UNIVERSITY OF
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STABILITY OF MONEY DEMAND AND MONETARY POLICY IN A SMALL DEVELOPING ECONOMY-UGANDA. AN ECONOMETRIC INVESTIGATION INTO SOME BASIC ISSUES

By

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Dedication

To my Dad and Mom, Kasolo Kimuli,
and to my brother, Christopher Lubwama Kimuli,
and my sisters, Miriam Nabagala Kimuli Lwanga, Catherine Nakku Kimuli,
and Esther Miriam Nalumansi Kimuli.

Declaration

The work described in this thesis was carried out by the author in the School of Business Economics and Finance, University of KwaZulu-Natal, Pietermaritzburg, from August 2002 to September 2004, under the supervision of Dr. Richard Simson.

The study represents original work by the author and has not otherwise been submitted in any form for any other degree or diploma to any University. Where use has been made of the work of others it is duly acknowledged in the text. All deficiencies that remain in the thesis are entirely mine.

Signed: ---------- Date: ----------/----------/---------

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Dr. Richard Simson (supervisor)

Abstract

A stable money demand function is the essence of planning and implementing monetary policy. This thesis explores the stability of the M2 money demand function in Uganda for the period 1980-2002. We estimate and interpret the elasticities of the determinants of the money demand function. After analyzing the dynamics of money demand determinants, the variables crucial to money demand estimation in this thesis were established as being: real income, the nominal rate of interest on Treasury bills, the actual rate of inflation and the change in the exchange rate. All variables had the correct signs as required by economic theory, where real income was found to be positive whilst the nominal rates of interest on Treasury bills, the actual rate of inflation and the change in the exchange rate all have negative signs. We estimate the money demand function for Uganda, using cointegration analysis and an error correction mechanism (ECM) on quarterly data over the sample period 1980–2002. The results from the Johansen and Juselius (1990) cointegration test suggest that real income, the nominal interest rates on Treasury bills and real M2, are cointegrated. The results of the error correction mechanism suggest that in spite of major policy reforms in the years 1987 and 1993 such as the introduction of new financial instruments, and liberalization of the financial system, the estimated money demand function for Uganda is stable only in one time period 1994-2002 that is after major policy reforms. The results of the study show that M2 is a viable monetary policy tool that could be used as an intermediate target to stimulate economic activity in Uganda. We also conclude that the feasible approach for conducting monetary policy in Uganda is to adopt an inflationary targeting regime. However, monetary policy might continue to benefit from other economic indicators by monitoring the impacts of changes in interest rates and the change in exchange rates on real money demand in Uganda.

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Abbreviations

ADF: Augmented Dickey-Fuller

AIDS: Acquired Immune Deficiency Syndrome

ATS: Automatic Transfer Services

BoP: Balance of Payments

BOU: Bank of Uganda

CMB: Coffee Marketing Board

CPI: Consumer Price Index

CSI: Commodity Systems Inc.

DF: Dickey-Fuller

EACB: East African Currency Board

ECM: Error-Correction Model

ERP: Economic Recovery Programme

FIS: Financial Institutions Statute

IFS: International Financial Statistics

IMF: International Monetary Finance

GDP: Gross Domestic Product

GNP: Gross National Product

HIV: Human Immunodeficiency Virus

LDC: Less Developed Countries

MMDA: Money Market Deposit Accounts

MMMF: Money Market Mutual Funds

MTN: Mobile Telecommunication Network

NCG: Net Capital Gains

NDA: Net Domestic Account

NER: Nominal Exchange Rate

NGO: Non-Government Organisation

NNP: Net National Product

NRS: National Resistance Movement

OLS: Ordinary Least Square

OMO: Open Market Operations

PEAP: Poverty Eradication Action Plan

PP: Phillip-Perron

SAP: Structural Adjustment Programme

RDP: Rehabilitation and Development Plan

REPO: Repurchase Agreements

RMP: Reserve Money Programme

TBs: Treasury Bills

URA: Uganda Revenue Authority

UCB: Uganda Commercial Bank

UCBL: Uganda Commercial Bank Limited

USD: United States Dollar

CHAPTER ONE

1.0 Introduction

The modelling of the demand for money has been a major focus of interest in macro econometrics since the early 1970's. The long-term money demand function has been playing an important, though different, role in macroeconomic models of the various schools of thought. Friedman's (1956) objective has been to find a stable function for money demand that depends on only a very limited number of variables. Meltzer (1963), Laidler (1966), Lucas (1988), and many others, have followed the same line of research. The empirical stability of money demand functions has been a concern for some time.[1] For the last decade, empirical researchers have applied mostly cointegration techniques to uncover a stable money demand relation in the long-term.[2]

This thesis empirically investigates the stability of the M2 money demand function in Uganda for the period 1980-2002. The purpose of this study is to establish whether or not the Ugandan M2 money demand function is stable following major policy reforms of the SAP in June 1987 and 1993. The stability of the money demand function has important implications for monetary policy in both developed and developing countries. For M2 to be an effective policy target variable, it must share a long-term relationship with other macroeconomic variables such as real income (GDP) and the interest rate. The quest for a stable, predictable money demand function is in most cases supported by extensive data sets, literature and a detailed knowledge about institutional settings. Almost the reverse is true for developing countries. Data sets are scarce and knowledge of the performance of these countries, like some of the African economies, is poor. On the other hand, the demand for knowledge regarding monetary conditions in developing countries is large. Some of the countries are trying to reform their financial systems and to introduce market-based economies. This is the case especially in countries that try to reform a centrally-planned economy into a market-based system; the fear of inflation is high. In those cases

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[1] See the review by Judd and Scadding (1982), and Goldfeld and Sichel (1990) of studies focusing on short-term stability.

[2] A few examples of early applications are Arestis (1988a, 1988), Arize (1994), Boughton (1991), Choudry (1995), Friedman and Schwartz (1991), Johansen and Juselius (1990), Hafer and Jensen (1991), and Hendry and Ericsson (1991). See also Laidler (1993), Ericsson (1998), Ericsson and Sharma (1996), Hoffman, Rasche and Tieslau (1995), Jean-Claude (2001), and Moosa (1992) for surveys of other empirical research.

knowledge of monetary conditions is an absolute precondition for a successful liberalization process. This is the main motivation of our study on monetary conditions in Uganda for the period 1980-2002.

In many countries, central banks rely on a money demand function both as a means of identifying medium-term growth targets for money supply, and also as a way of manipulating interest rates and the reserve money for the purpose of controlling total liquidity in the economy. However, the usefulness of a money demand function in the effective conduct of monetary policy depends crucially on its stability. The existence of a stable demand function, the link between money and prices, and the endogeneity or exogeneity of money are all recurring issues in the literature[3]. Obtaining stable empirical money demand equations has, however, proven elusive, leading many prominent economists to declare that no such constant relation exists (see Goldfeld and Sichel, 1990). Recently, however, a number of empirical studies of money demand have been successful in finding stable money demand relations. Among them are Hendry and Ericsson (1991) for the UK, Ericsson and Sharma (1996) for Greece, Reinhardt (1998) for South Africa, Hoffman, *et al.*, (1995) for the US, Japan, Canada, the UK, and West Germany, and Jean-Claude (2001) for Cameroon.

The expansion of monetary aggregates is substantially important for monetary policy authorities, especially in the context of economic programs in which performance criteria are determined by using limits on the monetary base or on other monetary aggregates. Hence, the role of monetary aggregates is determined through a policy-making perspective. Estimating money demand becomes a vital focus, as the empirical relationship represented by the money demand equation enables one to examine the interaction between monetary aggregates and other economic indicators.

In light of the fundamental changes to the financial system, the Ugandan economy has altered in the last two decades. Implementation of major policy reforms and deregulations together with the introduction of new financial products has changed the structure of the financial system. In view of the fact that broad money comprises a wider

[3] Stability as used in the literature refers to the actual behaviour of parameters overtime or the uncertainty associated with the changes in the value of parameters over time. Therefore, a parameter is said to be stable if it is constant overtime or if changes in the parameters are known with certainty.

range of financial instruments reflecting the consequences of the financial innovations and the recent changes in the Ugandan financial system, M2 demand is the scope of this study.

As it was mentioned before, the relation between the demand for money balances and its determinants is one of the fundamental questions in economic policy. The elements of our particular interest are the demand for real money balances' sensitivity to changes in real income, interest rates, the actual inflation and the change in the exchange rate, and demand stability over time in Uganda. This is because empirical investigation of the demand for money in Uganda has received little attention. A few studies, which have been conducted on the demand for money in Uganda, have given conflicting results. There exists evidence of both stability and instability in the relationship of the long-term money demand models. For example, papers written by Atingi-Ego and Mathews (1996) and Jean-Claude (2001) show results of a stable relationship while papers by Henstridge (1999) and more recently, George (2002) demonstrate observations of instability. One might ask the question why empirical results point in such different directions? First of all, different studies cover different time periods. Second, there are many different opinions about the specification of the money demand function;

- Should the demand for real money balances be measured by narrow or a broad definition (M1 or M2)? For example, different theories of money demand can be considered to fall into two categories, transaction theories and asset or portfolio theories.[4]

- Should the function include permanent income or current income?

- Should the short-term interest rate or long-term interest rate represent the opportunity cost?

Consequently, the researcher's opinion of what is the appropriate explanatory variable also affects the results of the studies. For this study, each of the studies previously done on Uganda considered different variables for the money demand function in different time periods. Jean-Claude (2001) using cointegration analysis examined the empirical relationship among money, prices, income, and a vector of interest rates in Uganda for the period 1982 through 1998. Jean-Claude finds that income, domestic and foreign interest

[4] See Judd and Scadding (1982: 997), Keynes (1936: 170) and Handa (2000: 36).

rates have a significant impact on real broad money. He further finds that there is income homogeneity, a strong own-rate-of-return effect, a high degree of international capital mobility, and asset substitutability, and demonstrates that both domestic and foreign factors are important determinants of inflation in Uganda. Although his study did not account fully for the major policy reforms, he nonetheless concludes that money demand is stable in Uganda for the study period. On the other hand, George (2002: 9) using the Cochrane-Orcutt method examined the money demand function in Uganda for the period 1981 through 1998. George finds that real income; the interest rate, the inflation and the real effective exchange rate have no significant impact on M2. His study did not account for the major policy reforms, which occurred in 1987 and 1993 respectively. George therefore concludes that there is no evidence of stability in the demand for money in Uganda for the study period.

The preceding studies have provided some insight in relation to the stability of money demand in Uganda. However, none accounted for the major policy reforms in Uganda especially during the 1987 and 1993 periods. This thesis fills this void by examining the stability of the M2 money demand function in Uganda for the period 1980 through 2002. Unlike the previous studies on the money demand function in Uganda, the present study fully accounts for the major policy reforms during the 1987 and 1993 periods. The study applies both a cointegration framework and an error correction mechanism to test for parameter stability. The study finds a stable real money demand function in Uganda for only one time period 1994-2002 after major policy reforms.

The remainder of this Chapter proceeds as follows: Section 1.1 provides the significant motivations for the analysis of money demand function stability in Uganda. Section 1.2 provides the *a priori* theoretical assumptions. Data issues are briefly presented in the next section. Section 1.4 provides a summary of the methodology of the study. Section 1.5 presents a brief discussion of the empirical results obtained from this study. Section 1.6 concludes the chapter with a summary of the major findings from the study.

1.1 Motivation for the analysis of money demand function

The money market plays a critical role in virtually all theories of income determination and is, as a result, one of the keystones of econometric modelling (see Lieberman, 1980: 44). Most economists use macroeconomic models, which assume that money demand is

consistently related to a number of predetermined variables, for example income and interest rates (see Hafer and Hein, 1982: 555). That is, the aggregate money demand functions link a relationship between transaction activity and the opportunity cost of holding real money balances. The central proposition of these models has been the proposition of a stable long-term aggregate demand function (see Hoffman, Rasche and Tieslau, 1995: 317). As mentioned before, an econometric relationship is stable if parameters in such a relation are not subject to permanent changes over time (see Laumas and Spencer, 1980: 456).

In this thesis, what is being sought is the existence of a long-term broad money demand equilibrium relationship in the presence of economic policy reforms. A stable demand for money function aids the effectiveness of the monetary policy; it is an essential link in the transmission mechanism of monetary policy (see Judd and Scadding, 1982). The significant motivations for the analysis of money demand functions are: First, a predictable long-term relationship between monetary aggregates such as broad money, and other jointly determined economic variables are important for general macroeconomic equilibrium. In order to predict the effect of changes in the supply of money on variables such as income, prices, and the rate of interest, with any degree of certainty, one must be reasonably confident that the demand function itself does not shift. So, the question of whether the money demand function is stable or not is crucial in economic theory and policy.

The second motive for studying the long-term stability of money demand is its significance for monetary policy. The policy and stability nexus was clear during the Ugandan era of monetary targeting, an era described concisely by Musinguzi (1996: 4). The basis of the switch in policy from discretion to rules in 1998 is apparent in the Bank of Uganda's intermediate target for broad money (M2) as a tool for controlling inflation. Monetary targeting is based on the monetarist perception of a strong and persistent correlation involving the growth of money demand and inflation. The success of targeting depends on the existence of a stable money demand relationship. However, as Jean-Claude (2001: 3) suggests, a stable money demand function remains very important in the new policy era of inflation targeting. Monetary aggregates such as M2 are key policy indicators and the stability of the relation between money demand and its customary determinants, influences the reliability of such measures.

The switch in policy emphasis from money to inflation targets does not alter the prospect of policy-induced changes of the cash rate[5] causing money demand instability. This effect of monetary policy on money demand is an example of the Lucas (1976) critique of economic policy generally.[6] Conventional money demand structures invariably contain interest rates and often include commodity prices or inflation, all of which may be influenced by monetary policy actions. In summary, the switch to inflation targeting has not removed the nexus between monetary policy and the stability of money demand. Therefore, the question of money demand stability in Uganda remains relevant.

The third significant motivation is the improvement in time series techniques, which accommodate policy reforms and long-term estimations in underlying relationships. The analysis of the demand for money has recently seen that "it is the application of new econometric techniques rather than advances in theoretical monetary economics which has provided the most informative research findings in recent years" (Taylor, 1991). The technique of cointegration and error correction modelling has allowed greater empirical analysis to be made of the traditional theories of money demand by providing new methods of incorporating the short-term dynamics into the long-term function, whilst also being able to correct for the disequilibrium experienced in the short-term. This thesis therefore examines the stability of the money demand function in Uganda in the context of cointegration analysis. The dynamics of money demand are important, with inflation and income elasticities being much smaller in the short-term than in the long-term (Ericsson and Sharma, 1996: 2).

1.2 A *priori* theoretical assumptions

Theory suggests that the demand for money is related to the use of money as a medium for transactions, and a set of opportunity cost variables which determine the portfolio demand for money as an asset (see Baumol, 1952: 545; Barro and Fischer, 1976: 133; Cuthbertson and Barlow, 1991: 72; Laidler, 1993; Sriram, 1999b: 23 and Tobin, 1956: 241).

[5] The Cash Rate is an interest rate set by the Reserve Bank to implement monetary policy, so as to maintain price stability. By setting the cash rate, the Reserve Bank is able to substantially influence short-term interest rates, such as the 90-day Treasury bills rate. In turn, this influences the overall level of economic activity in the country and therefore inflation. Note however that this sequence takes time and the pace of adjustment varies depending on the economic context.

[6] Ericsson (1998: 311) argues that where instability of money demand exists, the unstable parameter estimates are evidence for the relevance of the Lucas critique.

Opportunity cost variables for Uganda include interest on Treasury bills, actual inflation rates (the opportunity cost of holding money relative to real goods) and the exchange rate (the opportunity cost of holding money relative to assets denominated in foreign currency)[7]. The transactions demand, or scale variable is income proxied by gross domestic product (GDP). Theory suggests that the elasticity on the scale variable should be unity for the quantity theory of money and one half suggested by Baumol. In general, the elasticities on the opportunity cost of holding money will have a negative sign: as other assets exhibit, or are expected to exhibit, higher returns, then the quantity demand for money is reduced.

1.3 Data issues

The data used in this study consist of quarterly observations on variables selected for the empirical analysis based on the studies done by Boughton (1991); Cagan (1956); Ericsson and Sharma (1996); Ericsson (1998); Hendry and Ericsson (1991); and Laidler (1993) as comprehensively discussed in Chapter Two, Section 2.7.2. The variables chosen include: broad money (M2) – defined as M1 (which includes currency in circulation) plus quasi money (demand deposits, time deposits and savings deposits) all measured on a quarterly basis. Empirical estimates are made using real money balances (*M2/P*) to obtain feasible and meaningful results. Real income (Y/P) (proxied by real GDP at current prices), the consumer price index (P) (1995 = 100), the interest on the 91-day Treasury bills (R), the actual inflation rate (π) measured from the consumer price index and the depreciation or appreciation of the Ugandan shilling per U.S. dollar (q). The data were collected from the International Financial Statistics' (IFS) reports for the period 1980:1 through 2002:4.

Table 4.1, pp. 108, briefly presents an analysis of the time-series characteristics of the data set. There are two main conclusions. First, that both quarterly inflation and the change in the exchange rate are stationary; secondly that the time-series characteristics of real M2, real income and the interest rate are non-stationary in level form but stationary in first difference form.

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[7] In the data used for the analysis in this thesis, the change in the exchange rate is expressed as Ugandan shillings per US dollar, with a depreciation being an increase in shillings per dollar.

1.4 Methodology

In this study, we adopt a money demand function model for Uganda suggested by Ericsson and Sharma (1996: 6) after a comprehensive review of the money demand literature in Chapter Two. In addition, the monetary policy tools discussed in Chapter Three of this thesis precisely support the money demand function model chosen. Consequently, real money demand is presented as the independent variable whilst real income, the interest on Treasury bills, the actual rate of inflation and the change in the exchange rate are the explanatory variables. This type of model is explicitly presented in Equation (2.3) of Section 2.7.3 (pp. 42) in Chapter Two. The anticipated signs of the coefficients are: real income is anticipated to be positive specifically, unity for the quantity theory of money and one half suggested by Baumol. The coefficients of the interest rate, the actual rate of inflation and the change in the exchange rate are anticipated to be negative. The results obtained from this study show that all the variables had the right anticipated signs.

First, a single-equation model of the (non-stationary) levels of real balances is estimated in Chapter Four, under Section 4.4.2 as presented in Table 4.2 (pp. 110) in an attempt to establish a model consistent with *priori* beliefs, within which there might be evidence of a cointegrating relationship. Second, based on the specification of the single-equation estimates, a VAR is estimated and the Johansen (1996) procedure is used to examine whether there is a unique cointegrating relationship and, if so, whether it could be shown that a single-equation estimate of money demand would be weakly exogenous with respect to the explanatory variables (see Tables 4.2: and 4.3: pp. 110 & 111 respectively). Third, using error correction mechanisms where appropriate, stationary models of the changes in real money balances are estimated (see Section 4.6; Tables 4.4: 119, 4.5a: 124 and 4.5b: 125).

The single-equation models and the specification of the VAR to which the cointegration analysis was applied, were subjected to standard diagnostic tests. In the latter case, the main consideration was the balance between information and efficiency in the length of lags used in the VAR. This is assessed with reference to tests for serial correlation and normality in the residuals of the equations in the VAR. It became apparent that the distributions across the whole sample 1980-2002 were rarely close to normal, but for several specifications were normal across shortened samples, which ran from 1988-2002 and 1994-2002. Given the variety of changes in the 1980-1993 sub-period, a key criterion

for model adequacy was the stability of the model specification and parameter estimates across the 1994-2002 sub-sample after major policy reforms. While parameter estimates did vary in models for the whole sample 1980-2002 and across sub-samples 1988-2002 and 1994-2002, only the specification for 1994-2002 is found to be stable.

Appendix I briefly presents the CUSUMSQ (residual) plots. These plots are based on the cumulative sum of squares of recursive residuals. We find that in Plot C (pp. 160) there is parameter stability for period 1994-2002. The CUSUMSQ plot for 1994-2002 stays within the five *per cent* significance level. However, the parameters and hence the variance for the 1980-2002 (whole sample) and 1988-2002 periods are unstable because their plots of CUSUMSQ move outside the five *per cent* critical lines.

1.5 Empirical results

The first step of our empirical analysis is to test for unit roots using a standard Augmented Dickey-Fuller Test (ADF) procedure (Dickey and Fuller, 1979: 427) where the null hypothesis is that a series contains a unit root, i.e. that the series is non-stationary. The results indicate that inflation and the change in the exchange rate do not have unit roots at the level form and thus they are stationary. On the other hand, real M2, real income and interest rates have unit roots at the level form. They are however stationary at the one *per cent* level of significance, after first differencing. The ADF unit root tests are reported in Chapter Four; Table 4.1 (pp. 108).

Having determined the order of integration for each of the time series, we next employ the Johansen and Juselius cointegration procedure to examine the existence of a long-term relationship between real income, interest rates and real M2 (see Ericsson and Sharma, 1996: 18). The results indicate that there is one cointegrating vector in the system. The trace statistic rejects the null hypothesis of no cointegration at the five *per cent* significance level. However, the null hypotheses of at most 1 and 2 cointegrating vectors could not be rejected, since the test statistics are less than critical values. The existence of cointegration suggests that there is a stable relationship between real income, interest rates and real M2. Table 4.2 (pp. 110) reports the estimated parameters of the Johansen and Juselius cointegration test. The cointegrating vector was normalized on real M2 by setting its coefficient to -1 (see Table 4.3: 111). Consistent with economic theory, real income has a positive and statistically significant effect on real M2. Interest rates have a negative and significant influence on real M2.

The final step in our empirical investigation involves checking for parameter stability in the money demand function over the study period. We employ the error correction mechanism to examine parameter stability over the study period 1980-2002 (see Ericsson and Sharma, 1996: 26). In Section 4.6.1, we present the results of this analysis for our whole sample period. The results suggest that the inflation rate and income variables performed poorly, the R^2 is low and although there is a return to equilibrium after a shock, these results suggest that (in terms of our stability requirements) real money demand is not stable over the whole sample covering the years 1980 to 2002. Consequently, the study period was broken down into sub-samples 1988-2002 and 1994-2002. Armed with our prior knowledge that there were two major policy changes in Uganda in 1987 and 1993, we re-estimated our model. First, we looked at removing just the first policy change in 1987. When we did this, we had some improvement in our model in terms of stability: the fit improved but two variables still had the incorrect signs. Also, the CUSUMSQ for this period moved outside the five *per cent* critical lines. On this basis, we concluded that despite taking out one policy change, real money demand was still unstable.

We then proceeded to do a second re-estimation but removing the effect of the second policy change in 1993 (and thus also the first) and were pleased to note that all variables now had the correct sign in terms of economic theory, although real income and the exchange rate were statistically insignificant. Appendix I reveals that Plot C (pp. 160) of the CUSUMSQ stays within the five *per cent* critical bounds, indicating the stability of the parameters and thus the overall model. Given that our model conforms to economic theory and the adjustment to equilibrium is in the right direction, even though the R^2 was a modest 0.24 (with $\overline{R}^2$ of 0.05), we concluded that our final estimation was one that exhibits stability of Ugandan M2 money demand function for the period 1994 through 2002.

1.6 Summary

This thesis examined the stability of the M2 money demand function in Uganda for the period 1980 through 2002. The ADF framework was used to determine the order of integration for real M2, real income, interest rates, the actual inflation rate and the change in the exchange rate. The Johansen cointegration test was used to ascertain the existence of long-term equilibrium relationship amongst the time series. To check for parameter

stability, we employed the error correction mechanism from which we derived the CUSUMSQ plots.

The results from the ADF test suggest that only inflation and the exchange rate variables have zero order of integration [i.e. I(0)]. The rest of the variables are integrated of order one [i.e. I(1)]. The Johansen and Juselius cointegration test indicates that there is a long-term relationship between real income, interest rates and real M2. The existence of cointegration among the series suggests that the M2 money demand function in Uganda is stable. The result from the ECM-CUSUMSQ frameworks suggest that the Ugandan M2 money demand function is only stable in one time period 1994-2002 and this after major policy reforms in 1987 and 1993. The results of this study indicate M2 as a feasible monetary policy tool in Uganda.

In conclusion, based on the stable real money demand function found for the one time period 1994 through 2002, an inflationary targeting regime is feasible in Uganda. Monetary policy in Uganda must target the inflation rate but also monitor the impacts of changes in interest rates on Treasury bills and the change in the exchange rate on real money demand.

The rest of the thesis is organized as follows: Chapter Two reviews the theoretical literature on money demand providing a clear guide on the selection and inclusion of variables into a money demand function. In addition, the distinction between real and nominal money balances, and inflation are clearly highlighted in this chapter. In Chapter Three, we discuss monetary policy management in Uganda emphasizing the usefulness of a stable money demand function for effective monetary policy management. Chapter Four presents and analyses the results obtained from the estimation of an error correction model to real money demand in Uganda. Chapter Five gives a summary of the findings and concludes the study.

CHAPTER TWO

LITERATURE AND THEORETICAL DEVELOPMENTS ON THE DEMAND FOR MONEY

2.0. Introduction

The demand for money assumes an important component of theoretical models of any economy and as such has been the subject of many studies for a wide variety of countries. Money is not itself the name of a particular asset and is best defined independently of the particular assets that may exist in the economy at any one time, since the assets which function as money tend to change over time in any given country and among countries. At a theoretical level, money is defined in terms of the functions that it performs (Handa, 2000: 4). Basically, money serves as: a medium of exchange and a standard unit in which prices and debts are expressed; a store of value; a standard of deferred payment; and a unit of account.

This chapter briefly reviews the main theories of money demand. This literature review is based on theoretical works from the classical tradition to Friedman's modern quantity theory of money. In this effort, it hopes to provide a reference in furthering both the theoretical and empirical research on money demand.[8] When initially formulating empirical models it is the underlying theory that is customarily relied on to construct the specifications of the equation to be tested. Once the empirical estimates are obtained they are assessed in terms of their consistency with this theory. As a result, it is crucial to review all the relevant economic theory surrounding the subject before proceeding with the actual estimation of the model. This ensures that the initial specification that the model is built on will then include valid relationships between variables, while also providing a basis for inclusion of the variables themselves.

The relation between the demand for money balances and its determinants is a fundamental question in economic policy. The most important things are the interest rate sensitivity and stability of money demand over time. The sensitivity of money demand to interest rates determines the slope of the LM curve (liquidity preference and money supply relationship); it thus influences how monetary and fiscal policy affects the economy. The stability of the money demand function is also crucial since having a stable money demand

function means that when estimated in one period it would be able to predict well in another period and thus is useful for monetary policy purposes.

The theory states that the demand for money is a demand for real balances. We are to show below that the variables crucial to money demand estimation in our study are: real income, the rate of interest on Treasury bills, the actual rate of inflation and the change in the exchange rate. In economic theory, the sign of the real income coefficient has been established as being positive (specifically, equal to one for the quantity theory of money or 0.5 as suggested by Baumol). The signs of the coefficients for the interest rate, the actual rate of inflation and the change in the exchange rate are anticipated to be negative (see Ericsson, 1998: 298; Ericsson and Sharma, 1996: 6 and 1998: 420; Mishkin, 1998: 382; Sriram, 1999b: 23). However, estimating money demand functions requires a well-defined procedure to capture the long-term equilibrium relationship. We do this with cointegration.

Cointegration procedures are the latest econometric techniques, which represent an attempt to capture the long-term equilibrium relationship (see Johansen, 1996). Consequently, if such a relationship is stable over the sample period there should exist a cointegrating vector. However, when the long-term relationships are shifting due to innovations and the impact of the innovations has not been eliminated or somehow captured in the definition of the variables or the procedure used, the sample data would not show a stable long-term relationship. In this case, the cointegration analysis gives results indicating that a long-term relationship does not exist. We hope to determine, with these techniques whether the demand for money function in Uganda is stable or unstable.

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 behavior and real money demand unchanged. On the contrary, individuals whose real behavior is affected by the changes in price level, when real variables values remain constant, will suffer from money illusion. The term money illusion, first introduced by Irving Fisher, was defined as "a failure to perceive that the dollar, or any other unit of currency, expands or shrinks in value" (see Fisher, 1928). Fisher considered money illusion to be an important factor in business-cycle fluctuations. We review more of his theoretical contribution in the subsequent sections.

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[8] Refer to Sriram (1999b and 2000a) for a survey of recent empirical work using the cointegration techniques in a number of industrial and developing countries. Ericsson (1998: 297) and Sriram (2000b) discuss important details concerning the modelling and estimating the demand for money.

In this chapter, we show that the stability of money demand is one of the most important recurring themes in the theory and actual implementation of monetary policy. In fact, Laidler (1982) suggests that:

> *"No proposition in macroeconomics has received more attention than that there exists, at the level of the aggregate economy, a stable demand for money function".*

Few economists would disagree with this view, especially following the adoption by many central banks of inflation targets as part of monetary policy. However, despite intensive analytical and empirical efforts; there is no general consensus concerning the stability[9] or (instability) of money demand function.[10] Without a stable money demand function it is very difficult to conduct monetary policy.[11]

Sometimes instability is illustrated by unexpected changes in the income velocity of money. More frequently, however, stability is analyzed in terms of the money demand function or the relationship between money stocks and a few key macroeconomic variables such as aggregate income and interest rates. In order to clarify conceptual differences and to provide a framework for the issues to be discussed in this study, it may be useful to distinguish; between three sources of instability:

(i) The income velocity of money will change in response to fluctuations in interest rates as well as to movements in other arguments of the money demand function, which are not related to income. Moreover, velocity changes may be observed because of lags in the adjustment of money demand to income. Usually, however, such changes are both predictable

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[9] See Barro, 1993.

