow on the strength of his expected future earned income and hold such extra asset as money. The inclusion of variable h is to allow for the fact that, given non-marketability of human wealth, the greater is the proportion of total wealth held in human form, the greater is the demand for money. He also suggested that changes in interest rate have little effect on the expected return on other assets relative to money and stressed that the money demand does not undergo substantial shift and so it is a stable function.

However, in most developing economies interest rates have little or no effect on the demand for money given the underdevelopment of the financial sector and permanent income is the primary determinant of money demand.

3.3 Empirical Literature Review

A study by Meltzer (1963)⁴ is one of the earliest comprehensive studies of money demand. A logarithmic function to annual United States (U.S) data for period 1900-58 was fitted, using three definitions of money stock M1, M2, and M3 in all the three cases he found a significant negative elasticity with respect to the long-term rate of interest rate. The absolute size of the interest rate elasticity varied with the definition of money used, all estimates were in the range of 0.5 to 0.95 and evidence suggests that the size of the elasticities remained relatively constant decade by decade⁵.

The interest rate elasticity of the United Kingdom (U.K) demand for money was first confirmed by Kavanagh and Walter (1966) using annual data for 1877-1961. During the decade after this, non-zero interest elasticity for either the short term or long term rate were confirmed for a wide variety of economies. The size of estimated interest rate elasticities depended on whether a short run or long run interest rate variable was included and to a lesser extent on the definition of money used, for example U.S, when a narrow definition of money was used, the elasticity with respect to the long-run rate was found to be about -0.7 but for a short-term rate only -0.2, the figures were slightly less for a broader definition of money (see Thomas, 1985).

Also estimates of scale variable elasticities were lower for narrow as opposed to broad definitions of money, long runs of annual data both for the U.S (Meltzer, 1963 and Laidler, 1971) and the U.K (Kavanagh and Walter, 1966 and Laidler, 1971) tended to produce elasticities generally in excess of unity. They argue that such findings appeared to hold no matter what scale variable was used, because of their tendency to decline over time, becoming less than unity in the post-war period. For example Laidler (1971) estimated the permanent income elasticity of demand for U.S broad money as 1.39 for the period 1900-16, 1.28 for 1910-40 but only 0.65 for 1946-64.

⁴ The partial adjustment modelling (PAM), semi-log linear specification was extensively used for estimating money demand up to the early 1970s.

⁵ See R.Thomas (1985)

However, empirical evidence on the stability of the demand function in United Kingdom came initially from studies of the long run function by Dow (1958), Paisn (1958,1959) and Kavanagh and Walters (1966) as Artis and Lewis (1984) notes. This was later supported by the short run function estimated by Laidler and Parkin (1970). By contrast, subsequent evidence of instability has come from Hacche (1974), Artis and Lewis (1974)⁶. The principal purpose of the Artis and Lewis (1984) study was to draw attention to the fact that the long run demand for money seems to display evidence of remarkable stability.

Mehra and Laumas (1977), while testing for the stability of the money demand function for the United States from 1900-1974 using chow stability test, confirmed the stability of the function. They derived the estimates of the demand equation under the general assumption that the parameters would be subject to permanent shift over time and all the estimated coefficients ranged from 0.5 to 0.95 with the correct and statistically significant signs. The statistical evidence showed that only those demand functions that allowed an adjustment mechanism yielded stable estimates of the parameters.

Studies of Australia's money demand generally defined money in real terms and tend to focus on M2 while predominantly applying the Engle-Granger and Johanson procedures, de Brouwer and Subbaraman (1993) and their results were ambiguous with regard to M1 and M2. Orden and Fisher (1993) and de Haan and Zelhorst (1991) found that M3 and GDP are not cointegrated after deregulation. In contrast, Lim and Martin (1991) concluded that M3 and GDP are cointegrated after deregulation. Using alternative definitions of money, income and interest rate and applying different testing procedure, de Brouwer, Ng and Subbaraman (1993) found no evidence of cointegration between M1 and income with only weak evidence of cointegration between base money and broad money. While Hayo (2000), using cointegration approach found stable money demand functions for M1, M2, and M3 with a speed of adjustment of 0.28, 0.02 and 0.01 respectively.

For New Zealand, Orden and Fisher (1993) found no cointegration relationship for the full sample (quarterly data between 1965-1984). Similarly, applying Canadian data from 1968-1999, Tkac (2000) found that money output, prices and interest rate were cointegrated.

It is evident from these studies in industrialised economies that results vary. Much of the variation is dependent on the cointegration test selected and a combination of money and interest

⁶ Artis and Lewis (1974) using Chow test found evidence of a definite shift in demand for money function for both M3 and M1 at the time of introduction of new competition and credit control systems.

rate as in Haug and Lucas (1966). Nevertheless, the existence of cointegration between money and income would not, in itself, necessarily establish a paramount role for monetary aggregate in policy making (see de Brouwer, Ng and Subbaraman 1993).

3.3.1 Studies on Demand for Money in Africa

Domowitz's and Elbadawi's (1987) study on money demand in Africa is one of the major and probably the most robust. They estimated the demand for narrow money for Sudan for the period 1956-1982 using annual data. The explanatory variables are GDP, rate of inflation and the official exchange rate of the Sudan Pound against the US Dollar. The rate of interest was left out due to the fact that it had been government administered. Applying the technique of cointegration and error correction modelling (ECM), for data on a small open economy, they found a stable demand function for money and their results appeared to refute the claim by ElGhoul (1977) that income effect on cash balance should be abnormally high in developing economies, particularly in the Sudan case due to the degree of instability, uncertainty and financial markets imperfections characterising the economy.

The income elasticity was 0.43, similar to 0.52 obtained by Gordon (1984) for the U.S over the period 1953-1972 using the partial adjustment technique. The impact elasticity with respect to inflation was -0.45 not high given an average annual rate of roughly 10% for the entire sample. In comparison Cardoso (1983) obtained an impact elasticity of between -0.72 and -1.2 for Brazil over a similar period, but in a more highly inflationary environment but organised financial markets. For example⁷ the impact effect of the exchange rate was much more smaller at -0.1 and the speed of adjustment was -0.82 lower than that estimated for developed economies such as the U.S but slightly higher than that estimated for a country in an intermediate stage of development such as Brazil. This brief comparison with the U.S, Brazil and Sudan is interesting insofar as they provide a contrast between money demand relationships in countries at different stages of development. But their conclusion was that in developing economies, where money markets are relatively less organised, with little systematic dealing in government securities and stocks and the information on financial yield of money market scarce, financial assets are not easily substituted for money.

⁷ Gordon (1984) reported a coefficient on lagged real balances of 0.9 for the U.S. Cardoso (1981) estimated range from 0.65 to 0.80 in comparable specification for Brazil.

Ajayi (1977) in his study of the demand for money function for Nigeria found that for all M1 and M2, the interest rate elasticities were low, statistically insignificant and had wrong signs. He attributed this observation to the imperfection in the financial markets. The income elasticities were significant and accounted for 85% and 89% of variations in M1 and M2 respectively. He concluded that interest rate elasticity for money demand was non-existent and therefore the substitution effect did not seem to exist where imperfect capital markets were still prevalent. Large changes in the interest rate are needed to induce asset holders to change the composition of their portfolio, but large interest rate changes are not feasible because of the constraint imposed by both external sector and government financing requirements.

Another important study on money demand in Africa is that of Adam (1992). Adam uses quarterly data to estimate the demand for M0, M1, and M3 in Kenyan economy. The explanatory variable in his study include GDP adjusted for changes in the terms of trade⁸, the consumer price index (CPI), the government regulatory treasury bill rate and the expected rate of domestic currency depreciation which is approximated by the rate of domestic parallel market⁹. Real money balances was regressed on income, the domestic rate of interest, the rate of return on holdings of foreign exchange (the currency substitution effect) and rate of inflation. Except for the inflation term, which showed slight instability, all the other coefficients revealed a strong degree of stability. He found out that there is a long run stable relationship between the demand for the different aggregates of money on the one hand and the explanatory variables on the other, his work shows also importance of correct specification of money demand function for designing a sound macroeconomic policy.

Simons (1992) estimated the demand for narrow money (M1) for five African countries, Congo, Cote d'Ivoire, Mauritius, Morocco and Tunisia. The findings show that in three of these countries the rate of interest played an important role. On the other hand the rate of inflation and exchange rates are significant in explaining the demand for money in countries where information on the rate of interest is lacking and the rate of inflation is higher. Simon argues that it is irrelevant to exclude the rate of interest from the money demand in developing countries during the present era of financial liberalisation.

⁸ The quarterly figure is obtained by interpolation.

⁹ Adam (1992) pp236 "...in a number of economies the parallel market is large & foreign currency holdings constitute a significant proportion of private sector wealth for example Uganda & Zambia, while in others notably Kenya, the parallel market in foreign exchange is illegal and more limited in scale".

Nacho's (1985), study was concerned about the factors that affect the money demand in developing countries. He used panel data for 1967-1981 including five countries; Uganda, Kenya, Tanzania, Rwanda and Burundi. Real money balances (M2) was regressed on real income, the government deficit ratio to income, was a proxy for money supply changes, the credit restraint variable was used as proxy for interest rate, it was found out that the demand for money in those countries was unstable.

3.3.2 Some Existing Work on Demand for Money in Uganda

Kararach's (2001), empirical analysis of the demand for money in Uganda using the ECM showed that treasury bill rate was included as a cointegrating variable primarily because for large part of the 1980s and up to 1992, it was institutionally fixed. He applied the Chow stability test at 1% and there was no evidence of stability in the demand for money function in Uganda. All variables were significant and had the expected signs while estimating real money demand using GDP, inflation and real interest rate and exchange rate as the explanatory variables.

The interest rate coefficient was low, about 0.3 percent and income elasticity of demand for money in Uganda was estimated to about 1.3 percent and of which it was expected to be at least equal to unity in order for velocity of circulation to be constant. In Friedman and Schwartz (1963), Fry (1978), Arestis (1993) the income elasticity of demand for money being greater than unity in low income developed countries (LDCs) was broadly acknowledged this is because of limited opportunities to economise on cash balances and the paucity of other financial assets in which to hold savings.

The conclusion from his study was that monetary policy environment was very unstable in Uganda and that there are other factors that influence the monetary policy environment and these may equally undermine Bank of Uganda's ability to pursue an effective monetary policy.

Atingi-Ego and Matthew (1996) estimated the demand for both narrow and broad money using annual data over 1970-1993. Studies by Atingi-Ego and Mathews and Henstridge omit both the Treasury bill and the foreign interest rate while that of Katarikawe and Ssebudde (1999) included the Treasury bill rate but also did not put into consideration the foreign interest rate; this could have been due to the belief that most economic agents in Uganda do not consider foreign securities as a relevant investment alternative.

Atingi-Ego and Mathews concluded that M2 was unstable and hence only M1 can be used for monetary targeting in Uganda. In contrast Katarikawe and Ssebudde (1999) find a stable demand

for M2 using monthly data over 1990-1996. Henstridge (1999) estimated separately the demand for currency, demand deposits and time and savings deposits rather than aggregated into M1 and M2 using quarterly data over 1968:Q2-1998Q2 and finds stable function in particular over the sub-sample 1982:Q2-1998Q2.

Kateregga (1993) estimated the demand function for Uganda over the period 1980 – 1992 using quarterly data with the help of the ECM. She estimated the demand function for Uganda while regressing the desired real money holdings on real GDP, real interest rate and expected rate of currency depreciation and expected inflation rate and found that the stability test showed that the demand for M0 and M2 had been stable and that for M1 were unstable over the period.

A cointegration analysis by Nachega (2002) to investigate the empirical relationship among money, prices, income and a vector of interest rate in Uganda from 1982-1998 found out that despite the substantial financial market liberalisation in early 1990's quarterly time series confirm that a stable relationship prevailed among real broad money, income, domestic and foreign interest rate from chow stability test. From his findings all parameters had the expected signs, the demand for broad money in Uganda was positively related to income and own interest rate; and negative to the foreign interest rate. The income elasticity was close to unity (1.23) and significantly different from zero and a test imposing unitary income elasticity was not rejected. This is consistent with the quantity theory hypothesis. It was further established in this paper that broad money balances had an adjustment speed of 30% to restore equilibrium in the money market. These results were in line with two other studies on money demand in Sub-Saharan African economies where Johannes multivariate cointegration framework was applied.

Nachega (2001), estimated a broad money demand function for Cameroon using annual data for period 1963/64-1993/94 and found among other results, a unitary income elasticity, a strong own-rate-of return, a positive deposit rate of 0.5 and a negative foreign interest rate of 0.1. His similar study of 2000 estimating a broad money demand function for Rwanda using quarterly data over 1982-1998 also established income elasticity homogeneity, a positive and significant (0.2) deposit rate elasticity.

3.4 Overview of the Literature

The empirical literature reviewed above concerning money demand suggests that there exists a relationship between money, income and some representative measure of opportunity cost of holding cash. The ideas of authors were based on the test of nature and stability of demand for money function but the results are mixed. Most studies like Hacche (1974), Artis and Lewis (1974), Orden and Fisher (1993), deHaan and Zelhorst (1991), Kararach (2001), Naho(1985) show that the demand function for money was unstable while a few studies like Hayo (2000), Adam(1992), Domowitz and Elbadawi (1987), Kateregga (1993), Katarikawe and Ssebudde (1999) also using ECM pointed to stability of the money demand function, yet some are uncertain about stability. In all the cases income is reported to have a significant influence on the demand for money while results on opportunity cost variable are mixed with regard to influence on the demand for money. Therefore, the choice of explanatory variables should be left to empirical test rather than netting out of some variables, for example, the interest rate.

Most empirical work on money demand function in Uganda has identified income, interest rate, rate of inflation and exchange rate as being important determinants of demand for real money balances. But given the fact that Uganda is a less developed economy with limited and fragmented money and capital markets characterised by small and self-financing economic units, the demand for real money balances is also likely to be influenced by the return on physical capital. Further more, the fact that the country has been politically unstable means that the individual's holding of real money balances will be affected.

This study will, therefore test the applicability of the MacKinnon-Shaw hypothesis given the liberalisation process that Uganda has been under-going. It is similar to previous studies in that it also tests the stability and determinants of money demand and apart from that it is using Error Correction Model (ECM) and time series data on quarterly basis for empirical analysis of the demand for money function in Uganda over the sample period.

CHAPTER FOUR

Methodology

This study investigates the determinants and stability of money demand function in Uganda for the period 1980-2004 on quarterly basis. Therefore, rather than seeking empirical justification to the theoretical model presented in equation (6) the study uses the equation as a guide to the empirical investigation of money demand in Uganda and a number of studies have been done on the demand for money following this specification of the general model.

4.1 Choice and Measurement of Variables

4.1.1 Monetary Aggregates

Money stock is mainly classified into two groups; narrow (M1) and broad money (M2). As the names suggest, narrow money consists of assets readily available for transactions¹⁰ while broad money encompasses a wider range of assets.¹¹ Laidler (1993) states that the correct definition of money is an empirical matter and the measure of money has to be selected based on the objective of the researchers. This research used M1 and M2, which are the widely used definitions of money in Uganda.

4.1.2 Income Variable

This scale variable is used as a gauge of transactions relating to economic activity. The most commonly used variables are Gross National Product (GNP), Gross Domestic Product (GDP) and Net National Product (NNP). According to Goldfeld and Sichel (1990) the segregation of transactions into various components under the idea that not all transactions are equally “money intensive”, has no firm evidence that such categorisation of GNP into various components will yield an improvement in the behaviour of money demand. However, theory suggests that the elasticity on the scale variable should be between 0.5 and 1. Therefore, we use GDP as a proxy for income since data is readily available and it is reported annually so interpolation exercise was done to create suitable quarterly data. The quarterly series were generated using export index. Each quarter GDP is equal to that quarter’s export index divided by the sum of the four export indices for that year multiplied by annual GDP.

¹⁰ M1 is Base money (M0), coins and notes that is in circulation of public +cash in tills in banks +demand deposits.

¹¹ M2 is M1+savings deposit +time deposits.

4.1.3 Interest rate Variable

The choice of a relevant interest rate as a measure of opportunity cost of holding money is very important in the modelling of money demand function. The choice was restricted because there are very few interest bearing assets held by economic agents in Uganda. Thus we used the 91-days Treasury bill rate as a proxy for the rate of return on all financial assets, since for a large part of the 1980s up to 1992, it was institutionally fixed. This rate also served principally as a measure of the own rate of return on money since in an economy like Uganda there is limited substitution between money and financial assets.

4.1.4 Expected Inflation rate

It is supposed that inflation by itself also affects money demand, because high inflation means the money loses its value rapidly and individuals tend to get rid of such money. This can be true where money is not spent on basic goods. But if the propensity to save is close to zero, inflation may lead to an increase in demand for money.