[10] In a recent review of the literature, Judd and Scadding (1982: 1014) concluded that the major shifts in US money demand could be related to financial innovations. However, when testing money demand functions for the seven major countries, OECD (1984) found that most shifts had been associated with the adoption of aggregate money supply target.

[11] On the other hand, before drawing firm conclusions, it is also important to recall Hendry's observation that "instability in an estimated *econometric* equation provides little evidence about the stability or otherwise of the sought-after *economic* relationship", (see Hendry, 1979: 217).

and transitory, and they can be interpreted as movements along an otherwise stable money demand function with constant lag structures;[12]

(ii) The money demand function itself may shift, reflecting either unstable parameters or new developments and involving unexpected velocity changes as well. For instance, the process of financial innovation and deregulation may at times accelerate, possibly affecting both the interest elasticity of different monetary aggregates and the balances held at each level of interest rates.[13] Another source of instability may be shifts in the precautionary demand for money that are related to changes in confidence, and ongoing institutional changes which can create "ratchet"[14] effects. So, both current and earlier peak levels of interest rates and aggregate income affect money demand;

(iii) Since changes in money stocks are induced by movements in money demand as well as by factors on the supply side, the money stocks observed at a given point in time might be "off" the money demand function, unless the speed of adjustment is very high. In other words, over shorter periods the money stocks actually held may not correspond to the money balances desired. Such discrepancies will, of course, induce large and unexpected changes in velocity and can also give the impression that the money demand function has become unstable.

Money demand theories have evolved over time and this chapter briefly touches on developments starting with classical theory and ending with more recent contributions.[15]

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[12] It is more difficult to classify velocity changes caused by shifts in the composition of either aggregate demand (see Tatom, 1983: 10) or monetary aggregates (see Wenninger, 1984b: 6), as these are unpredictable, though usually only transitory.

[13] In other words, financial innovation may induce a shift as well as a change in the slope of the money demand function (for detailed illustration see Johnston, 1984) though the size and even the direction of these changes are difficult to predict (see Simpson, 1984: 249; and Wenninger, 1984a: 5).

[14] To cause to increase or decrease by increments.

[15] Refer to Barber (1967), Barro and Fischer (1976), Cuthbertson and Barlow (1991), Goodhart (1989), Goldfeld and Sichel (1990), Grossman (1991), Laidler (1993), McCallum and Goodfriend (1987), Papademos and Modigliani (1990) and Schumpeter (1954) for earlier surveys of literature on theoretical developments on money demand.

The rest of the chapter is organized as follows: Section 2.1 presents the classical economists views on the money demand function. Section 2.2 presents the neoclassical view. Section 2.3 presents the Keynesian theory perspective, while the post-Keynesian theories are discussed in Section 2.4. Sections 2.5 and 2.6 present the views of the asset and consumer demand theories respectively. Section 2.7 discusses the definition of the demand for money, highlighting the difference between real and nominal balances. In this section we also look at the modelling of the demand for money function from both a theoretical and practical point of view. The next section discusses the theoretical estimation of the long-term and short-term money demand functions describing the cointegration and error correction methodology employed in Chapter Four of this thesis. A final section provides a chapter summary and presents our conclusions.

2.1. Classical economists view on the money demand function

Economists beginning from the classical tradition prevailed upon these four major functions of money to formulate their theories of money. According to the classical theory, all markets for goods continuously clear and relative prices flexibly adjust to ensure that equilibrium is attained. The economy is always at the full employment level except for transitory deviations as a result of real disturbances. In such an economy, the role of money is simple: it serves as the numeraire, that is, a commodity whose unit is used in order to express prices and values, but whose own value remains unaffected by this role. It also facilitates the exchange of goods (medium of exchange) as Jevons (1875: 38) pointed out that the use of money overcomes a lack of a double coincidence of wants.[16] However, it does not influence the determination of relative prices, real interest rates, the equilibrium quantities of commodities, and thus aggregate real income. Money is "neutral" with no consequences for real economic magnitudes. Its role as a store of value is perceived as limited under the classical assumption of perfect information and negligible transaction costs. The roots of the modern theory of money demand began to establish from the early contributions of Leon Walras, whose money demand theory is simply a part of his

[16] See Goodhart (1997) for a recent study on a historical account of various concepts of money. Ritter (1995: 134) presents the theoretical underpinning on moving from barter to the fiat- money regime. The references contained in the article point out various studies on the evolution of money.

general theory of economic equilibrium (see Schumpeter, 1954: 1082).[17] Apart from Walras, there was little emphasis on money demand *per-se* in the pre-1900's. However, there was a clear recognition that the economic agents under a specified set of circumstances would desire some particular quantity of real money holdings (see Mill, 1848 and Wicksell, 1906). The concept of money holdings began to take a formal shape in the quantity theory especially through the writings of Pigou (1917: 38). Earlier, Fisher (1911) provided the famous formulation of the quantity theory through the so-called equation of exchange.

2.1.1. The classical quantity theory approach

The quantity theory brings forth a direct and proportional relationship between the quantity of money and the price level. This relationship was developed in the classical equilibrium framework by two alternative but equivalent expressions. The first version called "equation of exchange" is associated with the work of the American economist Irving Fisher (1911) and the second "Cambridge approach or cash balance approach" is associated with a group of classical economists in Cambridge, which included A. Marshall (1923) and A.C. Pigou (1917). Both versions are primarily concerned with money as a means of exchange, and hence, they yield models of the transactions demand for money. While Fisher (1911) concentrated on institutional details of the payment mechanism in his analysis, Cambridge economists focused on motives for holding money by individuals.

2.1.1.1. Fisher's "equation of exchange"

In the classical quantity theory, demand for money was not even mentioned, instead what was stressed was a concept called "*transactions velocity of circulation of money*", which measures the average number of times a unit of money is employed in carrying out transactions in the given period. This approach associated with Fisher (1911), is based upon the "equation of exchange", $M_s V_T \equiv P_T T$, which relates the quantity of money in

[17] Schumpeter was referring to Walras's 4th edition of the *Elements d'economie politique pure* (1900), in which Walras's pure theory of money was fully developed, although he has been

circulation M_s, to the volume of transactions T, and the price level of articles traded P_T, in a given period through a proportionality factor V_T called the "transactions velocity of circulation". This equation is an identity and only has economic content once you fix V_T and T.

Referring to Fisher's writings, Schumpeter (1954) pointed out that in the equation of exchange, M_s is normally the most important "active" variable and P_T is the "passive" element. Although, M_s, V_T, and T are only "proximate causes" of P_T, there are scores of other variables, which act through M_s, V_T, and T on P_T. The velocity variable incorporates the technological factors and an institutional arrangement of the monetary system governed by non-monetary factors and is assumed to be stable in the short run. The quantity of money is assumed to be determined independent of other variables shown in the equation, and so is the variable T, the volume of transactions. In the classical economics framework of full-employment equilibrium, it is assumed that there exists a stable ratio between the level of transaction and output. Given these considerations, the equation of exchange can be shown as: $\overline{M}_s \, \overline{V}_T = P_T \, \overline{T}$ where bars over M_s, V_T, and T signify that these variables are determined independently of others. It is evident from this framework by treating $\overline{M}_s$ exogenous and holding $\overline{V}_T$ and $\overline{T}$ constant, the equilibrium price level moves in strict proportion to the quantity of money, that is, money is "neutral".

2.1.1.2. Cambridge approach or cash balance approach

As an alternative paradigm to the quantity theory approach to the demand for money, the cash balance approach relates the quantity of money to nominal income. It stresses the role and importance of money demand in determining the effect of money supply on the price level. This so-called Cambridge approach or cash balance approach is primarily associated with the neoclassical economists Marshall (1923) and Pigou (1917), among others associated with Cambridge.

Three issues are different in the cash balance approach compared to Fisher's quantity theory of money:

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developing his theory over the years 1876-1899.

1) The Cambridge economists assumed that people hold money to make transactions. This was in contrast to the earlier approach by Fisher, who raised the question; what determines the amount of money an economy needs to carry out a given volume of transactions? The focus changed from a model where V was determined by the payments mechanism to one where agents have a desired demand for money (Cuthbertson and Barlow, 1991: 16).

2) They also assumed that two functions of money motivate people to hold money: its utility as a medium of exchange and as a store of wealth. Money is held not only as a medium of exchange as in Fisher's case, but also as a store of value that provides satisfaction to its holder by adding convenience and security. The concept of money demand comes across more explicitly as discussed in the subsequent sections below.

3) The Cambridge economists indicated the role of wealth and the interest rate in determining the demand for money.

The Cambridge economists, particularly Pigou (1917: 45), assumed that for an individual the level of wealth, the volume of transactions, and the level of income over short periods at least move in stable proportions to one another. Other things being equal, the demand for money in nominal terms (M_d) is proportional to the nominal level of income (Py) for each individual and hence, for the aggregate economy as a whole, that is: $M_d = kPy$. It was recognized that k might depend on other variables in the consumer allocation problem such as the interest rates and wealth, but the main focus was the level of transactions.

Incorporating the money market equilibrium condition of $\overline{M}_s = M_d$, an equivalent expression of $\overline{M}_s * (1/k) = \overline{M}_s V = Py$ can be obtained. Since, $\overline{M}_s = M_d = M$ in equilibrium, the equivalent expression leads to the familiar quantity theory formulation of $MV = Py$ relating the quantity of money to the nominal income. Unlike in Fisher's formulation, V is termed here as the "income velocity of circulation" determined by technological and institutional factors and is assumed to be stable. Given that the real income y is at the full-employment level and V being fixed, an increase in the quantity of

money results in a proportional increase in P, that is, money is "neutral", the familiar quantity theory exposition.

The Cambridge formulation of the quantity theory provides a more satisfactory description of monetary equilibrium within the classical model by focusing on the public's demand for money. In particular, the demand for real money balances is the important factor determining the equilibrium price level consistent with a given quantity of money. The Cambridge economists' view on the money demand function influences both the Keynesian and the Monetarist theories. And it is very important, that the Cambridge approach emphasized individual choice, but it did not point out the influence of interest rates on the demand for money.

2.2. Other neoclassical approaches on the money demand function

The neoclassical economists considered the primary role of money as a medium of exchange. It was sought for the command over goods and services that it provided. Money was economically interesting as it was spent and circulated throughout the system and its store of value function was also emphasized. One shortcoming, however, was that there was no explicit role for interest rates in determining the demand for money in their writings. They also attributed various other factors affecting the demand for money. For example, Marshall (1923) and Pigou (1917: 39) suggested that the uncertainty about the future was a factor influencing the demand for money (see Laidler, 1993: 53). Cannan (1921: 456) postulated a negative relationship between money demand and anticipated inflation, which was also recognized by Marshall (1926), (see McCallum and Goodfriend, 1987).

Previously, the Cambridge economists implicitly stated the potential importance of the interest rate as a key variable affecting money demand by the term *"ceteris peribas"* (other things being equal) where, the factor k in the Cambridge model as discussed above contained a possible influence of the rate of return on alternative assets. Lavington (1921) identified the interest rate as a key determinant of the marginal opportunity cost of holding money, with which Fisher (1930) later concurred. Hicks (1935: 2) argued that the money demand theory should be built within a framework of traditional value theory, in which money demand is the outcome of a problem of choice among alternative assets subject to a wealth (balance sheet) constraint, and hence, is influenced mainly by anticipations of yields

and risks of these assets as well as by transactions costs. However, it was Keynes who provided a convincing explanation on the importance of the interest rate variable affecting money demand and emphasized the significance for macroeconomic analysis of the interest sensitivity of money demand or "liquidity preference".

2.3. Keynesian theory

Keynes provided a more rigorous analysis than his predecessors and looked at the money demand question from an entirely different analytical approach. When the classical and neoclassical economists analyzed money demand mainly in terms of "money in motion", that is, there is no hoarding possibility as all income is spent; Keynes analyzed money in terms of "held" (as in the Cambridge approach of the quantity theory). He focused on the motives that lead people to hold money and the money demand arising from these motives.[18] In this respect, Keynes associated himself with the Mercantilist views.

Keynes postulated that individuals held money on the basis of three motives: transactions, precautionary, and speculative. The transactions motive is similar to the emphasis the quantity theories placed on money as a medium of exchange. He hypothesized that the level of transactions conducted by an individual, and the aggregate of individuals, bears a stable relationship to the level of income thereby suggesting that the "transactions demand" for money depends on the level of income. The transactions demand for money arises because of the non-synchronization of payments and receipts. Keynes' second motive for holding money was the precautionary one, defined by him as the individual's desire for security as to the future cash equivalent of a certain proportion of total resources (Keynes, 1936: 170). In other words, the precautionary motive for holding money arises because of the uncertainty of future income and consumption needs and purchases. He further stated that the precautionary demand for money provides for contingencies requiring unscheduled expenditures for unforeseen opportunities of advantageous purchases, and also to hold an asset of which the value is fixed in terms of money (Keynes, 1936: 196). Keynes' significant contribution to the money demand theory, however, came from the role of the speculative motive and his analysis of the demand for money balances arising from this motive. The speculative demand for money is what Keynes termed as "liquidity preference". Unlike in the case of Marshall (1923) and Pigou

(1917), who focused on uncertainty in general, Keynes' focus was on one economic variable, that is, the future level of the interest rate.

The store-of-value function is emphasized in the speculative motive of the demand for money. Individuals have a choice as to the form in which to hold their wealth. They may hold these in a monetary form or in bonds. The price the individuals are willing to pay for bonds depends on the rate of interest, as the prospective buyers would wish to earn at least the going rate of interest on their bond portion of their portfolio. Keynes (1930) argued that, at any time, there was a value or perhaps a range of values of the rate of interest that could be regarded as normal. When the rate is above this normal range there is a tendency for people to expect it to fall, and rise when the rate is below this range.

For an individual agent with given and precise expectations about the future value of the interest rate, the speculative demand for money is a discontinuous function of its current level. However, for the economy as a whole, people may have divergent expectations about the rate of change of the interest rate toward their own precise estimates of its future value. Provided that there is some diversity of opinion about the expected rate of interest at any moment, the money and bond holdings of each agent are insignificant relative to the total amount in the economy. The aggregate speculative demand for money function becomes a smooth and negative function of the current level of the interest rate.

Accordingly, the interest rate was formally introduced in the money demand function, and the function now can be represented as $m^d = f(y, i)$, where the demand for real money balances m^d is a function of real income y and the interest rate i. Consequently, the Keynesian theory of money demand, like its predecessors, is a theory of demand for real money. The major implication of the Keynesian analysis is that when the real interest rate is very low, everyone in the economy will expect it to increase in the future, and hence, prefer to hold money at whatever interest rate supplied. At this stage, the aggregate demand for money becomes perfectly elastic with respect to the interest rate. The economy can get into a situation called "liquidity trap", in which the interest elasticity of money demand can be infinite at low levels of the interest rate (Keynes, 1936).

[18] The Keynesian approach on the money demand theory was well developed in Keynes (1930 and 1936).

After Keynes' contribution to the theory of money demand, researchers put forward a number of other theories including both income and interest rates as arguments to examine the nature and the determinants of the money demand function. These theories implicitly address a broad range of hypotheses by emphasizing the transactions, speculative, and precautionary motives, or utility considerations, for holding money (see Miller and Orr, 1966: 413; Chow, 1966: 111). The following subsection discusses briefly some of the major aspects of these theories.

2.4. Post-Keynesian theories of the money demand function

Post-Keynesian theoretical developments have moved in several different directions in order to explain the three Keynesian motives for holding money. The medium of exchange function leads to transactions models, of which inventory models assume the level of transactions to be known and certain, and precautionary demand models treat net inflows as uncertain. The store-of-value function gives rise to asset or portfolio models, where money is held as part of the portfolio of assets of individuals. Thus, the special characteristics of money lead to the formulation of theories that are based on explicit motives for holding it. There are also theories, which ignore the motives' aspects altogether, but instead assume that people do hold money for consumption purposes and thus analyze the demand for money in a general consumer demand theory framework.

2.4.1 The "demand for transactions money" approach

Baumol (1952: 545) and Tobin (1956: 241) uses the demand for transactions money approach to develop, in a deterministic setting, a theory of money demand in which money is essentially viewed as an inventory held for transactions purposes. Although liquid financial assets other than money offered higher yields, the transactions costs of converting between money and these assets justified holding such inventory. These models assume the presence of two stores-of-value (money and an interest-bearing alternative asset), a fixed cost of making transfers between money and the alternative asset, and exogenous receipt and expenditure streams. All payments are made with money and there is no uncertainty in the model.

The household's portfolio problem, therefore, involves balancing two factors: one, that earning assets pay interest while money does not; and two, that money, however, is

required to make transactions due to lack of synchronization between receipts and expenditures. Brokerage costs may be incurred when earning assets must be sold to finance a transaction. Consequently, higher average holdings of money help minimize such transactions costs, but also mean greater foregone earnings of interest. Therefore, even though the holdings of assets may be for shorter periods, the interest earnings may be worth the cost and inconvenience of converting the asset to currency.

The optimal transactions frequency, therefore, involves a balance between the increase in transactions costs and the reduction in interest costs. By minimizing the sum of brokerage costs and interest income foregone, Baumol (1952) obtained a transactionary demand for money model well known as "square-root formula", which can be empirically stated as follows:

$$m^* = \sqrt{(a_0 y)/2r}\,, \tag{2.1}$$

Where optimal demand for real money balances (m^*) positively relates to the square root of brokerage charge (a_0) and real income (y), and inversely relating to the square root of interest rate (r).[19] The income elasticity is assumed to be 0.5, which means that an increase in the real income level raises the demand for real money balances by less than the actual increase in the income level, implying the existence of economies of scale (Baumol, 1952: 551). This means that, a one *per cent* increase in the level of real income causes the level of real money balances to rise by 0.5 *per cent*, so that when an individual's income increases he then holds proportionately less money. Dornbusch and Fischer (1990) explain this as being due to the occurrence of better cash management at higher levels of income as a result of the individual paying lower brokerage fees per transaction in terms of the cost of each unit of cash transacted. In other words, this enables more frequent transactions, as they cost comparatively less per unit of cash due to their increased sizes, and hence lower levels of money being demanded at anyone time. On the other hand the interest elasticity is assumed to be -0.5 also implying that an increase in the nominal interest rate causes a

[19] A summary extension of these models can be found in Barro and Fischer (1976), and Cuthbertson and Barlow (1991). Roley (1985) lists the theoretical work done by Clower and Howitt (1978), Akerlof (1979), Akerlof and Milbourne (1980a), and Santomero and Seater (1981), among others, as alternatives to the transactions demand approaches of Baumol (1952) and Tobin (1956). Smith (1986) also develops a dynamic version of this framework.

decrease in the demand for real balances that is proportionately less in absolute value than the initial increase in the rate of interest.

Barro (1976: 133) introduced integral constraints to Baumol's inventory model with the assumption that individuals withdraw cash in integer amounts, as opposed to Baumol's model where it was assumed that any number of transactions, such as 1.75, could be made. The implication of limiting the number of transactions to the realistic values of whole positive numbers is that the income elasticity of the demand for real money then ranges from 0.5 to 1. This is because, given that the lowest number of withdrawals any individual can make is one, certain individuals who are too poor to invest part of their income in bonds, as they cannot afford additional brokerage charges, will make the one obligatory withdrawal at the beginning of the month and then spend all their income without investing any during that period, resulting in an income elasticity of 1 (and an interest elasticity of zero). It can therefore be seen that the income elasticity can conceivably range between 0.5 and 1, and the interest elasticity between -0.5 and 0.

This result should not be very surprising when applied to developing countries, as a large proportion of the individuals from these countries receive very low incomes, incomes that are often not sufficient to cover their basic needs and so they cannot even opt to invest any of their income in interest earning assets. In this regard, the individuals' demand for money is likely, therefore, to be a corner solution with an income elasticity close to one and interest elasticity of close to zero (see Tobin, 1956: 245).

Another class of models that emphasizes the transactions role of money are the "cash-in-advance models". These are equilibrium models, which incorporate a specific sort of restriction that purchases in a given period should be paid for by currency brought in from the previous period. This type of limitation is commonly known as a "cash-in-advance constraint" (from the fact that the buyers need cash in advance) or "Clower constraint" (bearing the name of the researcher who first developed this type of constraint) (see Clower, 1967: 5). It provides an alternative for including money in the utility function, and offers an intuitively appealing and simple analytical tool to investigate why rational agents may hold money. The earlier impetus for the cash-in-advance constraint comes from the work of Brunner (1951: 152) who recognized the transactions role of money not in the utility function but from the constraints faced by an individual when deciding how much to supply and demand of each good (see Howitt, 1992: 318).

As regards to money in the utility function approach, agents are assumed to derive utility not only from consuming goods and services but also from holding real balances (see Patinkin, 1965). The agents get utility because holding real balances reduces the probability of running out of cash as a result of the stochastic payment process. In other words, it influences the shopping time involved in taking trips to banks (see Brock, 1974: 750). Feenstra (1992: 790) provides a brief account of the money in the utility function approach. Lucas (1980: 203) made seminal contributions in developing the cash-in-advance models to provide micro foundations for money and to extend the theoretical support for the transactions demand for money. He incorporated the optimizing behaviour of individuals as discussed in Baumol (1952) and Tobin (1956), and the cash-in-advance constraint in a macroeconomic equilibrium setting to study the transactions demand for money.

Although there are many variations that exist, in general, the cash-in-advance models have the following five elements: First, there are a large number of identical agents deriving utility over time by consuming goods; second, the agents have certain endowments, and are allowed to trade with other agents for money that was brought in from the previous period; third, the total amount of consumption goods acquired should not exceed the total amount of money, thus, the available money establishes a ceiling for the goods to be consumed;[20] fourth, the trading is conducted according to some strict rules regarding the time, place, and interval of trading; and fifth, in equilibrium, the total amount of production equals consumption and the demand for money is exclusively the transactions demand. The transactions demand for money arises from Lucas (1982: 339) assumption that the agents learn in the beginning of each period the current state of economy, after which they trade their assets and money, and buy consumption goods. Further, by introducing uncertainty, one can develop combined transactions, precautionary, and store-of-value motives of the demand for money (see Svensson, 1985: 919).[21]

[20] However, there are models that exist, which allow for credit markets with people having no cash at the beginning of the period (see Sargent, 1987) and where one can finance the entire purchases through trade credit rather than by giving cash in advance (see Kohn, 1981: 177).

[21] Follows by way of modifying the assumption that the agents must decide on their cash holdings before they know the current state and hence, before they know their consumption.

However, there are a number of problems associated with this theoretical apparatus. It failed to provide a convincing explanation why people use money or what objects circulate as money; it could not provide the micro foundations for money, which it intended to do. It also put severe restrictions on the timing and interval of transactions (see Howitt, 1992: 318). As the cash-in-advance constraint puts a strict upper limit on purchases during a given period, the demand for money tends to be less sensitive to interest rate changes (see McCallum and Goodfriend, 1987). Since introducing uncertainty in the model brings in, not only the transactions demand for money but also the precautionary motive and demand for money as a store-of-value, McCallum and Goodfriend (1987) propose a "shopping-time" model to bring out the medium-of-exchange role of money more explicitly.

2.4.2. Demand for precautionary money approach

Models that explore the precautionary motive of the demand for money have been developed together with the inventory models. The precautionary demand for money arises because people are uncertain about the "payments they might want or have to make", in the future (Whalen, 1966: 314). In this framework, the more money an individual holds, the less likely he or she is to incur the costs of illiquidity. But the more money the person holds, the more interest he or she is giving up. Therefore, the person optimizes the amount of precautionary cash balances to hold by carefully weighing the interest costs against the advantages of not being caught illiquid (Dornbusch and Fischer, 1990). As interest rates rise, the opportunity cost of holding precautionary money rises, and as a result the holdings of this money fall. The result of the developed model is similar to the one found for the Baumol-Tobin analysis. The precautionary demand for money is negatively related to interest rates. One important implication of the model is that an increase in the overall volume of transactions would lead to a less than proportional increase in money holdings.[22]

2.5. Money as an asset (demand for speculative money) approach

As an alternative explanation for Keynes' original liquidity preference model, arising from the differences in expectations of future interest rates, Tobin (1958: 65) demonstrated that the theory of risk-avoiding behaviour of individuals provided a basis for the liquidity

[22] Barro and Fischer (1976: 133), and Cuthbertson and Barlow (1991) summarize the work done in this area by other researchers. Also Akerlof and Milbourne (1980a: 145), and Milbourne (1983: 685) present some recent models on the precautionary demand for money.

preference and for a negative relationship between the demand for money and the interest rate. Actually, the risk-aversion theory is based on the simple principles of portfolio management. In this framework, the risk and reward characteristics of various assets together with the tastes of the individual determine the optimal portfolio structure, which is obtained by maximizing utility consistent with the available opportunities. The idea was that people diversify their portfolio by holding both bonds and money, reducing the total amount of risk. That is why people may hold money as a store of value even if money has zero expected rate of return.

Tobin (1958: 65) postulated that an individual would hold a portion of his or her wealth in the form of money in the portfolio because the rate of return on holding money was more certain than the rate of return on holding earning assets. Therefore, it is riskier to hold alternative assets in comparison with holding just money alone. The difference in riskiness may arise because government bonds and equities are subject to market price volatility, while money is not. In spite of the market price volatility, the individual is willing to face this risk because the expected rate of return from the alternative assets exceeds that of money. Consequently, risk-averse economic agents may want to include some money in an optimally structured portfolio. However, Fischer (1975: 509) has shown that the risk-aversion behaviour of the economic agents alone does not provide a basis for holding money. It is primarily because money is not completely riskless as Tobin (1958: 70) postulated above, since it is subject to the risk of price level changes. There are other assets, such as time deposits, that have preciously the same risk characteristics as money but yield higher returns. The safe asset is, therefore, an indexed bond.

A class of models called "overlapping-generations models" also emphasizes the store-of-value function of money. Originally pioneered by Samuelson (1958: 467), two classical macroeconomists, Thomas Sargent and Neil Wallace, among others brought these models to prominence in the 1980's (see Sargent and Wallace, 1982: 1212; and Wallace, 1977: 2 and 1988: 25). These overlapping-generations' models are dynamic equilibrium models, which emphasize the differing perspectives on saving of young and old individuals. For a simple exposition, the agents are assumed to live in two periods (periods 1 and 2) so that at any one moment, half the economy's population is young and the other half is old, enabling the generations to overlap.

Money is considered purely as an asset in these models with its medium-of-exchange function to facilitate current transactions being completely ignored. Money, instead, makes possible otherwise impossible intergenerational transactions. Each agent receives at birth a certain endowment of consumption goods, which are non-durable that cannot be stored for consumption in the next period. However, the endowment can be exchanged for money, which can be stored between periods. In each period, the young exchanges some of its endowment of consumption goods for money from the old generation, thereby facilitating the older generation to smooth out its consumption across periods. Introduction of money in this framework has opened up the possibility of inter-generational trade, which brings benefits to all concerned.

It appears as if money is playing the role of a medium-of-exchange in these models, but it is the durability or its capacity to act as a store-of-value that is facilitating the inter-temporal shift of consumption possibilities. Thus, these models provide a vehicle to understand the demand for money as an asset rather than as a means of exchange. The major criticism against them however, is that they fail to explain the observed tendency for agents to hold money when other assets exist, which are devoid of nominal risks but pay positive interest rates (see McCallum, 1989). Apparently, theoretical models that combine both the transactions and portfolio approaches of money demand are extremely rare. Goldfeld (1987) cites Ando and Shell (1975) for such a study. Spencer and Yahya (1985: 10) refer to a study by Frenkel and Jovanovic (1980: 25), which blends the transactions and the precautionary demand for money.

2.6. Friedman's modern quantity theory of money approach

Another important development for the theory of the demand for money was Friedman's (1956: 4) modern quantity theory of money. This approach is often associated with the "Chicago School", which considers the demand for money as a direct extension of the conventional theory of the demand for any durable good.[23] This was the case in the "restatement of the quantity theory", in which Friedman (1956: 4) argues, that the demand for money must be influenced by the same factors that influence the demand for any asset. Friedman begins with the general demand theory as an explicit starting point by treating

[23] See Feige and Pearce (1977: 439) for further discussion of this approach.

money as any other asset yielding a flow of services and using a broad measure of wealth (human and non-human) as the appropriate budget constraint.

Instead of asking, what prompts the individuals to hold money as Keynes did, Friedman assumes that people do hold money as in the Cambridge approach of the quantity theory, and analyses how much money people want to hold under various circumstances. One minor difference is that the measure Friedman uses in his analysis corresponds to broad money, while the earlier approach refers to narrow money. He went along with the views of the neo-Keynesians' portfolio approach of money demand, where money was part and parcel of financial assets, but added further that real goods should also be included in the portfolio as they yield a stream of services. Consequently, he suggested that a significantly broad range of opportunity cost variables, including the expected rate of inflation (as a proxy for yield on real goods), have theoretical relevance in a money demand function. He also demonstrated that wealth is a key determinant of money demand.[24]

Friedman's money demand formulation also gives an explanation for the pro-cyclical velocity phenomenon. Because much of the increase in income will be transitory, permanent income rises much less than income. Friedman's money demand function then indicates that the demand for money increases only a small amount relative to the rise in measured income, so velocity increases. In this way it explains the procyclical movements in velocity.

Friedman made use of the theory of portfolio choice to indicate that the demand for money will be a function of permanent income and the expected returns on alternative assets relative to the expected return on money. Friedman believed that changes in interest rates have little effect on the expected returns on other assets relative to money. He therefore, stressed that money demand does not undergo substantial shifts and so is stable. These two aspects also indicate that velocity is predictable; yielding a quantity theory conclusion that money is the primary determinant of aggregate spending.