Theoretically, Friedman (1956,1969) pioneered the inclusion of the expected rate of inflation, and the relationship between demand for money and the expected inflation is well documented by Arestis (1988). Arestis postulated that the real value of money falls with inflation whilst the value of real assets is maintained. Therefore, there is strong incentive for persons to switch out of money into real assets when there are strong inflationary expectations. In this study expected inflation rate was computed from composite price index (CPI)¹² for Uganda.

4.1.5 Real Exchange rate Variable

The exchange rate used was the real effective exchange rate (Uganda shilling per U.S\$). This index represents the ratio of an index of period average exchange rate of the Uganda shilling to a weighted of exchange rates for the U.S dollar see Appendix A. This series is taken from BOU quarterly reports. It is included in this study in order to capture the external opportunity cost of holding domestic currency. Since the exchange rate is expressed in terms of units of domestic currency per unit of foreign currency, a rise in the rate of exchange means depreciation of the domestic currency and consequently, a shift to foreign currency holding (money demand falls) may cause a rise in money demand.

¹² See appendix A

4.1.6 The Return on Capital Variable

In McKinnon (1973), the return on capital affects positively the demand for real money balances because it is positively correlated with the investment-to-income ratio, a distinct determinant of the demand for money in LDCs. Investment is positively related to real interest rate within the range of low (negative) real interest rate observed in many LDCs, although this relationship becomes negative when the real rate of interest is positive. McKinnon (1973) and Fry's (1988) theoretical underpinning is that the economy of a typical LDC is composed of households, firms and capital markets that are fragmented. The demand for money by the households and firms increases as they shift from consumption to investment, because the latter is lumpy and requires longer periods of accumulation of a given income.

Therefore, a rise in the average rate of return on physical capital will be complemented by more money and since this increase leads to an increase in the investment/income ratio $\left(\frac{I_{t-1}}{Y_t}\right)$ this ratio is used as a measure of the return to physical capital. Many measures¹³ have been suggested but McKinnon (1973) used a ratio of GDI/GDP as a measure of the return to physical capital and this study adopted the same measure by using the ratio of private capital formation to income (GDP).

4.1.7 Financial Innovation

Financial innovation was captured by currency-money ratio (C/M), which is negatively correlated with the money balances. The improved banking services following reforms are expected to make the non-bank public to shift their portfolio from currency to bank deposits and financial holdings (see Bordo and Jonug, 1990). This implies that there will be a decrease in money balances as the expansion of banking and financial services induce the non-bank public to make greater use of banking services.

A dummy variable takes on the values of zero for the period before 1993 (pre-liberalisation and one for the period after 1993 (post liberalisation). This dummy variable was included as a proxy to capture financial developments.

The study used currency-money ratio (C/M) as a measure of financial innovation.

¹³ The ratio of manufacturing output to total output has also been suggested see Galbis.v (1979) pp.429

4.1.8 Political Regime Variable

Uganda has also been characterised by both political and social crisis from independence in 1962 to date. Replacement of one government by another and the change in economic orientation and policy have an important impact on the behaviour of economic agents. In 1980 Milton Obote over-threw Idi Amin, and in 1985 military government of Tito Okello over threw the regime of Obote II. Museveni over threw the military regime of Tito Okello on 26th Jan 1986 and power passed into the hands of the current government.

We choose the Museveni political regime because this is when economic liberalisation by the Economic Recovery Program (ERP) has been intense and it has been termed as a period of economic, social and political reforms. The political change was captured by the dummy variable D_{86} to denote this regime. A dummy variable, which takes on the value of zero for the period before 1986 (Pre-Museveni) and period after 1986 (Post-Museveni) takes on the value of one.

4.2 Model Specification

The conventional money demand function takes the form of $M = f(y, i)$ as stated by Keynes (1936) Where; M is real money balances, y is income and i is interest rate.

Our specification of the demand for money is as follows;

$$RM = f(RGDP_t, REER_t, CM_t, IR_t, R_t, \pi_t D_{86}, D_{93}, \mu) \dots\dots\dots(7)$$

Where; RM is the real money balances

RGDP is the real GDP

REER is Real exchange rate

CM is Currency-money ratio as a measure of financial innovation

IR is Return on physical capital=(Investment/income ratio)

R is interest rate on 91-day Treasury bill

π is Expected inflation rate

D_{93} is the dummy (0=pre-liberalisation and 1=post-liberalisation)

D_{86} is dummy variable for changes in political regimes (0=Pre-NRM government and 1=Post-NRM government)

μ is Error term and t is time.

In log linear form the Equation (7) can be expressed as;

$$\ln RM_t = \beta_0 + \beta_1 \ln RGDP_t + \beta_2 \ln REER_t + \beta_3 \ln CM_t + \beta_4 \ln IR_t + \beta_5 R_t + \beta_6 \pi_t + \beta_7 D_{86} + \beta_8 D_{93} + \mu_t \quad (8)$$

Such that the expected sign are; $\beta_1 > 0$ ¹⁴, $\beta_2 < 0$ or > 0 , $\beta_3, \beta_4, \beta_5, \beta_6 < 0$, $\beta_7, \beta_8 \neq 0$

4.2.1 Estimation Techniques

The objective behind any econometric model is to obtain estimates for the parameters of the independent variables included in the model in order to predict the behaviour of real cash balances. The ordinary least square method was utilised as an appropriate economic tool and the Eviews 3.1 statistical package was used.

4.3 Partial Adjustment Modelling, Buffer Stock Models and Error Correction Model

Modern empirical studies of money demand initially were based on annual data and based on the following log-linear specification:

$$\ln\left(\frac{M_t}{P_t}\right) = \beta_0 + \beta_1 \ln Y_t + \beta_2 \ln R_t, \quad (9)$$

Where M_t/P_t –demand for money;

Y_t –level of real income;

R_t – opportunity cost of holding money;

Another popular model was the partial adjustment model (PAM), which proposes the existence of a “desired” level of money balances M_t^*/P_t and further assumed that the actual level of money balances adjusts in each period only part of the way towards its desired level:

$$\ln\left(\frac{M_t}{P_t}\right) - \ln\left(\frac{M_{t-1}}{P_{t-1}}\right) = \lambda \left[\ln\left(\frac{M_t^*}{P_t}\right) - \ln\left(\frac{M_{t-1}}{P_{t-1}}\right) \right], \quad (10)$$

expanding and re-arranging equation (10) we have the money demand as a weighted average;

$$\ln\left(\frac{M_t}{P_t}\right) = \lambda \ln\left(\frac{M_t^*}{P_t}\right) + (1 - \lambda) \ln\left(\frac{M_{t-1}}{P_{t-1}}\right), \quad (11)$$

Expressing (M_t^*/P_t) as a function of Y_t and R_t and substituting into the PAM gives (M_t/P_t) as a function of Y_t , R_t and (M_{t-1}/P_{t-1}) , (see Mishkin, 1998).

Where λ -governs the speed of adjustment; $\lambda\beta_0, \lambda\beta_1, \lambda\beta_2$ are short-run coefficients; $\beta_0, \beta_1, \beta_2$ are long-run coefficients.

¹⁴ $\beta_1 > 0$ (more specially $\beta_1 = 1$ for the quantity theory or $\beta_1 = 0.5$ for the Baumol-Tobin model of economies of scale)

Up to the 1970s, the money demand function was considered to be one of the most stable and reliable in economics. The earlier empirical work on money demand primarily involved producing estimates of velocity, characterising its behaviour over time and identifying the institutional factors responsible for longer-run movements in velocity. But following the developments of world financial markets and financial innovations the money demand function started to reveal instability and almost all industrialised economies faced this problem.

As critics grew for the PAMs, it lost its appeal to alternative approaches like the buffer stock models (BSMs) and more recently the error correction mechanism (ECM). Therefore most recent research has focused on improving the PAM by using more appropriate econometric techniques.

The buffer stock models were predominant in the 1980s as alternative methods for the money demand estimation to overcome the problems of PAM, namely the short run interest rate overshooting and long run implausible lag of adjustment. Proponents of the BSM postulated that the reason the PAMs did poorly was that they failed to consider the short run impact of monetary shocks (see Sriram, 1999). In the BSMs, in addition to the lagged money demand variable, the difference between the desired and actual money holding are also included.

On the other hand, ECM approach has been used in estimating the demand for money because of the belief that instability is a short-term event, which acts as a correction process for the long-term equilibrium relation. Thus we estimated an error correction model for the money demand function of Uganda since it explains the short-run dynamics.

4.4 Time series characteristics of the data

As part of the model specification exercise, we tested for the time series properties of the data before the actual estimation of the error correction model as laid out in the next sections. The specification encompasses models in both level and differenced forms with proportional long-run equilibrium dynamics in order to ensure that spurious regression problems¹⁵ are dealt with by taking appropriate differenced variables in the model, without losing the long-run information.

¹⁵ The standard t and F-testing procedure are not valid for non-stationary data.

4.4.1 Unit Root Test

To enable us ensure the stationary nature of the data, the first step in this investigation was to determine the order of integration of the variables.

The Augmented Dickey-fuller (ADF) unit root test has been applied to the macroeconomic data set prior to testing theoretical models to ensure that all relevant variables are integrated of the correct order and also to establish whether a cointegrating relationship exists. This is important due to the fact that making inferences based on spurious regression is not valid.

To test whether each variable is non-stationary we performed a unit root test on each of the variables and tested the order of integration of each series. The Dickey fuller and “Augmented” Dickey fuller tests were used.

$$\Delta x_t = \alpha_1 + \alpha_2 T + \beta x_{t-1} + \sum_{i=1}^k \sigma \Delta x_{t-i} + \mu_t \dots \dots \dots (12)$$

$$\Delta x_t = \alpha_1 + \beta x_{t-1} + \sum_{i=1}^k \sigma \Delta x_{t-i} + \mu_t \dots \dots \dots (13)$$

Where Δ is the difference operator, x_t is the time series, k is the number of augmentations necessary to rid the series from autocorrelation¹⁶, T is a trend term, α_1 , α_2 , β , σ , are coefficients while μ_t is a white noise error term. Equation (12) is with intercept and trend term while equation (13) is with intercept and no trend term.

The null hypothesis of non-stationarity (unit root) is $\beta=0$ and the test will be resolved by comparing the τ -statistics for β with the appropriate McKinnon critical values at conventional levels of significance. The unit root test results on variables in levels and differenced form are reported in the next chapter.

4.4.2 Cointegration Test

The first test for cointegration is usually an informal graphical inspection of the time series. However, caution was taken with this graphical tool to detect cointegration since the series are in different scales. More formally we used two methods to test variables for cointegration namely: (a) the Engle-Granger (EG) or Augmented Engle-Granger (AEG) Test; and (b) the Cointegrating Regression Durbin-Watson (CRDW) Test.

¹⁶ k was determined by applying the general to specific procedure. We started by selecting a reasonable large value of k and then systematically reduced the number of augmentations by observing the Schwartz information Criterion (SIC) and Akaike information Criterion (AIC).

4.4.3 Engle-Granger (EG) or Augmented Engle-Granger (AEG) Test

The notion of cointegration was initiated in the Granger (1983) and Engle and Granger (1987) in order to show a better combined treatment of both short run and long run equilibrium dynamics in the frame work of an error correction model. Their notion is that if the variables are integrated of the same order $d > 0$, a test for cointegration must be conducted.

They provided a three-step methodology to test for cointegration, among variables. First, is to subject the relevant variables to unit root test. Second, if all variables share the same time series property and are non-stationary, estimate the ordinary least square (OLS) equation with the relevant variables and recover the residuals. Finally, subject these residuals to unit root test. If the residuals are stationary, then these variables are cointegrated and equation (8) can be appropriately estimated in levels or an error correction model can be specified. On the other hand if the residuals are not stationary, then the variables are not cointegrated and equation (8) should be estimated in differences to avoid problems of spurious regression.

To test for cointegration of the residuals obtained from structural equation (8) of non-stationary series, we do a unit root (ADF) test. If these residuals are stationary, it might be the case that the original series are cointegrated. But, since the true residuals are unknown and estimates of these residuals are based on the estimates of the cointegrating coefficients in equation (8) above, the ADF critical values will no longer be appropriate for resolving the test. Corresponding critical values have been calculated by Engle and Granger, and are readily calculated in some statistical tables, for instance, in Charemza and Deadman (1992). By using the appropriate Engle-Granger critical values, the ADF test on the residuals becomes the Augmented Engle-Granger (AEG) test.

However the Engle-Granger approach is a valid way of proceeding only if the data has certain characteristics, in particular; the variables in first step equation must be integrated of the same order, and the residuals from the first equation must be integrated of order zero $I(0)$. See Table (5) and (6) for results on order of integration of the residuals.

4.4.4 Cointegrating Regression Durbin-Watson (CRDW) Test

This test is a simple and quicker method of testing for cointegration. It uses Durbin-Watson d value obtained from the regression of the non-stationary series/cointegrating regression. The null hypothesis of the test becomes $d=0$, rather than $d=2$ as is the case in the standard test for first order autocorrelation.

The critical values to test the hypothesis that $d=0$ were first calculated by Sargan and Bhargava (1983)¹⁷ and are as follows: 1%, 5% and 10% critical values to test the hypothesis that the true $d=0$ are 0.511, 0.386, 0.322, respectively. Thus if the computed d value is less than, say 0.511, we reject the null hypothesis of cointegration at 1% level.

For that matter, cointegration analysis was employed to test whether money demand is cointegrated with its determinants in the long run. Cointegration of money demand with its determinants implies that the monetary aggregates are useful tools for long run intermediate targeting of monetary policy in Uganda. If cointegration was not present then targeting monetary aggregates will be of no use.

4.4.5 Error Correction Model

According to Engle and Granger (1987), an error correction model can be constructed after establishing that the variables in the money demand function are cointegrated. This means there, exists a long-run relationship between them even though in the short-run, there may be disequilibrium. In constructing the Error correction model, the residuals (error term) obtained after running the cointegrating regression, that is, the regression in levels of the variables may be treated as the “equilibrium error” and may be used to tie the short-run disequilibrium behaviour of real money balances to its long-run value.

Therefore, the error correction model is the regression of all the I(1) variables entered in first difference and a one period lagged value of the empirical estimates of the equilibrium error ECM(-1) whose series was generated in conducting the Augmented Engle-Granger test.

The ECM is represented as:

$$\Delta \ln \frac{M}{P}_t = \beta_0 + \sum_{i=1}^k \beta_{1i} \Delta(\ln M)_{t-i} + \sum_{i=1}^k \beta_{2i} \Delta(\ln RGD\mathcal{P})_{t-i} + \sum_{i=1}^k \beta_{3i} \Delta(\ln REER)_{t-i} + \sum_{i=1}^k \beta_{4i} \Delta(\ln CM)_{t-i} + \sum_{i=1}^k \beta_{5i} \Delta(\ln IR)_{t-i} + \sum_{i=1}^k \beta_{6i} \Delta(R)_{t-i} + \sum_{i=1}^k \beta_{7i} \Delta(\pi)_{t-i} + \beta_8 ECM_{t-1} + \beta_9 D93 + \beta_{10} D86 + \varepsilon \dots \dots \dots (14)$$

Where k is lag length, ECM is the error correction term, whose series were generated from the regression of equation (8) in levels termed as the cointegrating regressions, [see tables (3) and (4) in chapter 5]. Since the residuals from our cointegrating regression are integrated of order

¹⁷ See Sargan and Bhargava (1983) in Gujarati, 2003 pp.824).

zero $I(0)$, it means there is existence of cointegration and the variables in equation (7)¹⁸ are also $I(0)$ proces, therefore it was appropriate for us to estimate an error correction model for money demand in Uganda.

4.5 Data Type and Sources

This study used time-series data covering period 1980-2004 on quarterly basis for the analysis. Data was sourced from the Bank of Uganda's monetary survey, quarterly and annual economic Reports, Bank of Uganda staff estimates, Uganda Ministry of Finance and Economic Planning (MFEP) publications, that is, Background to the Budgets various issues, Uganda Bureau of Statistics and International Finance Statistics (IFS)-CD-ROM. GDP and GDI on quarterly basis was derived from annual figures through interpolation.

¹⁸ A statistically significant value for β_8 in the model gives the proportion of the disequilibrium in M/P in one period that is corrected in the next period while ECM captures adjustment to wards the long-run equilibrium and the rest of the differenced variables capture the effect of short-run disturbances.

CHAPTER FIVE

Empirical Results

This section commences with the discussion of preliminary or pre-model estimation tests such as unit root and cointegration tests then later the investigation of empirical results. However, the main purpose of this study is to estimate a money demand function for M1 and M2 in Uganda using the error-correction model in order to identify the factors affecting its movements both in the long and short term.