[24] See Cuthbertson and Barlow (1991), and Kaufman (1992) for further elaboration on this approach.

2.7. Modelling the demand for money function to analyse long-term stability: theory and practice.

There is a growing empirical research on the demand for money function, which stems from the realization that a stable money demand forms the cornerstone in formulating and conducting an effective monetary policy (see Judd and Scadding, 1982: 993 and Sriram, 1999b: 3). In addition, researchers have increasingly expressed keen interest in looking at the stability of these functions. This is in view of the rapidly changing external and internal economic and financial environment and the increasing tendency toward liberalization of international transactions (see Sriram, 1999b: 41). Following the surveys of empirical research on demand for money in both developed and developing countries as carried out by authors such as: Adekunle, 1980; Arango and Nadiri, 1981: 69; Arize, 1994: 217; Goldfeld and Sichel, 1990: 300; Hamburger, 1977: 25; Honohan, 1994: 215; Laidler, 1993; and McKenzie, 1992: 176, there is a diverse spectrum of money demand theories emphasizing the transactions, speculative, precautionary, or utility considerations. These theories implicitly address a broad range of hypotheses. One significant aspect, however, is that they share common important elements (variables) among almost all of them. In general, they bring forth a relationship between the quantity of money demanded and a set of a few important economic variables linking money to the real sector of the economy (see Judd and Scadding, 1982: 993). What sets each apart, however, is that although they consider similar variables to explain the demand for money, they frequently differ in the specific role assigned to each (see Boorman, 1976: 350). Consequently, one consensus that emerges from the literature is that the empirical work on the money demand is motivated by a blend of theories (see also Sriram 1999b: 16).

Modelling the demand for money function to analyse whether the demand for money is stable, concerns the estimation and quantification of the demand for money function, utilizing data and econometric methodology. While basically empirical it must be informed by the theory. The post-1973 economic events call into question conventional wisdom concerning the stability of money demand. Much effort has been expended to rationalize these events. One approach considers the appropriate definition of money—M1, M2, M3, or other constructed measures. Another approach explores the specification of short-term dynamic monetary adjustments, in terms of supply *versus* demand-adjustment models. And a virtually inexhaustible supply of other competing hypotheses exists. Judd

and Scadding (1982: 995) provide a thorough literature review of the different rationalizations that explain post-1973 events in the money market.

In this thesis, we further provide an overview of recent work, beginning with the most basic issue of how to define money and its determinant variables (such as the scale variable and the rates of return on money) to be included in the money demand function. This serves to illustrate the variety of choices that need to be made before any attempt at estimation can start. The definition of money in Uganda, however, is not so clearly identifiable. Rather, there is a whole spectrum of assets of varying liquidity and acceptability. The monetary base M0, the narrowest definition of money, constitutes notes and coin held by the general public. If we add demand deposits we obtain the definition M1, which is also regarded as useful for measuring those balances liable to be used for transactions. Adding further components produces progressively broader monetary aggregates that incorporate monetary assets with successively declining liquidity. The addition of time and savings deposits to M1 gives M2. Since 1990 the Bank of Uganda has compiled a series on M3. In Uganda, M3 equals M2 plus the value of foreign exchange accounts held by the commercial banks.

2.7.1. Real and Nominal money balances

The difference between nominal and real money can be seen to essentially involve the unit of measure used. This is because nominal money balances refer to the actual nominal number of units of money in circulation while real money balances are the value of this money in terms of its purchasing power of goods and services (see Barro, 1993: 67).

Friedman (1959: 330) argues that the nominal stock of money is determined by the monetary authorities and not by, non-bank[25] holders of money; while the real stock of money is determined by the (non-bank) holders of money. In Uganda, the Bank of Uganda is the monetary authority, which controls the amount of nominal money that is demanded and it does so by adjusting the monetary policy instruments and tools at its disposal so that the amount of money demanded equals the amount of nominal money which the Central Bank wishes to supply. One of the ways in which this can occur is through the Reserve

[25] Non-bank here should perhaps rather read non-(Central) Bank, as the non-bank holders of money alluded to here include commercial, merchant and other banks besides private individuals, but not the reserve bank or any other monetary policy maker.

Bank's discount policy where the cost of obtaining credit is raised through an increase in the discount rate, which causes the cost of credit to become more expensive and hence less attractive. In this way, the monetary authorities can decrease the demand for credit and hence indirectly exert some control over the quantity of money.

Another means the Reserve Bank employs in controlling the level of money demanded is through the informal agreement between the Reserve Bank and clearing banks on the 'price' of money. This is possible as the clearing banks prime overdraft rate (the lowest and only rate at which a clearing bank will lend on overdraft) is linked to the bank rate at a level, which exceeds the bank rate by a certain amount (for example, between 2.5 and 3.5 *per cent* in the case of South Africa (Falkena, *et al.*, 1991 and Fourie, *et al.*, 1992). By increasing the bank rate the monetary authorities can decrease the demand for credit by making credit more expensive and hence indirectly exert some control over the quantity of money that is demanded. The market rates of interest are then influenced by the Reserve Bank's lead when the bank rate is raised or lowered because, as the commercial banks borrow from the Reserve Bank at the bank rate, increases or decreases in the bank rate will cause the commercial banks to increase the rates at which they lend, so that these changes in the cost of credit are then passed on into the market.

It can therefore, be seen that non-bank holders of money may be unable to influence the nominal amount of money demanded in the Ugandan economy as it is assumed that they cannot directly influence the monetary policies of the Reserve Bank. On the other hand, non-bank holders of money can control the level of real money demanded. This is because when these agents desire to hold less real money, they are able to do so at an aggregate level by increasing their level of expenditure on goods and services, which then causes the prices of these goods and services to rise. This will then decrease the amount of goods and services that a fixed nominal amount of money can buy; thereby decreasing the real value of money, so the amount of real money demanded decreases even though the nominal amount demanded remains unaltered (see Hafer and Thornton, 1986: 540; and Reinhardt, 1998: 8).

The demand for money is therefore a demand for real balances as individuals are interested in the purchasing power of their money and not about how many units of currency they hold (see Hafer and Thornton, 1986: 540). This is because the demand for real money balances remains unchanged when the price level increases as individuals will

conceivably still demand the same number of goods and services as before, but the demand for nominal money balances increases to pay for the general price level increase of all goods and services. An alternative way of looking at the difference between real and nominal money balances is that real money balances are just nominal money balances (*M*) deflated by the price level (*P*), or *M/P*. In other words, nominal money is divided (deflated) by a suitable price index such as the Consumer Price Index (*CPI*) or the Gross Domestic Price (*GDP*) deflator in order to remove the price factor (inflation is adjusted for), so that, the demand for money can be measured in real terms by the amount of goods and services that it can buy. A demand for money function that is specified in its nominal form should be divided through by the price level in order to obtain the real specification (see Milbourne, 1983: 688).

Individuals whose real behaviour, including the demand for real money balances, is affected by changes in the price level are said to be suffering from 'money illusion'. This means that these individuals are not taking into account the real value of their money balances, as they do not look at what they can purchase but rather at the nominal amount of money they have. When an individual is affected by money illusion then the specification of his demand function is in nominal terms.

The empirical evidence on the demand for money shows a large support for the estimation of the demand for money being a demand for real balances and not nominal balances (see Ericsson and Sharma, 1996: 6). Gupta and Moazzami (1988: 229) in examining whether the adjustment of actual to desired (equilibrium) money balances is real or nominal for eleven Asian countries found that a nominal adjustment should be used in the error correction models. Bahmani-Oskooee, 1991: 1037; Choudry, 1995: 661; Haug, 1994: 713; Hoffman and Tahiri, 1994: 305; Lim, 1993: 995; and Psaradakis, 1993: 215; have concluded that a real adjustment should be used in the error correction models. For our study, we estimate the demand for money as real balances and thus use a real adjustment in the error correction model.

Turning to money demand studies conducted using Ugandan data; the recent estimations of Jean-Claude (2001: 7) and George (2002: 7) have specified the money demand function in real terms and have obtained contrasting results. When comparing our results to previous studies, the income elasticity is close to George's estimate of approximately 0.24 but below Jean-Claude's estimate of approximately 1.23. The long-

term demand for real money is found to be sensitive to the interest rate as the semi-elasticity is estimated at approximately -0.003 as compared to the 11.14 estimated by Jean-Claude and –0.03 estimated by George. The impact caused by the inflation variable is a decrease of approximately 0.1985 in real money balances as compared to 1.2 and 5.4 reductions induced in real money balances estimated by Jean-Claude and George respectively (see Chapter Four Section 4.6 for a detailed comparison of results). The actual specification of the relationships of the variables included in the model used in this thesis has been derived from the economic theory on the demand for money, which is reviewed in the next subsection below.

2.7.2. Choice of variables

The first choice of variables to be included in the model, then, is between narrow or broad money, depending on whether we are interested in the medium of exchange or payment function of money, associated with transactions behaviour, or its store of value function, linked with saving. Another consideration, particularly, if the function is to be estimated over a considerable period of time, say thirty years or more, is that some components may have altered with respect to liquidity due to innovation and deregulation. A simple aggregation of the components may be unwise. Such changes have led some economists such as Barnett (1990: 227) to question the validity of simply adding up the components with equal weights. His alternative is that the weights should vary according to the 'money-ness' of each. The Divisia aggregation scheme (the formal definition of money) adopts this approach.

Although definitions of money stock vary across countries due to either institutional characteristics or arbitrary decisions, money stocks are generally classified into two major groups--narrow and broad money (see Boughton, 1992: 323). Narrow money consists of those assets readily available and transferable in every day transactions, which provide the means-of-exchange function. Broad money comprises a wide range of assets rendering portfolio opportunity to asset holders. As far as the demand for narrow money is concerned, for individuals holding currency and low-or-zero-interest checkable deposits of significant amounts, the asset motives of holding money can be of little relevance. Similarly, the asset holders are more concerned with evaluating the substitutability of each asset, which will further enable them to decide which type to hold in their portfolio. The

correct definition of money to be used, therefore, becomes an empirical matter (see Laidler, 1993: 160).

A narrow view of money is generally captured by M1, which includes currency plus demand deposits at the commercial banks. Broad money on the other hand, typically represented by M2, has fewer liquid assets and comprises time deposits at commercial banks and savings and loan associations and money market mutual funds and so on over and above M1 (see Sriram, 1999b: 18).

Several empirical studies exclusively estimate the demand for M1 with an argument that broader aggregates might muddy the interest rate effects on the assumption that M1 is more amenable to control by the monetary authorities, (see Boorman, 1976: 350; Feige and Pearce, 1977: 462; Goldfeld, 1973: 625; Judd and Scadding, 1982: 1010; and Kremers and Lane 1990: 792; who present the results of the work done by a number of other researchers using M1 as the money stock variable). Studies on a number of developing countries also indicate that models using a narrow definition of money work better than those employing broad money reflecting a weak banking system and low level of financial sector development (see Moosa, 1992: 107). However, since the boundaries of M1 shift over time to accommodate the new instruments created as a result of an evolving financial system and institutional framework, arguments were raised in favour of using broad money in empirical work. This latter measure is thought to yield a stable money demand function (Laidler, 1966: 55) and is considered a preferable measure with which to evaluate the long-term economic impact of the change in monetary policy (see Hafer and Jansen, 1991: 155).

The interest in estimating the demand for broad money also emanates from the fact as pointed out by Ericsson and Sharma (1996: 1); "although, easier to control, narrowly defined aggregates are less useful in policy issues because their relationship with nominal income appears subject to considerable variability. Broader aggregates appear more stable relative to nominal income, but they are less amenable to control". Goldfeld and Sichel (1990: 315) cite the empirical difficulties in using a narrow definition of money for estimation purposes coupled with blurring distinctions between transactions and portfolio consideration of money, as the reasons for the heightened interest among researchers in using a concept like M2. However, it is not uncommon to find studies that evaluate the demand for money using both narrow and broad money aggregates (see Ahmed, M., 1996: 86; Ahmed, S., 1977: 230; and Murty and Murty, 1978: 452). For this study, we use the M2

definition of money or M1 plus quasi money (time deposits and saving deposits) and our empirical estimates are made using real money balances (*M2/P*) to obtain more feasible and meaningful results. The variable *P* is the price level measured by the consumer price index.

Once chosen, the monetary aggregate can be in nominal or real terms. Usually a real definition of money balances is employed, imposing a coefficient of unity on the price variable in the real money demand function that appeals to the theoretical property of homogeneity. Some studies by Boughton (1991) and Coghlan (1980) suggest that the price coefficient should be freely estimated and only restricted to unity if warranted by the data. When the parameter on the price variable is freely estimated, however, it is often not possible to reject the homogeneity restriction (see Spencer and Yahya, 1985: 14). Nominal balances must then be deflated by a measure of the price level. This is done by choosing a basket measure of the price level such as the consumer price index (CPI) measuring prices of a range of goods. The monetary aggregate selected affects the choice of the scale or income variable. A narrow definition of money, based on the medium of exchange function, where the demand for money represents purchasing power for transactions, would normally be matched with GDP to measure total transactions in the economy. Nevertheless, on theoretical grounds there is a question mark over the validity of linking the *stock* of money at a point in time to a measure of transactions over a period of a year or a quarter, which is a *flow* variable. Desirably, stocks should be explained by stocks and flows by flows.[26] However, in practice, current income can be used as a proxy for permanent income, which in turn can be thought of as analogous to wealth, which is a stock term (see Friedman, 1956).[27] In principle, Keynesians suggest current income to reflect transactions and precautionary behaviour, while monetarists prefer permanent income because current

[26] Patinkin (1972) helpfully elaborates on the distinction between stocks and flows using wealth and income.

[27] Friedman (1956) put the distinction in the following terms: "From the broadest and most general point of view, total wealth includes all sources of 'income' or consumable services. One such source is the productive capacity of human beings, and accordingly this is one form in which wealth can be held". From this point of view, 'the' rate of interest expresses the relation between the stock which is wealth and the flow which is income, so if *Y* be the total flow of income, and *r*, 'the' interest rate, total wealth is $W = Y/r$. Income in this broadest sense should not be identified with income as it is ordinarily measured. The latter is generally a 'gross' stream with respect to human beings, since no deduction is made for the expense of maintaining human productive capacity intact; in addition, it is affected by transitory elements that make it depart more or less widely from the theoretical concept of the stable level of consumption of services that could be maintained indefinitely. Since reliable data on wealth is lacking, as it almost always is, Friedman replaced it by 'permanent income', which can be interpreted as the average expected income over the future.

income includes temporary as well as permanent income and may over-or under-state the levels of sustainable purchasing power.

Recently, the suitability of income measures in general has been questioned. Since income excludes many intermediate transactions to avoid double counting it also excludes many intermediate exchanges. Some authors have argued for expenditure rather than income as the scale variable because it avoids these problems (see Goldfeld and Sichel, 1990: 332; and Mankiw and Summers, 1986: 420). Aside from the theoretical emphasis, income is often justified as a proxy for wealth on the grounds of greater data availability and reliability. Evidence from Adam (1991: 401), and Grice and Bennett (1984: 239) in the UK, points to better performance from models of the demand for broad money when wealth is included than when it is left out. Wealth in most cases refers to financial wealth, although non-financial measures, such as valuation of the housing stock, appear to have become more important. A number of other related variables that move together with GDP such as net national product (NNP) and gross national product (GNP) have also been widely used as substituting one for another does not present any significant differences (see Laidler, 1993). However, for this study we employ GDP at current prices as a proxy for permanent income on the grounds of greater data availability and reliability in light of the reasons mentioned above.

The next decision is the choice of the opportunity cost variable. The main question to address here is how many assets are genuine alternatives to money, for this will determine what interest rate (or rates) to include. A yield on a government bond is likely to be preferred by Keynesians as a proxy to 'the' rate of interest, while monetarists would be more inclined to include a number of rates as the returns on equities, bonds, capital goods, and other assets. But this still leaves a considerable choice. For many applications, the issue is not so much to do with the particular rates but how to capture the information in long and short interest rates accurately. This is a matter of choosing a representative rate for the long-term, such as the twenty-year government bond yield or the consol rate, and a short-term interest rate on an asset with a maturity of say three months, such as a three-month Treasury bill or the three-month inter-bank rate. So, choosing any one of them is likely to give a good indication of the opportunity cost to money from other assets with a short-term period to maturity. The long-term rate is likely to give a better indication of the opportunity cost of money incorporating expectations of future inflation rates. Including both rates in

the same demand function can create estimation problems since these rates are likely to move together. This problem can be overcome by calculating the long-short differential (see Sriram, 1999b: 23).

The opportunity cost of holding money involves two main components: the own-rate of money and the rate of return on assets alternative to money. Omission of an own-rate of money variable often leads to a break down of the estimated money demand function, especially when financial innovation occurs in the economy (see Ericsson, 1998: 304). The rate of return on assets involves yields on financial and real assets for the domestic economy. And for an open economy, yields on foreign assets are added to capture the influence of currency substitution on domestic money holdings.

A number of instruments are available to represent the yields on domestic financial assets. The yields on real assets are usually a proxy of expected inflation, while that of foreign assets is by a foreign interest rate or some form of exchange rate variable. The combination of the proxies to represent these variables depends mostly on the state of the domestic financial sector, the extent to which interest rates are liberalized, the openness of the economy, and the availability of data (see Sriram, 1999b: 24). According to Friedman (1970: 193), the demand for money (real cash balances) is a function of the interest rate, income and the general utility of holding money.

Following the studies by Cagan (1956) and Frenkel (1977), most studies have adopted the expected rate of inflation as an important determinant. The inclusion of the expected rate of inflation follows Friedman (1956: 5 and 1969), who argues that "if money were a way of holding wealth, the demand for money should be viewed as a demand for the services yielded by this asset". He further, postulated that the expected rate of inflation could be considered as (the negative of) the own-rate of return on cash balances, since it measures the depreciation cost, which the individual can avoid by increasing the consumption at the same rate. The relationship between expected inflation and the demand for money is well documented by Arestis (1988a: 421), who states that "the real value of money falls with inflation whilst that of real assets is maintained, so that there is a strong incentive for economic agents to switch out of money and into real assets when inflationary expectations are strong". This is especially true of developing countries, where, given the existence of underdeveloped monetary and financial systems and non-market determined interest rates, physical assets represent one of the major hedges against inflation and an

alternative asset in portfolio of the non-bank public, (Jean-Claude, 2001: 6). The conventional idea is that, in developing countries, where interest rate ceilings and capital controls prevail, asset substitution is likely to be between money and physical assets rather than between money and financial assets. However, most subsequent studies include an own rate of return on money, such as the seven-day deposit rate (that is most relevant to the personal sector) or the rate on certificates of deposit (CDs)[28] (see Adam, 1991: 419; Grice and Bennett, 1984: 252; and Hendry and Ericsson, 1991: 29).

Further arguments have been made regarding the choice of the expected rate of inflation variable emphasizing that nominal interest rates alone are sufficient in the money demand models, especially the Baumol-Tobin type transactions demand models. The justification is that, when moderate inflation prevails in an economy, variations in nominal interest rates capture the variations in the expected rate of inflation. Therefore, the expected rate of inflation should not have any additional explicit impact on the demand for money other than its implicit influence through interest rates (see Heller and Khan, 1979: 115; and Jusoh, 1987: 7). However, in many studies, it is also included along with the nominal interest rates because in countries where interest rates are not unregulated, although these two variables show some relationship, the level of nominal interest rates might not fully incorporate the expected inflation rate. In this situation, there is room to include both variables in the money demand function (see Arestis and Demetriades, 1993). Hendry, 1985; Hendry and Ericsson, 1991; and Hendry and Mizon, 1990; include inflation as a separate explanatory variable. They found that inflation does have an independent effect, perhaps because until the mid-1980's sight deposit accounts in the UK and the USA were non-interest bearing and inflation imposed a significant loss in purchasing power on idle balances. As a result of deregulation and financial innovation, in these countries money has begun to pay interest. Barro and Santomero (1972: 409) were the first to compute the implied rate of return on money in demand for money functions but the significance of this

[28] Certificates of deposit (CDs) are debt instruments issued by banks and other financial institutions to investors. In exchange for lending the institution money for a predetermined length of time, the investor is paid a set rate of interest. Maturities on certificates of deposit can range from only a few weeks to several years with the interest rate earned by the investor increasing in proportion to the time his capital is tied up in the investment. Certificates of deposit yields are quoted on an interest-bearing basis, versus the discounted basis used for Treasury bills, commercial paper, and bankers' acceptances. The yield on CDs is higher than that on Treasury securities of the same maturity due to the credit rating of the issuing bank, the liquidity of the CD market, and the supply and demand for CDs.

term has become much greater since the advent of explicit rates on current accounts in the 1980's.[29]

The choices of assets for portfolio diversification in an open economy is wider as foreign currency denominated assets are now available in addition to the domestic financial and real assets. Noticeably, with increasing financial globalization and the empirical evidence on portfolio balance models in open economies, the expected rate of return on foreign assets has often been added as an explanatory variable. This is done either by adjusting the foreign interest rate through exchange rate movements or by introducing a measure of expected exchange rate depreciation separately in the money demand function, (see Arango and Nadiri, 1981: 76). As more and more countries are moving toward the floating exchange rate regime, the domestic money demand could also be sensitive to external monetary and financial factors (see Bahmani-Oskooee, 1991: 1039). In that respect, if foreign securities were to form an appropriate investment alternative, then their expected rates of return plus expected exchange rate changes should appear in the money demand function (see McKenzie, 1992: 187). The direct currency substitution literature refers to the portfolio shifts between the domestic and foreign money, which is influenced by the expected exchange rate changes. Hence, if the domestic currency were expected to depreciate the domestic portfolio holders would be encouraged to re-adjust their portfolios in favour of foreign assets (see McKinnon, 1982: 320; and Leventakis, 1993: 1005). In this thesis the nominal interest rate on Treasury bills, the actual rate of inflation (as a proxy for the expected rate of inflation) and the change in the exchange rate are employed as variables accounting for the opportunity cost of holding money in the Ugandan economy. This is based on Uganda's domestic financial sector, the extent to which the interest rates are liberalized, the openness of the economy and the availability of data.

Summarizing the above-mentioned considerations and taking into account the availability of variables in Ugandan statistics the following variables have been selected for the empirical analysis based on the studies done by Cagan (1956); Laidler (1993); Ericsson and Sharma (1996) and Ericsson (1998):

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[29] In models of real money demand, the inclusion or exclusion of inflation is an issue of dynamic specification. Exclusion imposes equality of the short- and long-term elasticities of nominal money with respect to prices. Often, that restriction is resoundingly rejected (see Ericsson, 1998; and Hendry and Ericsson, 1991).

M2 - M1 (which includes currency in circulation) plus quasi money (demand deposits, time deposits and savings deposits) all measured on a quarterly basis. Empirical estimates are made using real money balances (*M2/P*) to obtain more feasible and meaningful results. This data are in million of Ugandan shillings for the period 1980-2002;

Y - GDP at current prices; quarterly data for the period 1980-2002;

P - Consumer price index (1995 = 100); in per cent; monthly data taken at the end of each quarter for the period 1980-2002;

R - The 91-day Treasury bills rate in per cent;

π - Actual inflation rate measured from *P*;

q - The depreciation or appreciation of the change in the Ugandan shilling per U.S. dollar; monthly data taken at the end of each quarter for the period 1980-2002.

2.7.3. Theoretical specification of the demand for money function

In standard theories of money demand, money may be demanded for at least two reasons: as an inventory to smooth differences between income and expenditure streams, and as one among several assets in a portfolio (see Sections 2.4.1 and 2.5). The transactions motive implies that nominal money demand depends on the price level and some measure of the volume of real transactions. Holdings of money as an asset are determined by the return to money as well as returns on alternative assets, and by total assets (often proxied by income), Ericsson and Sharma (1996: 5). These determinants as suggested by Ericsson (1998: 297) lead to a long-term specification in which nominal money demanded (M^d) depends on the price level (*P*), a scale variable (*Y*), and a vector (**R**, in bold) of rates of return on various assets summarized in the following form:

$$(M^d/P) = f(Y, \mathbf{R}), \qquad (2.2)$$

The function f(.,.) is assumed to be increasing in (*Y*), decreasing in those elements of **R** associated with assets excluded from money (*M*), and increasing in those elements of **R** for assets included in (*M*) none of which we use.

Once the variables have been isolated and chosen, equation (2.2) is expanded and transformed into real terms. In light of the financial structure, economic policy changes and data properties described elsewhere in this thesis, the choice of real money, real GDP, the

nominal interest rate, the change in the exchange rate, and the inflation rate variables appears to be economically reasonable and are assumed to be highly representative of spending and economic activity in the real sector. Thus, the relationship between real money demand and its determinants can be explicitly written following the Ericsson and Sharma (1996: 6) model as:

$$(m - p)_t = \alpha + \beta y_t + \gamma R_t + \eta \pi_t + \lambda q_t + \varepsilon_t, \qquad (2.3)$$

Where $(m\text{-}p)$ is real money demand, y is real GDP; R is the rate of interest proxied by the rates on Treasury bills-the rate used by most commercial institutions. The actual rate of inflation is represented by π and q is the change in the Ugandan shilling per U.S. dollar exchange rate. The anticipated signs of the coefficients are $\beta > 0$ (specifically, $\beta = 1$ for the quantity theory of money and $\beta = 0.5$ suggested by Baumol), $\gamma < 0$, $\eta < 0$ and $\lambda < 0$. Variables in lower case denote natural logarithms and ε_t is the error term of the regression.[30]

The money demand function in (2.3) above assumes the Cagan model on the choice of the inflation variable. However, we define our inflation variable different from Cagan's and use the actual rate of inflation. We do this as in many developing countries, such as Uganda, where financial markets are not well developed; data on the expected rate of inflation is unreliable. Cagan's insight is that under extreme inflationary conditions, real money holdings will be largely determined by inflationary expectations (Cagan, 1956). In addition, under the classical approach with rational expectations, the determinate component on the interest rate is the real interest rate and is invariant with respect to the changes to the money supply, and past rates of inflation. Therefore, at significant rates of inflation, variations in the real rate tend to be much smaller in magnitude than the expected rate of inflation, so that the interest rate and the expected rate of inflation will be closely correlated. Given this close correlation and that between the expected rate of inflation and the actual rate of inflation, the rate of interest and the actual rate of inflation are likely to be closely correlated in periods with significant inflation rates. Therefore, incorporating both the rate of interest and the actual rate of inflation in the money demand function, often leads to multicollinearity and biased estimates of their coefficients. As a way round these

[30] Chapter Four of this thesis assumes such a specification of equation (2.3) throughout the respective empirical estimations.

statistical problems, the actual rate of inflation is often dropped in favour of the rate of interest from the estimated money demand functions for developed economies with reliable data on interest rates. However, economic theory implies the inclusion of the inflation rate in addition to the inclusion of interest rates, so that its omission could result in a misspecified function (Handa, 2000: 70). In many empirical studies on money demand especially for developed economies, the proper variable used is the expected rate of inflation and that the actual rate of inflation π_t is only one of the possible proxies to it as used in the money demand equation (2.3) above.[31]

Consequently, in countries whose central bank has an inflation target, the latter may be the basis for inflation expectations provided, however, that the central bank enjoys absolute authority. As mentioned earlier, inflation will have a negative effect on money demand. Higher inflation causes a shift from money to other assets and reduces economic efficiency (see Arestis, 1988a: 421; Fisher, 1974: 525).

This section has examined the form of the money demand function to be used for estimation purposes, as well as some of the issues that arise in estimation. Among these was the measurement of the expected rate of inflation, which is itself not reliable in Uganda, so that a proxy has to be adopted for its estimation. We therefore, adopt the actual rate of inflation as proxy of the expected rate of inflation. Consequently, equation (2.3) is used for the respective empirical estimations in Chapter Four of this thesis.

2.8. Theoretical estimation of Long-Term and Short-Term money demand functions

There is a poor tradition of estimating money demand in Uganda unlike in other countries. Certain dynamic problems have been identified in the initial empirical analyses carried out in countries such as the United States. Difficulties with autocorrelation arose and the once-lagged money stock possessed a significant role (see Courchene and Shapiro, 1964: 500). Thus, the distinction between the long-term and short-term demands for money surfaced.

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[31] Inflation expectations can be estimated in several ways. The actual rate of inflation can be used as an approximation of the expected inflation rate, but since a period of high inflation is often followed by a period of low inflation, the actual inflation rate may be a poor measure of expected inflation. If the real rate of interest were constant, the nominal rate of interest becomes the better proxy to the expected rate of inflation (Handa, 2000: 70).

Chow (1966: 117) argued that short-term money demand adjusted slowly toward long-term equilibrium; this stock-adjustment specification has weathered significant storms and remains the center-piece of many money demand studies. However, the stock-adjustment specification did not go unchallenged. First, Feige (1967: 462) demonstrated that a model of the long-term demand for money produces equations similar to those emanating from the stock-adjustment model without requiring a slow adjustment of money demand when the determinants of demand are permanent, rather than current values. No distinction exists between long-term and short-term demands for money. The long-term money demand depends on permanent (long-term) values of the determinants of money demand. To the extent that permanent variables can be modelled with distributed lags of measured values, the inclusion of measured, rather than permanent, variables into the money demand function mimics the stock-adjustment specification.