5.1 Unit root tests

To get a feel of the data used in this study, we plotted respectively the log levels of real M1, M2, GDP, effective exchange rate, currency-money ratio, investment ratio, 91-day Treasury bill and inflation rate. Results are reported in Appendix(B). The visual inspection of these figures convincingly shows that all of the series are non-stationary but great caution ought to be exercised with this kind of tool when employed to test for cointegration since the series are in different scale.

The empirical estimation of money demand function was preceded by a test for the existence of unit roots. The Augmented Dickey–fuller unit root test results for the variables are presented in Table (1) below. Due to scanty evidence for deterministic trend, tests were conducted both with and without trend terms, but always included intercept terms. All variables in the model showed first order serial correlation, which was filtered using the lag structures indicated in Table (1). The choice of lag length was through investigation of the nature of serial correlation in each variable while observing the AIC and SIC. These criteria suggested that second and fourth lags should be used and that is what we opted for in the model.

For the test in levels, the null hypothesis of a unit root could not be rejected for all variables at all conventional levels of significance except for the inflation rate, when both intercept and trend terms are included.

The test in first differences of the variables showed practically non-conflicting results. The null hypothesis was strongly rejected for all variables irrespective of assumptions made regarding the deterministic trends. Therefore, the results suggest that the variables were, generally, I(1) processes as reported in Table (2) and were potentially cointegrated.

Table 1: Results of Augmented Dickey-Fuller Test on Variables in Levels

Period 1980:1-2004:4 Variable	Model with Intercept		Model with intercept and Trend		Lag Length	Order of Integration
	Test-statistics	Critical* values 5%	Test-statistics	Critical* values 5%		
Log RM1	-1.4446	-2.8912	-1.3324	-3.4561	2	I(1)
Log RM2	-1.3929	-2.8912	-1.3171	-3.4561	2	I(1)
LogRGDP	-1.4507	-2.8912	-1.5424	-3.4561	4	I(1)
LogREER	-1.8403	-2.8918	-3.2288	-3.4561	4	I(1)
LogCM1	-2.5710	-2.8912	-2.7891	-3.4571	2	I(1)
LogCM2	-1.3655	-2.8912	-1.9981	-3.4571	2	I(1)
LogIR	-1.8439	-2.8915	-3.2547	-3.4566	3	I(1)
π	-6.7343	-2.8922	-6.7106	-3.4576	4	I(0)
R	-1.5024	-2.8918	-2.0497	-3.4571	4	I(1)

Note: (i)*Denote absolute MacKinnon critical values for the rejection of null of unit root at 5%. 3.498, 2.582 and 4.056, 3.154 are critical values at 1% and 10% for model with intercept and; model with intercept and trend respectively.

(ii) I(1)=The variable is integrated of order one.

Table 2: Results of Augmented Dickey-Fuller Test on Variables in their Differences

Period 1980:1-2004:4 Variable	Model with intercept		Model with intercept and Trend		Lag Length	Order of Integration
	Test-statistics	Critical values 5%	Test-statistics	Critical values 5%		
Log RM1	-7.0108	-2.8918	-7.3572	-3.4571	3	I(0)
Log RM2	-6.9350	-2.8918	-7.2369	-3.4571	3	I(0)
Log RGDP	-6.7306	-2.8918	-6.9555	-3.4571	3	I(0)
Log REER	-7.6063	-2.8918	-7.5847	-3.4566	2	I(0)
LogCM1	-7.3329	-2.8915	-7.2934	-3.4566	2	I(0)
LogCM2	-7.3534	-2.8915	-7.3393	-3.4566	2	I(0)
Log IR	7.6846	-2.8915	-7.6471	-3.4566	2	I(0)
R	-5.7454	-2.8915	-5.8908	-3.4566	2	I(0)

Note: I(0)=A variable is stationary

It should be noted, that some of the results may be sensitive to the number of included lags and it can not be ruled out that inflation rate follows an I(0) process. Dickey and Rossana (1994), Harris (1995) suggest that such variable should not be excluded from the Cointegration equation. The strategy of adding lags to the Dickey-fuller regressions is based on the objective to remove any autocorrelation from the residuals, which is tested by applying an LM-test for fourth order autocorrelation.

5.2 Cointegration Analysis

As mentioned in the previous chapter, regressions involving time series data are likely to give spurious results in a sense that the results may look good but, on further analysis they behave differently and suspect. Granger and Newbold (1974), have suggested that, $R^2 > d$ is a good rule of thumb to suspect that the estimated regression suffers from spurious regression (see Gujarati 2003, pp 806-807). Since it is not the case with our models in Table (5) and (6) below, it can be assumed, that these regressions are not spurious. To make sure this assumption is correct the test for cointegration was done to avoid spurious regression problems.

The second step in the development of an error correction model is the test for the existence of cointegration. Given that the series are non-stationary and integrated of the same order one; it was justifiable to include all variables in one cointegrating regression. Therefore, regressions in Tables (5) and (6) are meaningful, that is they are not spurious; and any valuable long-run information is not lost, which could be the case if the first differences were used instead.

The first test for cointegration was conducted and following Engle and Granger (1987), equation (viii) is used as the cointegrating equation (static long-run regression). The estimates of residuals were obtained from the cointegrating regression in Tables (5) and (6) below and the Augmented Dickey-Fuller¹⁹ test was applied on the residuals of the static cointegrating regression. But intercept, trend term and one lagged difference were included in the test equations to reduce the degree of serial correlation.

5.2.1 Cointegration Test Results

In testing for cointegration, the residuals from the cointegrating regression equations were subjected to a unit root test and the results are reported in Tables (3) and (4) below. From Table (3) results of Augmented Engle-Granger test on narrow money, it is noted that the absolute test statistic for a unit root of -6.0355 is statistically significant since the computed value is greater than the critical values at all conventional levels. Thus, since the residuals (error terms) are stationary, the logarithm of real narrow money and its determinants are cointegrated.

¹⁹ Engle and Granger (1987) have calculated the appropriate critical values and the ADF test becomes the Augmented Engle-Granger (AEG) test. We used the critical value from Charemza & Deadman (1997), pp293-298

Table 3: AEG Test on residuals of cointegrating real narrow money

ADF Test Statistic	-6.035507	1% Critical Value*	5.61 to 5.45
		5% Critical Value	4.93 to 4.85
		10% Critical Value	4.60 to 4.55
*Engle-Granger critical values for rejection of hypothesis of a unit root (minus sign omitted) are extracted from Charemza & Deadman (1997).			

Similarly with respect to broad money in Table (4) below, the absolute test statistics for a unit root of -6.2088 is statistically significant at all conventional levels implying that the error terms are also stationary. Therefore, the logarithm of real broad money and its determinants are cointegrated, and estimation of money demand in levels may be meaningful.

Table 4: AEG Test on residuals of cointegrating real broad money

ADF Test Statistic	-6.208812	1% Critical Value*	5.61 to 5.45
		5% Critical Value	4.93 to 4.85
		10% Critical Value	4.60 to 4.55
*Engle-Granger critical values for rejection of hypothesis of a unit root (minus sign omitted) are extracted from Charemza & Deadman (1997).			

It is noted that the absolute test statistics for a unit root are statistically significant at all conventional levels for both narrow and broad money. Thus, since the residuals from the cointegration regression are integrated of order zero $I(0)$, there is existence of cointegration. The Stationary residuals from the cointegrating regressions were treated as equilibrium error and were used to tie the short-run disequilibrium behaviour of all the variables to their long-run values.

In the CRDW test the Durbin-Watson d value reported in the cointegrating regressions in Tables (5) and (6) above is used. In this case it is equal to 1.633 in model (5) and 1.663 in model (6), which is higher than the 5% critical value of 0.511, which suggests that the variables are cointegrated. This conclusion reinforces the findings on the basis of the E-G test.

The conclusion based on E-G and CRDW tests is that the selected variables; that is, logRM1, logRM2, logRGDP, logREER, logIR, and R are cointegrated. Cointegration of money demand with its determinants implies that these monetary aggregates are useful tools for long run intermediate targeting of monetary policy in Uganda. Although they are individually non-

stationary there exists a stable long-run equilibrium relationship between them, even though in the short run, there may be disequilibrium.

5.2.2 Long-Run Demand for Narrow money

The cointegrating regression found corresponding to the long-run open economy demand function for narrow money in Uganda, can be presented as in Table (5) below. Different diagnostic test are conducted to make the model reliable and to validate the results.

Table 5: Long-Run Regression Results for real narrow money

Dependent Variable: LogRM1				
Method: Ordinary Least Squares				
Sample (adjusted): 1980:2 2004:4				
Included observations: 100 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.6238	1.4248	1.1397	0.2573
LogRGDP	0.9166	0.0115	79.657	0.0000
LogREER	-0.1952	0.1078	-1.8107	0.0734
LogCM1	-0.6147	0.2959	-2.0775	0.0405
LogIR	0.4715	0.1233	3.8248	0.0002
R	-0.8750	0.3077	-2.8438	0.0055
R-squared	0.9964	Akaike info criterion		0.2997
Adjusted R-squared	0.9962	Schwarz criterion		0.4559
Sum squared resid	7.0074	F-statistic		5219.83
Durbin-Watson stat	1.6335	Prob [F-statistic]		0.0000
ARCH-test: (2) F[2,100]	1.5125[0.2217]	RESET-test: F[1,100]		4.4652[0.0141]
AR-test: (2) F[2,98]	1.1482[0.3217]			

We find that, the model is significant according to the F-test. The R^2 coefficient of determination is high enough, implying that the regression fits data well. In addition R^2 does not exceed Durbin-Watson statistics and this is evidence that the model also is not the case of spurious regression. All the coefficients are statistically significant. It can also be noted that the long-run demand for narrow money in Uganda is positively related to income, investment ratio and; negatively related to Treasury bill rate, real effective exchange rate and currency-money ratio.

The estimated elasticity with respect to income for narrow money is 0.916, which is close to unity and consistent with the transactions motive of holding money. The parameter estimates of Treasury bill rate, real effective exchange rate, and currency-money are statistically significant with the expected signs meaning that in the long-run they exert a significant impact on real narrow money in Uganda.

The real effective exchange rate has a long-run coefficient of 0.195, which is negative and significant at 10%. This elasticity signifies that in the long-run, narrow money responds less to a real depreciation of the shilling. Putting it differently, it implies that whenever there is a depreciation of the shilling demand for real narrow money is likely to decrease. This could be a result of people expecting the shilling to appreciate.

Currency-money ratio (CM1), which is a proxy for developments in the banking industry, has a significant coefficient of -0.6147 with expected sign. It implies that developments in the banking industry will lead to a reduction in money holdings. This suggests that there has been improved banking services due to competition in the banking industry following reforms and it has made the non-bank public to shift their portfolio from currency into bank deposits and financial holdings.

The parameter estimate of investment ratio as a measure of return on capital is without the expected sign but it is significant. This is in line with MacKinnon (1973) hypothesis, that the return on capital has a positive influence on money balances. This could be explained by inadequate information on financial markets by asset holder and that they hold money for purposes of making expenditures associated with large investments.

In the long-run the movement in narrow money demand are strongly affected by interest rates proxied by the 91-day Treasury bill rate. It has an elasticity of -0.875, which is significant with expected negative sign indicating that in the long-run there is greater portfolio consideration in determining money holding by asset holders. The increase in the interest rate induces movement from money holding into financial assets, which are interest bearing.

5.2.3 Long-Run demand for real broad money

Using a similar specification, the cointegrating regression for the long-run open economy demand function for broad money in Uganda, is presented in Table (6) below. Also a number of different diagnostic tests were conducted to ensure the reliability of the model and validity of the results.

Table 6: Long-Run Regression Results for real Broad money

Dependent Variable: LogRM2				
Method: Ordinary Least Squares				
Sample (adjusted): 1980:2 2004:4				
Included observations: 100 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.6870	1.2651	2.1239	0.0363
LogRGDP	0.9164	0.0125	73.0029	0.0000
LogREER	-0.2325	0.1074	-2.1642	0.0330
LogCM2	-0.8271	0.2766	-2.9900	0.0036
LogIR	0.4954	0.1232	4.0223	0.0001
R	-0.7668	0.4089	-1.9128	0.0588
R-squared	0.9965	Akaike info criterion		0.3083
Adjusted R-squared	0.9963	Schwarz criterion		0.4646
Durbin-Watson stat	1.6626	F-statistic		5354.750
ARCH-test: (2) F[2,100]	0.9852[0.3773]	RESET-test: F[1,100]		4.680 [0.0116]
AR-test: (2) F[2,98]	0.4537[0.6367]			

A similar analysis is performed for broad money. Looking at the F-test the model is significant. The R^2 coefficient of determination is high enough, implying that the regression fits data well. Also the R^2 does not exceed Durbin-Watson statistics, meaning that the model also is not the case of spurious regression

All the coefficients are statistically significant. It can also be noted that, the long-run demand for broad money definition in Uganda is positively related to income, investment ratio and negatively related to Treasury bill rate, real effective exchange rate, and currency-money ratio. The estimated income elasticity of broad money is also close to unity, which is consistent with the transactions motive of holding money. The parameter estimates of Treasury bill rate, real effective exchange rate, and currency-money are statistically significant meaning that they exert a significant impact on real broad money in the long-run.

The long-run elasticity with respect to real effective exchange rate is 0.2325, which is negative and significant. This is interpreted that if the exchange rate depreciates, the demand for real broad money will fall, other variables remaining constant. The depreciated exchange rate will cause the expected yield from held foreign currencies to increase, which will in turn reduce the demand for money (shilling) in the long-run. The significance of the exchange rate variable in terms of the demand for money suggests that there is existence of currency substitution and that foreign monetary developments in Uganda's trading patterns have an impact on the domestic demand for money.

Like in case of the model for real narrow money demand, the coefficient for investment ratio as a measure of return on capital is without the expected sign but it is significant. Meaning that the return on capital has a positive influence on real money balances. This could be explained by inadequate information on financial markets by asset holder and that they hold money for purposes of making expenditures associated with large investments.

The estimated interest rate elasticity is -0.7668 and significant with expected sign. Implying that in the long-run it strongly affected the demand for broad money because Treasury bill is an asset that is very liquid for both individuals and financial institutions. So there is greater portfolio consideration by asset holders in holding money balances or cash deposit in the long-run.

5.3 Modelling Short-Run Dynamics Money Demand equations for Real M1 and M2

The next step in this section is to estimate the dynamic error correction models, having established the existence of cointegration between the variables of the models. In line with the Engle-Granger theorem, the changes in both narrow and broad money are modelled as a response to departure from the stationary linear combination of the $I(1)$ variables, augmented by short-run dynamics from the current and lagged first difference of the variables included in the cointegrating equation as well as by other stationary variables like inflation rate.

With little information provided by Engle and Granger about the nature of the dynamic process behind the long-run solution, the error correction model is initially specified by setting the lag length to five in all the models. By using the general to specific methodology, the intention was to maximise on the goodness of fit with minimum number of variables and eliminate the insignificant lags. Also the SIC²⁰ and AIC acted as a guide to parsimonious reductions along with a number of diagnostic tests, parameter stability and economic theory at each stage. This yielded a more interpretable and parsimonious model, with most of the variables found to be significant and of the expected sign for the short-run dynamics.

²⁰ The optimal lag length of the model was chosen on the basis of the SIC and AIC, as well as on the residuals being white noise.

5.3.1 Error Correction Model for real narrow money

We commenced by estimating the over parametrised error correction model as seen in Appendix (C). Because it would be difficult to interpret it in a more meaningful manner adjustments were done on the model by gradually dropping the insignificant lags based on the insignificance in their t-statistics. At each stage several tests were done to ensure that the model passes diagnostic tests relating to the properties of the residuals. Through this dynamic modelling, the final short-run error correction model obtained is presented in Table (7).

Table 7: Error-Correction Model for $\Delta(\text{LogRM1})$

Dependent Variable: $\Delta(\text{LogRM1})$				
Method: Ordinary Least Squares				
Sample (adjusted): 1981:3 2004:4				
Included observations: 94 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
$\Delta(\text{LogRM1}(-3))$	0.2062	0.0856	2.4092	0.0182
$\Delta(\text{LogRGDP})$	0.4759	0.0662	7.1852	0.0000
$\Delta(\text{LogRGDP}(-3))$	0.0928	0.0586	1.5845*	0.1169
$\Delta(\text{LogCM1}(-1))$	-0.2765	0.2097	-1.3182	0.1910
$\Delta(\text{LogCM1}(-2))$	-0.3600	0.2087	-1.7247*	0.0883
$\Delta(\text{LogIR})$	0.2985	0.0884	3.3772	0.0011
$\Delta(R(-2))$	1.1891	0.4939	2.4073	0.0183
π	-0.4366	0.0798	-5.4738	0.0000
$\pi(-3)$	0.3453	0.0903	3.8224	0.0003
$\pi(-5)$	-0.1135	0.0421	-2.6924	0.0086
ECM1(-1)	-0.5734	0.0834	-6.8766	0.0000
R-squared	0.8907			
Adjusted R-squared	0.8775	Schwarz criterion		-0.1871
Durbin-Watson stat	1.9446	Akaike info criterion		-0.4847
AR-test: (2) F[2,92]	0.0424[0.9588]	Standard Error		0.1798
ARCH-test: (2) F[2,92]	1.6624[0.1955]	F-statistic		67.6092
RESET-test: F[1,94]	1.6903[0.1641]	Prob [F-statistic]		0.0000

Note: Δ is the difference operator, * 10% level of significance and "Prob" denotes probability.