Second, the stock-adjustment model implies an unusual dynamic adjustment when the money stock is exogenous. The determinants of money demand must overshoot their long-term (permanent) values to clear the money market on a period-by-period basis (see Starleaf, 1970: 443). This second challenge has spawned a series of more recent money demand studies in the demand, rather than supply, adjusting framework (see Coats, 1982: 223; and Judd and Scadding, 1982: 1004). Third, some economists proposed a revolutionary approach to the money market-- abandon the market-clearing assumption for the short-term money demand (Laidler, 1984: 17). This strategy lies within the tradition of disequilibrium reinterpretations of Keynesian economics but focuses on non-market-clearing problems in the money market. The buffer-stock and shock-absorber views of the money market, although not commanding a great following, at least in the United States, distinguishes between long-term equilibrium and how the economy reaches it (see Sriram, 1999b: 33).

In the next sub-section, we describe the cointegration and error-correction modelling mechanism. This methodology encompasses each of the different approaches to money demand described above as special cases. For example, Thornton (1985: 18) argues that the short-term dynamic adjustment categories, which are identified as either real or nominal, and price adjustment--can each be rewritten as an error-correction equation.

2.8.1. Cointegration and Error-Correction modelling

Cointegration analysis and error correction models (ECM) have become standard techniques for the study of money demand since their formal development by Engle and Granger (1987). Subsequent developments related to this approach have relied on the use of new techniques to identify cointegrating relationships (for example, the Johansen procedure (1988)). These developments are as a result of the increasing concern by economists about the possibility of spurious co-movement between variables. Yule (1926: 1) conducted the first formal analysis; he argued that spurious correlation could persist in large samples with non-stationary time series. If two series are growing over time, they can be correlated even if the increments in each series are uncorrelated. Granger and Newbold (1974: 424) went on to conduct a study of non-stationary data with simulations using repeated independent random walks; the simulation results were confirmed theoretically by Phillips (1986: 311). Nevertheless, practitioners continued to employ standard techniques with little regard for the possibility of discovering spurious relationships. Spurious regression is particularly likely when the adjusted coefficient of determination $(\overline{R}^2)$ exceeds the Durbin-Watson (DW) statistic (see Granger and Newbold, 1974).

Cointegration analysis confronts spurious regression, attempting to identify conditions for which relationships are not spurious (Engle and Granger, 1987: 251; Granger, 1986: 213; and Hendry, 1986: 201). The error correction mechanism (ECM) first used by Sargan (1964 and 1984) and later popularised by Engle and Granger (1987) corrects for disequilibrium. An important theorem, known as the Granger representation theorem, states that if two time-series variables Y and X are cointegrated, then the relationship between the two can be expressed as an ECM.

Spurious regression possibilities arise because most economic time-series exhibit non-stationary tendencies. High $\overline{R}^2 s$ may only indicate correlated trends and not true economic relationships; and low DW statistics may reflect non-stationary residuals. A standard specification check for spurious regression entails performing first-differenced regressions, since first differencing probably generates stationary series, and seeing if relationships discovered in levels' regressions continue for the first-differenced specifications. However, first differencing filters out low-frequency (long-term) information. Cointegration and error-correction modelling reintroduces the low-frequency information in a statistically acceptable way (see Handa, 2000: 215).

Consider two non-stationary time-series, x_t and y_t, with stationary first differences (that is, x and y have unit roots). Cointegrated series occur when a factor β exists, such that $z_t = y_t - \beta x_t$ is stationary. If cointegration occurs, then β must be unique in the bivariate case, since another factor $(\beta + \delta)$ generates an additional term $(-\delta x_t)$, which is non-stationary by definition. The temporal characteristics of z_t and its components differ so that a special relationship must exist between cointegrated variables. In other words, the low-frequency (long-term) components of y_t and βx_t must cancel, producing the stationary series z_t. The long-term (equilibrium) relationship may emanate from economic theory, where z_t measures short-term deviations from the long-term (equilibrium) relationship (Engle and Granger, 1987: 253).

Consequently, having identified the cointegrated variables, a constrained error correction model exists that captures the short-term dynamic adjustment of these variables. And the error correction model is a vector-autoregressive (VAR) system constrained by the lagged error correction term. As such, each variable is treated as potentially endogenous. Moreover, the low-frequency information is reintroduced to the first-difference VAR system through the error correction term. Since x_t and y_t are cointegrated, the error correction term is stationary, matching the stationary first-differenced series already in the error correction model (Engle and Granger, 1987: 254).

Cointegration procedures represent an attempt to capture the long-term equilibrium relationship and there should exist a cointegrating vector if such a relationship is stable over the sample period. However, when the long-term relationships are shifting due to innovations and the impact of the innovations has not been eliminated or somehow captured in the definition of the variables or the procedure used, the sample data would not incorporate a stable long-term relationship. In this case, the cointegration analysis should not give results indicative of the existence of the long-term vector. Where the instability is sufficiently limited, the analysis might improperly yield a cointegrating vector, indicating the existence of a stable long-term relationship when the data hides the shift, so that the elements of the cointegrating vector would be invalid estimates of the true elasticities.[32]

[32] Gordon (1984), Motley (1988) and Rose (1985) employ error-correction models, unconstrained by cointegration equations, to study money demand.

2.9. Summary and conclusion

The theories of the demand for money have developed considerably since the 20th century. In this chapter, we have surveyed the different money demand paradigms in macroeconomics, as well as the form of the money demand function to be used for estimation purposes. The variables crucial to money demand estimation in our study have been established as being: real income, the rate of interest, the actual rate of inflation and the change in the exchange rate. In economic theory, the sign of the real income coefficient has been established as being positive (specifically, equal to one for the quantity theory of money and 0.5 as suggested by Baumol). The signs of the coefficients for the interest rate, the actual rate of inflation and the change in the exchange rate are anticipated to be negative.

Given recent advances in macro-econometric modelling, it is possible to examine the joint time series properties among a set of variables in addition to the individual time series properties. Several of the variables crucial to money demand estimation may not stationary. This is especially likely to be so for the monetary aggregates themselves, as well as for the income variable. This may or may not be so for the interest rate in the particular data set available. Consequently, cointegration analysis is an appropriate procedure in this case and has become quite common in recent years for estimating money demand functions. Its combination with error-correction modelling has the further advantage that the estimation yields both the long-term and the short-term demand functions.

As pointed out by Hoffman, *et al.* (1995: 317), a stable long-term money demand function is a central proposition to monetarist models, New Classical monetary models, and even some new Keynesian models and business cycle models that incorporate inflation and the general price level. Empirically, however, the literature on long-term money demand functions has documented periods of "missing money". The most famous of these studies is a study conducted by Goldfeld (1976: 683) who first documented this phenomenon in the U.S. Other researchers have found that conventional money demand functions are often plagued by the problem of unstable parameters (see Breuer and Lippert, 1996: 496; and Judd and Scadding, 1982: 996).

We conclude from our survey of monetary theory and testing, that estimations of money demand functions have typically focused on obtaining estimates of the elasticity of money demand with respect to income and a vector of rates of return. These estimates can

be used to more accurately predict future money supply growth provided they are stable over time. It is important to have information about the stability of money demand in order to implement effective and appropriate monetary policy. Given that monetary policy may have significant implications for the macro economy, early studies of money demand focused mainly on the stability of individual coefficient estimates.

In the next chapter, we examine monetary policy management in Uganda, and how more effective this policy can be if one can identify a stable long-term relationship between real money demand, real income, and a vector of rates of return. Chapter Four presents the estimated results of real money demand obtained from the cointegration and error correction mechanism. In the same chapter, we address whether the critical economic theory features of a money demand function have been met for our estimation. The results of the thesis are summarized in Chapter Five providing the Bank of Uganda with useful information regarding the appropriate monetary policy choices to make.

CHAPTER THREE

MONETARY POLICY MANAGEMENT IN SMALL DEVELOPING ECONOMIES-THE CASE OF UGANDA

3.1. Introduction

The term monetary policy refers to the actions undertaken by a central bank, such as the Bank of Uganda, to influence the availability and cost of money and credit as a means of helping to promote macroeconomic goals. The Bank of Uganda (BOU) implements monetary policy indirectly using its influence on money market conditions by use of three major tools:

- Open market operations. The buying and selling of financial instruments by the BOU in the open market
- Discount window lending. Lending to depository institutions directly from their BOU's lending facility (the discount window), at rates set by the BOU
- Reserve requirements. Requirements regarding the amount of funds those depository institutions must hold in reserve against deposits made by their customers.

In making use of these tools, the BOU influences the demand for and supply of balances that depository institutions hold on deposit at the BOU (the key component of reserves). Usually, the major economic goal for the BOU is "macroeconomic stability" – low unemployment, low inflation, economic growth, and a balance of external payments.[33] Using the monetary policy tools at its disposal, the BOU can promote an environment of price stability and reasonably damped fluctuations in overall economic activity that helps to encourage the health and stability of financial institutions and markets. The BOU also helps advance financial stability through the supervision and regulation of several types of banking organizations to ensure their safety and soundness. In addition, the BOU operates certain key payment mechanisms and oversees the operation of the payments system more generally, with the goal of strengthening and stabilizing the system. In this chapter we

[33] Monetary policy in Uganda is set within the context of the macroeconomic objectives of achieving real economic growth (sustainable) and the maintenance of price stability as defined by government from time to time.

provide an overview of monetary policy management in Uganda. This chapter is well supported by the theoretical underpinnings discussed in Chapter Two Section 2.7. An effective and efficient monetary policy is a sufficient and necessary tool in achieving a stable real money demand function. This in itself is an important component of macroeconomic stability. The choice of Uganda is easily justified, as it is one of many developing economies that underwent tremendous change during the 1980's and 1990's. These changes were aimed at restoring macroeconomic stability. In assessing the effectiveness of monetary policy, the timing and its eventual impacts on the economy are not easily visible. In any event, insights into monetary policy are very important to an investor as key considerations in the pricing of an investment are the availability of money and credit.

Under the monetary policy framework introduced in 1993, its objectives are clear and precise as described in Section 3.4 of this chapter. The primary objective of monetary policy, set out in the Bank of Uganda Act 1993, is price stability. The monetary authority is required to hit a specific inflation target - 5 *per cent* for the 12-month increase in the Consumer Prices Index (CPI) excluding mortgage interest payments at all times. This provides an anchor for inflation expectations and allows the monetary authority's performance to be assessed objectively. The fact that the target is symmetric - deviations below target are treated as seriously as those above - means that there is no motivation for the monetary authority to drive inflation below target at the cost of lost output and employment.

As mentioned earlier, monetary policy is implemented by the BOU, which is an independent banking institution. Interest rate decisions are therefore removed from short-term political pressures and are based solely on the long-term interests of the economy. The main monetary policy instrument of the BOU is the Treasury bill rate. The BOU also has limited foreign exchange reserves available for intervening in the foreign exchange market to support its monetary policy objective.

The superior use of indirect monetary instruments can be seen as the corresponding item in the monetary area of the extensive movement toward enhancing the role of price

signals in the economy (Alexander, *et al.*, 1996). Both functions aim to improve market efficiency.[34]

The development of a country's financial markets is an important factor in the effective implementation of monetary policy. Uganda being one of those countries with underdeveloped financial markets, conducts open market-type operations through the BOU's interventions in primary markets for securities. The BOU fulfils this function by holding regular auctions of Treasury bills and varies the net amount auctioned in order to influence bank reserves. Its common practice that the Treasury bill instrument is used in agreement with other monetary policy instruments.[35]

As mentioned earlier, in this chapter we review how monetary policy is being implemented in Uganda. To this effect we find that indirect monetary policy instruments encourage intermediation through the formal financial sector. They also allow the monetary authorities to have greater flexibility in policy implementation. If there are any small regular changes in instrument settings, they become feasible enabling the monetary authorities to respond swiftly to shocks and to correct policy errors quickly. Hence, there is evidence that from 1994 onwards, monetary control in Uganda has improved as a result from the adoption of indirect instruments of monetary policy. For example, we find a stable real money demand function for the years 1994-2002. We also note that inflation has been brought down to single digits and that the interest rates are determined by market forces.

The rest of the chapter is organised as follows: Section 3.1 provides a brief introduction to monetary policy management in Uganda. Section 3.2 presents a brief background of the financial sector in Uganda. Section 3.3 attempts to map out the salient evolution of monetary policy frameworks right from the establishment of the Bank of Uganda in 1966 to date. The current monetary policy framework (the Reserve Money Programme) is discussed in Section 3.4. Section 3.5 discusses the existing monetary policy instruments, their operational procedures, and their performance in the implementation of monetary policy. The current challenges to monetary policy management in Uganda are

[34] For further theoretical discussion on the implementation of indirect instruments see Alexander, Balino and Enoch (1996: 14) and Meijer (1992).

[35] These include auctions of central bank credit, use of rediscount facilities, and changes in reserve requirements (see Meijer, 1992).

presented in the next section while Section 3.7 gives the summary and conclusions on monetary policy in Uganda.

3.2. Background

Macroeconomic stability is an essential precondition for achieving the Ugandan government's objective of high and stable levels of growth and employment. The government therefore put in place new frameworks for both monetary policy and fiscal policy to achieve economic stability for the long-term. The monetary policy framework aims to deliver low and stable inflation, while the fiscal policy framework is designed to achieve sound public finances over the medium term, and to support monetary policy over the short term. The macroeconomic policy framework introduced in 1993 by the Bank of Uganda, is designed to deliver stability and avoid a return to the cycles of high inflation and slow growth that have characterised the Ugandan economy in the past.

From the 1960's through to the early 1980's, the Ugandan economy experienced high and volatile inflation along with several political and social crises. The financial structure was an underdeveloped one with a large informal sector. Before 1988, the formal financial sector was heavily regulated with direct government control over interest rates, exchange rates and credit policy. For example, in the 1970's and early 1980's there were selective and preferential allocations of foreign exchange and credit to sectors in terms of their 'priority' according to government programmes. With distortions evident in most sectors of the economy, GDP growth was negative, and quarterly inflation reached 260 *per cent* in 1987. High inflation was a consequence of fiscal deficits financed by seigniorage (see Brownbridge, 1998; and Sharer, *et al.*, 1995: 121p). On an annual basis, inflation averaged 179.5 *per cent* over 1985-1988 against 41.5 *per cent* over 1982-1984. Since the exchange rate was fixed and most interest rates controlled, the currency soon became overvalued, and real interest rates turned negative. This situation aggravated Uganda's balance of payments difficulties and triggered a process of financial disinter-mediation. However, there has been a considerable attempt by the government to expand the formal financial sector, for example, the expansion of rural banking and micro-credit lending.

In 1987 Uganda adopted a rehabilitation and recovery programme aimed at restoring macroeconomic stability from poor economic and financial management. The recovery programme also aimed at eliminating the distortions in the key markets under the

auspices of the International Monetary Fund, the World Bank, and the donor community at large. Wide-ranging reforms and policies were undertaken in all the major sectors of the economy. These reforms brought inflation under control. In the year 2002, inflation averaged at least 6 *per cent* from a high of 260 *per cent* in 1987. Real GDP growth rate averaged at least 7 *per cent* in 2002 from a low of 3 *per cent* in 1987. The current and capital accounts of the balance of payments and the domestic marketing system have also been liberalized. The government has privatised most of the inefficient parastatals, thus reducing its involvement in commercial activities. This has provided an avenue for private sector participation. Consequently, price controls on goods and control on interest rates have been eliminated. Uganda has also benefited substantially from financial support from donors, which has helped to finance the fiscal and the current account deficits, and to boost the foreign exchange reserves for which the Bank of Uganda is the custodian.[36]

Like a number of sub-Saharan countries, Uganda shifted from direct to indirect monetary policy control as part of the financial sector liberalization process undertaken under the Structural Adjustment Programme (SAP). There was growing consensus that, direct controls on interest rates and credit, should be abandoned because they led to the misallocation of resources and inefficiency in financial intermediation with knock-on effects for savings mobilization, investment, and economic growth. Consequently, monetary policy is designed with a view to achieving the target on inflation, while providing adequate credit to the private sector to sustain the desired economic growth and improve the balance of payments. Indeed, in recent years the central bank has pursued a strategy of tight monetary policy proactively in order to prevent inflationary pressures arising from exchange rate depreciation and excess liquidity in the banking system.[37]

In order for monetary policy to be successful in achieving the set objectives, the monetary authorities must have an accurate assessment of the timing and effect of the policies on the economy. This requires an understanding of the monetary transmission mechanisms beyond traditional channels. In the 1970's and 1980's, the capacity of the Bank of Uganda (BOU) to manage monetary policy, regulate and supervise financial institutions had been greatly undermined by government. During this period monetary

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[36] See Bank of Uganda State of the Economy Report, (2002).

[37] See for instance the Bank of Uganda, Quarterly Economic Reports (1999 and 2000, several issues).

policy formulation was under the responsibility of the Ministry of Finance. Realizing the need to rationalize the activities of the central bank, the BOU Act of 1966 was amended as per the BOU Statute of 1993, empowering the BOU as the only monetary authority in Uganda. This development gave the BOU the autonomy to formulate and implement monetary policy. The BOU was also empowered to supervise and regulate the financial institutions under the Financial Institutions Statute of 1993.

Since 1993, when the BOU assumed its primary responsibility in the formulation and implementation of monetary policy, it adopted the Reserve Money Programme (RMP) as the operating framework to facilitate indirect monetary control. From 1993, monetary policy instruments have been developed to regulate liquidity in the economy, with varying degrees of success. In terms of the overall macroeconomic objectives, the RMP has helped to determine an appropriate monetary policy stance that delivers sustainable real economic growth, and low and stable inflation as defined by government from time to time. A low and stable inflation target pays, as it guides economic agents to make rational decisions, lengthens the planning horizon, reduces uncertainty, and also safeguards against eroding the purchasing power of a currency.

3.3. Evolution of the Monetary Policy framework

The evolution of the monetary policy framework cannot easily be described without tracking developments in the economy as a whole, especially monetary and credit aggregates, and other major economic indicators. This section briefly attempts to track monetary policy developments from the time the Bank of Uganda (BOU) was formally established in July 1966.

3.3.1. Credit controls under monetary policy cooperation (1966-1971)

The functions of the BOU, when it was set up, are contained in the preamble to the Bank of Uganda Act of 1966, namely to:

1) Issue legal tender;

2) Maintain external reserves in order to safeguard the international value of the currency;

3) Promote stability and a sound financial structure conducive to a balanced and sustained rate of growth in the economy and other macroeconomic objectives;

4) Act as banker and financial adviser to the government;

5) Ensure that monetary and credit conditions are in accordance with the broad lines of economic policy decided by government;

6) Act as banker to commercial banks and exercise certain powers over their operations for the execution of monetary and credit policy.

Until the establishment of the BOU, the East African Currency Board (EACB) issued a common currency that circulated in Uganda, Kenya, and Tanzania. The BOU did not issue its own currency until January 1967, which was allowed to co-circulate with the EACB currency. The latter's notes continued to be legal tender until September 1967 and the coins until April 1969. Both the notes and coins were still accepted by the BOU for conversion purposes only.

The Treaty for East African Co-operation, which came into force in December 1967, required the central bank governors from the respective East African countries to meet at least four times a year; to consult and co-ordinate their monetary, balance of payments, and interest rate policies. The central banks of Uganda, Kenya, and Tanzania agreed to maintain their official rates of exchange for external currencies and interest rates in line with one another. They based their rates broadly on the EACB rate for rediscounting, which had been 5 *per cent* since 1964. The Treasury bills were made available to commercial banks on a *tap*[38] basis at 5 *per cent*, with an undertaking that they would be repurchased at the same rate to encourage commercial banks to invest surplus funds locally rather than use them to purchase foreign exchange. However, commercial banks showed an interest in investing in the Treasury bills even after the withdrawal of the *tap* facilities. After the *tap* rate of 5 *per cent*, the rate on the Treasury bills remained for a greater part of the year (1967) at 4.5 *per cent*.

The level of foreign reserves dictated monetary and credit policy aimed at avoiding any unnecessary increase in demand not matched by receipts of foreign exchange. For

[38] A "tap" facility or "cash loan" are means through which the central bank securities were offered at predetermined rates of interest, and the authorities accepted whatever sales occurred at that rate.

some years, commercial banks' advances from the central bank were in excess of their deposits, and the difference was met by borrowing from their foreign exchange reserves. Additional demand for seasonal crop financing increased an already borrowed position from their foreign exchange reserves abroad. In view of the high rates in London, commercial banks exerted a lot of pressures on the BOU for advances to minimize on their foreign exchange reserves abroad. The BOU on realizing the possible serious consequences of increased money supply on import demand and on foreign exchange reserves; it implemented in 1967 the following directives to contain balance of payments difficulties:

- Reduce by 5 *per cent* of commercial banks' outstanding credit to non-essential sectors, in preference to essential sectors of the economy[39];
- Limit advances against bonded goods to 75 *per cent* of the value of goods;
- Restrict letters of credit facilities to within 80 *per cent* of the value of goods to be imported. But also require importers to advance cash deposits equivalent to 20 *per cent* of the value of goods being imported before issuing a letter of credit.

In conjunction with these measures, government imposed higher customs duty on a wide range of imports. The response by commercial banks to these directives was very satisfactory and the objective was achieved. But as long as the relatively shallow money and capital markets prevailed, fiscal measures remained the primary means of achieving economic stability. These credit restrictions and the reduction in foreign payments boosted the BOU's reserves, enabling it to follow a more liberal policy in its rediscounting of "cash loans" for commercial banks in 1967.

In 1969, credit measures were relaxed, this contributed to lowering the foreign exchange reserves of the BOU. A new Banking Act came into place, consolidating the law relating to banking in Uganda and also aimed at ensuring that commercial banks and other credit institutions would operate on sound financial principles and in conformity with overall government economic policy. The law prescribed liquidity requirements of 20 *per cent* on commercial banks' demand deposits, and 15 *per cent* on time and savings deposits

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[39] The essential sectors of the Ugandan economy required to benefit from this facility included: agriculture, mining and quarrying, water and electricity, building and construction, manufacturing and processing of goods, and marketing of agricultural products.

to be held in cash. However, in 1970, there was a turnaround in the economic events, with real GDP growth of at least 1.9 *per cent* down from an exceptionally high rate of at least 10.7 *per cent* in 1969. The economic slowdown occurred mainly in the agricultural sector and in trade activity. The former was mainly attributed to a substantial decline in the production of coffee and the later being connected to the uncertainties in the private sector. A new government in 1971 decided to restrict its participation to a maximum of a 49 *per cent* share in companies of strategic importance to the economic development of the country. Monetary developments during this period were heavily affected by a large expansion in government's expenditures in order to match the amounts needed to meet the government's financing needs.[40]

3.3.2. Credit and interest rate controls under the "printing press" regime, (1972-1985)

In 1972, Uganda's political leadership took a decision to declare a national economic war. A number of non-citizens who had for a long time dominated a number of economic sectors were ordered to depart from the country so as to give way for Ugandan nationals to take over their businesses. The repatriation of non-citizens and the state of the economic environment in the late 1970's, led to the collapse of the economy. The collapse of the economy was due to the massive economic and financial mismanagement, and a general state of insecurity throughout the country. The BOU continued to enforce restrictive measures in the form of quantitative ceilings on essential imports and credit limits to finance non-essential purposes. However, due to heavy foreign exchange bills to cover fares and freight charges for the departing non-citizens, there was a major drain on foreign reserves. In addition, the export proceeds derived from export deals that had been concluded by the departing non-citizens never materialized. Furthermore, nearly all the departing non-citizens never liquidated their financial obligations with banks, while new credit had to be extended to the new businessmen. These factors made the imposition of the BOU's restrictive policy inevitable. The leadership further directed that all banking business of government bodies, parastatal bodies, and cooperative unions be transferred to the Uganda Commercial Bank (UCB). The UCB was the only fully indigenous bank at that time. This resulted in a number of foreign owned commercial banks closing down their

[40] A basic tool of efficient debt management—that would see securities sold in exact quantity desired—did not exist.

rural area branches and sub branches. Consequently, the UCB became the biggest commercial bank in the country and the only one operating in the rural areas.

Over the years 1972-1980, there was continuous growth in government borrowing from the BOU as a result of low or negative economic activity, especially after the declaration of the economic war. Credit extension was more for speculative transactions rather than genuine economic activity. A large part of the monetary sector virtually collapsed. In 1981, government embarked on a rehabilitation programme to bring the economy into balance, eliminate distortions, and restore conditions to sustain growth. In respect to monetary policy all interest rates were raised sharply in October 1981, partly to mobilize resources for development and partly to encourage banking habits. This triggered a shift in the structure of financial assets, favouring quasi money and Treasury bills. As a result, Treasury bills rates were raised again in 1982 and tax on earnings was also waived.

The BOU also adjusted both the Bank rate and rediscount rate[41] in conformity with the change in interest rate conditions. An increase in overall credit was limited in agreement with the IMF, and the relevant outstanding amounts were subject to quarterly ceilings. Selective credit policy in form of channeling a certain proportion of total credit to the various economic activities and individual ceilings for commercial banks was abandoned. Selective credit controls were replaced by the stipulation that at least half of any increase in credit had to be extended to crop finance, other agricultural credits, and industry. At this stage, it was not possible to float the exchange rate because of the inadequacy of foreign exchange reserves, and instead the country opted for a dual exchange rate system.

3.3.3. Credit and interest rate controls under the Stabilization Programme (1987-1992)

The policy environment changed dramatically when the authorities adopted the Economic Recovery Programme (ERP) in 1987, principally designed to restore macroeconomic stability. One of its priorities was to contain inflationary pressures by restricting the monetary growth largely associated with the monetization of budget deficits. In May 1987,

[41] The bank rate is the interest rate on loans established by a bank. Bank rate can also mean the discount rate set by a country's central bank. On the other hand the rediscount rate is the rate of interest charged by a country's central bank for loans to its member banks.

a new Uganda shilling equivalent to 100 old shillings was introduced, coupled with a conversion tax of 30 *per cent*, all intended to reduce the excessive liquidity and generate additional tax revenue. But it was clear that the economic recovery could not progress without providing credit to the private sector to cover the cost of imports. Therefore, monetary policy was confronted with the problem of limiting monetary growth, while accommodating private sector credit needs and this necessitated the repayment of the government debt owed to the banking system. Other measures entailed a re-orientation of pricing and marketing policies and the rehabilitation of the industrial sector, in order to prepare the economy for market-oriented policies to stimulate the economy. For reasons beyond the control of the authorities, the 1988 budget deficit turned out higher than envisaged. The programme, somewhat underestimated the damage inflicted on the economy after a decade of progressive disintegration and political instability.

In 1988, the BOU focused on limiting government financing in order to contain inflation. This could not be tackled without expenditure controls and enhancing government revenues. With a narrow tax base heavily dependent on coffee exports, the only way to raise revenues was to discretely devalue the exchange rate. However, the coffee prices plummeted and the targets on revenue could not be achieved. Coupled with government lending for crop finance purposes, the money supply expanded rapidly. The responsibility for the provision of crop finance was transferred from the government to the BOU. This was to enable the Coffee Marketing Board (CMB) to pay off its liabilities. Such a move led to a doubling of the money supply, contributing to inflationary pressures of about 86 *per cent*. In retrospect, the programme overestimated the speed with which stabilization could be achieved. The programme for 1989 contained measures aimed at controlling credit expansion, mainly for crop financing. Repayment of debt by the CMB and the liberalization of the exchange rate system were the principal measures. In response to these measures, the domestic situation improved remarkably, monetary growth decelerated, the real GDP growth rate was higher than 7 *per cent*, and inflation fell to 30 *per cent*.

At the beginning of 1990, foreign exchange bureaus were introduced as part of the gradual process of liberalizing the exchange rate system. This move was in recognition of the important role of the secondary market, parallel to the official market. It provided a legitimate channel for the execution of certain foreign exchange transactions at market-

based exchange rates, thus providing an incentive to convert receipts for export commodities other than coffee, whose receipts were still subject to surrender requirements. In order to improve the competitiveness of coffee relative to other exports, and also to reduce the spread between the official and bureau rate, the official exchange rate underwent a series of devaluations. The expected benefits from devaluation fell below expectations. Repayments by government were less than envisaged in the programme, largely on account of shortfalls in donor support disbursements. There were also declines in coffee export receipts, and higher fiscal expenditures. In the same year, real GDP rose by 5 *per cent*, while prices rose by almost 39 *per cent*, mainly on account of a sharp rise in international prices that led to an increase of 70 *per cent* in local retail petroleum prices.

In 1991, there was a fiscal policy change resulting from severe shortfalls in donor support inflows and revenue collections. The repayment trend that had started in the previous year was reversed, leading to liquidity expansion. Annual inflation shot up by 63 *per cent*. However, tight fiscal policy was adopted in 1992, during which time the government of Uganda made repayments to the banking system and the rate of inflation plunged to negative 1 *per cent* on a financial year-end basis. Other contributing factors that slowed monetary expansion included the increase in foreign exchange purchases for imports and the large amount of non-performing loans. In April 1992, a Treasury bill's auction was initiated, allowing the participation of commercial banks for the first time. Since then, Treasury bills have been used as an instrument of monetary policy. Before 1992, Treasury bills had been used as a fiscal instrument to mobilize funds for the national budget, and commercial banks had not been allowed to hold them. This new arrangement of allowing commercial banks to hold Treasury bills helped to improve the BOU's liquidity management.

3.3.4. Market-based monetary policy regime (1993 to date)

The tight fiscal conditions pursued in 1992, continued to prevail in 1993 as the government continued to carry out repayments to the banking system. For the first time in 1993, the government's net position with the banking system turned into a credit. The liberalization of the exchange and trade system in the same year, and the net donor support inflows, led to an accumulation of net foreign assets by the banking system. Although net foreign assets increased, the net domestic assets of the banking system declined. Inflation fell from an annual average of 28 *per cent* in 1992 to 6.5 *per cent* in 1993. This trend of monetary

growth coming from increased net foreign assets of the banking system has been observed since then.

Consequently, the government realized that an efficient financial sector with an effective banking system was essential to support and foster its stabilization and adjustment programme. In 1993, there was another development, this time in the form of the Financial Sector Adjustment Programme. This programme was in collaboration with the International Monetary Fund (IMF) and the World Bank. The programme's overall and long-term objectives were to deepen the financial system and to establish an efficient system of resource mobilization, which would offer a greater variety of instruments to borrowers and savers in an increasingly liberal and market-oriented environment. The components of this programme included the following:[42]

- Reform of the legal and regulatory framework of the banking system.
- Reducing financial repression by liberalizing interest rates and eliminating credit controls.
- Restructuring the commercial banks.
- Establishing freedom of entry into and procedures for orderly exit from the banking industry.
- Instituting the transition from direct to indirect monetary policy.
- Developing financial markets, including the Treasury bill's market and other money markets.
- Improving the financial infrastructure including bank supervision, the payments system, auditing, and accounting.

The adoption of the financial sector liberalization, particularly the transition from direct to indirect monetary policy management is best supported by the tight monetary policy and fiscal stance. Other factors that would make a favourable contribution include;

[42] The available literature indicates that certain preconditions have to be in place for financial sector liberalization to bring about the desired benefits (see Popiel, 1994: 260p; and Roe and Sowa, 1994: 227).

the existence of the TB's auction, the gradual liberalization of interest rates, and a strong political commitment to maintaining macroeconomic stability.

In summary, for the period 1971 to 1992, the conduct of monetary policy was largely subdued and subordinate to fiscal considerations. Monetary control was exercised through direct means, characterized by interest rate controls; credit controls (selective and directed credit) and was basically undeveloped. Even when liquidity conditions called for a change, reserve requirements remained unchanged at 10 per cent of commercial banks' deposit liabilities between 1971 and 1992. Statutory limits were hardly enforced and a number of commercial banks had open-ended access to credit from the BOU. Interest rates were administratively set and remained unchanged for long periods, despite inflationary developments. When interest rates changed, the adjustments were not high enough to offset inflation. This resulted in negative real interest rates for most of the period, and created excessive demand for bank credit, with suppressed mobilization of financial resources. The Treasury bill instrument hardly served its monetary policy role, given that it was still under the supervision of the Ministry of Finance (and not the central bank). In this regard, the Ministry of Finance determined the TB issues and approvals given to the customers without due consideration for the desired liquidity conditions in the economy. Monetary policy therefore, remained virtually inactive even under the stabilization programmes pursued in the 1980's, despite its crucial role in promoting macroeconomic stability. The introduction of the Reserve Money Programme (RMP) in 1993 was part of the broader set of reforms in the financial sector, which not only included the development of the financial system but also the upholding of macroeconomic stability in the whole economy.

3.4. Current monetary policy framework

The current monetary policy framework in Uganda operates under an indirect approach, the Reserve Money Programme (RMP), which was introduced in 1993. This was after the Bank of Uganda Act of 1993[43] gave powers to the BOU to formulate and implement

[43] The Act empowered the BOU to formulate and implement monetary policy directed at the economic objectives of achieving and maintaining economic stability. Added responsibilities are: to maintain external reserves, issue legal tender, banker and financial adviser to government and manager of public debt, to provide a clearing house for cheques and other instruments for financial institutions; supervise, regulate, control, and discipline all financial institutions and, where appropriate, participate in the economic growth and development programmes. The Uganda Constitution of 1995 also clearly stipulates that the BOU must not be under the direction of any other person or body.

monetary policy. Up until 1993, the Ministry of Finance was responsible for the implementation of monetary policy. However, since 1993 the BOU has exercised its autonomy in the formulation and implementation of monetary and exchange rate policy. Concurrently, the Financial Institutions Statute (FIS, 1993) was enacted, giving the BOU the mandate to supervise and regulate financial institutions. This opened up the financial sector to new entrants and allowed commercial banks more operational freedom, thus, improving bank supervision. The RMP is based on a conventional IMF financial programme. There were basically three factors that led the monetary authorities to use the RMP in the shift from direct to indirect monetary control:

1) Where monetary targeting is adopted, the most effective operational tool is one that the monetary authorities can easily control, namely the central bank's balance sheet.

2) Data on base money could become easily available with a shorter lag than data on broader monetary aggregates.

3) There existed underlying economic relationships among base money, broader monetary aggregates, economic growth, and inflation that underpin the workings of the RMP.[44]

The RMP is a flow of the consolidated assets and liabilities of a central bank. In determining the demand for base money, the BOU follows three steps:

1) The ultimate macroeconomic objectives are defined in terms of quantitative targets for real GDP growth rates, inflation, and import cover.

2) Broad money growth for M2 and other components of the monetary survey are projected, consistent with the macroeconomic objectives with assumptions for velocity. This makes the broad money supply the intermediate target.

3) The growth of base money is then projected to be in line with the broader monetary aggregates and inflation. The annual growth target is converted into

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[44] See Katarikawe and Sebudde, (1999: 15).

monthly targets that reflect seasonality in the money demand. The desired levels for daily movements are worked out from the monthly targets.

On the supply side, factors affecting base money are divided into two categories: autonomous (non-discretionary) factors that are not directly under the control of the central bank and policy factors driven by the discretionary actions of the central bank. For a particular week or month, the actual base money is compared with the desired level and the gap dictates the basis for a monetary policy intervention stance[45], bearing in mind developments in the prospective supply of base money and other macroeconomic variables (inflation, the exchange rate, and the interest rate). Thus, the RMP has been flexibly applied to guide monetary policy.

The supply of base money impacts broad monetary aggregates (M2) via the money multiplier. However, since there is a relationship between broader monetary aggregates, and final prices (inflation, the exchange rate, and the interest rate) and growth, the supply of base money will also impact ultimate targets in the same direction as broader monetary aggregates do. The link between monetary policy and the economy is summarised in the schematic below:[46]

	Primary Target	**Intermediate targets**	**Ultimate targets**
Tools of Operating on Monetary Policy	⟶ Base money	⟶ M2, NDA, NCG, Debt, BOU reserves	⟶ Inflation, GDP, Exchange rate, Interest rate, BoP

3.4.1. Usefulness of the RMP (Effects)

The transition to indirect monetary policy control, supported by major reforms on the fiscal front and other policy measures, has provided positive benefits:

1. Inflation has been brought under control, down from double-digit levels of 66 *per cent* in June 1992 to single-digit levels currently, and has been maintained. This achievement reflects two major factors: first, the continued pursuance of prudent monetary and fiscal policies. Fiscal restraint, evidenced through continued savings with the banking system, combined with close coordination between the monetary and fiscal authorities, assisted tremendously in bringing

[45] To ease or tighten, or leave monetary policy unchanged.

[46] Refer to roman xi for abbreviations.

down inflationary expectations. At times when there were fears that fiscal operations would lead to liquidity injections, which would not be easily sterilized by available monetary policy instruments, the fiscal authorities would postpone and cut down on expenditures in favour of macroeconomic stability. Second, the reduction of inflation in the early 1990's and the commitment of the monetary and fiscal authorities to contain inflationary pressures, probably contributed to lowering inflationary expectations.

2. Partly as a result of declining inflation, interest rates became positive in real terms, which bode well for the mobilization of domestic financial resources. Indeed, financial savings in the form of time and savings deposits and non-bank holdings of Treasury bills have increased tremendously from 0.63 *per cent* of GDP as at end-1988 to 4.1 *per cent* as at end-1999. Gross domestic savings have increased from 1 to 10 *per cent* respectively.

3. Increased use of the financial sector evidenced through the reduction in the share of cash holdings to broad money from 40.5 *per cent* as at end-June 1991 to 29.5 *per cent* as at end-June 2001.[47]

3.4.2. Shortcomings and weaknesses of the RMP

There are two interrelated concerns that have cropped up in the day-to-day use of the RMP:

- Deciding how quickly a deviation in base money from the target (or desired level) should be corrected.

- Deciding when the RMP-based policies should be suspended in case conflicting signals arise.

Other things being equal, the gap between the actual and desired levels would give the direction of a monetary policy stance: ease monetary policy if base money is below desired level, tighten monetary policy if base money is above desired levels, and leave monetary policy unchanged if base money is in line with desired levels. However, in the current situation of structural changes in the financial and non-financial sectors, any action would have to be strongly supported by developments in other indicators (inflation, the

exchange rate, the interest rate and GDP). If such movements call for an easing of the monetary policy, while developments in other indicators show the contrary, allowing discretion such as temporary suspension of the RMP-based policy may be preferable. In any case, easing monetary policy under such conditions may be inappropriate as it would fuel rather than contain inflation. In the short-term, because of the innovations partly brought about by the liberalization process, the relationships between real money, prices, and other indicators tend to become hard to predict, thus complicating the conduct of monetary policy (see Honohan, 1994: 215).

3.4.2.1. Problems in forecasting autonomous factors

Up until 1996, the monetary policy stance in Uganda was driven by the gap between the actual of base money and the desired level, implying a backward-looking approach. Monthly liquidity forecasts were made, showing the likely supply factors of base money and the desired size of monetary policy operations. These could only give an indication of the direction of monetary policy on an annual basis, but could not provide an input into the determination of the monetary operations from one week to another, for two major reasons:

a. The problems in forecasting autonomous factors affecting base money, evidenced by the observed wide divergences between the monthly forecasts and the actual numbers of these supply factors, and

b. Failure to anticipate the exact timing of these transactions within a month. The variable that provided the biggest challenge to forecasting was and still remains the government's operations.

The BOU's monthly foreign exchange and the government's cash flows were the major sources of data for the autonomous flows on the BOU's net foreign assets and net claims on government. They contain information on net donor resources and movements in the cheque float, which are crucial for determining the impact of net government operations on base money. On similar items appearing in both data sets, there were often differences that gave discretion to the compiler to choose which set to use and, in any case, donor import support disbursements proved very difficult to forecast, since they were often influenced by considerations beyond the control of the BOU. In addition, there were delays

[47] See for instance the Bank of Uganda, Quarterly Economic Reports (1991 – 2001: several issues).

in remitting tax revenues from the Uganda Commercial Bank Limited (UCBL) with resulting additive effects on the commercial banks' reserves and base money. Consequently, because government pursued a cash-driven budget, there were no fiscal slippages to cause any macroeconomic instability.

Starting with 1997, the monetary programme was designed in such a way as to ensure uninterrupted and fairly smooth fiscal expenditures (unless there were shortfalls in government revenues), and reduce the BOU's intervention in the foreign exchange market. [48] This effectively protected fiscal expenditures and intervention from exogenous factors affecting donor budgetary support disbursements, external debt service payments, non-bank financing of the fiscal deficit, and other transactions whose exact timing could not easily be established at the beginning of the programme period. Although this has helped to monitor the programme to ensure that the IMF's quantitative benchmarks on monetary and credit aggregates are met, it has created challenges for monetary and exchange rate policy management in Uganda.

Weekly liquidity forecasts, which are consistent with monthly forecasts and the annual monetary programme, now form the basis for determining the size of the offers for Treasury bills and repurchase agreements. This enables the BOU to take a forward-looking approach to the conduct of monetary policy, while combining it with past developments. Despite the delays in the payments system, the BOU has established a fairly reliable weekly pattern of tax revenue receipts and has also set up a mechanism to project government expenditures in the form of cheque payments and automatic (direct) releases, together with other factors affecting base money. One of the setbacks is that it is currently difficult to extend these projections beyond a week. Hence, there is a need to improve on the current liquidity forecasts before extending their use. This can be met through the timely production of the central bank's balance sheet, and shortening the lag of reporting by commercial banks to enable the BOU to make assessment of the movements in the broader monetary aggregates (M2 and M3) and the money multiplier.

[48] To the extent that the BOU's operations have been conducted beyond the need to smoothen wide fluctuations in the exchange rate, this would be reflected as sterilization rather than intervention.

3.4.2.2. Instability in the money multiplier

The link between the central banks' balance sheet and the broader monetary aggregates is through the money multiplier, which is a function of the currency ratio, required reserve ratio, the proportion of time deposits to demand deposits, and the excess reserve ratio. Although the required reserve ratio is under the central bank's control, the portfolio behaviour of depositors and the commercial banks, drive the other three ratios. The workings of the reserve money programme dictate a predictable money multiplier. In 1994 and since 1998 the multiplier has been very unstable and this has somewhat raised questions about the credibility of the desired path of base money.[49]

The observed volatility of the money multiplier reflects a number of factors:

- Uganda was faced with a positive shock in 1992 when the international prices of coffee more than doubled, boosting agricultural incomes with spill over effects on the rest of the economy. This led to the Uganda shilling appreciating against the U.S. dollar by 15.4 *per cent* and agents shifted out of foreign to domestic currency denominated assets. However, the recent terms of trade shock characterized by a steep decline in coffee prices coupled with the steady increase in oil prices, led to a depreciation of the exchange rate. On average, the exchange rate depreciation was 15 *per cent* on an annual basis from 1998 (the BOU annual economic report, 1999). Agents responded by shifting out of domestic to foreign denominated assets to hedge against the depreciation. These complications are largely associated with the over-reliance on coffee as a major export item.

- The closure of four commercial banks between 1998 and 2000 created some panic and hurt confidence in the use of the banking system among the non-bank public.[50] Economic agents shifted into more liquid financial assets such as cash,

[49] See the Bank of Uganda, Economic Quarterly Report, (1994 – 1999: several issues).

[50] Galbis (1986: 117) argued that such bank failures should not be unexpected because the financial sector in the Least Developed Countries (LDC) are characterized by 'bank holding companies' with interest in both financial and non-financial markets. Financial liberalization would place excess supply of financial savings in the reach of these companies, which finance questionable ventures in their attempts to maintain market share (see also Jean-Claude, 2001: 3). Clearly liberalization and other changes to the banking system may well lead to instability of money demand: financial innovation is usually seen as leading to a change in the velocity of circulation (see Arestis and Demetriades, 1993; and Kaldor, 1983).

demand deposits and foreign exchange deposits at the expense of time and savings deposits in local currency. This was made worse by a depreciating Uganda shilling.

- There was a flight to quality as depositors shifted their funds from small local commercial banks to big foreign-owned commercial banks for the safety of their funds.

- Following enhanced supervision; there has been a slowdown in credit extension to the private sector, leading to high excess reserves of commercial banks. Annual growth of credit to the private sector of about 10-15 *per cent* in 1998 has, in recent times been below programmed levels consecutively for two financial years, unlike in the past, when it expanded by over 25 *per cent*.

In view of these shifts, which were aggravated following the liberalization of the capital account in July 1997 and have tended to become noticeable when Uganda is faced with an adverse terms of trade shock, the monetary authorities regularly review the pattern of the money multiplier and the movements in all monetary aggregates, including the demand for base money.

Money velocity has been on a decline, a reflection of three factors: first, the increased monetization of the economy. Since the start of the SAP in 1987, the proportion of monetary GDP to total GDP has been rising steadily from 65.1 *per cent* in 1987 to 75 *per cent* in 2002. This has been possible with the return to political and economic security, the rebuilding of good infrastructure, and improved marketing and distribution systems. Second, the maintenance of positive real interest rates has encouraged economic agents to keep financial assets such as time and savings deposits, and wholesale deposits. Third, the sources of monetary growth have changed from net domestic assets to net foreign assets. Sharer, *et al.* (1995: 121p) suggest that it may be that the transmission mechanism between foreign assets and prices is less certain and direct to cause a shift from net domestic assets to net foreign assets.

3.4.2.3. Interest rate sensitivity

Indirect monetary policy works best in a situation where all the different interest rates are well integrated with one another and with the credit market (see Ncube, 1997; and Roe and Sowa, 1994: 212). The changes in Treasury bills rate feed through to affect the deposit rate, lending rates and other rates. The objective of interest rate risk management is to control the effects that interest rate fluctuations have on net interest revenue and the net present value of the commercial banks' assets, liabilities and off-balance-sheet instruments. Interest rate risk is measured using net interest margins' simulation and asset or liability net present value sensitivity analyses. Simulation tools serve as the primary means to gauge interest rate exposure. The net present value sensitivity analysis is the means by which the commercial banks' long-term interest rate exposure is evaluated. These analyses provide an understanding of the range of potential impacts on net interest revenue and portfolio equity caused by interest rate movements.

Weak interest rate sensitivity is evaluated on the assumptions made regarding the replacement of maturing assets and liabilities to stimulate the impact of future changes in rates and balance sheet composition. Accordingly, the effect of changes in future interest rates on the mix of assets and liabilities may cause actual results to differ from simulated results. In addition, certain financial instruments provide customers a certain degree of "optionality". For instance, customers may migrate from lower-interest deposit products to higher-interest products. Also, customers may choose to refinance fixed-rate loans when interest rates decrease.

Consequently, in Uganda's case weak interest rate sensitivity has been noted, with changes in the Treasury bills rate, which have failing to trickle down to commercial banks' deposit and lending rates. This is partly on account of the low share of time deposits in M2 at less than 30 *per cent*, which would form the interest sensitive component of deposits. Over 60 *per cent* of total domestic currency denominated deposits are in demand deposits, which are relatively passive and not sensitive to interest rate changes. Roe and Sowa (1994: 238) argue that the dominance of the transactions demand in overall money demand could be one of the explanatory factors for this insensitivity. This is justifiable on the grounds that Uganda's transactions are predominately carried out in cash. Ncube (1997) states that the impact of monetary policy on interest rates and output tends to be faster in economies where the large part of their wealth is held in highly interest-rate sensitive assets and a

large share of securities in total credits. However, there has been an observed sensitivity between the 91-day Treasury bill rates and the commercial banks' prime lending rates, albeit with a lag, and sometimes between 91-day Treasury bill rates and weighted inter-bank lending rates (see Musinguzi and Katarikawe, 2001: 13).

Therefore, in view of the above mentioned shortcomings, there is a great deal of interest and preliminary work to assess whether the RMP should be abandoned in favour of inflation targeting as a framework for the conduct of monetary policy in Uganda. Accordingly, inflation targeting is discussed in the next section below.

3.4.3. Inflation targeting

Inflation targeting means controlling inflation through the monetary policy actions of the central bank. Debelle, *et al.* (1998) indicate that inflation targeting has two requirements:

1. Central banks need freedom to choose instruments that they can use to control inflation. To comply with this requirement, fiscal policy considerations should not dictate monetary policy. In fact, government borrowing from the central bank should be low or nil. Domestic financial markets should be deep and broad enough to absorb placements of public debt and government should have a broad revenue base to minimize its reliance on seigniorage.

2. The monetary authorities should be willing and able to refrain from targeting other indicators apart from inflation. In practice, the authorities need to be wholly devoted and committed to achieving future inflation targets and must indicate to the public that achieving these targets takes precedence over the other objectives of monetary policy.

Inflation targeting would require the monetary authorities to adopt a forward-looking approach to ensure that monetary policy instruments can be adjusted to meet the targets. In this regard, the authorities should be fully aware of how long it takes for monetary policy action to impact on inflation and the relative effectiveness of the different monetary policy instruments available. This monetary policy should be easy to model in order to obtain reliable forecasts of inflation, and the economic relationships should be firmly stable.

Regarding the inflation targeting requirements for Uganda, the following issues can be pointed out:

- Uganda satisfies the institutional prerequisites (e.g. central bank independence and commitment to fighting inflation). Monetary and fiscal policies are committed to low and stable inflation. The central bank's independence in using the Treasury bills instrument as a major monetary policy instrument exists.

- The technical prerequisites are problematic, with the biggest drawbacks being the lack of reliable forward-looking indicators for inflation and a reliable model for forecasting inflation. This is partly a reflection of the scarcity of high frequency data on real sector activity. Data on GDP are currently available on a semi-annual basis but data on industrial production (monitored on the basis of the few key industries) have a lag of more than six months. The model we identify in Table 4.5b might be one solution to this problem.

- The government has a very narrow tax base and its tax ratio of about 13 *per cent* to GDP is lower than about 26 *per cent* in neighbouring Kenya. This has partly contributed to its being a net receiver of donor import support flows to finance its public expenditure programmes.

The shortcomings highlighted within the above issues require further attention and consideration before the BOU can fully adapt to inflation targeting.

3.5. Monetary policy instruments and operational procedures

With effect from 1993, the BOU abandoned the use of direct monetary policy instruments and adopted indirect monetary policy instruments. In line with indirect monetary control, the BOU requires effective monetary policy instruments to control commercial banks' reserves and to ensure that the supply of base money is in line with the desired levels. Currently, the BOU employs the following monetary policy instruments:

- Open-market type operations through Treasury bills, the BOU bills, and recently the repurchase agreements (repos).

- Cash reserve requirements on all deposit liabilities irrespective of their denomination.
- The Bank rate to regulate commercial banks' borrowing from the BOU.
- The Rediscount rate to address any liquidity shortages.

3.5.1. Open Market Operations (OMO)

Open market-type operations conducted through Treasury bills (TB's), the BOU bills and repurchase agreements (repos) are either sold to or bought from the public by the central bank to influence deposits with commercial banks (and thus credit creation). These have been the most important monetary policy tools in liquidity management since 1992.[51] Of the three instruments, the TB is the most commonly used. The BOU decides on the size of offer and lets the market determine the interest rate. Net Treasury bill issues are varied in line with current and prospective prevailing liquidity conditions, which are facilitated by the weekly liquidity forecasting techniques.

In 1992, the government revived the sale of Treasury bills as a way of raising money for its operations as opposed to borrowing from the central bank. The government started with weekly short term offers with a maturity of 91 days. Later it introduced monthly categories with maturities of 182-, 273- and 364-days. The TB had fallen into disuse during the years of economic stagnation. At the time TBs were revived, inflation was well over 66 *per cent*. The following year inflation fell to below 10 *per cent* and presently stands in the range of 5-6 *per cent*.

The TB is used solely as a monetary policy instrument because the government rarely uses the TB proceeds to finance its expenditures. This has minimized conflicts between the government's debt management and monetary policy needs that would have ensued if the TB played its usual dual role. The government pays the interest costs associated with the TB and the net TB proceeds held on account of the non-bank public goes towards improving its position with the banking system. Participation in the TB's market is heavily dominated by commercial banks with a share of over 75 *per cent* (see Table 3.1, pp. 78). This skewness indirectly limits the scope and effectiveness of the TB as

[51] The BOU bill was introduced in November 1996 as an additional tool for liquidity management.

a sustainable financing source for government; otherwise private sector credit would be squeezed through high TB rates. This has caused considerable volatility in interest rates, which may outweigh gains from the control aspects of the policy. This could happen in the event that commercial banks set different attractive interest rates in order to expand their clientele base. In addition, there was a lack of secondary trading in TBs during the review period, resulting in the majority of the purchasers holding the bills until maturity. However, the BOU did of course regulate its liquidity stance via its rediscount rate.[52] Accordingly, the stock of TBs as a share of base money for instance, increased from about 18 *per cent* recorded in June 1992 to 65 *per cent* in June 2000, indicating an increased deepening of the market (see Table 3.1).

3.5.2. The BOU bills and repurchase agreements

In November 1996, the BOU introduced its own bill to supplement the TB purely for liquidity management. This was done as a measure to increase the BOU's array of monetary policy instruments and exercise greater flexibility in monetary management. The BOU decided on the volume of the BOU bill offer and left the commercial banks to decide on the rate. Like the TB, it was sold on a discount basis and to the commercial banks only. Its maturity was limited to a maximum of 60 days to avoid having similar features as the TB's, which would confuse the market. The BOU bill was usually deployed during the intra-auction days to bring base money to desired levels. It was a very effective instrument, but its use was halted in 2001 when the BOU introduced repurchase agreements (repos).

The inherent flexibility of the repo was seen as having a potential for enhancing liquidity in the underlying securities, thus helping the development of the secondary market. Furthermore, it has an advantage of offering more protection to the cash lender than a collateralized loan in case of the insolvency of the borrower.

The acceptable collateral is the TB only. Dealing and settlement are done on the same day and repos are priced on an effective yield basis, with a minimum dealing amount of 100 million Uganda shillings. The length of the repo is limited to 70 days and the BOU announces the repo rate and leaves the volumes to be determined by the market

[52] The rediscount rate is defined as the rate at which government securities can be purchased or sold (a bill, note, or other commercial paper) at a reduction equal to the amount of interest that will accumulate before they mature. However, these securities are discounted a second time (rediscounted).

participants. In line with a monetary-targeting framework, the BOU usually determines *a priori* the volume desired to be traded, depending on the desired monetary policy stance.

It is often argued that a central bank in conducting open market operations cannot control both the price and the quantity of an asset at the same time. More so, the announcement of a repo rate in the case of Uganda runs contrary to its current operating framework that focuses on monetary targeting. This was viewed as a short-term measure to prevent commercial banks from using high interest rates to outbid the BOU, a trend observed with the BOU bill. In most cases, the BOU has used the repos to mop up excess liquidity and most offers have been over-subscribed.[53]

3.5.3. Reserve requirements

The use of the cash reserve requirements can affect commercial banks' free reserves in the short-term and the supply of broad money in the long-term. The cash reserve requirement is one of the monetary policy instruments available to the BOU for controlling base money. Historically, however, central banks have regarded the reserve requirements more as a prudential instrument than as a monetary policy instrument to ensure that the commercial banks kept sufficient liquidity to meet any unforeseen shortfalls associated with unexpected cash withdrawals. The reserve requirements were and are still differentiated, with a higher rate on demand deposits than on time and savings deposits.

During most of the 1980's, the commercial banks grossly violated the reserve requirements due to the open-ended borrowing at the BOU. In 1988, commercial banks were required to operate three separate accounts at the BOU (interest-bearing loan account, statutory reserves account, and the clearing account) in order to make the reserve requirements a more effective monetary policy instrument. This performed remarkably well and then in November 1994, the three accounts were merged into one transactions account.

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[53] See Musinguzi and Katarikawe (2001: 16) who also argue that in the present circumstance, the repo would only achieve the intended reduction in base money if the repo rate were set sufficiently high to ensure that the auction would not be under-subscribed. If it were under-subscribed, the BOU would have failed to mop up the desired liquidity. If it were over-subscribed, the BOU would sell repos at a rate higher than the market would have dictated, with consequences for the profit and loss account of the BOU. In practice, it is difficult (nearly impossible) to know in advance the repo rate that would lead the market-determined volumes, and vice versa. It would be desirable to set the volumes dictated by the liquidity forecasts and leave the market to decide on the repo rate or announce the repo rate with a clearly defined objective.

In April 1996, the maintenance of and compliance with cash reserves were changed from a daily basis to an average basis covering a two-week period. Today, the commercial banks are allowed to have automatic recourse to their cash balances with the BOU on a daily basis of up to 50 *per cent* of their reserve requirements, as long as the average level of transactions' balances plus 30-50 *per cent* of vault cash at least equals the reserve requirement by the end of the reserve maintenance period. It was hoped that the reserve averaging procedures would give the commercial banks room for flexible liquidity management, encourage a reduction in high levels of excess reserves, and prompt the development of the inter-bank money market. However, these have not developed to the degree expected.

In November 1996, the cash reserve ratio on domestic currency deposits was raised by one percentage point from 7 and 8 *per cent* to 8 and 9 *per cent* on time and savings deposits, and demand deposits respectively. This was done in order to contain the rapid expansion of private sector credit. In August 2000, the reserve requirements were extended to cover foreign currency deposits, partly to control for excess liquidity and partly to provide a level playing field among deposits. In December 2000, the cash reserve requirements were again raised by one percentage point from 8 and 9 *per cent* to 9 and 10 *per cent* on time and savings deposits, and demand deposits, respectively, to control for excessive liquidity. In an era of developing indirect monetary policy instruments, it is often argued that the reserve requirements should not be used as a first option in the conduct of monetary policy because of its potential interruption effects (see Musinguzi and Katarikawe, 2001: 17). Nevertheless, in a financial system like Uganda, reserve requirements are still used on an infrequent basis, partly because of an inherent weakness in the financial sector and because the market instruments are not fully developed.

In 1998, the portion of vault cash that is an eligible reserve asset was raised from 30 *per cent* to 50 *per cent* for those commercial banks with ten or more bank branches outside the capital city-Kampala. The aim was to ease the burden of and costs incurred in transportation of currency from the commercial banks to currency centres in a cash-dominated economy; otherwise, it remained unchanged at 30 *per cent*. Regarding overall performance, commercial banks have met their reserve requirements with huge margins,

indicating persistent excess reserves due to inefficiently functioning inter-bank and money markets.