Before interpretation of the empirical results, the diagnostic tests need to be looked at, since in applied economic research, it is not common to estimate a totally meaningless model and also obtain correct signs and a high coefficient of determination. Hendry (1995) has suggested that economists need to supplement conventional regression outputs with diagnostic checks so that *"...we generally drive across bridge without worrying about the soundness of their construction because we are sure that someone rigorously checked their engineering principles and practices. Economists must do the same with models or else attach the warning not responsible if attempted to use leads to collapse."* (Hendry, 1995, pp.68)

The diagnostic tests on the model show that it performs well on statistical grounds; the AR-test is a single equation Lagrange Multiplier (LM) test for serial autocorrelation in the residuals. The computed value for the test is 0.0424 which is less than the critical value required for rejection of the null hypothesis of serial autocorrelation at 5% level of significance. Therefore, the null that there is no serial correlation is accepted.

The ARCH-test for autoregressive conditional heteroscedasticity has a computed value of 1.6624, which is below the critical value meaning the null of no heteroscedasticity is accepted, indicating that the model is properly specified. The Ramsey RESET-test is such that the null that there is no misspecification is accepted, since the computed F-statistics of 1.6903 is below the critical value at 5% level. With these diagnostic tests we conclude that the error-correction model for narrow money provides a true presentation of the dynamic money demand function. In addition, it can also be noted that a more parsimonious and interpretable model was produced since SIC has fallen from 1.0400 to -0.4847, also implying improvement in the model. The functional form is correctly specified and is stable (see Appendix D) for the CUSUM plot, F-statistics is significant looking at its probability value so the model is of good fit.

We find out that the error correction term ECM1 has a significant and negative influence on the growth of real M1. This means that there is a feed back of approximately 57% of the previous quarter's disequilibrium. This value is higher than that of 25% found by Kararach (1999) for Uganda, 8% for Serbia by Jelena and Mirjana (2005) and 18% for Sudan by Domowitz and Elbadawi (1987) and 32% obtained by Adam (1992) for Kenya. The significance of the ECM supports the conclusions that real narrow money, income, currency-money ratio, investment ratio and interest rate on 91-day Treasury bill are cointegrated.

The elasticity with respect to income is estimated at about 0.568 that is, $(0.4759 + 0.0928)$ implying it has positive influence on money growth, which is in accordance with economic theory. Comparing this income elasticity with 0.57 obtained by Domowitz and Elbadawi (1987) for Sudan and; 0.44 by Ajewole (1989) for Nigeria all are less than unity. These results as with Domowitz and Elbadawi (1987) also refute the claim by Hossian and Chowdhry (1996) and EIGHoul (1977) that the short-run income elasticity in developing countries is expected to be greater than unity.

The coefficient of currency-money ratio with a lag of one and two are significant and with the expected signed, its elasticity of -0.6365 (that is $-0.2765 + -0.3600$) signifies that increased financial innovations leads to decrease in demand for money. This also indicates that there is a decrease in money holding due to expansion of banking and financial services in the economy, leading to a reduction in the growth of the second economy.

The elasticity for investment ratio as a measure of return on capital is 0.2985 without the expected sign but it is significant. This is in line with MacKinnon (1973) hypothesis, that the return on capital has a positive influence on real narrow money balances while Ajewole (1989) obtained similar result for Nigeria, Galbis (1979) tests of the hypothesis in 19 Latin American countries revealed that the investment ratio did not perform in 7 out of 19 regressions. This could be explained by inadequate information on financial markets by asset holders and that they hold money for purposes of making expenditures associated with large investments.

In the short-run the movements in narrow money demand is strongly affected by interest rates proxied by the 91-day Treasury bill rate with an elasticity of 1.1891 which is significant. However, this unexpected positive coefficient indicates that when interest rates increase, real money balances will respond positively. The result is different from the one obtained by past studies such as Katarikawe and Ssebudde (1999), Henstridge (1999), Adam (1992), Kararach (2001). It implies that when interest rate on treasury bill increase, interest on deposits that are included in monetary aggregate (M1) will also increase because banks make more profits on their loans and they want to attract more deposits by paying high interest rate on them. This could also be attributed to the fact that asset holders prefer to hold real assets like stock of food, animals, houses and machinery rather than treasury bill because capital markets do not function well in Uganda.

The overall impact elasticity with respect to inflation rate is -0.2048 ($-0.4366 + 0.3453 - 0.1135$) but it occurs with lag of 0.3453 and -0.1135 for the third and fifth lag respectively. This implying that if inflation expectations rise, money holding will fall, other variables being held constant. The rise in inflation will result in increased returns on alternative forms of non-monetary assets, which will in turn reduce the demand for money. This conforms to the high inflation rate experienced during the early years of the sample period. It can also be due to high inflation rates experienced in the country for most of the years in the sample period so the inflation rate matter more than interest rates to asset holders when making their portfolio decisions.

It can also be noted from our results that the demand for money adjusts to changes in its determinants with a lag length of three quarters. The lag arises due to costs of adjusting money holdings because economic agents' expectations are high to adjust to its full long-run change.

The real exchange rate variable and the dummy variables capturing qualitative changes in economic and political regimes were dropped in this dynamic estimation because they were insignificant and seemed to compromise the quality of estimation of the parameters on other variables. This dropping improved the overall fit of the model. This implies that there is no impact of real exchange rates and the dummy variables on money holding in the short-run.

We also did re-estimation of our short-run model using real interest rates [see appendix (G)] in order to be able to make a comparison with the results obtained in table (7) above where nominal interest rates are used. In general, it can be noted that all the estimated coefficients with respect to income, currency-money ratio, investment ratio and the error correction term are slightly higher although not significantly different from those obtained above. However, the coefficient of real interest rate assumes a negative sign but with a smaller value of -0.0173. This may be an indication that there is some degree of portfolio consideration in holding money balances or cash deposit by both individuals and financial institutions when adjustments are made for inflation.

5.3.2 Error Correction Model for real broad money

Following the same estimation technique we also modelled the short-run dynamic demand for real broad money as reported in Table (8). Based on the diagnostic tests, the model is of good fit and it performs well in statistical sense. The AR-test is a single equation Lagrange Multiplier (LM) test for serial autocorrelation of the residuals. The computed value for the LM-test is 0.3854, which is less than the critical value required for rejection of the null hypothesis of serial autocorrelation. Therefore, the null that there is no serial correlation is accepted.

The ARCH-test for autoregressive conditional heteroscedasticity has a computed value of 0.5589, which is below the critical value meaning that the null of no heteroscedasticity is also accepted indicating that the model is correctly specified. The Ramsey RESET-test is such that we accept the null that there is no misspecification is accepted, since the computed F-statistics of 1.6269 is below the critical value at 5% level. It can be observed that most of the variables are significant and they also have the expected signs except for the interest rate. Worth to note first,

is that the real exchange rate and dummy variables capturing qualitative changes in economic and political regimes were also dropped in this dynamic estimation because there was nowhere in the modelling process where they showed some level of significant.

Table 8: Error-Correction Model for Δ (Log RM2)

Dependent Variable: Δ (LogRM2)				
Method: Ordinary Least Square				
Sample(adjusted): 1981:4 2004:4				
Included observations: 96 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Δ (LogRM2(-3))	0.1929	0.0869	2.2182	0.0291
Δ (LogRGDP)	0.4534	0.0663	6.8385	0.0000
Δ (LogRGDP(-3))	0.1306	0.0601	2.1749	0.0324
Δ (LogCM2)	-0.2867	0.1769	-1.6204	0.1088
Δ (LogIR)	0.2891	0.0905	3.1936	0.0020
Δ (R(-2))	1.1512	0.5063	2.2737	0.0254
π	-0.4445	0.0783	-5.6734	0.0000
π (-3)	0.3587	0.0947	3.7894	0.0003
ECM2(-1)	-0.5486	0.0862	-6.3661	0.0000
R-squared	0.8764	Akaike info criterion		-0.4356
Adjusted R-squared	0.8651	Schwarz criterion		-0.1951
Durbin-Watson stat	2.0748	Standard Error		0.1861
AR-test: (2) F[2,94]	0.3854[0.6814]	F-statistic		77.0928
ARCH-test: (2) F[2,94]	0.5589[0.5738]	Prob [F-statistic]		0.0000
RESET-test: F[1,96]	1.6269[0.1508]			

First of all the model is significant according to the F-test value of 77.0928 and P-value zero. The R^2 is about 87.6% indicating that the model fits data well. It can still be noted that a more parsimonious and interpretable model was produced since SIC has fallen from 0.9023 to -0.4356. Equally, the functional form is correctly specified and is stable as it can be seen in Appendix (E) for the CUSUM plot.

The error correction term ECM2 is significant with a negative sign, indicating the gradual convergence of the system towards the long-run equilibrium values. It indicates that when the money demand determinants in the previous period call for higher (lower) quantity of money than observed, the demand for money in the current period tends to increase towards the equilibrium level predicated by the determinants in the long-run equation. The speed of adjustment is 54.9%, which is considered to be high indicating a faster adjustment of the amount of money demanded towards its long-run equilibrium value, that is about 54.9%, of the deviation is corrected, which means that the money market in Uganda is still under developed. Comparing with other empirical studies on M2, this speed of adjustment is quite high than that

of 30% obtained by Nachega (2001) for Uganda, 20% obtained by Adam (1992) for Kenya and 2% by Hayo (2000) for Austria, which is a more developed economy.

Taking into account lagged effects, the estimated elasticity with respect to income is about 0.58 ($0.4534 + 0.1306$), indicating a positive influence on money growth. This can be an indication that in the short-run there are greater portfolio considerations in holding money. These results also refute the claim by Hossian and Chowdhry (1996) and ElGhoul (1977) that the short-run elasticity with respect to income in developing countries is expected to be greater than unity. It is interesting to compare these results with those of industrialised economies, like the 0.70 short-run elasticity for U.S.A and 0.13 for Austria obtained by Plamen and Hayo (2000) respectively.²¹

The coefficient for CM2 at -0.2867 is significant lower than for M1 implying that improved banking services have led to decrease in real money holdings and that the second economy has been declining over time. Indeed, this result explains the fact that current reforms in the banking industry have made the non-bank public to shift their portfolio from currency into bank deposits and financial holdings. It can thus be inferred from these findings that financial liberalisation generated some significant financial innovations and reduction in the growth of the second economy.

The elasticity for investment ratio (IR) is 0.2891 which is significant and without the expected sign. It did not perform according to our expectation but it is in accord with the MacKinnon (1973) hypothesis, that the return on capital affects the demand for real money balances positively because it is positively correlated with the investment to income ratio, which he called a distinct determinant of the demand for money in LDCs (see Galbis, 1979). This could be explained by the fact that, following financial liberalisation interest rates have not been adequate enough to stimulate the desired economic performance because of fragmentations in households, firms and capital markets coupled with inadequate information on financial markets.

²¹Comparison of our findings with these results can further be extended by considering whether our model encompasses the models of these other studies. Such an analysis has to take into account the fact that there are differences with respect to variable choice and estimation methods.

As in the case of the M1 in the short-run model, the coefficient for interest rate in the M2 model is significantly positive. This could be due to substitutability of the component measures of M2²² by asset holders when interest rates increase. The result is an indication that money demand is more sensitive to interest rate therefore, it become hard for monetary authority to unpredictable velocity. The rise in interest rates on treasury bills means that interest payments on deposits will also increase, banks make more profits on their loans and they would want to attract more deposits by offering high interest rates.

On the other hand, the impact elasticity with respect to inflation rate is -0.4445 but with a counteracting positive influence of 0.358 in the third lag, implying that if inflation expectations rise, money holding will fall other variables being held constant. Therefore, inflation rate is a significant factor in the demand for broad money, which affects portfolio decision of asset holders, who will prefer to keep their assets in real goods and services than bank deposits if they anticipate an increase in inflation. Another explanation for this positive interest rate could also be that asset holders in Uganda still take real assets as a major form in which they can hold their portfolios. Therefore, the existence of curb-markets cannot be denied, although its usage is limited to the “second economy” due to regulation by the Bank of Uganda. This results is similar to that obtained by previous studies [see Nachega, 2001] who obtained a positive deposit rate.

In this short-run estimation, we find an autoregressive adjustment lag of about 0.1929 up to the third lag which is an indication of the existence of costs of adjusting money holdings. This may also arise because money holders’ expectations are high to actual changes in rates of return implying that they will re-evaluate their portfolio adjustments later on.

We also re-estimated as in the case of M1 modelling our short-run model for broad money [see appendix (G)] in order to be able to make a comparison specifically on the elasticity of interest rate. In general, it can be noted that all the elasticities with respect to income, currency-money ratio, investment ratio and the error correction term are significant and with slightly higher elasticities. The elasticity with respect to real interest rate is significant and with the expected negative sign but still with a smaller value of about -0.0211 indicating some degree of portfolio consideration in holding money balances by both individual and financial institutions. This can be attributed to the high inflation rate experienced for most of the years in the sample period.

²² See chapter four for definition of M2

5.4 Analysis of money demand stability for M1 and M2

The stability of money demand is of great importance because during the study period the Ugandan economy experienced both political crisis and economics reforms. To get an impression on the stability of the final two models for RM1, RM2 and their parameters, Chow tests and recursive regression method were used. The models in Tables (7) and (8) were re-estimated using the recursive least square estimator to test whether there has been any significant change in the value of the coefficients of the model throughout the sample period. The results of the recursive estimators were then analysed for their stability.

Considering the model for real narrow money first, the recursive graphs of all the coefficients are presented in Appendix D from where it can be seen that movements in the values of these coefficients have been stable and significant. The error correction term is relatively steady throughout the sample period. This steady coefficient of the error correction term implies that at no point in the period did the feedback to the long-run equilibrium differ significantly from 0.57.

The recursive residuals of the model are within twice their standard errors (+ or -) although violating the 95% confidence interval around 1994 and 2004. This indicates that there was a significant change during these periods. The One-step ahead Chow forecast test as shown in figure (5) also confirms that the model failed to explain changes in real narrow money in 1994 and 2004. This was because during the period 1994-1995 Uganda experienced a coffee boom where its export earnings increased, which destabilised the monetary sector.

While in 2004, there was increase in inflation compared to the quarterly averages due to decrease in food supply, as a result of poor harvest occasioned by the prolonged drought in the food producing areas. Also during the same time, the Uganda shilling depreciated because oil companies stepped up their demand for forex as the domestic fuel prices responded positively to the increasing global oil prices. Supply of foreign exchange in the market was mainly from diplomatic missions and international agencies, embassies and non-governmental organisations. In spite of these two shocks, it can be safely concluded that all our coefficients remained fairly stable.

Concentrating again on broad money, the recursive coefficients of lagged real M2, real GDP, REER, CM2, IR, R, inflation rate, error correction term (ECM2(-1)) are stable and significant over the sample period. ECM2(-1) also has a stable coefficient and shows no deviations that are

significantly different from 0.54, implying still that the feed back to the long-run equilibrium did not largely differ from 0.54. Therefore, we conclude that the demand for broad money in Uganda was stable.

The analysis of the recursive residuals of the model show that there was still some violation the 95% confidence interval around period 1994 and 2004, indicating a significant change around these periods. The one-step ahead Chow forecast test in figure 9 also confirms that the model failed to explain changes in real broad money around 1994 and 2004. As noted earlier, this was due to the 1994-1995 coffee boom and the negative oil shock in 2004. In general the recursive residuals of the equations indicate that at no point was the one period equation error statistically insignificant and the one-step ahead chow forecast test for the entire sample indicates that stability of the model is noted before and after 1994. Taken together, these results could be regarded as sufficient evidence to support the existence of a stable demand for both narrow and broad money to be used for the monetary aggregate targeting.

The qualitative economic and changes in political regime captured by dummy variables were found to have had no significant effect on the demand for real money balances in Uganda. This implies that in spite of the structural changes that occurred in the country in 1986 and 1993, the demand for money continues to be stable. The next chapter provides observations and policy implications of the study.

CHAPTER SIX

Observations and Policy Implications

6.1 Summary Observations

The primary objectives of this study were: to investigate the determinants of money demand in Uganda, to investigate the stability of the money demand function and to investigate whether narrow definition of money or broad definition of money is more relevant to demand for money in Uganda for the period 1980 –2004. The study attempted to empirically model the demand for money using narrow and broad money. The modelling in the study takes place within the framework of the ordinary least square (OLS) single equation estimation method. The choice of this single equation estimation technique was because it is simple to use and it has been widely used with good results. To estimate the demand for money, two-equation error-correction models are constructed which contain the short-run dynamics and long-run economic equilibrium. The determinants of money demand were identified from existing economic theory, development literature and empirical work as: real GDP, effective exchange rate, currency-money ratio, return on capital, interest rate and inflation. For each monetary aggregate M1 and M2, along-run money demand function was conformed to exist with the use of the Engle-Granger cointegration econometric procedure. This then permitted specification of short-run dynamic error correction model for M1 and M2 which were also validated by the statistical significant of the error correction term.

All the hypotheses that were set out could not be rejected except in five cases. First, since the inflation rate variable was found to be stationary, it could not be included in the cointegration tests and it was therefore concluded that it is not a long-run determinant of real money demand. This implying that in the long-run there are no strong incentive for individuals to switch out of money holding into real assets when there are strong inflationary expectations.

Second, though real exchange rate has been found to be a long-run determinant of money demand, its short-run effects have been found to be insignificant. This suggests that devaluation and exchange rate liberalisation in Uganda during the economic recovery program had a great impact on money holdings in the long-run but not in the short-run. Third, from the estimated parsimonious short-run equation the interest rate was found to be positively related to real money demand. This finding is different from previous studies see Atingi-Ego and Matthew (1996), Kateregga (1993), Henstridge (1999), Domowitz and Elbadawi (1987) Adam

(1992). This kind of elasticity could be due to substitutability of the component measures of M1 and M2 by asset holders when interest rates increase. This could also be attributed to the fact that asset holders prefer to hold real assets like stock of food, animals, houses and machinery rather than treasury bill because capital markets do not function well. Fourth, the investment ratio that captures return on physical capital assumed unexpected positive sign both in the long-run and short-run implying that indeed, the money demand model followed the MacKinnon hypothesis of positive relationship between money balances and investment and not the classical approach of negative relationship suggesting that interest rates have not been adequate enough to stimulate investment following liberalisation of the financial sector. Finally, the impact of the qualitative economic reforms and change in political regime on the demand for real money balances captured by dummy variables were found to have had no significant effect on the demand for real money balances in Uganda. This implies that in spite of the structural changes that occurred in the country in 1986 and 1993, the demand for money continues to be stable.

This study is a departure from earlier studies like those of Atingi-Ego and Matthew (1996), Kateregga (1993), Henstridge (1999), Katarikawe and Ssebude (1999), and Nachega (2001) carried out to estimate the money demand function in Uganda by testing the applicability of the MacKinnon-Shaw hypothesis. There are similarities with the findings in this study that the return on physical capital positively related to the demand for real money balances for example see a study by Ajewole (1989) for Nigeria and Galbis (1979) in 7 Latin American countries out of 19. Nonetheless, the classical approach may not necessarily match the current economic situation given that there are still some signs of financial repression after several years of financial liberalisation. Therefore, this finding is a contribution towards the existing empirical literature on the demand for money in Uganda and other developing countries.

Also worthy to note from the income coefficient is that it adjusts with a relatively smaller amount in the short-run and a relatively large amount in the long-run. The coefficients with respect to income are also greater than those of the opportunity cost variables of holding money. The long-run income coefficient is close to unity, which is in line with the quantity theory while the short-run is slightly above 0.5 implying the Baumol-Tobin model of economies of scale. This result is a departure from those of Kateregga's (1993), where she got a negative income elasticity, which she attributed to high inflation.

The analytical framework from the stability tests indicates that there is a stable money demand function for both narrow and broad monetary aggregates. The result is similar to the findings by earlier studies carried out to estimate the money demand function like that of Katarikawe and Ssebude (1999), Henstridge (1999), Hayo (2000), and Nachega (2002). Although the findings by Nacho (1985), Simons (1992), Domowitz and Elbadawi (1987), Adam (1992), Atingi-Ego and Matthew (1996), indicate that M1 was stable and M2 unstable.

With regard to the error correction term, the findings shows that the absolute size of the adjustment coefficient is slightly greater in narrow money (57.3%) than in broad money (54.8%). Therefore, a long-run disequilibrium exerts a stronger pressure on narrow money than on broad money. This result could be due to the dependence of this aggregate on the level of economic activity and currency-money ratio. This indicates that the process of adjustment to the shocks in the money market is slow and it could be due to the fact that money and capital markets are not well developed. It takes time therefore, for individuals and firms to adjust their demand for money if there is a shock in the market.

The lags of M1 and M2 were also found to be important in explaining the demand for real money balances, which is an indication that real money balance adjusts with a lag to changes in its determinants to restore to its long-run equilibrium.

6.2 Policy Implications

The evidence of a stable narrow and broad money demand functions that has been strongly established in this study implies that narrow and broad money aggregates can be used in the process of monetary targeting for price stability. However, narrow money would be a good target if policy makers interpret monetary policy as a medium-term horizon because it is characterised by high short-run fluctuations. On the other hand if monetary policy is interpreted as a short-run target then broad money aggregate would be preferred because its long-run equilibria are slightly less influential.

With respect to the positive interest rate elasticity, it means that monetary authority will need to place a considerable premium on the establishment of an acceptable definition of the monetary aggregate. Therefore, requiring them to couch their policy objectives and directions that is they will need to couch their policy objectives increasingly in terms of monetary aggregates.

Although the financial liberalisation has caused changes in the institutional environment but still the money demand and its parameters reveal stability, indicating that there may be need for monetary authorities to pay more attention to control of money supply rather than switching to exchange rate and interest rate control. We can also draw a policy implication from the findings that, there is need for continuity of reform programs in the liberalisation of markets. Nevertheless, there is also need for monetary authorities to pay attention to institutional details through effective supervision of the financial institutions, that is to say, the capacity of banks, capital structure, loan portfolio, non-price methods of competition, banks' internal capacity to appraise and monitor borrowers and strengthening of commercial banks to fore close on defaulters more speedily.

Finally, the study also calls for an appropriate monetary action such as keeping positive interest rates, strict money growth and exchange rate stability, all these can be effective in maintaining price stability. Thus, policies that foster growth and reduce inflation are important for Uganda in order to achieve the desired outcome.

The significance of lagged values of real money in our models indicates that the process of adjustment to equate money supply to money demand is slow such that the impact of monetary policies adopted in a given quarter spills over to the following quarter. The same applies to inflation. This suggests that policies designed for a particular period will influence the functioning of the monetary sector in the following period. Therefore, policy makers should take into account the presence of lags in the economy that affect the implementation of monetary policy.

6.3 Limitations and Suggestions for further research

It has not been possible in this study to investigate the impact of budget deficit, foreign interest rate on demand for money in Uganda, which could also be of importance to policy makers because for fear to estimate an over parameterised model that could cost loss of some degree of freedom.

The evidence of positive interest rates and the insignificance of real effective exchange in the short-run could be due to the sample period chosen and the estimation method employed. For this case I believe that it is still useful to examine alternative specification of the short-run money demand dynamics to see whether they will improve money demand stability. Therefore, it would be interesting if another research is carried out to capture the short-run dynamics using

other specification. Comparison of this study with alternative specification would provide a better foundation for the monetary authority in Uganda.

This study was unable to do an estimation of a broader monetary aggregate of M3 because, information for this aggregate is lacking for some periods especially in the 1980s. This is attributed to the political crisis in the country that rendered failure of the economy to have proper records on most of the variables.

Also for the period 1980-1989, CPI was recorded in three forms; low income, middle income and high income, although in this study the middle income CPI was used to compute inflation rate for that period. It was also noted that the price indices of some commodities were recorded for particular towns and in others not yet, which was not a good representation for the whole economy.

REFERENCES

- Abuka, G.A (1993), "Import Support and Real Exchange Rate Trends in Uganda 1980-1992," Unpublished Masters of Arts dissertation, Makerere University.
- Adam, C.S (1992) "On the Dynamic Specification of Money Demand in Kenya", *Journal of African Economies*, Vol.1, 2:pp.233-270.
- Ajayi, J.S (1977), "Some Empirical Evidence on Demand for money in Nigeria"; *The American Economist* Vol.21, pp 51-59.
- Ajewole, O.J (1989), "Some Evidence on Demand for Money in Nigeria; a test of MacKinnon, Model of Money Demand in Developing Economies," *Savings and development* Vol.13, No.2
- Arestis, P (Ed), (1993), "Money and Banking-Issues for the Twenty First Century" New York. St.martine's Press.
- Artis, M.J and Lewis, M.K (1984), "How Unstable is the Demand for Money in the U.K?" *Economica*, new series, Vol51 No.204.
- Atingi-Ego, M and Matthew, K. (1996), "Demand for Narrow and Broad money in Uganda" *African Review of Money, finance and Banking* 1-2.
- (1998), "Monetary Policy Rules....", unpublished mimeo, Bank of Uganda.
- Baumol, William, J (1952), "The Transactions Demand for Cash: An Inventory Theoretic Approach," *Quarterly Journal of Economics*, Vol.66 (November), pp.545-56.
- Bahmani-Oskooee, M. and Maxili (1991), "Exchange rate Sensitivity of Demand for Money in Developing Countries," *Applied economics*, Vol.23, pp 1377-1384.
- Bhattachara, B.B (1974), "Demand and supply of money in developing countries: A Structural Analysis for India" *The Review of Economic and Statistics*, Vol.56, No.4
- Bordo, M and Jonug, H (1990), "The Expansion of Financial Services and Instruments Due to their Reforms", *IMF Working paper* WP/90/14.
- Cardoso, E.A (1983), "A Money Demand Equation for Brazil". *Journal of Development Economics* Vol.12, pp 183-193.
- Charemza W.W and Deadman D.F, (1997) New Direction in Econometrics Practices, 2nd ed, Publishing Ltd, Cheltenham: Edward Elger, U.K; Lyme, U.S.
- Chow, G.C (1966), "On the Long run and the Short run Demand for Money", *Journal of Political Economy*, Vol.74, pp 11-31
- Crockett, A.D and Evans, O.J (1980) "Demand for Money in Middle Eastern Countries", *IMF staff paper*, 27, pp 543-577.

- Dickey, D.A and Fuller, W.A (1979), "Distribution of the estimators for autoregressive time series with a unit root," *Journal of the American statistical association*, Vol.74, pp427-31
- De Brouwer, M.Ng, T and Subbaraman, S.S (1993), "An Econometric Analysis of Demand for M3 in Malaysia."1973-95, Centre for Economic Research, Discussion paper, George Washington University.
- Domowitz, I and Elbadawi, I (1987), "An Error Correction Approach to Money demand: The case of Sudan" *Journal of Development Economics*, Vol.26, pp 257-275.
- Elbadawi, I.A (1990), "Inflationary Process Stabilisation and the role of public expenditure in Uganda" The World Bank Investigation.
- EIGHoul, A.E (1977), "Demand for Money in Sudan", Discussion paper No.58, Economic and Social Research Council, University of Khartoum.
- Engle, R.F and Granger, C.W.J (1987), "Cointegration and Error Correction: Representation Estimation and Testing" *Econometria*, Vol.55, 2 March, pp.251-276.
- Ericsson, N.R (1998), "Empirical Modelling of Money Demand," *Empirical Economics*, Vol.23 (No.2), pp295-315.
- Fisher, D (1911) The Purchasing Power of Money. New York: Macmillan.
- Friedman Milton, (1956), "The Quantity Theory of Money-A Restatement," in studies in the quantity theory of money, *ed* by Milton Friedman (Chicago: University of Chicago press), pp 3-21.
- (1959) "The Demand for Money: Some Theory and Empirical Results", *Journal of political Economics*, Aug, pp 327-351.
- & Schwartz, A.J (1982), "Monetary Trends in the U.S and the U.K," Chicago, University of Chicago press.
- Fry, J.M (1988), Money, Interest rate and Banking in Economic Development. The Johns Hopkins University press, U.S.A.
- Galbis, V (1979), "Money, Investment, and Growth in Latin America, 1961-1973," *Journal of Economic Development and Cultural Change*, University of Chicago, pp 423-443.
- Goldfeld, S and Sichel, D.E (1993), The Demand for Money in Benjamin Milton. Friedman and Frank, H. Haan (Ed), *Handbook of Monetary Economics*, Vol.1 North-Holland, Amsterdam.
- Gordon, R.J (1984), "The 1981-82 Velocity Decline; A Structural Shift in Income or Money Demand?" In John.P.Judd *ed*, proceedings of the conference on monetary targeting and velocity.
- Granger, C.W.J and Newbold, P (1974), "Spurious Regressions in Econometrics" *Journal of Econometrics* Vol.2, pp.111-120

- Gujarati, D.N (2003), Basic Econometrics, 4th edition. McGraw-Hill Co.
- Hayo, B (2000), "The Demand for Money in Austria" *Zei Working paper B6 2000*.<http://www.zei.de>
- Hendry, D (1995), Dynamic Econometrics. Oxford University press, U.K, pp.68
- Haug, A and Lucas, Robert, F (1966), "Demand and Supply Function in the U.S" *Econometrica*, Vol.32, pp 476-509.
- Henstridge, N.M (1999), "De-monetisation, Inflation and Coffee: Demand for Money in Uganda," *Journal of African Economics* Vol.8 (November) No.3, pp345-385.
- Hossain, A and Chowdhury, A (1996), Monetary and Financial Policies in Developing Countries, London: Routledge.
- Jelena, M and Mirjana, P (2005), "Econometric Analysis of Money Demand in Serbia" Research Department of national bank of Serbia, 3rd Annual Conference for the Balkan Countries' Central Banks May 16-17, 2005.
- Kahwa, I.d (1995). "Interest Rate Policy and Efficiency of Commercial Banks in Uganda," Dissertation for MAEPP of Makerere University.
- Kararach, G (2001), "Evidence on the Demand for Money in Uganda" *Journal of economic Literature* Classification, C1.
- Katarikawa, M and Ssebudde, R.K (1999), "Is the Reserve Money Program still a useful operating frame work for the conduct of monetary policy in Uganda?", Bank of Uganda, staff paper.1,1,pp1-36.
- Kasekende, L and Ssemogerere, G (1994) "Exchange rate Unification and Economic Development: the case of Uganda," *World Development* (august).
- Kavanagh, N.J and Walter, A.A (1966), "The Demand for Money in the United Kingdom.1877-1961: preminary findings", *Bulletin of the Oxford University, Institute of Economics and Statistics*, Vol.28, pp 93-116.
- Keynes, J.M (1936), The General Theory of Employment, Interest rate and Money, New York, Macmillan Co.
- Kihengira, B and Katarikawa, M (1995), "What role will interest rates play in the Macroeconomic Stabilization in Uganda" Bank of Uganda internal research paper.
- Laidler, D.E.W (1985), The Demand for Money: Theories, Evidence and Problem, 4th ed New York: Row: HarperCollins College Publisher.
- Lim,D and Martin,W (1991), "The Stability of the Demand for Money in the European Community Countries", A survey Research Memorandum WO&E Nr.9321.

- Laumas, G.S and Mehra (1977), "The Stability of the Demand for Money Function 1900-1974", *The Journal of finance*, Vol.32, No.3
- Mankiw, G.N (1994), Macroeconomics, Worth Publishers, pp 466-473.
- Mbiire, B and Musinguzi, P (1992), "Money and Inflation in Uganda" A Paper Presented at the National Economic Policy Workshop, Entebbe.
- Mckinnon, I.R (1973), Money Capital in Economic Development, The Brooking Institute, Washington D.C, pp.59-61.
- Meltzer, A.H (1963), "The Demand for Money: The Evidence from the Time Series" *Journal of Political Economy*, Vol.71, pp 219-46.
- Millbourne, R and Akelof, G.A (1980), "The Short run Demand for Money", *economic Journal*, Vol.90, pp 885-900.
- Mishkin,F(1998), The Economics of Money, Banking and Financial Markets. Addison Wesley, pp 531-553.
- Naho,A.M(1985), "The Demand for Money in Developing Countries: The Empirical Evidence from Eastern African Countries." Economic Research Bureau, paper 85.
- Nachega, J.C (2001), "Financial Liberalisation, Money Demand, and Inflation in Uganda." *IMF Working paper*, WP/01/118.
- Orden, H and Fisher, T (1993), "The Interest rate Elasticity of Transaction Demand for Cash," *Review of Economics and Statistical*, Vol.38(3), pp 241-247.
- Plamen, K.Y (1998), "Estimation of a Money Demand Function for M2 in U.S.A: in a Vector Error Correction Model." May 1998, PhD in Economics, University of Delaware.
- Rother, G (1998), "Nominal Vs Real Adjustment in the Demand for Money Function: *applied Economics*", Vol.22 (1), pp 5-12.
- Rudaheranwa, N (1995), "An Assessment of the Fiscal Deficit in Inflationary Process in Uganda". Unpublished M.A (Economics) Thesis University of Botswana.
- Salvatore, D (1996), International Economics. 4th edition, A publication of the McGraw-Hill Inc.
- Shaw, E.M (1973), Money and Capital in Economic Development, The Brooking Institution, Washington D.C.
- Simons, R (1992), "An Error correction Approach to Demand for money in Five African Developing Countries." *Journal of economic studies* Vol.19 (1), pp 29-47.
- Sriram, S.S (1999), "Survey of Literature on Demand for Money: Theory and Empirical Work with special reference to ECM", *IMF working paper*: WP/99/64.