Table 3.1. Participation of Different Agents in the Treasury Bills Market, 1992-2000 (all figures are end of June in real terms)

Period	1992	1993	1994	1995	1996	1997	1998	1999	2000
Stock of TB's (billion Shs)	22.0	20.1	45.8	62.8	93.8	95.0	143.2	205.7	361.8
Share of Agent (%)									
Commercial Banks	41.0	53.2	71.4	68.4	75.0	77.1	76.2	70.3	75.7
Bank of Uganda	0.1	14.7	0.1	1.2	2.6	1.2	8.6	18.8	13.4
Insurance Companies	6.1	6.1	7.3	7.3	5.0	0.9	1.0	0.5	4.3
Others	52.9	26.0	21.1	23.1	17.4	20.8	14.2	10.4	6.6
TB's as (% of base money)	18.1	13.8	22.1	22.4	33.5	28.6	37.8	44.7	65.0

Source: Bank of Uganda Quarterly and Annual Reports

In Table 3.1 above we observe an increase in the volume of TBs from 143.2 billion shillings to 361.8 billion shillings between 1998 and 2000 respectively due to an increase in the TB's interest rate. This increase reflected several factors; notably the need to offset liquidity created by maturing promissory notes.[54] Second, the liquidity generated by the government's spending of donor aid and hence, the need to dampen depreciation pressure on the exchange rate following the fall in the terms of trade. Over the years, the Treasury bill auctions have been dominated by the commercial banks. This dominance has been attributed to the prevalence of excess reserves controlled by the commercial banks and the lack of knowledge about Treasury Bills among the general public. However, this changed with the introduction of the central depository system (CDS) in 1998, as investors were now able to arrange to buy and sell TBs. The intermittent closure of the commercial banks in 1998 also made Ugandans switch to investing in government instruments rather than make time deposits. With the introduction of the CDS, issuance of the Treasury bill certificates ceased in 1999, though those, which had not matured by then were honored by government. This change helps make the secondary market more liquid as investors hold the actual TB instead of the certificate.

[54] These had been issued to commercial banks that took over deposits from the closed banks in 1999.

3.5.4. Discount window facility

The BOU usually limits the commercial banks from accessing central bank funds. The BOU carries out this measure by using a penal rate and/or through the prescribed amounts under discounting facilities. There are various mechanisms through which these can operate: such as open market operations, rediscounting of the TB's before their maturity and short-term lending by the BOU (through the bank rate). The 91-day TB rate is the key market rate and has not been effective as a channel of monetary policy for one or two reasons:

- Since, for example, the securities market is dominated by the commercial banks; developments in the securities market have on several occasions not reflected monetary policy signals, but rather conditions in the financial sector. In Table 3.2 (pp. 80) we observe a decline in the TB rates from 1994 to 1999. Such a decline is attributed to the high liquidity in the commercial banks that occurred during the 1994 coffee boom. In view of that, the demand for TB's was increased due to the lack of good substitutes to ensure that there is low liquidity in the commercial banks (see Atingi-Ego and Rwebeyanga, 1998).

- The TB's rate did not lead to significant changes in the commercial bank rates, which weakened the link between interest rates and output. It has been argued that lending rates were sticky due to high intermediation costs faced by the commercial banks during our sample period. Hence, resulting to insignificant credit effects via lending rates (see Nannyonjo, 2001).

Table 3.2. Monetary Policy and Performance Indicators, 1993-2000 (all figures are end of June)

Indicator	1993	1994	1995	1996	1997	1998	1999	2000
Growth in Base Money, (%)	19.8	42.7	35.1	0.1	18.3	14.1	21.6	20.9
Growth in Money Supply, M2 (%)	41.5	33.8	25.3	20.7	15.8	23.7	9.1	8.5
91-day Treasury Bill Rate, (%)	23.7	10.8	7.4	11.8	9.8	6.9	8.1	18.4
Reserve Ratio (%)								
Demand Deposits	8.0	8.0	8.0	9.0	9.0	9.0	9.0	9.0
Time & Savings Depo's	7.0	7.0	7.0	8.0	8.0	8.0	8.0	8.0
Inflation, (%)	-2.4	16.1	3.4	5.4	10.4	-1.4	5.3	2.1
Official Exchange Rate-Shs/USD	1,199.1	962.6	964.8	1,041.4	1,067.6	1,231.0	1,447.2	1,565.6
Real GDP growth (%)	8.4	5.4	10.6	7.8	4.5	5.4	7.4	5.1

Source: The Bank of Uganda Quarterly and Annual Reports

3.5.4.1. Rediscount rate

The BOU Statute of 1993 requires that the Rediscount rate be linked to the bank rate by a margin of not less than one percentage point and it is administratively set. The rediscount rate is defined as the rate at which government securities can be purchased or sold (a bill, note, or other commercial paper) at a reduction equal to the amount of interest that will accumulate before they mature. However, these securities are discounted a second time (rediscounted). Before April 1995, the rediscount rate was out of line with the market-determined Treasury bill rate. The determination of the rediscount rate was then changed to reflect developments in the Treasury bill market. Thus, the rediscount rate is determined on the basis of the four-week moving average of the annualized yield of the 91-day Treasury bill plus a policy margin that reflects the monetary policy stance. In order not to put at risk monetary policy, eligible instruments for rediscounting are limited to the Treasury bills with remaining days to maturity of 91 days or less. The commercial banks have not normally rediscounted Treasury bills except for speculative purposes in the foreign exchange market during periods of seasonal flows. This practice was very common in 1999.

3.5.4.2. Short-term lending facility (Bank rate)

Before the introduction of indirect monetary policy instruments in the early 1990's, the BOU called for systematic and gradual repayment by the commercial banks. This was to eliminate commercial banks' prevalent open-ended borrowing, thus limiting monetary

expansion. Later on, an inter-bank money market was established, with the intention of encouraging trading among the commercial banks. As a result, commercial banks with surplus funds could then lend to those banks that were in need of liquidity, instead of accessing the BOU credit. Meanwhile, credit from the BOU was regulated through the new clearing-house rules introduced in 1993. These rules merged the existing three accounts of the commercial banks at the BOU into one account, the clearing (or transactions) account. Under the new rules, all the commercial banks had to meet liquidity requirements. If a commercial bank found that it had insufficient funds, it would then be required to cover the shortage from either the inter-bank money market or the BOU. With an undeveloped and segmented inter-bank money market coupled with a restricted discount facility, these rules had to be relaxed. In view of that, the shortcoming was that commercial banks found they were operating overdrawn accounts at the BOU and on many occasions were not collateralised.

In 1994, the BOU provided four separate arrangements for advances on a secured basis at the bank rate. These were the basic borrowing facility limited in amount and frequency, a supplemental borrowing arrangement, a seasonal line of credit, and under exceptional circumstances, credit for periods of more than three months. However, this approach was never implemented. Previously, the bank rate was administratively set at one percentage point above the rediscount rate. However, in April 1995, the determination of the bank rate was changed to take into account interest rate developments in the inter-bank money market. The bank rate was then determined on the basis of the four-week moving average of the inter-bank money market plus a policy margin reflecting the monetary policy stance from April 1995 to August 2000.

Since 1996, the commercial banks have been allowed to borrow from the BOU automatically up to a maximum of 5 *per cent* of their reserve requirements against shilling deposits for a maximum of five days. Beyond this amount, the commercial banks may borrow on a case-by-case basis, subject to approval by the BOU. Treasury bills or any other eligible instruments as determined by the BOU, with an original or remaining term to maturity of not more than 91 days, should be the collateral for the credit. Any amounts borrowed should not exceed 75 *per cent* of the market value of the collateral.

Regrettably, commercial banks have not actively used the automatic borrowing facility and/or the discount window. This, however, excludes the commercial banks that

have faced structural and liquidity problems as well as having operated overdrawn accounts at the BOU for longer than five days. As a result, they require liquidity support of a long-term nature. Possible reasons for this mode of arrangement include the following:

- The reserve averaging system gives some room for flexible liquidity management. The commercial banks can fall below their reserve requirements by not more than 50 *per cent* of their required amount on any day within the reserve maintenance period as long as they meet their requirements by the end of the period.

- The commercial banks, as a whole, have been holding excess reserves at the BOU by an average of about 5-10 *per cent* of their requirements.

- An inter-bank money market exists and the commercial banks can lend to one another, sometimes at rates below the bank rate and for periods longer than five days. They can also lend in amounts exceeding 5 *per cent* of their required reserves.

- Some commercial banks lack the required collateral to pledge when borrowing from the BOU.

- The bank rate has tended to be above the inter-bank lending rate, making it quite expensive for the commercial banks to borrow from the BOU.

Accordingly, the limited access to the automatic BOU credit of 5 *per cent* of the required reserves was prompted, among other things, by the need to develop the inter-bank money market, rather than being accommodated at the BOU. Indications are that this has been achieved, if judgment can be done in terms of liquidity management. The habit of open-ended lending by the BOU to the commercial banks is a thing of the past. There have been few, if any, instances when the commercial banks have accessed credit from the BOU for liquidity management. However, the inter-bank money market is still underdeveloped and continues to be segmented, with foreign-owned commercial banks wishing to trade among themselves and reluctant to trade with the small indigenous commercial banks. Consequently, the development of this market might take a long time to have a significant impact on the financial sector.

Due to the segmentation and the lack of integration between the inter-bank money market and the TB's market, it became difficult, at times, to ensure that the bank rate remained above the rediscount rate as determined by the BOU. To address this problem, the policy of linking the bank rate to inter-bank lending rates ceased in 2000. Presently the bank rate is set, at least one percentage point above the rediscount rate. The BOU extended liquidity support on a long-term basis to assist the commercial banks undergoing restructuring. With the recent enhanced bank supervision and given past experience (that some of the commercial banks, which operated overdrawn accounts at the BOU eventually closed them), the BOU can only extend short-term liquidity support to solvent but illiquid commercial banks. This measure is motivated by the need to reduce costs and minimize losses in the financial sector.

In summary, the availability of a short-term lending facility can, therefore, be seen more as a safety net to meet any unforeseen liquidity shortages rather than a key monetary policy tool. This is demonstrated by the dismal extent to which the commercial banks have used this facility in day-to-day liquidity management.

3.6. Challenges to monetary policy management

During a four-year period ended 2002; monetary policy management faced a number of challenges. The first was associated with the payment of depositors of closed commercial banks while, at the same time, ensuring overall macroeconomic stability. When the closure of the commercial banks occurred in 1998 and 1999, the government decided to pay depositors the full amount of their deposits net of their debts. This was over and above the insured amount in accordance with the regulations of the Deposit Insurance Fund (DIF). However, in order to smooth over the monetary injections involved in such an exercise, the BOU paid for compensations through cash payments to small depositors, and interest-bearing promissory notes issued to large depositors. In particular, compensation was paid to the commercial banks that had agreed to take over the deposit liabilities of the dissolved banks (for example, the Cooperative Bank which was closed in 1998). At the same time as promissory notes matured in 2000 and 2001, an effort was made to roll them over into TB's. The second challenge was the continuous weakening of the Uganda shilling against the U.S. dollar. This was as a result of the deterioration in the terms of trade. Consequently, this was further characterized by a sharp fall in coffee prices and was compounded by increased oil prices in 2001 and 2002.

Another challenge emanated from the widespread drought that adversely affected agricultural production with implications for low real GDP growth, higher inflation, and reduced real money demand. In addition, as the country was undergoing a terms of trade shock, there were liquidity injections associated with expenditures on poverty-reduction programmes in the monetary programme. Finally, the September 11th 2001 terrorist attacks that occurred in the U.S. increased the uncertainty surrounding medium-term global growth prospects, with a heightened risk of slower global growth. This led to the deterioration in Uganda's external terms of trade as coffee and other export commodity prices were pushed downward by the weakening global demand. Accordingly, shipping costs increased because of higher insurance rates and there is a possibility that tourism may continue to be adversely affected.

However, while all these factors have the potential to adversely affect Uganda's external sector, the overall risk to Uganda's economy is limited. Uganda's medium-term balance of payments position is still very strong, based on the large surpluses projected in 2002. These surpluses have enabled the economy to absorb any further weakening of the external terms of trade without serious disruption to the economy. Besides, the financial sector is still underdeveloped with low monetary depth as reviewed in the next subsection.

3.6.1. Underdeveloped financial sector

Uganda's financial sector comprises of the central bank (Bank of Uganda), 13 commercial banks (after the closure of 4 banks), six credit institutions, the Post-Bank (PB), and 18 insurance companies. It also comprises of three development banks (which primarily manage donor funds), the National Social Security Fund (NSSF), the Uganda Securities Exchange (USE), 76 licensed foreign exchange bureaus and a fairly well developed and diversified micro-finance industry[55]. The commercial banks play an important role in the transmission of monetary policy in several ways. Accordingly, commercial banks dominate the financial sector, accounting for about 75 *per cent* of the total financial assets in Uganda (excluding the BOU) by extending credit to the private sector.[56] The former Government-

[55] The micro-finance industry, which has direct links with two commercial banks and two non-bank financial institutions, has up to 100 non-government organizations and numerous financial cooperatives. It remains quite small relative to the needs of the rural population where the bulk of the population resides and contributes almost 40 *per cent* of GDP.

[56] This ratio is derived from total credit extended by the commercial banks and Non-Bank Financial Institutions (NBFIs) as at the end of June 2000.

owned commercial bank (UCBL), which was recently sold to the Stanbic bank of Uganda, is presently the biggest commercial bank. The UCBL, when still under the management of the Government, accounted for slightly less than one-third of the total deposits in the financial system. Whereas, four other foreign-managed banks (Barclays, Bank of Baroda, Citibank, and Standard Chartered) combined hold an additional 55 *per cent* of deposits.

The commercial banks' credit lending has been concentrated in three main areas: manufacturing, agriculture, and trade and commerce. Credit extended to trade and commerce is in the form of short-term credits of one year or less and in overdrafts, and at very high interest rate spreads averaging 15-20 *per cent*. Credit owed to the agricultural sector has been declining because of pre-financing from abroad. Nevertheless, most agricultural lending is in the form of crop finance, providing short-term funds to coffee exporters until they receive payment from foreign purchasers. Consequently, there is little commercial banks' lending to farmers for agricultural production, yet the agricultural sector contributes almost one-half of the country's total GDP.

The effectiveness of monetary policy is to a large extent likely to be affected by the commercial banks' perceptions of the reactions among borrowers to changes in credit conditions. Other imperfections that could affect monetary policy include imperfect information and the costly enforcement of contracts when assessing the credit worthiness of borrowers (see Krylova, 2002: 10). As a result of these effects, Mishkin (1995: 6) argues that a tight monetary policy in this case, would weaken the borrowers' balance sheet in several ways. For example, it weakens the financial position of the firm by diminishing the value of the borrower's deposit and the value of the firm's net worth. Monetary policy also decreases net cash flows where a rise in interest rates increases interest expenses (supposing that a firm has floating-rate or short-term debts). The adverse selection problem arises, when the drop in the net worth causes higher losses by adverse selection for lenders (this shrinks lending). Whereas, the drop in the net worth of firms also makes owners more motivated to engage themselves in risky investment projects, which is referred to as being a moral hazard problem in the financial market. In addition, a major problem faced by the commercial banks during our sample period, was a high default rate. For this reason there

was accumulation of bad loans in bank balance sheets, thus imposing significant losses on them.[57]

Non-performing loans per commercial bank averaged about 27 *per cent* and reached a peak of about 59 *per cent* in 1994 as observed in Table 3.3 (pp. 87). We observe that loan growth as a percentage of total assets of commercial banks declined particularly after 1996 (with the exception of 1998). There also appears to be selective allocation of credit in favour of some sectors such as the trade and services sectors. For example, because of the risk associated with production in the agricultural sector, less credit was allocated to the sector throughout the review period (see Table 3.3). As a result of this, interest rates have not played a significant role in the allocation of credit. In general, as the commercial banks strive to overcome the persistent problem of bad debt through their improvements in loan screening and monitoring, they have become increasingly prudent in their credit lending.

Due to a lack of confidence in the market and a shortage of good investment opportunities, commercial banks preferred to purchase more government securities, whose share of assets in their portfolios increased from 2.5 *per cent* in 1993 to 17 *per cent* in 2000 (see Table 3.3). However, the implication resulting from commercial banks' reluctance to lend the private sector is that part of the transmission mechanism between the BOU's open market operations and output is put out of action.

However, there were other distortions to the allocation of credit during our review period. For example, there were episodes of reduced demand for domestic credit due to increased use of foreign credit to finance production. Unfavourable weather conditions during 1996 and 1997, also resulted in a decline in the demand for credit due to reduced activity in the economy, especially in the agricultural sector. Such factors make it difficult to identify the real effects of monetary policy, since they may have acted as exogenous driving forces in the data generating process of GDP.

[57] Default losses were mainly attributed to the diversion of funds meant for accredited developmental projects. Hence, with such mismanagement of credit funds, the administration of loans became very expensive and many projects performed poorly.

Table 3.3. Commercial Bank Activities, 1993 – 2000 (all figures are end of June)

Indicator	1993	1994	1995	1996	1997	1998	1999	2000
Assets (billion Shs.)	472.8	587.7	706.4	805.9	965.9	1,279.8	1,456.6	1,801.5
Credit (% of assets)	32.7	33.3	34.0	41.9	34.9	36.1	41.2	27.8
Securities (% of assets) 1/	2.5	5.6	6.1	8.7	7.6	9.0	11.0	17.0
Excess Reserves (% of assets)	4.6	6.5	10.1	3.1	5.1	4.7	4.3	2.6
Lending Rate (%)	26.8	21.3	19.5	20.8	21.7	21.5	23.0	21.9
Growth in Deposits (%)	57.5	32.3	25.3	19.1	21.6	30.7	5.4	9.2
Growth in Total Credit (%)	47.6	25.8	23.0	37.4	4.9	24.0	16.3	0.6
Growth in Credit to Agric. (%)	43.7	29.0	15.0	12.9	10.0	2.1	-7.7	-27.9
Growth in Credit to T&OS (%)	64.7	15.8	25.7	24.1	28.1	32.1	2.5	5.9
Non-Performing Loans (% of total loans) 2/	16.1	58.7	46.3	41.7	29.2	20.1	16.3	28.3

1/ Securities include Treasury Bills and BOU bills.
2/ The figures for non-performing loans are average ratios per bank.
Source: Bank of Uganda and Uganda Bureau of Statistics

Other distortions to credit allocation were created by the restructuring of some commercial banks. For example, the removal of bad loans from the UCBL balance sheet in 1997 led to a 14 *per cent* fall in the banking system's stock of credit. The upward revision of minimum capital requirements for all financial institutions that was effected in January 2000, further, led to an additional monetary channel, since the commercial banks suffering from large negative capital shocks were not able to offset a drain in reservable deposits following tight money by issuing large time deposits. Consequently, the loan supply from the undercapitalized commercial banks was more responsive to tight monetary policy than from the well-capitalized banks.

3.6.2. Interest rate volatility

Monetary policy is often perceived as working through changes in real interest rates. It is argued that monetary policy affects real interest rates through changes in nominal rates because nominal frictions make the adjustment of prices sluggish. However, there is also a concern that greater openness in monetary policy-making may lead to volatility in financial markets especially in interest rates.[58] Excessive interest rate volatility can discourage the

[58] Central banks appear to dislike interest rate volatility. Arguments in favour of reducing interest rate variability have been put forward. There have been a number of papers documenting and analysing so-called 'interest rate smoothing' (see for example, Goodfriend, 1991: 7; and Goodhart, 1996: 81p). Although the primary focus of that literature is the observed tendency for the smoothing of policy rates, part of the motivation for such behaviour has been to provide a stable environment for financial markets.

development of domestic money markets and forward foreign exchange markets. Interest rate volatility can further reduce the policy information content of interest rate movements, and adversely affect the transmission mechanism from short-term to long-term interest rates *viz-á-vi* the health of the financial sector. Interest rates on TB's, which had declined from 1995 to 1999, started to increase thereafter, fast approaching the peak level of 19 *per cent* in 2000. In view of that, not only did interest rates rise but were volatile too, as evidenced by the variability observed in Table 3.2 (pp. 80). The interest rate volatility in 2000 could be account that commercial banks were still learning to price the longer-dated government securities at a more frequent interval than before.

The increase in TB rates reflected a sharp rise in the volume of TB's issued and held by the commercial banks. In 2000, the BOU limited its exchange rate market intervention to smoothen the pace of currency depreciation, while leaving the exchange rate to adjust to the economic fundamentals. As a result, it put a lot of pressure on TB's as evidenced by the increased interest rates from 8.1 *per cent* in 1999 to 18.4 *per cent* in 2000 as the BOU mopped up excessive liquidity in order to bring base money in line with desired levels (see Table 3.2). The high level of interest rates posed a threat of crowding out the private sector since the yields were close to the commercial banks' lending rates.[59] Consequently, the monetary authorities changed the mix of instruments and scaled down TB issues combined with sales of foreign exchange to allow TB rates to fall. However, the dangers of this stance were that the market sometimes failed to take up the dollars and/or quoted outrageous rates, not permitting the BOU authorities to offset or '*sterilize*' the effects of the resulting change in the official foreign asset holdings on the domestic monetary base. This ran the risk of fuelling inflationary pressures. Consequently, balancing the available monetary policy instruments to ensure macroeconomic stability without

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[59] Crowding out happens when the government is borrowing heavily while businesses and individuals also would like to borrow. The government can always pay the market interest rate, but the private sector cannot, and is therefore crowded out. In other words the government is borrowing so much that the interest rates increase, which in effect squeezes the private sector out of credit markets. Crowding out can also come from government expenditure on areas that may be provided more efficiently by the private sector, such as; health care or even through charity and redistribution. At times, excessive government borrowing has caused low private sector borrowing and, consequently, low investment and (because the economic returns on public borrowing are typically lower than those on private debt, especially corporate debt) slower economic growth. This has become less of a concern in recent years as government indebtedness has declined and, because of globalization, companies have become more able to raise capital outside their home country.

crowding out the private sector remains a major challenge facing the monetary authorities in Uganda.

In the short-term, there is a need for further harmonization of monetary and fiscal policy to improve the liquidity forecasts and the payments system. In addition, there is need to establish regular contact with both the domestic and foreign markets for timely information. In view of that, this would enable the BOU to decide on the appropriate amount of sterilization required and enable better information to be obtained from the markets.

3.6.3. Markets for open market operations

There appears to be general consensus that the conduct of monetary policy is facilitated by the existence of well-functioning markets, and that indirect monetary policy instruments contribute to the deepening of financial markets (see Ncube, 1997; and Roe and Sowa, 1994: 212). On the one hand, one view is that developed markets serve as one of the channels of transmitting monetary policy, and on the other hand, the introduction of indirect monetary policy instruments helps markets to develop. Besides, most indirect monetary policy instruments are market-based and so markets need to work efficiently.

3.6.3.1. Treasury bills market

Treasury bills dominate the money market in Uganda, accounting for the largest portion of all government domestic debt. The introduction of TB's in 1992 through an auction system provided the minimum market base necessary to facilitate the transition from direct to indirect monetary control. The 91 days TB's were offered to commercial banks and to the non-bank institutions on a fortnightly basis, but the frequency was later increased to a weekly basis. In the same year, the term structure of the TB's market was lengthened, with the weekly auction being augmented by a monthly allocation of 182-days and 273-days TB, and later by the 364-days TB in 1994. This continued until 2000 when the auction of the 182-, 273-, and 364-days TB's changed from a monthly to a weekly basis.

Since the majority of bids for TB's are competitive, small purchases are allowed on a non-competitive basis. Accordingly, commercial banks' holdings account for the highest portion, standing at 75 *per cent* of the outstanding stock of TB's. The BOU's holdings, a

large part of which facilitate repurchase agreements, account for the second-largest share at 15 *per cent*. This is followed by other categories with 8 *per cent* and insurance companies with 2 *per cent*. Due to an enormous need to mop up excessive liquidity, the BOU continues to issue TB's as the main tool of monetary policy to control liquidity. For example, TB's amounting to 893 billion shillings were issued during the fiscal year 2000 for liquidity absorption. As a result, there was a net redemption of 30.8 billion shillings in the same fiscal year. In addition, the stock of TB holdings increased by 227.6 billion shillings from 361.8 billion shillings recorded by the end of June 2000, to 589.4 billion shillings as at the end of June 2001. The activity in the TB's market for the period 1999–2001 is shown in Table 3.4 (pp. 91).

Despite the amount of TB holdings in 2001, which is equivalent to almost 50 *per cent* of M2, trading in TB's has been primarily between the BOU and the commercial banks. The secondary market has not developed, with the exception of rediscounting and repurchase agreements done at the BOU, since most participants hold them until maturity. Hence, commercial banks have hardly engaged in inter-bank lending backed by TB's (liens)[60], thus largely relying on mutual trust. Consequently, the TB instrument has remained illiquid[61].

The annualised yield on 91 day TB's fell from 18.9 *per cent* recorded in the first quarter of the 2000/2001 financial year (June 2000 to August 2000) to 6 *per cent* in the fourth quarter end 2000/2001 financial year (March 2001 to May 2001). The decrease was a reflection of the change in the monetary policy instruments used for foreign exchange intervention, which eased pressure on the TB instrument in the third quarter (from December 2000 to February 2001) of the 2000/2001 financial year (see Table 3.4, pp.91).

[60] A lien is any type of financial instrument secured by your property or another asset for the payment of a debt. It can also be defined as a restriction on a certain parcel of property that usually reflects an amount of money due to a third party from the owner of the property, which may or may not be related to the property.

[61] Illiquid refers to an asset not readily convertible into cash. An illiquid security is one without an active secondary market, making it difficult for an owner of the security to sell it. Small-capitalization stocks tend to be illiquid because they have fewer shares outstanding and lower trading volumes that can make them more volatile to own. Others include bonds, or commodities.

Table 3.4. Stock of Treasury Bills, Issues and Maturities, 1999 – 2001

Indicator	1999/2000 FY	June-Aug 2000 Q1	Sept-Nov 2000 Q2	Dec 2000-Feb 2001 Q3	Mar-May 2001 Q4	2000/2001 FY
Stock of Treasury Bills	**361.8**	**436.2**	**485.9**	**527.7**	**589.4**	**589.4**
91 Day Treasury Bill Factors						
Average Price	96.7	95.8	96.7	95.5	98.2	96.6
Annualised Discount Rate (%)	10.2	16.9	13.1	16.7	5.9	13.2
Annualised Discount Yield (%)	10.9	18.9	14.3	17.8	6.0	14.3
Reference Rate (%)	9.9	17.5	14.2	18.9	8.7	14.8
Rediscount Rate (%)	15.2	23.8	17.3	21.9	10.7	18.4
Net Issues	**225.2**	**-80.9**	**42.9**	**36.4**	**32.4**	**30.8**
Total Issues	**849.6**	**319.1**	**173.3**	**181.6**	**219.0**	**893.0**
91 Days	702.5	111.9	33.4	32.0	34.0	211.3
182 Days	42.0	66.3	37.8	41.7	40.0	185.8
273 Days	47.4	68.3	46.2	49.3	56.5	220.3
364 Days	57.8	72.6	55.9	58.6	88.5	275.6
Total Receipts	813.0	283.9	149.7	151.6	201.1	786.3
91 Days	702.4	107.2	32.4	30.6	33.4	205.4
182 Days	39.7	60.0	34.3	36.7	38.1	168.1
273 Days	43.8	58.3	38.9	39.3	51.7	188.2
364 Days	51.9	58.4	44.2	44.9	77.9	225.4
Total Maturities	**624.3**	**238.2**	**216.2**	**217.9**	**250.5**	**922.8**

Source: Bank of Uganda
Where FYrefers to Financial Year and Q refers to Quarter.

The bank rate and rediscount rates moved from 9.9 and 15.2 *per cent* to 14.8 and 18.4 *per cent*, respectively, from end of 1999/2000 financial year to the end of 2000/2001 financial year. These rates initially fell to 14.2 and 17.3 *per cent* respectively during the second quarter period of September 2000 to November 2000 before rising again to record 18.9 and 21.9 *per cent* in the third quarter period of December 2000 to February 2001. After which they fell to their lowest levels in the fourth quarter period of March to May 2001 by the close of the 2000/2001 financial year (see Table 3.4 above).

3.7. Summary and conclusions

The country's long-standing poor inflation record prior to the adoption of indirect instruments by the monetary policy framework in 1993, reflected shortcomings in the previous design and conduct of monetary policy. Monetary policy in Uganda did not have well-specified objectives, was not sufficiently forward-looking and lacked transparency and accountability. Decisions were too easily subject to the influence of short-term political considerations. The roles and responsibilities of the government and the Bank of Uganda (BOU) were not clear or consistent thus harming their credibility. However, the monetary

policy framework implemented from 1993 onwards addressed these concerns and has helped to keep inflation close to the BOU's target.

Like other sub-Saharan countries, Uganda shifted from direct to indirect monetary policy control as part of the financial sector reforms adopted within the context of the Structural Adjustment Programme. For over two decades, since its establishment, the BOU had to ensure that monetary and credit conditions, were in accordance with the overall economic policies determined by the government. For a large part, the conduct of monetary policy was subdued and subordinate to fiscal considerations. With the exception of the years 1966 to 1970, monetary developments were strongly influenced by the monetization of the government deficit, especially following a breakdown of the country's economy after the declaration of the national economic war in 1972.

The adoption of the reserve money programme in 1993 has enabled Uganda to employ adequate affiliated measures in implementing effective monetary control. In this chapter, we have found that to have an effective indirect monetary policy framework, a number of issues have to be considered some of which have been summarized below.

Monetary policy remains focused on promoting price stability to support the broad macroeconomic objectives outlined by the BOU. To achieve these objectives, the central bank needs to remain independent and restrictive towards monetary financing of the fiscal deficit. The restructuring of the banking system in Uganda as mentioned in Section 3.6.1 of this chapter has little impact, if weak prudential supervision allows the system's solvency to be compromised again. Thus, Uganda needs to put in place protective measures and enforcement mechanisms that encourage prudent behavior.

The BOU actively reviews the pricing of the liquidity providing windows to ensure that accessibility to both the rediscount and discount windows (commercial banks' borrowing at Bank of Uganda). In addition, the BOU allows the rediscount rate to be based on movements in the Treasury bills market. The BOU, further, provides a margin to ensure that the window is used as a last resort source of liquidity and hence does not deter development of the secondary market in Treasury bills.