Thomas, L.R (1985), Introductory Econometrics: Theory and Applications, Prentice-Hall.
Chapter10, pp292-333

Tkac, A.P (2000), “The Determinants of flow of funds of managed portfolios” *working paper*
2000, Federal Bank of Atlanta.

Tobin, J (1956), “The Interest rate Elastities of the Transactions Demand for cash,” *Review of Economics and Statistics*, Vol.38 (August), Vol.38, pp 241-47.

IMF, International Financial Statistics and World economic outlook 1965-98

Bank of Uganda, Annual Reports and Quarterly Economic reports. <http://www.bou.or.ug>.

Government of Uganda “Background to the budget” Various Issues.

-----Uganda Yearly Economic Review (2000).

Uganda Investment code (1991) statute pg.3

International Financial Statistics (IFS), 1995, 2000 issues.

International Chamber of Commerce (ICC); The World Business Organisation, 2005

APPENDICES

Appendix A: Definition of Variables and data Construction

Variable Name	Definition
RM1	Real narrow money deflated by CPI in billion of Uganda shilling.
RM2	Real broad money deflated by CPI in billion of Uganda shilling.
CM1	Ratio of currency in circulation to M1 in billion of Uganda shilling.
CM2	Ratio of currency in circulation to M2 in billion of Uganda shilling.
RGDP	Real Gross Domestic Product in billions of Uganda Shillings.
REER	Real effective exchange rate (Uganda shillings per US dollar) ²³ = eP_m/P_o Where e =nominal exchange rate, P_m -U.S CPI, P_o -Uganda CPI.
CPI	Consumer price index (1997=100).
π	Inflation rate computed from CPI as; $\pi = (CPI_t - CPI_{t-1})/CPI_t$
R	Real interest rate on 91-days of Treasury bills. It was computed as; $r = r^* - \pi^e$ Where r =real interest rate, r^* =nominal interest rate and π^e =expected inflation.
IR	Investment ratio which captures the return on physical capital. It is computed as a ratio of private capital formation to income.

Note: All variables have been converted into logarithmic units, except interest rate and inflation rate.

Sources: The Monetary Survey of the Bank of Uganda, Uganda Bureau of Statistics (UBOS), International Financial Statistics (IFS)-CD-ROM, Government of Uganda Background to the Budget various issues.

²³ A depreciation will mean an increase in the shilling per dollar.

Appendix B: Plot of Variables in levels and difference.

Figure 5 Plot of the Variables in Levels

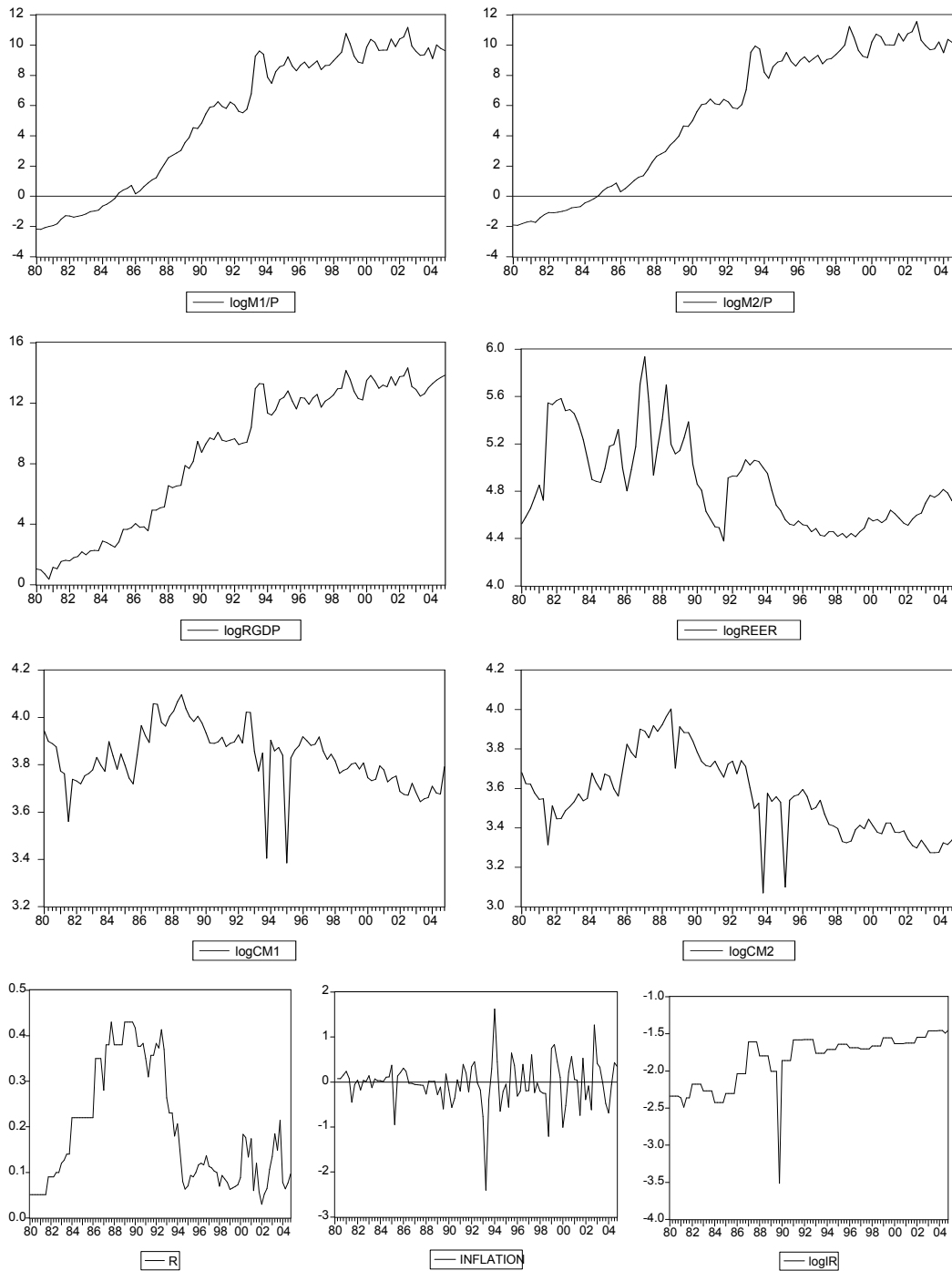
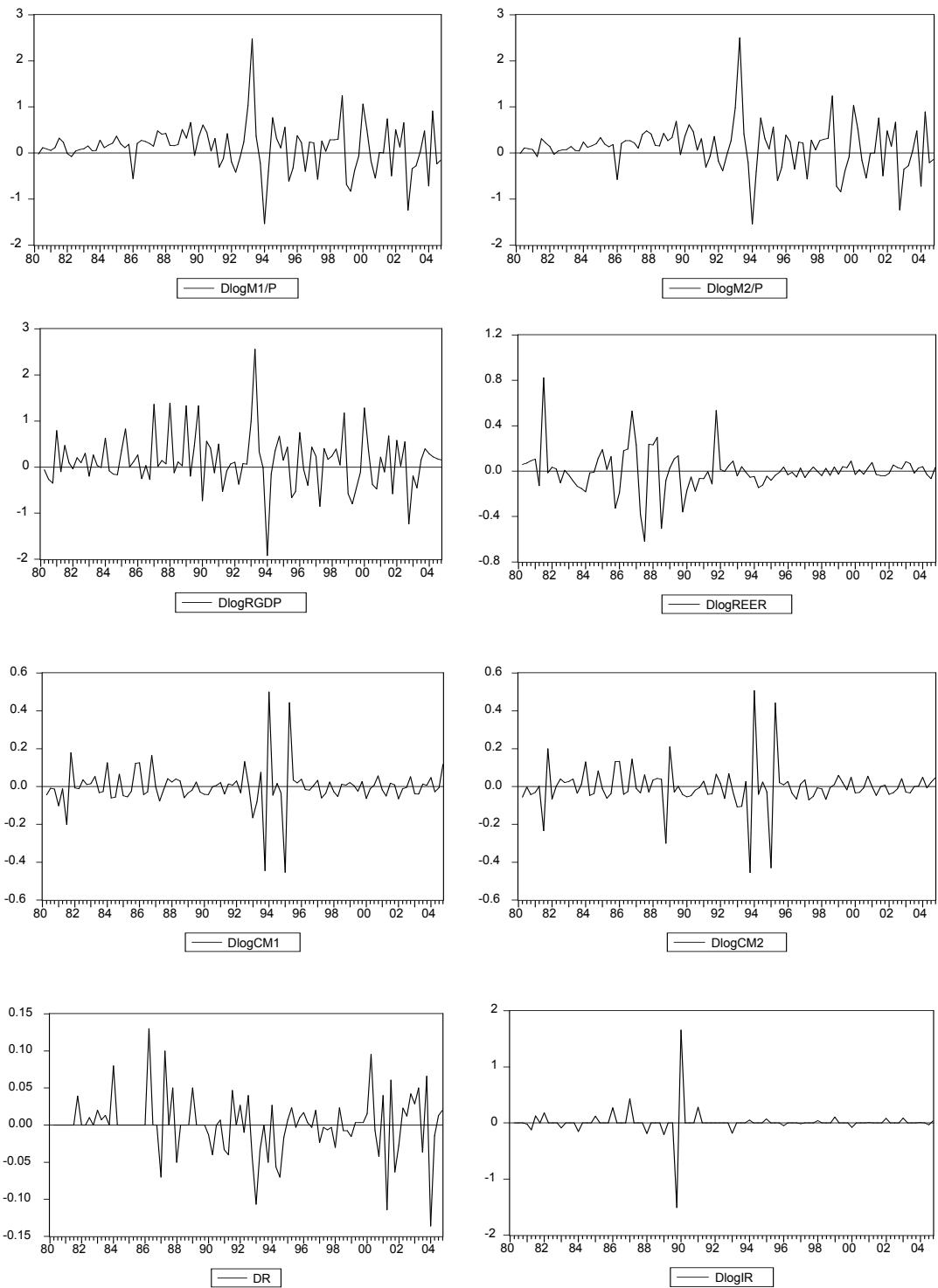


Figure 6: Plot of Variables in their first difference



Appendix C: Over parameterised models for both real narrow and broad money

Dependent Variable: D(LogRM1)				
Method: Ordinary Least Squares				
Sample (adjusted): 1981:3 2004:4				
Included observations: 94 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LogRM1(-1))	-0.220716	0.238921	-0.923804	0.3600
D(LogM1(-2))	-0.172948	0.222282	-0.778056	0.4402
D(LogRM1(-3))	0.055381	0.191559	0.289107	0.7737
D(LogRM1(-4))	0.069874	0.200338	0.348781	0.7287
D(LogRM1(-5))	0.248366	0.181831	1.365913	0.1781
D(LogRGDP)	0.409702	0.118599	3.454528	0.0011
D(LogRGDP(-1))	-0.100359	0.244796	-0.409969	0.6836
D(LogRGDP(-2))	0.086801	0.204126	0.425232	0.6725
D(LogRGDP(-3))	0.261127	0.173056	1.508921	0.1376
D(LogRGDP(-4))	0.121491	0.172605	0.703864	0.4848
D(LogRGDP(-5))	0.008457	0.137027	0.061716	0.9510
D(LogREER)	0.029416	0.153798	0.191264	0.8491
D(LogREER(-1))	0.042151	0.158236	0.266381	0.7910
D(LogREER(-2))	0.133626	0.161113	0.829395	0.4108
D(LogREER(-3))	-0.184766	0.168064	-1.099380	0.2769
D(LogREER(-4))	-0.199090	0.163019	-1.221267	0.2277
D(LogREER(-5))	-0.023700	0.167129	-0.141808	0.8878
D(LogCM1)	-0.539086	0.337022	-1.599559	0.1160
D(LogCM1(-1))	-0.367351	0.421962	-0.870577	0.3881
D(LogCM1(-2))	0.219332	0.413727	0.530138	0.5984
D(LogCM1(-3))	0.698666	0.382621	1.825997	0.0738
D(LogCM1(-4))	0.584862	0.338318	1.728734	0.0900
D(LogCM1(-5))	0.325763	0.288231	1.130217	0.2638
D(R)	1.251129	0.709259	1.763995	0.0838
D(R(-1))	0.379126	0.776339	0.488351	0.6274
D(R(-2))	0.802677	0.868309	0.924414	0.3597
D(R(-3))	-0.154724	0.759267	-0.203780	0.8394
D(R(-4))	0.613253	0.800463	0.766123	0.4472
D(R(-5))	-0.256982	0.797182	-0.322363	0.7485
D(LNIR)	0.336056	0.137832	2.438161	0.0184
D(LogIR(-1))	-0.032392	0.188960	-0.171420	0.8646
D(LogIR(-2))	-0.021265	0.168220	-0.126412	0.8999
D(LogIR(-3))	0.163024	0.156381	1.042480	0.3022
D(LogIR(-4))	0.080645	0.172063	0.468696	0.6413
D(LogIR(-5))	0.003943	0.157763	0.024992	0.9802
π	-0.527186	0.119684	-4.404824	0.0001
π (-1)	-0.409257	0.160479	-2.550228	0.0139
π (-2)	-0.107199	0.152275	-0.703978	0.4847
π (-3)	0.273356	0.143520	1.904652	0.0626
π (-4)	0.057579	0.186751	0.308317	0.7591
π (-5)	0.119799	0.188875	0.634274	0.5288
ECM1(-1)	-0.440629	0.233083	-1.890435	0.0645
D93	0.067189	0.069021	0.973452	0.3350
D86	-0.047348	0.067227	-0.704301	0.4845
R-squared	0.924307	Mean dependent var		0.121908
Adjusted R-squared	0.859211	S.D. dependent var		0.513587
S.E. of regression	0.192708	Akaike info criterion		-0.150385
Sum squared resid	1.856814	Schwarz criterion		1.040093
Log likelihood	51.06812	F-statistic		14.19909
Durbin-Watson stat	1.755068	Prob[F-statistic]		0.000000

Dependent Variable: D(LogRM2)				
Method: Ordinary Least Squares				
Sample(adjusted): 1981:3 2004:4				
Included observations: 94 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LogRM2(-1))	-0.046579	0.192654	-0.241777	0.8098
D(LogRM2(-2))	-0.036192	0.182840	-0.197944	0.8438
D(LogRM2(-3))	0.119444	0.166141	0.718935	0.4751
D(LogRM2(-4))	0.051712	0.195664	0.264290	0.7925
D(LogRM2(-5))	0.066370	0.177029	0.374910	0.7091
D(LogRGDP)	0.332344	0.112096	2.964818	0.0044
D(LogRGDP(-1))	-0.251402	0.191760	-1.311025	0.1951
D(LogRGDP(-2))	0.014707	0.174920	0.084080	0.9333
D(LogRGDP(-3))	0.204324	0.155187	1.316629	0.1932
D(LogRGDP(-4))	0.119531	0.156829	0.762170	0.4491
D(LogRGDP(-5))	0.076306	0.133793	0.570328	0.5707
D(LogCM2)	-0.401728	0.291963	-1.375953	0.1742
D(LogCM2(-1))	-0.149286	0.335771	-0.444607	0.6583
D(LogCM2(-2))	-0.169192	0.269273	-0.628330	0.5323
D(LogCM2(-4))	0.240158	0.245940	0.976489	0.3329
D(LogCM2(-5))	0.275232	0.251172	1.095789	0.2778
D(LogIR)	0.225100	0.142469	1.579992	0.1196
D(LogIR(-1))	-0.218075	0.166160	-1.312440	0.1946
D(LogIR(-2))	-0.039941	0.158997	-0.251206	0.8026
D(LogIR(-3))	0.135170	0.155499	0.869266	0.3883
D(LogIR(-4))	0.120508	0.174084	0.692241	0.4916
D(LogIR(-5))	0.098392	0.156773	0.627612	0.5328
D(R)	1.316223	0.693645	1.897546	0.0628
D(R(-1))	-0.174730	0.783200	-0.223098	0.8243
D(R(-2))	0.339076	0.845666	0.400957	0.6900
D(R(-3))	0.080987	0.773054	0.104763	0.9169
D(R(-4))	1.321889	0.770719	1.715138	0.0918
D(R(-5))	0.120454	0.744560	0.161779	0.8721
π	-0.567512	0.115168	-4.927708	0.0000
π (-1)	-0.357070	0.164544	-2.170061	0.0342
π (-2)	-0.021924	0.147295	-0.148845	0.8822
π (-3)	0.324115	0.145024	2.234912	0.0294
π (-4)	0.098819	0.184757	0.534857	0.5948
π (-5)	0.024138	0.182698	0.132118	0.8954
ECM2(-1)	-0.526201	0.195357	-2.693528	0.0093
D93	0.041092	0.070039	0.586697	0.5597
D86	-0.005573	0.068219	-0.081689	0.9352
R-squared	0.906762	Mean dependent var		0.125197
Adjusted R-squared	0.847875	S.D. dependent var		0.511579
S.E. of regression	0.199533	Akaike info criterion		-0.098689
Sum squared resid	2.269354	Schwarz criterion		0.902396
Log likelihood	41.63836	F-statistic		15.39829
Durbin-Watson stat	1.832181	Prob[F-statistic]		0.000000