Indirect monetary policy that is in line with other policies (for example, fiscal policy), has enabled the monetary authorities to bring down inflation from double-digit to single-digit levels, and ensure that positive interest rates on Treasury bills and time deposits

prevail. The RMP has been the operating framework for the conduct of indirect monetary policy. Of the monetary policy instruments available to the BOU, we conclude that the TB's instrument is the most commonly used in controlling commercial banks' reserves. The fact that TB's are used solely as a monetary policy instrument eliminates the policy conflict that might ensue between debt and monetary management, if the instrument was to play a dual role.

Imperfections in the financial sector have to a great extent, undermined the effectiveness of monetary policy. The Treasury bills market is narrow with a modest stock of TB's, and is concentrated among commercial banks. Secondary trading of securities is limited, while the inter-bank market is not functioning efficiently. These weaknesses have often led to large movements in market interest rates without any significant impact on credit supply. High intermediation costs (of which default risk seems to be a major cause) also leads to distortions of credit allocation, further weakening the link between interest rates and economic activity. Some of these challenges faced by the monetary authorities are structural in nature, and thus they are beyond the scope of current monetary policy.

The effectiveness of the RMP for monetary policy control is undermined by a number of factors such as; problems in forecasting the independent factors that affect broad money, especially the net effect of government operations and the instability of the money multiplier. The BOU may need to reduce interest rate volatility. A reduction in interest rate volatility might be possible through better liquidity forecasting. Thus, a possible future research item is that broad money forecasts need to be improved. The empirical model identified in the next chapter may be of some use in this regard.

In conclusion, we provide an overview of monetary policy management in Uganda. Monetary policy, as often perceived, works through changes in interest rates as may be implemented by the monetary authorities. In view of that, the estimation of a stable real money demand function requires the use of effective monetary policy instruments. Hence, the review of monetary policy management in Uganda is a major contribution to the empirical study of real money demand stability in this thesis. In Chapter Four, we estimate the real money demand function for Uganda and thus draw monetary policy conclusions from the results obtained. In particular, we employ the cointegration and error correction methodology to examine whether there exists a stable real money demand function, or not for the sample period 1980-2002. Consequently, if a stable real money demand function is

found to be supported by the data, then the real money stock can be used as a monetary instrument in the implementation of monetary policy in Uganda.

CHAPTER FOUR

EMPIRICAL METHODOLOGY, MODEL SPECIFICATION, AND ANALYSIS OF RESULTS

4.1. Introduction to empirical methodology

The theoretical and literature reviews in Chapter Two, have emphasized the need for the inclusion of certain features when specifying for the demand for real money. While the opinions expressed in the theory are often not in agreement, a general consensus exists on the use of the money stock as the dependent variable with some measure of income and opportunity cost of holding money as explanatory variables.

To interpret money growth obtained from real money demand modelling, one requires the presence of a stable real money demand function. The Ugandan literature in this area is particularly weak, lacking regular assessments of stability of this function in a more sophisticated econometric model in order to extract the policy significance of observed real money demand changes. A real money demand function is said to be stable when it is unchanging over time. This means that when it is estimated over two (or more) separate time periods, similar estimates for the regression coefficients are obtained. Two issues that are relevant to the stability of real money demand functions are the neutrality of money and the super neutrality of money. Money is said to be neutral when a once off change in the aggregate quantity of money influences the nominal variables in the real money demand function but leaves the real variables unaffected (see Barro, 1993). This can be explained by looking at the situation that arises when the money stock doubles: when the level of money stock is doubled the price level will double, as will the level of income, but the level of real money balances will remain unchanged.

Superneutrality occurs when all real variables are also unaffected by the change in the money stock, so that, even if constant changes occur in the level of money, the real variables are unchanged. Although, money is regarded by many to be neutral where changes to the quantity of money affect nominal but not real variables, money has not proved to be superneutral, which means that variations in the rate of growth of money do have real effects (Barro, 1993). Because money is not superneutral, the demand for real money is very important to policy makers as changes in the growth rate of the money

supply causes changes in the demand for real money. Therefore, for policy makers to be able to effectively carry out the desired changes through their policies, they need to accurately predict what effect any change in the growth rate of money stock will have on other variables within the economy so as to be able to accurately include these effects into the consequences their policies will have.

Modelling the demand for real money concerns the estimation and quantification of the real money demand function, by utilizing data and econometric methodology. Collecting and organizing the data involves choices about the frequency of observations, the sample length, and the reliability of the data. For some countries, financial data are available at annual, semi-annual, quarterly or monthly observations, but the national accounts data are collected less frequently (usually quarterly). In many developing countries, few quarterly data are available and empirical work relies on annual series and longer-runs (see Ghatak, 1983). Nevertheless, using longer sample lengths has some merits because the random component has less influence due to the smoothing effect of temporal aggregation. Some go further, Friedman and Schwartz (1982) deliberately used smoothing methods to average out behaviour over business cycles. Whatever sample size and data frequency is chosen, data are usually converted into natural logarithms. This has several benefits. First, it smoothens out the data in comparison to un-logged data. Second, the parameter estimates resulting from an estimated equation are elasticities and are easier to interpret. Third, equations in logarithmic form allow non-linear specifications to be estimated in such a way that the coefficients can still be interpreted as elasticities.

In this chapter, we examine monetary dynamics with a cointegration and error-correction modelling methodology that marries in an econometrically acceptable manner, long-term trend relationships between economic variables to a system of short-term dynamic adjustment equations. One of the short-term dynamic adjustment equations identifies how changes in the money stock responds to changes in the determinants of long-term real money demand; the other equations identify how the determinants of long-term real money demand adjust to each other and to adjustments in the money supply. Questions about the exogeneity or endogeneity of variables, a problem in most demand for money studies, fade away, since all variables are potentially endogenous, including the money supply. Thus, the cointegration and error-correction methodology encompass the traditional

money demand theories with the modern micro-founded dynamic stochastic general equilibrium models as discussed in chapter two Sections 2.1 – 2.8.

The studies done in Uganda on the demand for real money have most often used the interest rate to measure the opportunity cost of holding money, but not always with theoretically consistent results in regard to the sign of the coefficient (see George, 2002: 10; Henstridge, 1999: 366; Jean-Claude, 2001: 12). More specifically, theory points to a negative relationship between the demand for real money and the opportunity cost of holding money so the attainment of a positive value for the estimated interest rate coefficient violates these expectations (see Sriram, 1999b: 23; and Arestis, 1988a: 421). Consequently, one of the main aims of the specification of a real money demand function for Uganda should be to obtain a function, which yields a negative relationship between the demand for real money, and the opportunity cost of holding money, along with the positive relationship between the demand for real money and income as expected by theory. A general or standard model for the demand for real money specifying these expected relationships between the variables is outlined below in Section 4.2 (see also Ericsson, 1998: 297; and Ericsson and Sharma, 1996: 6).

The discussion in the sub-sequent sections, further, relates to the quest of determining stable real money demand in Uganda, since both the supply- and demand-adjustment views imply that the money market exhibits short-term departures from long-term equilibrium. Cointegration analysis is employed to determine the long-term relationships between observed time-series variables, where the residuals measure short-term disequilibria. The error-correction model later used in this chapter captures the short-term dynamic adjustment and permits the examination of the temporal ordering of the money stock and the long-term determinants of real money demand. The subsequent Sections (4.2, 4.3, 4.4, 4.5, 4.6 and 4.7) describe the specification and functional form of real money demand; and present an analysis of the cointegration and error-correction results, and a final section gives a summary and conclusion.

We can summarize the chapter as follows: First, in Section 4.6 we present and update the requirements for stability in the literature. Keeping in mind these requirements and developments in the econometrics literature that we exercise caution when working with data that is not stationary. Second, we employ cointegration to estimate the short-term and long-term dynamics of a previously used real money demand equation. Finally, the

conclusion of this chapter will show that, once we break our sample into periods of major policy and macroeconomic structural change, a stable real money demand relationship does emerge after 1994. Now let us specify our model.

4.2. Specification of the model

In standard theories of money demand, money may be demanded for at least two reasons (see Chapter Two, Section 2.4.1, pp. 23): as an inventory to smooth differences between income and expenditure streams, and as one among several assets in a portfolio. The transactions motive implies that nominal money demand depends on the price level and some measure of the volume of real transactions. Holdings of real money as an asset are determined by the return to real money as well as returns on alternative assets, and by total assets (often proxied by income). Our study follows the Ericsson and Sharma (1996: 6) model. However, we use only one interest rate variable and also include an exchange rate variable as a cost of holding money. Thus, the Ericsson and Sharma model is explicitly written as:[62]

$$(m - p)_t = \alpha + \beta y_t + \gamma R_t + \eta \pi_t + \lambda q_t + \varepsilon_t, \qquad (4.1)$$

Where $(m-p)$ is real money demand, y is real GDP; R is the rate of interest proxied by the rates on Treasury bills- the rate used by most commercial institutions.[63] The actual rate of inflation is represented by π and q is the change in the Uganda shilling per U.S. dollar exchange rate. The anticipated signs of the coefficients are $\beta > 0$ (specifically, $\beta = 1$ for the quantity theory of money and $\beta = 0.5$ suggested by Baumol), $\gamma < 0$, $\eta < 0$ and $\lambda < 0$. Variables in lower case denote natural logarithms and ε_t is the error term of the regression.

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[62] A money demand function of this type is not only the result of traditional money demand theories but also of modern micro-founded dynamic stochastic general equilibrium models (see for example Jean-Claude, 2001). Also suggested by Ericsson (1998: 296); Goldfeld and Sichel (1990: 300); and Henstridge (1999: 353).

[63] The Treasury bill rate has been directly included to capture the opportunity costs on money holdings. These government securities present commercial banks with less risk when stable compared to investing in private sector portfolios (see Stiglitz and Weiss, 1981: 393). Effectively, the commercial financial institutions exhibit signs of being risk averse in credit extension to private sector. Of course there existed a curb or black market for funds but it can be argued that its usage was limited to those in the informal sector due to the threat of official 'punishment' (George, 2002: 9).

Once we have adopted a log-linear format we can cover the functional form represented by coefficients on explanatory variables (these are the elasticities estimated in the model). This specification and functional form methodology forms the basis of our modelling in this study. This serves to illustrate the variety of choices that have been made in order to estimate a money demand relationship with the support of economic theory. The quest here is to determine whether real money demand has been stable. In Section 4.6 below, we outline the requirements for stability and determine if our estimated models meets these requirements. An essential element in conducting quantity-based monetary policy is to have a stable money demand function. A significant relationship between real money, activity, and interest rates enables policy-driven changes in monetary aggregates to have predictable influences on output, interest rates, prices and the change in the exchange rate.

Economic theory offers little guidance in modelling the behaviour of money out of equilibrium, beyond saying that adjustments to "desired" levels of money holdings are not likely to be instantaneous due to adjustment costs. Further, empirical specifications that unduly restrict short-term dynamics may contaminate the estimation of the long-term specification itself. Sections 4.3 to 4.6 develop a dynamic error correction mechanism (ECM) of real money demand, allowing the economic theory reviewed in chapter two to define the long-term equilibrium while determining short-term dynamics from the data. A similar approach to modelling money demand is adopted in Hendry and Ericsson (1991: 8) and Ericsson and Sharma (1996: 24).

4.3. Data Processing and Estimation

The data used in this study consist of quarterly observations on variables selected for the empirical analysis based on the studies done by Cagan (1956); Laidler (1993); Ericsson and Sharma (1996); and Ericsson (1998) as comprehensively discussed in Chapter Two, Section 2.7.2 (pp. 35). The variables chosen include: broad money (M2) – defined as M1 (which includes currency in circulation) plus quasi money (demand deposits, time deposits and savings deposits) all measured on a quarterly basis. Empirical estimates are made using real money balances (*M2/P*) to obtain feasible and meaningful results. Real income (Y/P) (proxied by real GDP at current prices), consumer price index (P) (1995 = 100), interest

rate on the 91 days Treasury bill (R), actual inflation rate (π)[64] measured from consumer price index and the depreciation or appreciation of the change in the Uganda shilling per U.S. dollar (q). The data were collected from the International Financial Statistics (IFS) reports for the period 1980:1 through 2002:4.

Figure 4.1 plots the logarithms of money and prices, showing that for the period 1980-1990 price increases were greater than broad money growth, however, for the period 1991-2002 broad money growth is observed as having been greater than the price increases due to the monetary policy stance implemented by the BOU authorities in order to control price fluctuations. Also, from 1987, there were changes in the computation of the consumer price index data; hence, we break down our sample period into sub periods to account for the data changes. Figure 4.2 plots the logarithm of real money (m-p), showing that real money grew steadily from 1986 when there was a regime change that has ensured political stability and economic growth through the 1990's and onwards. Figure 4.3 plots the quarterly growth rates of money and prices. Velocity can be constructed from real GDP and real money: Figure 4.4 plots the annual growth rates of both these variables. While high money growth is coincident with a rapidly growing economy in the early and late 1990's, there are numerous other periods when the movements of the two variables appear unrelated (i.e. throughout the 1980's where velocity is observed to be high). Overall, monetary growth has been faster than income growth giving a falling velocity that is consistent with the central bank's successful fight against inflation. Figure 4.5 plots the quarterly inflation rate and the change in the exchange rate. These two series do fluctuate, but seem to return to a given level or mean value over time. Series like these are called stationary and explicit tests for this in Section 4.4.1 show that this is indeed the case.

[64] The inclusion of an inflation variable in the estimation of the demand for real money in Uganda has, as mentioned in Chapter Two, Section 2.2 (pp. 20), been suggested by Ericsson and Sharma (1996: 16) in order to improve the results and fully capture the real balances within the economy, hence when inflation is excluded from the model, (m-p) will impose equality of the short- and long-term elasticities of nominal money with respect to prices (see Ericsson, 1998: 298). When inflation is excluded from the money demand function, the results obtained are not as good and economically reasonable as when it is included.

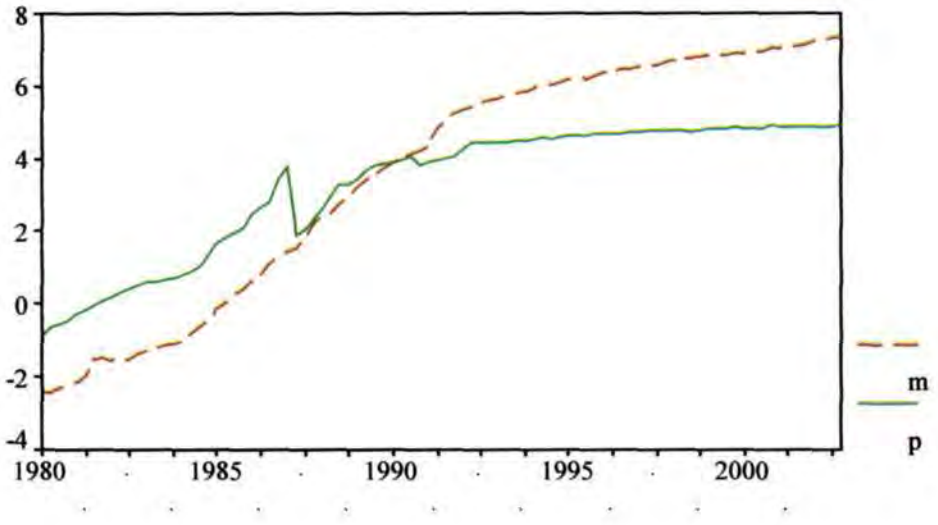


Figure 4.1: Logarithms of broad money (m) and prices (p).

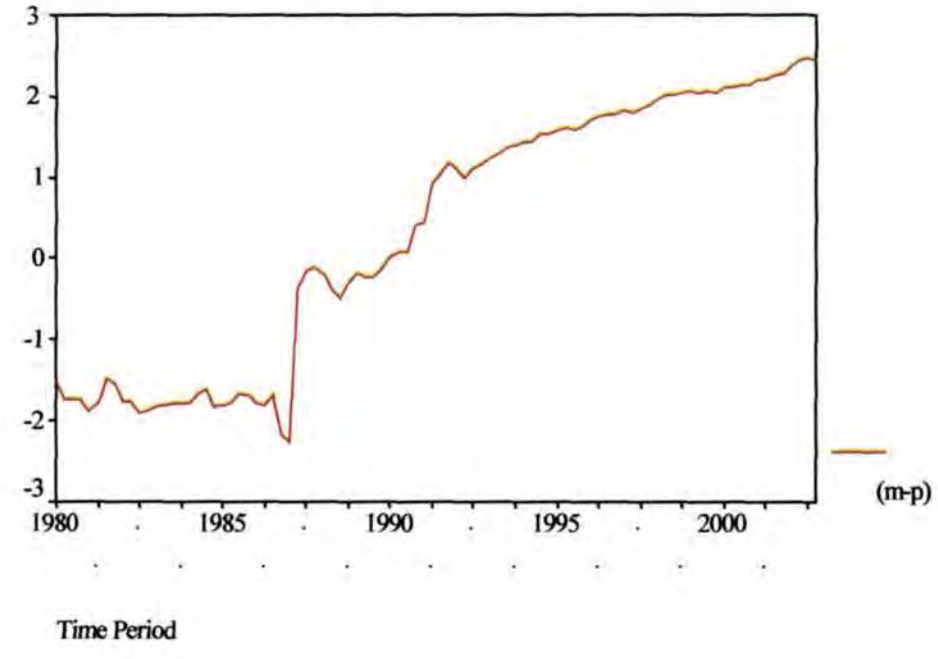


Figure 4.2: Logarithm of real money (m-p).

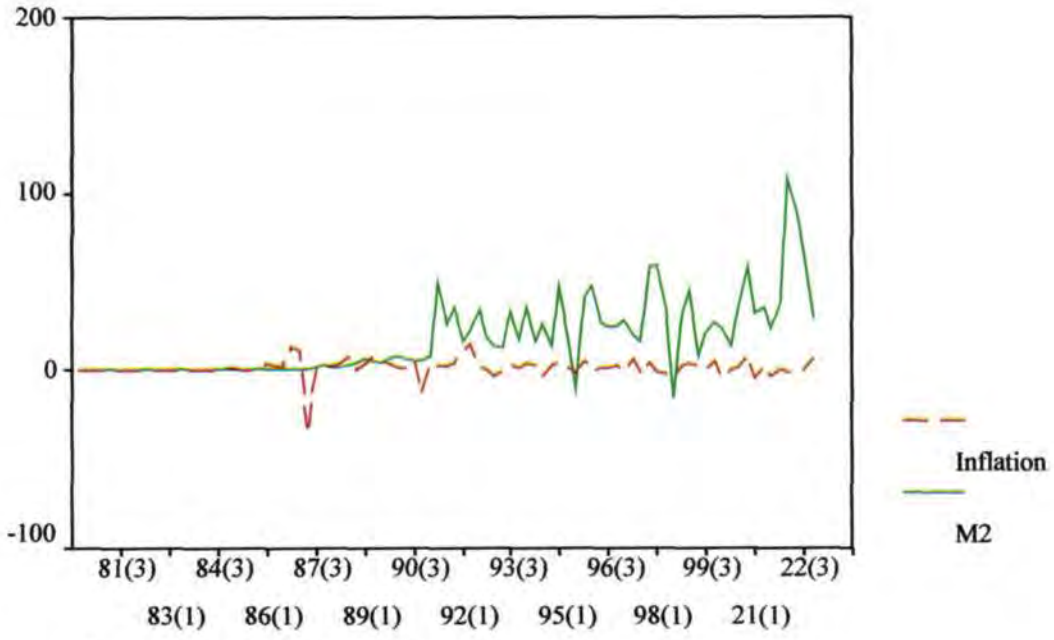


Figure 4.3: The quarterly growth rate of M2 and the quarterly inflation rate.

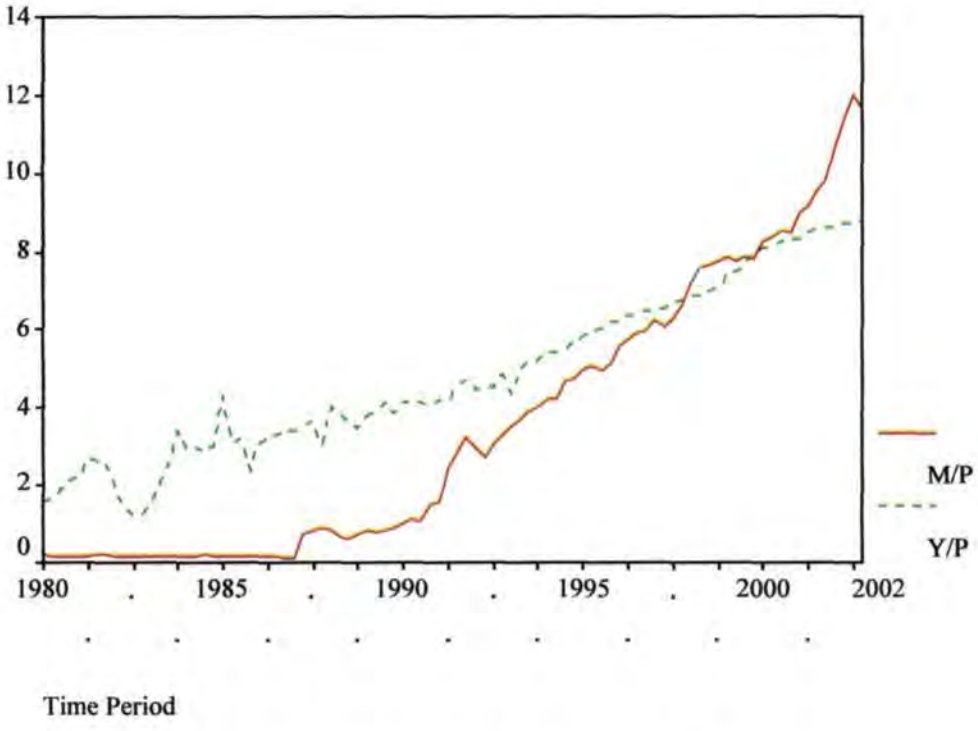
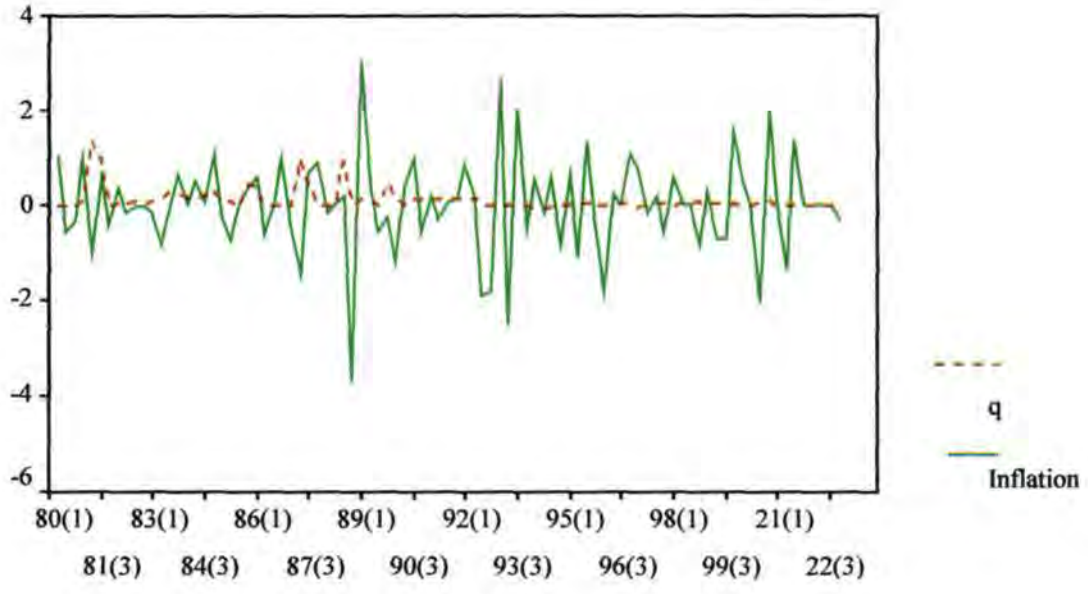


Figure 4.4: The annual growth rates of real M2- (M/P) and real GDP- (Y/P).



Time Period (Third digit in brackets representing respective quarter)

Figure 4.5: The quarterly inflation rate and quarterly depreciation of the change in the exchange rate-q.

4.4. Integration and Cointegration

This section presents unit root tests for the variables of interest (Section 4.4.1). Then, Johansen's (1988: 231), and Johansen and Juselius (1990: 169) maximum likelihood procedure is applied to test for cointegration among real money, real income (GDP), inflation, the interest rate on Treasury bills and the depreciation of the exchange rate (Section 4.4.2). For further discussion of integration and cointegration, see (Engle and Granger, 1987: 251; Ericsson, 1992: 465; Gujarati, 1995; Stock and Watson, 1988: 147).

4.4.1. Integration

A prerequisite for cointegration analysis is that individual variables considered should be integrated of the same order. Thus, the stationarity property of the relevant variables in Equation 4.1 (pp. 98) needs to be examined. Stationarity is defined as a condition in which the fundamental characteristics of a series do not change over time. These time periods could refer to a series over many time periods or across adjacent or next to adjacent (and so on) time units. Stationarity is a common assumption found in theoretical economic models (see Gujarati, 1995). Stationarity also plays an important role in the statistical analysis of economic relationships. In order to get an accurate estimate of the coefficients determining

the relationship between two or more variables, the underlying characteristics of the data series must remain constant across the sample period. If a time series is not stationary in the sense defined above, it is called a non-stationary time series.

A non-stationary error structure is said to be associated with relationships estimated using highly trended variables (see Malley, 1989: 52) because the variables are influenced by a trend component that, when not taken into account by including it in the regression as a variable, is then captured by the error term of the regression and the error term will then become non-stationary. The error terms then become correlated with one another in a regression run on non-stationary data with the result that the regression suffers from autocorrelation (hence the low Durbin Watson-- DW values showing the presence of autocorrelation). The consequences of this are (see Granger and Newbold, 1974: 424, and Hendry, 1986: 201) that:

(a.) the parameter estimates obtained in the regression are inefficient, i.e. the variances of the regression coefficients are large;

(b.) forecasts made from these spurious regressions are inferior;

(c.) the usual tests of significance (t and F) tests are no longer reliable (and neither is the DW statistic).

The problem of spurious regression arises because if the time series involved exhibits strong trends (sustained upward or downward movements), the regression is virtually certain to produce significant relationships, even if the time series are, in fact, independent. The high R^2 observed is due to the presence of the trend, not to a true relationship between them. It is therefore; very important to find out if the relationship between economic variables is true or spurious (see Gujarati, 1995).

Philips (1986: 311) noted that the *t*-tests distributions tend to diverge from the normal distribution, which then causes the use of conventional critical values of the standard *t*-distribution to be invalid. Further, as the sample size increases, the tendency to reject the null hypothesis that the estimates of the regression coefficients equal zero increases, due to the tendency of non-stationary series to exhibit increasing variance as time goes by (as the sample size increases), which means that the probability of accepting the existence of a (false) relationship between unrelated non-stationary time series

increases (see Granger and Newbold, 1974: 424; and Harris, 1995). It can therefore, be seen that regression coefficients of non-stationary time series do not tend to converge in probability to constant values as the sample size increases (as time goes by), so that, the estimated regression is unstable and therefore not ideal for forecasting purposes. Stock and Watson (1988: 147) argue that because of random walks, forecasts of the levels of non-stationary data will increase in uncertainty as the time frame over which the forecasts are being made lengthens because the random change in the stochastic trend of the variable in one period forms the base from which the next period's change results.

The above problems associated with running regressions on non-stationary time series can be solved, however, by making the relevant time series stationary. This can be done by running a regression of the form:

$$X_t = \alpha + \beta t + u_t, \qquad \textbf{(4.2)}$$

and then simply removing the deterministic time trend, βt (where a trend is roughly described as being deterministic when it is perfectly predictable and not subject to erratic changes) and the intercept, α . The term u_t is the usual error term, which is stationary (see Reinhardt, 1998).

Nelson and Plosser (1982: 139), however, observe that macroeconomic time series tend to display upwards trends and increasing variances, so that, it is more appropriate to describe them as being non-stationary with a (stochastic) trend rather than stationary with a (deterministic) time trend - a stochastic trend being one which is highly variable and so is subject to random movements or shifts away from the path previously being followed by the variable (see Box and Jenkins, 1970). Non-stationary time series that exhibit stochastic trends, therefore, follow random paths or walks because of the stochastic trends influencing them and so do not have a constant mean, variance or auto-covariance over time. A stationary time series in comparison is one that is governed by a deterministic trend because it continues to revert back to the mean over time and therefore, has a finite variance and autocovariance.

Nelson and Kahn (1981: 741) argue that applying the above trend stationary process to remove non-stationarity in the data when the underlying data generating process is non-stationary with a stochastic drift trend causes valid dynamics to be lost, which then results

in a loss of information previously contained in the data. Instead, they advocate the process of differencing the variables in order to render them stationary (see Granger and Newbold, 1974: 424). This involves subtracting the value of the variable lagged by one period from its current value, and, if necessary, repeating the process by subtracting lagged values from the new values until X_t equals u_t. To explain the concept of differencing more fully, see (Granger, 1981: 121; and Harris, 1995).

This distinction between different trends is of importance to our analysis as it has already been established in a review of the theory that the demand for money is stochastic and not deterministic in nature, as summed up by Milbourne (1983: 633) who states that:

> *"Money is held not only because of the lack of synchronization between receipts and payments, but also because the timing and amounts of inflows and outflows cannot be perfectly anticipated. Consequently, the stochastic nature of inflows and outflows plays an important role in the demand for money, and optimal rules of money holdings under stochastic specifications are likely to be different from those of deterministic models."*

Thus, as our variables are stochastic, we perform the necessary tests to check for stationarity. However, to avoid losing information by either de-trending the data or differencing, we make use of additional tests (cointegration) that avoids this problem.