Appendix D: Stability tests for LogRM1

Figure 7: Cusum test for RM1

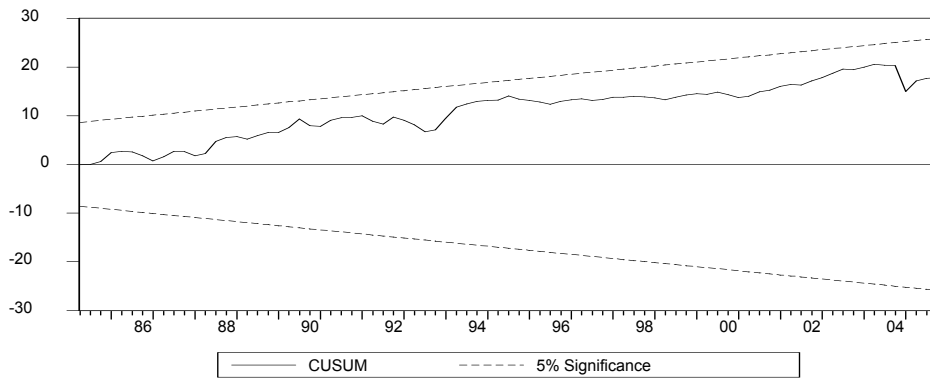


Figure 8: One step-Chow forecast for Model RM1

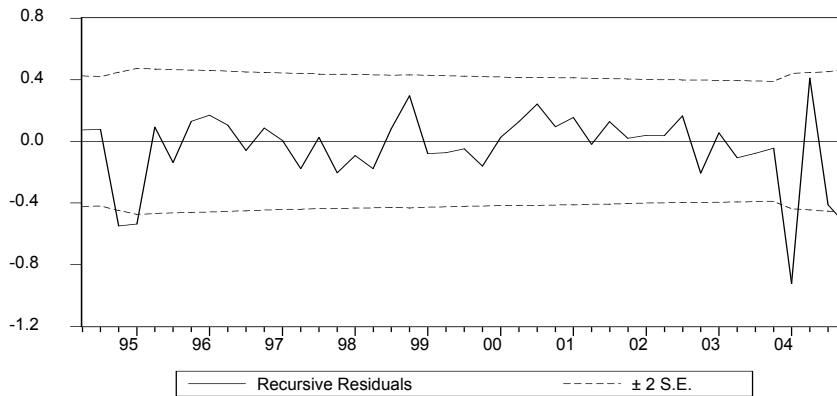
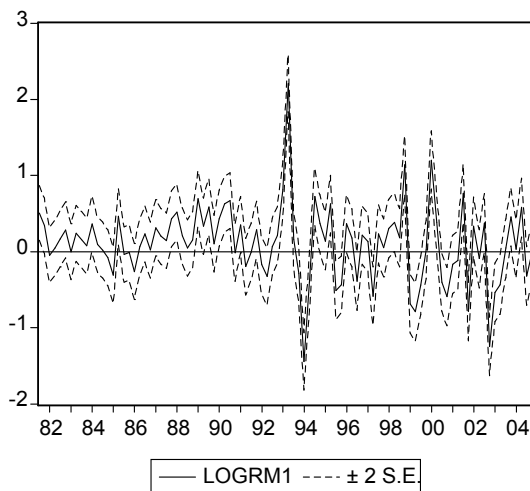


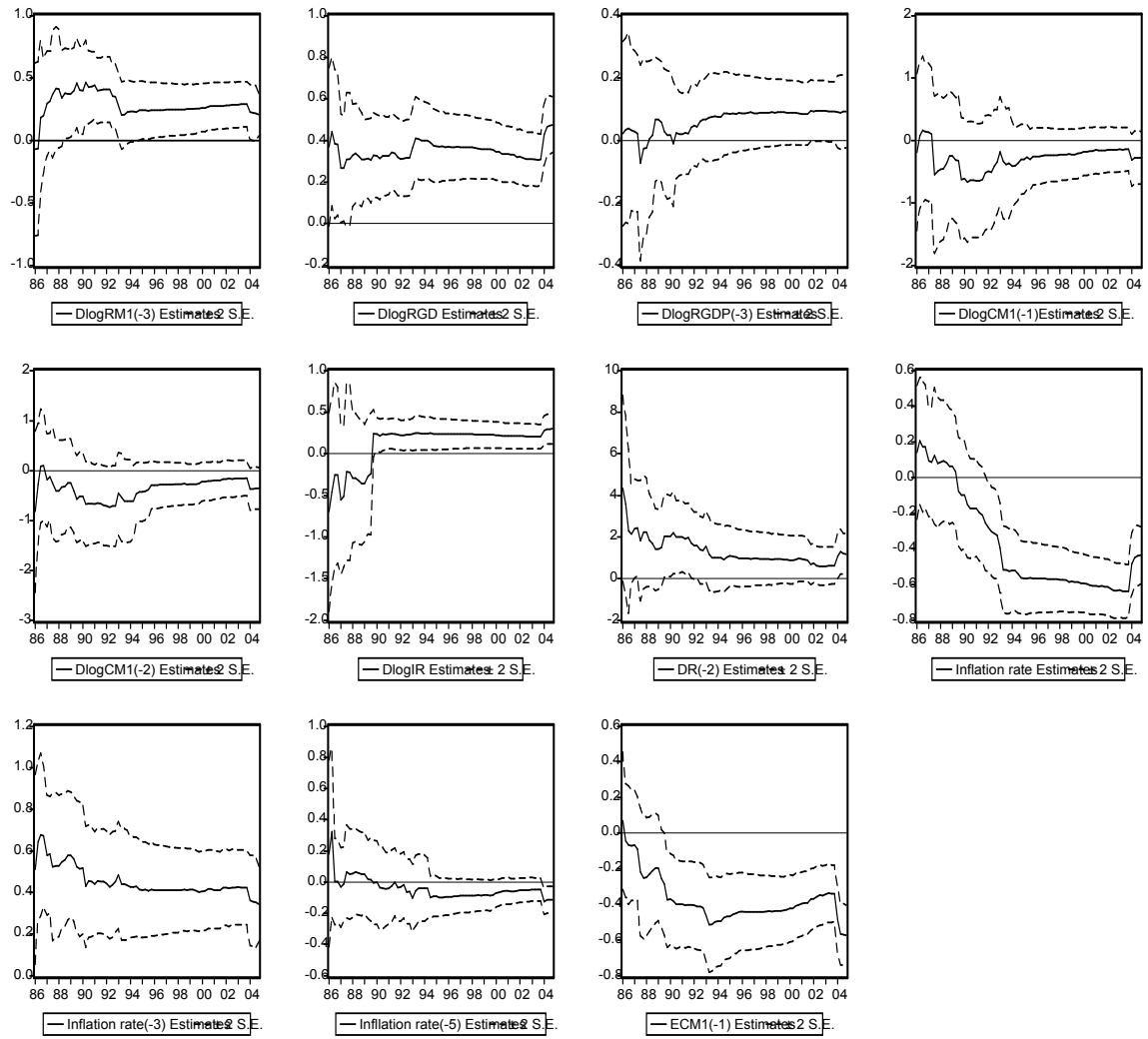
Figure 9: One-step ahead forecast of Δ (Log RM1); Actual Vs fitted



Forecast: LOGRM1
Actual: D(LogRM1)
Forecast sample: 1980:1 2004:4
Adjusted sample: 1981:3 2004:4
Included observations: 94

Root Mean Squared Error 0.172120
Mean Abs. Percent Error 0.122550
Mean Absolute Percentage Error 48.0402
Theil Inequality Coefficient 0.167704
Bias Proportion 0.010733
Variance Proportion 0.014372

Figure 10: Recursive coefficients for parameter constancy and Model stability of RM1



Appendix E: Stability tests for LogRM2

Figure 11: Cusum test for RM2

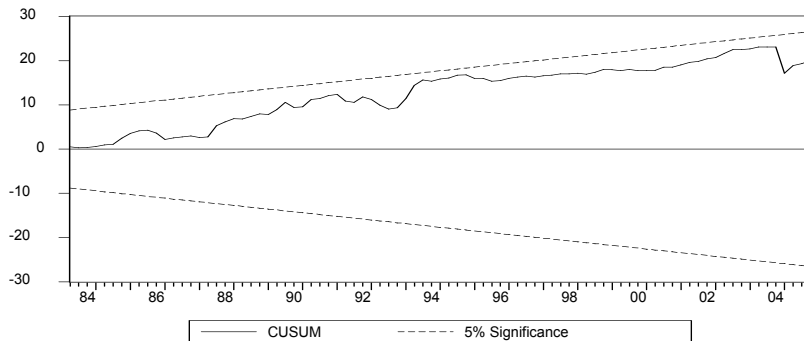


Figure 12: One step-Chow forecast for Model RM2

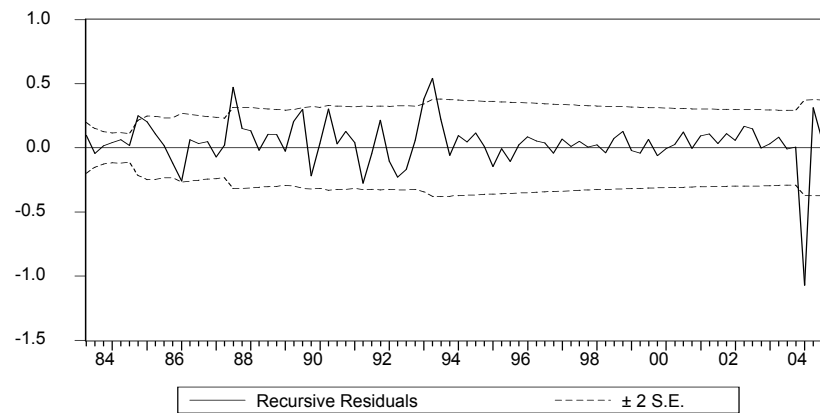


Figure 13: One-step ahead forecast of Δ (Log RM2); Actual Vs fitted

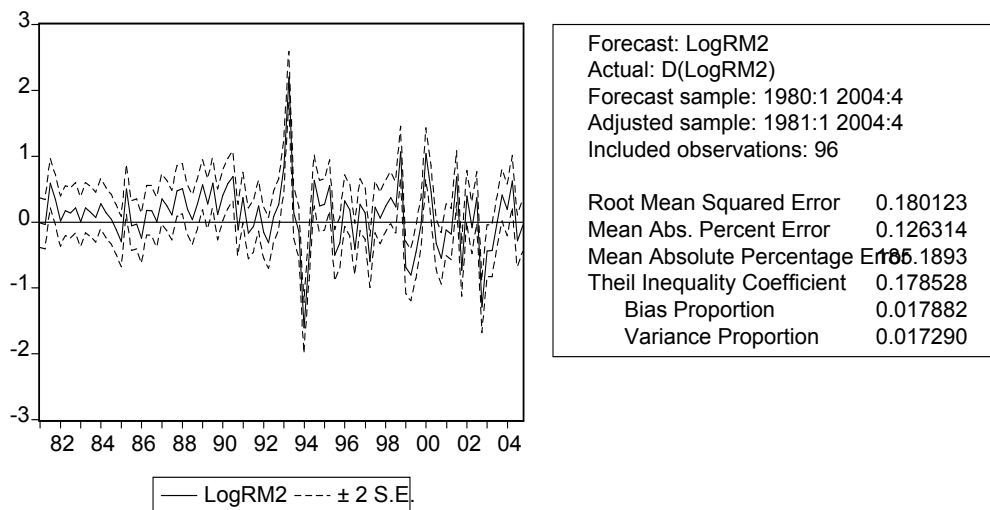
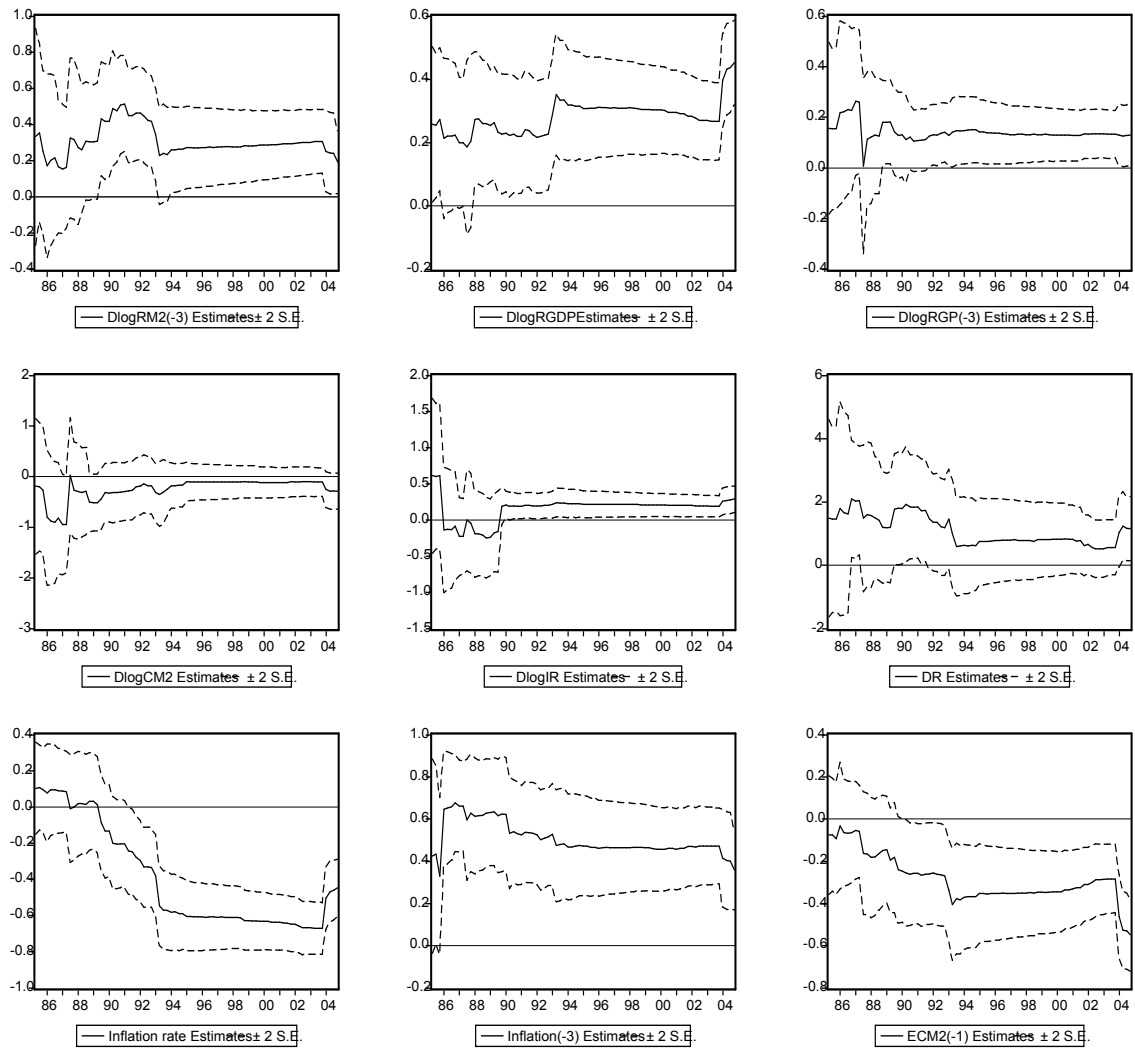


Figure 14: Recursive coefficients for parameter constancy and model stability for RM2



Appendix F: Error correction term for Narrow and Broad money

Figure 15: Plot of Error correction term for real RM1

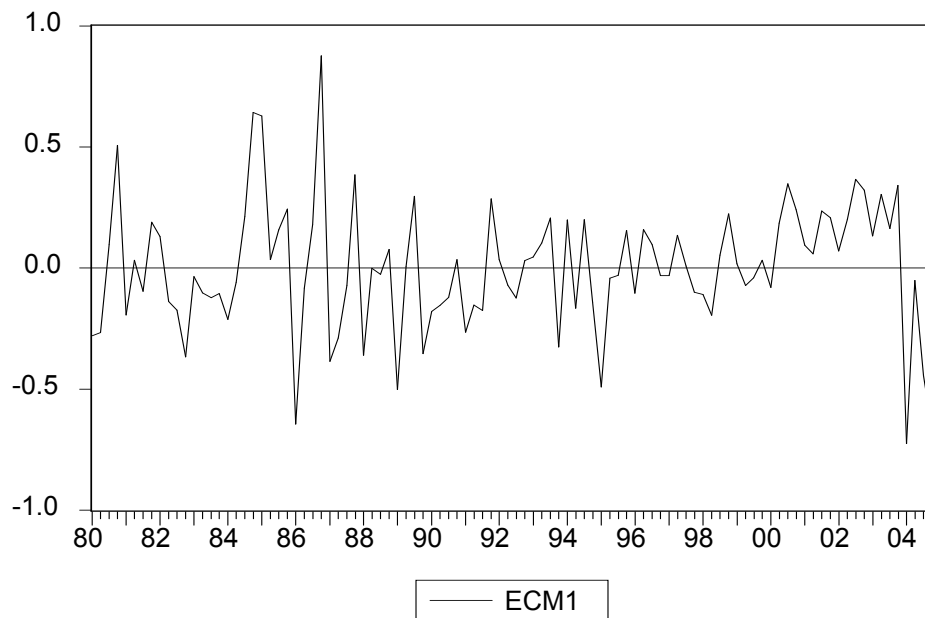
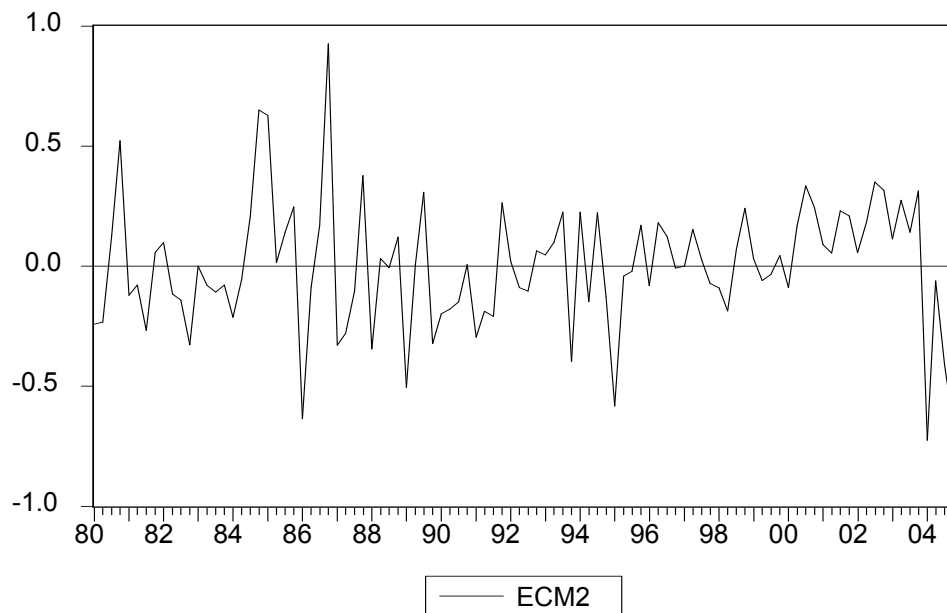


Figure 16: Plot of Error correction term for real RM2



Appendix G: Results of both narrow and broad money using real interest rates

Dependent Variable: D(LogRM1)				
Method: Ordinary Least Squares				
Sample(adjusted): 1980:4 2004:4				
Included observations: 97 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LogRGDP)	0.798658	0.042278	18.890	0.0000
D(LogCM1)	-0.329752	0.222277	-1.4835	0.1414
D(LogIR)	0.436674	0.100727	4.3352	0.0000
D(R-INTEREST(-2))	-0.017398	0.006027	-2.8866	0.0049
ECM1(-1)	-0.746262	0.095186	-7.8399	0.0000
R-squared	0.799320	Akaike info criterion		-0.039625
Adjusted R-squared	0.790595	Schwarz criterion		0.093092
Sum squared resid	4.923974	S.E. of regression		0.231347
Durbin-Watson stat	1.726883	F-statistic		91.61049
AR-test (2) F[2,96]	2.0824[0.1306]	Prob[F-statistic]		0.000000
ARCH-test(2) F[2,95]	1.1437[0.3231]	RESET test F[1,97]		2.4976[0.1175]

Dependent Variable: D(LogRM2)				
Method: Ordinary Least Squares				
Sample(adjusted): 1980:4 2004:4				
Included observations: 97 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LogRM2(-1))	0.088455	0.048563	1.821448	0.0718
D(LogRGDP)	0.777737	0.042539	18.28280	0.0000
D(LogCM2)	-0.573590	0.208912	-2.745609	0.0073
D(LogIR)	0.449023	0.100480	4.468773	0.0000
D(R-INTEREST(-2))	-0.021111	0.006212	-3.398618	0.0010
ECM2(-1)	-0.763879	0.094882	-8.050848	0.0000
R-squared	0.801943	Akaike info criterion		-0.038361
Adjusted R-squared	0.791060	Schwarz criterion		0.120899
Sum squared resid	4.829588	F-statistic		73.69259
Durbin-Watson stat	1.820218	Prob[F-statistic]		0.000000
AR-test: (2) F[2,96]	1.5284[0.2225]	RESET test F[1,97]		2.3241[0.1309]
ARCH-test:(2)F[2,95]	0.6858[0.5063]			

Appendix H: DATA SET

Year	CM1	CM2	RM1	RM2	91days- TB rate	REER	GDP	GDI	CPI
1980-1	51.619	39.677	0.1143	0.1487	5.08	92.22	2.7989535	0.0365751	135.7
2	49.33	37.491	0.1115	0.1467	5.08	97.78	2.636737	0.0372483	146.7
3	48.88	37.377	0.1248	0.1632	5.08	105	2.0264749	0.030852	158.1
4	48.222566	35.779817	0.1357	0.1788	5.09	114.97	1.4331717	0.0253247	183.5
1981-1	43.537415	34.650785	0.1436	0.19219	5.1	127.92	3.1632088	0.0691585	232.4
2	43.017751	34.701671	0.1605	0.1773	5.1	112.6	2.8693963	0.0600788	251.8
3	35.176991	27.46114	0.2215	0.24086	5.1	256.13	4.591691	0.0691585	160.1
4	42.03252	33.517018	0.2782	0.29902	9	252.49	5.020611	0.0716041	151.6
1982-1	41.716738	31.354839	0.2746	0.34406	9	261.23	4.815661	0.085939	158
2	41.215686	31.401255	0.2538	0.3326	9	266.23	5.9009106	0.0882438	132.4
3	42.692308	32.67589	0.2641	0.3469	10	240.12	6.4745901	0.1000404	136.8
4	43.116185	33.341989	0.2838	0.37137	10	242.04	8.7173392	0.1357768	137.9
1983-1	43.763087	34.222222	0.3103	0.4002	12	233.82	7.1710247	0.1174339	158.7
2	46.128501	35.578145	0.3601	0.4608	12.69	214.39	9.3029017	0.1339147	139.5
3	44.62968	34.342797	0.3772	0.4861	14	187.71	9.6189819	0.1477948	148.9
4	43.454295	34.760243	0.3978	0.5083	14	161.08	9.5116277	0.1508566	153.7
1984-1	49.273053	39.546036	0.5267	0.6437	22	134.07	17.766717	0.2483235	158.2
2	46.373057	37.713985	0.5912	0.7267	22	132.04	16.314047	0.2307582	160.1
3	43.838634	36.305587	0.6997	0.8484	22	130.9	13.991195	0.2208938	178.7
4	46.788795	39.392037	0.8681	1.0347	22	146.76	11.862275	0.2100245	200.4
1985-1	44.586895	38.906153	1.2473	1.4404	22	177.63	16.975096	0.4925188	291.1
2	42.239186	36.543753	1.5171	1.7487	22	180.15	38.817156	0.4364165	112.8
3	41.186072	35.17658	1.7027	1.9939	22	204.8	38.9218	0.4984991	128.5
4	46.542553	40.076336	2.0478	2.3957	22	147.53	43.894649	0.6925655	158.3
1986-1	52.7439	45.7672	1.1683	1.34639	22	121.85	56.918001	1.5935218	214.5
2	50.5102	43.9024	1.43853	1.65505	35	145.86	44.196665	1.571944	272.5
3	49.0982	42.7574	1.88836	2.1684	35	177.13	45.718082	1.576827	264.25
4	57.8352	49.4475	2.41797	2.82813	35	301.23	34.947244	1.1677072	256
1987-1	57.7191	48.9387	2.97723	3.51139	28	378.52	136.79239	6.6200237	241.5
2	53.4615	47.2789	3.43612	3.88546	38	258.51	138.5782	6.303783	227
3	52.6271	50.3241	5.55294	5.80706	38	139.09	160.27623	6.825092	212.5
4	54.8426	48.8673	8.34343	9.36364	43	176.03	172.16508	6.8311013	198
1988-1	56.0967	50.5368	12.7365	14.1377	38	222.05	689.62598	17.325241	151.533
2	58.349	52.7256	14.9936	16.5927	38	298.75	609.70624	15.571163	154.043
3	60.0948	54.7659	17.5747	19.2848	38	180.41	682.6309	17.670103	156.133
4	56.6394	40.5417	21.073	29.4404	38	166.55	702.92627	18.463493	158.433
1989-1	54.7437	50.018	35.203	38.5289	43	171.12	2651.9293	42.75518	119.867
2	53.6823	48.5588	48.4983	53.6153	43	190.66	2182.8939	31.347062	106.767

3	54.9074	48.5984	94.0806	106.294	43	218.15	3426.4962	27.068353	58.7333
4	53.321	46.513	89.3365	102.412	43	152.48	12995.58	27.169404	70.3333
1990-1	51.1492	44.0199	126.996	147.564	41.67	128.77	6234.8833	56.924426	58.7
2	48.9924	41.9451	233.73	273	37.67	122.32	10909.641	56.56151	33.3333
3	48.9023	41.1134	363.605	432.489	37.67	102.41	16395.367	59.416804	23.3
4	49.2204	40.8676	380.435	458.191	38.33	96.14	14492.896	55.22726	24.5
1991-1	50.2469	42.0284	523.15	625.45	35	89.91	23875.355	98.25406	20
2	48.2779	40.299	383.525	459.459	31	89.4	14074.573	85.723053	29.6
3	48.918	38.7469	339.184	428.221	35.67	79.72	13004.378	96.24116	35.9667
4	49.2489	41.3738	515.272	613.349	35.67	136.05	13963.401	82.651727	28.7667
1992-1	50.6881	42.0236	423.11	510.347	38.33	138.2	15502.683	129.07682	66.74
2	48.9667	39.4408	278.217	345.413	37.33	137.84	10661.748	139.58085	63.3667
3	55.8346	42.1789	249.689	330.528	41.33	144.87	11502.121	147.09737	81.64
4	55.7558	40.9372	316.615	431.225	37	158.39	12297.579	131.35496	83.86
1993-1	47.2538	36.7191	888.641	1143.59	26.33	151.75	32869.538	135.55232	84.22
2	43.5503	33.0591	10561.1	13912.6	23	157.87	424637.01	157.87399	81.49
3	46.9549	33.9332	15169.3	20990.5	23	156.26	591792.09	148.93663	81.88
4	30.092	21.5161	12201	17064.1	18	148.14	583455.57	196.89706	84.33
1994-1	49.5964	35.7198	2631	3653.11	20.67	141.38	85427.223	153.82647	90.79
2	47.3697	34.2667	1775.53	2454.47	15	122.31	73647.584	208.45904	94.18
3	48.0948	35.0853	3824.08	5242.04	8	107.99	105113.73	155.09192	90.45
4	46.4993	34.0901	5251.52	7163.13	6.33	103.33	205450.19	244.98257	92.93
1995-1	29.5247	22.1686	5843.92	7783.07	7	95.39	237943.61	290.51793	97.58
2	46.0197	34.4494	10247.2	13688.9	9.33	91.95	367342.58	256.29027	99.45
3	47.5596	35.174	5546.83	7500	9	91.11	188740.41	249.95144	99.03
4	48.4548	35.4805	4003.73	5467.8	10	94.51	111260.01	212.03037	103.94
1996-1	50.3342	36.4134	5817.59	8041.67	11.67	91.59	235768.31	313.60967	104.88
2	49.4862	35.1429	7298.86	10277.8	12	90.79	224453.59	243.27066	106.17
3	48.5112	32.8795	4882.3	7203.46	11.67	86.27	150474.21	240.92722	107.49
4	48.7104	33.2404	6207.04	9095.77	13.67	88.63	231383.48	303.50246	110.34
1997-1	50.3049	34.4574	7732.39	11288.6	11.33	83.69	292619.48	311.89114	110.22
2	47.3114	32.1151	4360.56	6423.91	11	83.13	124941.5	243.63974	116.20
3	45.6869	30.4951	5678.04	8506.67	10.33	86.29	186949.28	288.70272	114.39
4	46.7405	30.2492	5871.08	9071.89	10	86.23	220940.31	333.1664	117.79
1998-1	45.4528	29.8842	7778.32	11830.5	6.98	82.97	280691.08	360.25285	101.4
2	43.0781	27.9122	10305.4	15904.8	9.31	85.04	415540.33	413.78647	98.0
3	43.6151	27.7448	13858.2	21785.2	8.53	82.01	434603.31	335.22451	96.8
4	43.9441	28.0198	48000	75279.4	7.76	85.01	1407194.3	324.73617	100.4
1999-1	44.8622	29.7084	24215.6	36567.5	6.23	82.79	785750.31	426.07385	102.5
2	45.0327	30.3306	10543.5	15654.2	6.58	86.24	354776.69	442.21898	104.3
3	43.8976	29.8162	7174.55	10562.9	6.93	88.84	223467.01	432.76818	103.6
4	45.075	31.2889	6712.5	9670.07	7.28	97.15	199758.95	427.64899	103.2

2000-1	42.3018	30.2427	19373.9	27099.1	8.83	94.44	723100.86	522.72772	112.2
2	41.7581	29.2995	32162.1	45837.9	18.36	95.63	1024234.6	440.24767	114.4
3	42.0751	29.0746	26845.1	38848.8	17.63	93.18	698993.79	373.2848	113.5
4	44.4741	30.6966	15525.5	22493.8	13.4	95.76	433018.21	408.90981	111.5
2001-1	43.7188	30.6924	15712.4	22381	17.41	103.37	535939.95	537.97668	110.9
2	41.5584	29.2834	15739	22336.5	5.98	100.48	480623.42	501.36953	112.2
3	42.2532	29.2542	33052.6	47739.5	12.05	96.68	945823.4	471.60561	109.3
4	42.6281	29.4795	20063.6	29012.4	5.71	92.82	531071.94	449.46818	110.5
2002-1	39.927	28.2786	33080.5	46706.9	2.97	91.04	947299.96	586.19828	109.2
2	39.4556	27.3586	37520	54110	5.26	96.18	969930.87	551.91104	108.9
3	39.2842	27.035	72453.5	105281	6.45	99.24	1682920.4	514.71733	109.9
4	41.3322	28.1663	20850	30596.1	10.66	101.05	490411.71	530.20335	114.8
2003-1	39.7774	27.3395	14795.2	21526.2	13.52	109.94	405428.14	717.35443	117.3
2	38.2268	26.4103	11222.3	16243.4	18.51	117.42	257245.87	632.06264	118.1
3	38.7292	26.3943	11567.3	16973.1	14.85	115.35	301215.53	719.15158	120.2
4	38.9105	26.4384	18643.2	27438	21.44	118.39	449015.17	666.11136	122.0
2004-1	40.8189	27.7517	9085.2878	13363.241	7.83	123.25	596814.9	922.90072	118.0
2	39.6986	27.5262	22597.759	32590.729	6.39	119.65	744614.6	774.44509	120.1
3	39.4694	28.144	17836.044	26284.557	7.67	111.88	892414.3	790.43479	125.2
4	44.3222	29.4523	15212.131	22892.428	9.64	115.66	1040214	819.3194	130.8