When it is only necessary to difference the time series once in order for it to become stationary the time series is said to be integrated of order 1, which is denoted I(1) and for a variable X_t (integrated of order 1) we use the following notation: $X_t \sim I(1)$. A time series that must be differenced ***d*** times to make it stationary is said to be **integrated of order *d***, **I(*d*)**, or that $X_t \sim$ **I(*d*)**. A time series that is integrated of order zero, **I(0)**, is therefore stationary (as it does not need to be differenced to become stationary) and a time series that is integrated of order one, I(1), or higher is non-stationary (see Engle and Granger, 1987: 253; and Granger, 1981: 121). The number of times a variable needs to be differenced to render it stationary therefore depends on how many unit roots are contained in the series, for one is removed each time the variable is differenced. Integrated time series can therefore be seen to be non-stationary because they contain unit roots that cause the presence of stochastic trends in the data (see Dolado, Jenkinson and Sosvilla-Rivero, 1990: 249).

To formally test the series for stationarity (unit roots in the levels and first differences), a standard Augmented Dickey-Fuller Test (ADF) (Dickey and Fuller, 1979: 427) is performed where the null hypothesis is that a series contains a unit root, i.e. that the series is non-stationary. Table 4.1 lists the augmented Dickey-Fuller (1981: 1057) (ADF) statistics for the central variables in this analysis. Unit root tests are reported for the original variables in levels (in logs where indicated) and for their changes in levels. Empirically, all variables appear to be integrated of order one except for the inflation and exchange rate variables, which appear to be integrated of order zero. Real money (m-p), real income (y), and the interest rate (R) appear to be I(1). For the other two variables, inflation (π) and the change in the exchange rate (q), the statistical evidence concludes that they are I(0) or stationary.

Running regressions on non-stationary time series using conventional econometric techniques such as OLS often results in spurious, or nonsense, regressions where a statistically significant relationship appears to exist between the highly trended variables (variables whose mean changes over time), but on closer inspection this relationship is found to be false as it is due to a trend component in the non-stationary data, and not to the existence of a valid causal relationship between the variables. These regressions typically have high R^2 values and very low Durbin-Watson (DW) statistics (see Banerjee, *et al.*, 1986: 253) and as a result appear to show meaningful relationships between the variables. Given this false appearance, the usual estimation by OLS is not valid. Having established that most of the series we use are integrated of the same order (namely order one) I(1), except for the inflation and exchange rate variables, tests for cointegration are undertaken, and the nature of any cointegrating vectors explored in Section 4.4.2.

Table 4.1. ADF Unit Root Tests in Levels and First Differences

Variables	ADF in Levels		ADF in First Differences
	Constant	Constant &Trend	With a constant
$(m-p)_t$	-0.578	-0.478	-5.376***
y_t	-1.008	-0.922	-5.421***
π_t	-5.660***	-5.660***	-14.791***
R_t	-1.485	-1.489	-8.229***
q_t	-4.029**	-4.000**	-6.693***

Notes: The ADF test is based on the following regression:

$$\Delta y_t = \delta_1 + \delta_2 t + \xi_1 y_{t-1} + \sum_{i=1}^{m} \xi_{1+i} \Delta y_{t-i} + \varepsilon_t$$

where Δ is the first difference operator and ε_t is a stationary random error. The null hypothesis is that Y_t is a non-stationary series and it is rejected when ξ_1 is significantly negative. The sample period runs from 1980Q1 to 2002Q4. The ADF is performed using the longest lag at which the conventional t-statistic is significant; in this case at m = 0 [ADF (0)] for each variable. The critical values for the ADF taken from McKinnon (1991: 267) at 1, 5 and 10 *per cent* significance levels are –4.08, –3.47 and –3.09 respectively.

***, ** denotes rejection of the non-stationary hypothesis at 1 and 5 *per cent* significance levels respectively.

4.4.2. Cointegration

Based on these statistical properties of the data and on the economic and historical context discussed in Section 4.4.1, this section tests for cointegration among the variables *m-p*, *y*, π, *R*, and *q* in a second-order vector autoregression. The method of cointegration is able to provide non-spurious results when regressing the level of the variables on each other even when the variables are non-stationary, providing that these variables are integrated of the same order. This is because when variables are integrated of the same order they contain the same trend(s) and therefore, to regress the variables on each other will cause these trends to cancel out, leaving only the pure relationship between the variables behind (see Engle and Granger, 1987: 252).

When two (or more) non-stationary variables form an equilibrium relationship in the long-term the method of cointegration allows these time series to be regressed on each

other in their level forms even though they may be non-stationary, provided that these variables are integrated of the same order, or, cointegrated. This is because the non-stationary components cancel out leaving a stationary relationship between the variables, so that, the equilibrium, stable or long-term relationship between the cointegrated variables is revealed. Engle and Granger (1987: 251) define equilibrium as:

> *"Equilibrium is a stationary point characterized by forces, which tend to push the economy back towards equilibrium whenever it moves away".*

This stationarity is displayed in the relationship between variables in the cointegrating regression. According to the stationarity test results in Table 4.1, most of the variables are integrated of order I(1) with the exception of the inflation and exchange rate variables that are found to be I(0). Consequently, the cointegrating regression to be verified can be summarized in the following form:

$$(m\text{-}p)_t = \beta_0 + \beta_1 y_t + \beta_2 R_t + \varepsilon_t, \qquad (4.3)$$

where ε_t is white noise (residuals of the cointegrating regression) and variables in the lower case denote natural logarithms. Since we are dealing with a multivariate case study, we only use the Johansen procedure, which tests for more than one cointegrating vector instead of the Engle-Granger procedure, which is only applicable to bivariate case studies.

The Johansen Procedure

Turning to the Johansen Maximum Likelihood procedure, it is first necessary to estimate the number of lags required in the vector autoregression (VAR) system. However, it is equally important that the variables entering the demand for money function under the Johansen procedure are all I(1). More specifically, following Johansen and Juselius (1990: 169), and Johansen (1988: 231), a vector of endogenous variables, x, that are integrated of order one, I(1), is analyzed using the vector error-correction representation of the form:

$$\Delta x_t = \mu + \sum_{i=1}^{k} \gamma_i \Delta x_{t-i} + \phi x_{t-1} + \varepsilon_t, \qquad (\varepsilon_t \sim \mathbf{IID}\ (0,\sigma^2)) \quad (4.4)$$

where the parameters μ and $\gamma_1 \ldots \gamma_k$ are allowed to vary without restrictions, k is the lag length of the model, and ε_t is a vector of normally distributed shocks with mean zero. The

presence of cointegration in the model is tested by examining the rank of ϕ. In the event of reduced rank of ϕ (that is, when rank (ϕ) = $r < n$, where n is the number of endogenous variables), there exist r-cointegrating vectors. Hence, the existence of a cointegrating vector is tested based on trace and maximum eigenvalue tests. Table 4.2 reports the standard statistics and estimates for Johansen's procedure. According to the maximal eigenvalue and trace test statistics (λ_{max} and λ_{trace}), the null hypothesis that "no cointegrating vector exists" is rejected in favour of 'at least one cointegrating vector exists" both at 5 and 10 *per cent* significance level.

Table 4.2. Johansen Trace test for Cointegration relationship (allowing for unrestricted intercepts and unrestricted trends in the VAR)**. For the years 1980-2002.**

List of eigenvalues (λ_{trace}) in descending order: 0.19714 0.000 0.000				
Null	Alternative	Statistic	95% Critical value	90% Critical value
r = 0	r = 1	19.7614^{+}	17.1400	15.0400
λ_{max} Chosen r = 1				

Note:

1. The number of cointegrating vectors was estimated using: the maximum eigenvalue of stochastic matrix, trace of stochastic matrix allowing for unrestricted intercepts and unrestricted trends in the VAR.
2. The null hypothesis is in terms of the cointegration rank r and e.g., rejection of $r = 0$ is evidenced in favour of at least "one cointegrating vector".
3. $^{+}$ denotes rejection of the joint likelihood ratio test at 5 and 10 *per cent* significance level respectively.

Table 4.3 reports the unstandardized and standardized eigenvector. The second row of the vector column is the estimated standardized cointegrating vector representing the long-term money demand function for real money, which can be written in the form of Equation 4.3 as below:

$$\mathbf{(m\text{-}p)}_t = \boldsymbol{\beta}_0 + 0.29805\mathbf{y}_t - 0.0030613\mathbf{R}_t + \varepsilon_t, \qquad \textbf{(4.5)}$$

where ε_t is white noise (residuals of the cointegrating regression).

The cointegration vector indicates that there is a long-term relationship between real money balances $(m - p)_t$, real income (y_t), and the interest rate (R_t). Each coefficient has its anticipated sign and is significantly different from zero. The long-term real money demand function has income elasticity of about 0.298. The semi-elasticity of the interest rate is about –0.08. The results mean that higher real income would induce an increase in real money balances. On the other hand, higher interest rates would induce a decrease in real money balances.

Table 4.3. Estimated Cointegrated Vector in Johansen Estimation (Normalized in brackets). **Chosen r = 1**

Variable	Vector Coefficients in brackets	List of I(1) variables included in the VAR	List of I(0) variables included in the VAR
$(m-p)_t$	0.26781 **(-1.000)**	$(m-p)_t$	q_t
y_t	-0.079822 **(0.29805)**	y_t	π_t
R_t	0.0008198 **(-0.0030613)**	R_t	

4.5. The Error Correction Mechanism

Recent developments and a growing literature in time series econometrics have shown that there are interesting and appropriate ways to estimate equations in the manner that allow the relevant economic theory to enter the formulation of long-term equilibrium in levels while the short-term dynamics of the equation are determined by changes in levels. The innovation of an error-correction mechanism (ECM) and advances in cointegration, in particular, have provided the tools to apply dynamic models that account explicitly for the dynamics from short-term data and long-term adjustment toward equilibrium.[65] To draw policy conclusions, however, the issue of whether the variables should be treated as exogenous or endogenous and how they interact in the short-term is important. More generally, it is often useful to examine how the economy adjusts toward the long-term equilibrium-here described by the money demand relationship-following various types of shocks.

In light of the results from Table 4.3, as discussed in Section 4.4.2, cointegration allows inferences on the equilibrium or long-term nature of the demand for money to be made using short-term data (see Taylor, 1991) as, when evidence of the existence of the long-term relationship is confirmed, a basis is then provided for the examination of the short-term movements of the demand for money. This is done by including an error

[65] The ECM approach employs a specification that uses a combination of levels and changes in levels simultaneously while attempting not to violate the basic set of assumption in regression analysis (see Malley, 1989: 52). The idea of incorporating the dynamic adjustment to steady-state targets in the form of error-correction terms, suggested by Sargan (1964) and developed by Hendry and Anderson (1977: 361), and Davidson, *et al.*, (1978: 661), among others, therefore offers the possibility of revealing information about both short-term and long-term relationships. Furthermore, ECM models can be estimated consistently by ordinary least squares, and appear to perform well empirically (see Hallam and Zanoli, 1993: 151; and Banerjee, *et al.*, 1993: 320).

correction mechanism, which 'corrects' for the short-term deviations of the variables from their long-term equilibrium.

When variables are cointegrated a long-term or equilibrium relationship exists between them, but as theory points to a relationship between variables both in the short- and long-term, it becomes necessary to also incorporate the short-term movements of the variables in the specification of a money demand function. The cointegrating regression does not take the short-term movements of the variables into account and is for this reason inappropriate to use as the final specification of the model.

Once the determinants of the cointegrating relationship are determined, the next step therefore, is to estimate the short-term demand for broad money using an error correction mechanism (ECM). The short-term model, with an error correction effect reveals how the adjustment mechanism works to revert to equilibrium when real money demand is disturbed by long-term exogenous shocks. The dynamics affecting the short-term real money demand are the differenced forms of the variables used in the long-term. Fundamentally, the ECM contains the one lagged error term to capture the long-term dynamics in the short-term, which represents adjustment to excess money in the previous period. The error term coefficient should have a negative sign not larger than one. The coefficient provides information on how much of the disturbance is adjusted for in one period. In other words, the inverse of the coefficient shows how many periods by which later the effect of the disturbance has faded (see Engle and Granger, 1987: 254; Granger, 1986: 213; and Salmon, 1982: 615). In our best model in Section 4.6.3 (pp. 121) we find that it takes about four years to restore equilibrium.

Here, an error correction representation of the cointegrating regression is therefore used to incorporate a short-term dynamic element into the model. Also, as these short-term dynamics of money demand are rarely in equilibrium due to non-stationary variables tending to spend more time moving fluctuating around equilibrium, the error correction model provides for this by including an error correction term, which corrects for any short-term movements away from the long-term (equilibrium) level of money demand. Consequently, Table 4.4 (pp. 119) presents an ECM estimation of the $\Delta(m-p)_t$ equation for the whole sample period 1980-2002 of the following form:

$$\Delta(m-p)_t = \delta_0 + \delta_1 t + \Delta(m-p)_{t-1} + \delta_2 \Delta y_{t-1} + \delta_3 \Delta R_{t-1} + \delta_4 q_t + \delta_5 \pi_t + \phi ECM_{t-1} + \varepsilon_t \text{, (4.6)}$$

where Δ represents the first difference operator of a specific variable, ε_t is the error term of the regression, and ECM_{t-1} is the error-correction term (lagged residuals of static regression, ε_{t-1} obtained from the cointegration regression in Equation 4.5, pp. 110). Variables in the lower case denote natural logarithms. Parameter ϕ on the ECM_{t-1} measures the speed of adjustment to the long-term equilibrium. If this is low (close to zero), it means that the dynamic effects dominate the behaviour of real money demand in the short-term. However, if this is large (closer to one), it implies that the long-term effects dominate the behaviour of real money demand in the short-term, so the short-term dynamics have little effect on real money balances.[66]

Granger (1981: 121), and Engle and Granger (1987: 253) argue that when an equilibrium relationship exists between a set of integrated variables, the cointegrating regression, which results from a regression run on these variables, can be represented in the form of an error-correction mechanism (ECM). The lagged error correction term (ECM_{t-1}) from the ECM should have a negative (significant) coefficient in order to guarantee that the divergences, which occur in one period, are then corrected for in the next period (see Engle and Granger, 1987: 254). The implications of this negative error correction term for the demand for real money is that when the level of the money stock is in disequilibrium, for example, if it is too high in relation to the explanatory variables, the negative value of the error term would cause a downwards adjustment in the level of the money stock to occur in subsequent periods in order to correct for the disequilibrating error.

4.6. Stability

Stability as defined in this chapter in Section 4.1, is when a function is unchanging over time meaning that when it is estimated over two (or more) separate time periods, the same estimates for the regression coefficients are obtained (see Barro, 1993). Although money is regarded by many to be neutral where changes to the quantity of money affect nominal but not real variables, money has not proved to be super neutral, which means that the

[66] The error correction model is very flexible in terms of the number of lags that can be used. This means that a large number of differenced lagged variables can be specified and then excluded if insignificant through the use of significance tests, with the result that the data itself is then able to exert a strong influence on the final specification of the dynamic structure of the model.

variations in the rate of growth of money do have real effects (Barro, 1993). Because money is not super neutral, the demand for real money is very important to policy makers as changes in the growth rate of the money supply causes changes in the real demand for money. Therefore, for policy makers to be able to effectively carry out the desired changes through their policies, they need to accurately predict what effect any change in the growth rate of money stock will have on other variables within the function so as to be able to accurately include these effects into the consequences their policies will have.

An effective prediction of what effect any change in the growth rate of the money stock will have on other variables can be met by estimating a stable specification of the real money demand function. This would then enable policy makers to make reliable, accurate predictions about the effect that proposed changes in monetary policy would have on the economy. Charemza and Deadman (1992), Johnston (1984), Judd and Scadding (1982: 993), and Judge and Griffiths (1980) are among the researchers who suggest that the following points are necessary for a money demand function to be stable:[67]

(1.) Parsimony, which means keeping a model as simple as possible, which is necessary as a model is essentially an abstraction of reality, and not a mirror of reality itself. A good model therefore will seek to simplify reality as much as possible whilst still capturing the essence of the problem. To this purpose as few explanatory variables as adequately explain the model should be used, and all other random or minor influences on the model should be relegated to the error term. These are met by looking at the signs and sizes of the coefficients in the model. For the estimated regressions to be construed as a demand for money equation, the estimated coefficients for the error correction model (given in Equation 4.6, pp. 113) should satisfy the necessary sign constraints (given above in Equation 4.1, pp. 98).

(2.) The goodness of fit of the model is traditionally measured by the R^2 or more preferentially adjusted R^2, to take into account the degrees of freedom associated with the residuals. Although a high adjusted R^2 value is always agreeable as it reflects the degree of variation in the dependent variable that is explained by the explanatory variables, it should be used with caution as a

[67] These points have been adequately followed, reviewed and reasonably met throughout the analysis in this chapter.

criterion for selecting models for the true model's adjusted R^2 value only exceeds that of an incorrectly specified model on average, not one hundred per cent of the time (Johnston, 1984). The test is also not useful in rejecting all of the models if none of them are actually the best one. Furthermore, the statistic is acknowledged not to be useful in model selection by Charemza and Deadman (1992) whilst Judge and Griffiths (1980) highlight the failure of this statistic, as it does not consider the purpose for which the model is to be used.

(3.) The error correction term ($ECM_{,-1}$), which contains the error term lagged one time period to capture the long-term dynamics in a short-term model, is expected to be less than zero, which represents excess money in the previous period. The error correction term coefficient should have a negative (significant) coefficient not larger than one in order to guarantee that any divergence from equilibrium, in one period, is then corrected in the next period. The implication of this negative error correction term for the real money demand is that when the level of real money stock is in disequilibrium, for example, if it is too high in relation to the explanatory variables, the negative value of the error correction term would cause a downwards adjustment (through strong forces that are set in motion) in the level of real money stock to occur in the subsequent periods in order to correct for the disequilibrium error. The coefficient, further, provides information on how much (size) of the disturbance is adjusted in one period. The dynamics affecting the short-term real money demand are the differenced forms of the variables used in the long-term.

(4.) These explanatory variables should be highly representative of spending and economic activity in the real sector.

Empirical evidence on estimated money demand functions, also gives an indication of the necessary attributes for a stable function. In the U.S.A. before 1973, money demand functions appear to be stable, but those estimated after 1973 have tended to be unstable[68]. In particular, Goldfeld (1976: 683) found a stable money demand function before 1973, while Enzler, Johnson and Paulus (1976: 261) and Goldfeld (1976: 683) show that after

[68] See Laumas and Spencer (1980: 455) and Hwang (1981: 234).

1973 the demand for money function tends to shift over time. Judd and Scadding (1982: 993) ascribed this shift to certain financial and monetary changes occurring at the time, namely adjustments in the regulations on interest rate ceilings, innovations in the short-term financial markets and increases in post-war inflation and interest rates. Goldfeld (1976: 683) and Enzler, *et al.*, (1976: 261) also found that the 'conventional' specifications of the money demand equations being used tended to regularly over predict the demand for actual money balances, leading them to believe that misspecification errors had occurred. Two sources of instability in money demand functions can therefore be identified as misspecification errors and the failure to incorporate the dynamic components of money demand into the function.

In general, there is some confirmation of the theoretical model identified in Chapter Two and reproduced in Section 4.2 above. The real money demand function is found to be stable over one sample period 1994-2002 after accounting for the major policy reforms. However, a visual inspection of the CUSUMSQ, Plot A (pp. 158) presented in Appendix I for the whole sample period 1980-2002, obtained from the estimated error correction model shows large errors representing instability in the estimated relationship for the periods (1986-1987 and 1990-1993) identified as times of major policy reforms. One of the major policy reforms was the structural adjustment program with IMF and World Bank support, approved in June 1987, which succeeded in restoring fiscal and monetary discipline, while simultaneously removing domestic price distortions and promoting the liberalization of trade, payments, and the exchange rate.

The other major policy reform was the legalization of the parallel market in foreign exchange in July 1990, which approved foreign exchange bureaus, and the creation of an inter-bank market in November 1993 brought about more market determined interest and exchange rates. These economic policy reforms were aimed at improving the BOU's liquidity management as far as the real demand for money in Uganda is concerned. The introduction of indirect monetary policy instruments in 1993 was part of the broader set of reforms in the financial sector, which not only included the financial sector but also improved macroeconomic stability and allowed greater liberalization of the whole economy in general. Even so, Plot A (pp. 158) for the entire sample period 1980-2002 shows large errors over the long-term where the CUSUMSQ move out side the five *per cent* critical lines. On the other hand, in Plot C (pp. 160), we observe a more stable long-

term relationship for the years 1994-2002 after major policy reforms, as the CUSUMSQ stays within the five *per cent* significance level an indication of parameter stability.

4.6.1. Real money demand stability for the period 1980-2002 (*whole sample*)

The coefficients of the various regressors in Table 4.4 measure the feedback effects of the (lagged) disequilibrium in the cointegrating relation on the variables in the regression equation. The error correction coefficient, estimated at -0.9209 is statistically significant (at the one *per cent* level) and has the right sign. Its numerical value implies a fast adjustment back to equilibrium —approximately 92 *per cent* in the next quarter. The larger the error correction coefficient (in absolute value) the faster is the economy's return to its equilibrium, once shocked.

The results in Table 4.4 show that changes in real GDP have a negative and insignificant effect on real money balances. The interest rate effect on real money balances is negative and significant at the five *per cent* level, estimated at about -0.012. The estimated coefficient for the exchange rate (approximately -0.084) is the right sign and statistically significant. This estimate is consistent with the idea that a depreciation of the domestic currency raises the domestic currency value of an individual's foreign assets, and if this is perceived as an increase in wealth, then the demand for real money balances could decrease (see Arango and Nadiri, 1981: 69). The negative coefficient of the exchange rate (-0.084) indicates currency substitution has a role to play in the determination of domestic real money balances in the short-term. Hence, a one *per cent* increase in the quarterly exchange rate induces a small fall in the demand for real money balances in the short-term. The low coefficient of the lagged monetary aggregate is insignificant and this suggests that past changes in the level of money holdings do not have any substantial impact on the present level of money holdings implying that agents are forward as opposed to backward looking. In other words, agents are not to base their decisions heavily on past levels of money, thereby tending to be more rational in their money holding decisions. Inflation has a positive and highly significant effect on real money balances, estimated at about 0.053. The positive sign for inflation is not what we expected based on the model presented in Section 4.2 (pp. 98).

Having a significant inflation rate coefficient implies that any inflationary changes would have a positive effect on real money balances in the short-term. This further means

that inflation grew inline with the desire to hold money. Hence, the demand for real money with respect to inflationary pressures can be "positively related, to some degree, to the levels of inflation" (Khan, 1980). When inflation rates are high "money holders may respond more to a given change in expected rate of inflation because of a greater awareness of the costs of holding money" (Hossain and Chowdhury, 1996). Therefore, high inflation rates in the short-term will lead to an increase in real money balances, which in turn leads to a loss in the purchasing power of money while increasing the cost of holding money. The first cause of the unhealthy increase in real money balances lies in the fact that prices, like the interest rate, lag behind their full adjustment and have to be pushed up, so to speak, by increased purchases. This is especially true in cases where the original impetus came from an increase in the quantity of money. The surplus money is first expended at nearly the old price level, but its continued expenditure gradually raises prices. In the meantime the volume of purchases will be somewhat greater than it would have been had prices risen more promptly. In fact, from the point of view of those who are selling goods, it is the possibility of a greater volume of sales at the old prices, which gives encouragement to an increase of prices. Seeing that they can find purchasers for more goods than before at the previously prevailing prices, or for as many goods as before at higher prices, they will charge these higher prices (see Fisher, 1922).

Table 4.4. ECM Estimation of the $\Delta(m-p)_t$ Equation from 1980 to 2002

Regressor	Coefficient	Standard Error	T-Ratio	Probability (One-tail)
Intercept	-0.7284	0.1658	-4.3928***	0.0000
Trend	0.0059	0.0030	2.0066**	0.0239
$\Delta(m-p)_{t-1}$	0.0862	0.0985	0.8751	0.1920
Δy_{t-1}	-0.0153	0.1927	-0.0793	0.4685
ΔR_{t-1}	-0.0120	0.0063	-1.8906**	0.0310
ECM_{t-1}	-0.9209	0.2052	-4.4871***	0.0000
q_t	-0.0841	0.0267	-3.1509***	0.0011
π_t	0.0529	0.0189	2.7977***	0.0032
R-Squared		0.25340	R-Bar-Squared	0.18967
S.E. of Regression		0.20523	F-statistic F(7, 82)	3.9760 [0.001]
Akaike Info. Criterion		11.0092	Equation. Log-LL	19.0092
DW-statistic		1.9598	SBC	1.0100
			System LL	19.0092
Diagnostic Tests				
Test Statistics		LM Version	F Version	
A: Serial Correlation CHSQ(4)		1.1773 [0.882]	F(4, 78)	0.25847 [0.904]
B: Heteroscedasticity CHSQ(1)		53.7477 [0.000]	F(1, 88)	130.4687 [0.000]

Note: The 1, 5, and 10 *per cent* critical t-values are 2.374, 1.664 and 1.292 respectively taken from Gujarati (1995).

***, ** denote coefficient is significant at 1 and 5 *per cent* confidence levels respectively.

A: Lagrange multiplier test of residual serial correlation

B: Based on the regression of squared residuals on squared fitted values

$$\mathbf{ECM_{t-1} = 0.26781\,(m-p)_t - 0.079822y_t + 0.0008198R_t}$$

As regards the interest rate effect, a one *per cent* increase in the quarterly interest rate induces, on average a 0.012 *per cent* fall in the demand for real money balances in the short-term. This is quite a limited impact induced by interest rates on real money balances in the short-term. In addition, interest rates have been kept high (from 20 to 25 *per cent*) in order to attract deposits and restore confidence in the banking system. This high interest rate policy resulted in commercial banks buying Treasury bills instead of lending to the private sector because government lending is considered risk-free. Also, the ever-increasing interest rates are due to the high cost of accessing development finance by the private sector.

The R^2 is found to be very low at 0.2534; this would imply that some of the explanatory variables are not representative of spending and economic activity in the real sector however, this R^2 is below the DW-statistic of 1.96 indicating that spurious regression is unlikely. The conclusion drawn from the above findings is that the real money demand

relationship in Uganda for the whole sample period 1980-2002 is unstable. Evidence for this comes from the fact that the interest rate, error correction and the change in the exchange rate are the only parameter estimates with the expected signs and are statistically significant. However, both the income and the inflation rate are found to have the wrong signs thus not satisfying the necessary sign constraints given in Equation 4.1 (pp. 98). Hence, the real demand function estimated for the period 1980-2002 does not meet the points (see Section 4.6 above) suggested by Charemza and Deadman (1992), Johnston (1984), Judd and Scadding (1982: 993), and Judge and Griffiths (1980) necessary for a money demand function to be stable.

4.6.2. Real money demand stability for the period 1988-2002

Now let us examine the short-term co-movements of the variables in the real money demand function over the sub-sample period 1988-2002. The ECM estimation results from 1988-2002 presented in Table 4.5a show that the coefficient of the error correction term is highly statistically significant, establishing that a long-term (cointegrating) relationship exists between real money, inflation, real GDP, the interest rate on Treasury bills and the change in the exchange rate. The negative error correction coefficient implies that lagged excess money induces smaller holdings of current money. Its numerical value implies a moderate adjustment to restore equilibrium—approximately 39 *per cent* in the next quarter, which is a bit smaller than the correction for the whole sample[69]. Therefore, disequilibrium influences the short-term behaviour of real money balances after 1988. Hence, real money balances do adjust back to equilibrium in the money market: should there be an exogenous shock that pushes real money balances off its long-term path, 39 *per cent* of the actual disequilibrium will be corrected in the next quarter.

The results in Table 4.5a using data for the years 1988-2002, further, show that changes in real income have a positive and statistically significant impact, inducing an increase in real money balances of about 0.41. The interest rate effect on real money balances is positive but statistically insignificant; hence, it has a limited impact on real money balances for the sub-sample period under review. On the other hand, the exchange rate has a negative but statistically insignificant effect on real money balances. As mentioned before, we include the inflation variable as $\Delta(m-p)$ does not fully capture real

money. So, with inflation included real money will be fully captured to give more reasonable and improved results. From Table 4.5a, inflation has a positive and highly statistically significant effect on real money balances, which is not what the model in Equation 4.1 suggests, as the coefficient is expected to be negative.

The R^2 in this period is found to have improved to 0.4696; this would imply that some of the explanatory variables are becoming more representative of spending and economic activity in the real sector than in the previous estimated period for the years 1980-2002. This also represents an improvement in the model estimates as compared to those for the whole sample period (see Tables 4.4 and 4.5a). However, on the basis of satisfying the necessary outlined criteria for a real money demand function to be stable; from the above findings we conclude that the real money demand function for the period 1988-2002 is found to be unstable. Evidence for this comes from the fact that the income variable, the error correction term and the exchange rate are the only parameter estimates with the correct expected signs and only the first two of these are statistically significant. However, both the interest rate and the inflation rate are found to have the wrong signs, thus not satisfying the necessary sign constraints given in Equation 4.1.

4.6.3. Real money demand stability for the period 1994-2002

Finally, we examine the short-term co-movements of the variables in the real money demand function after excluding the periods of major policy changes over the second sub-sample period, 1994-2002. The results in Table 4.5b show an improvement (where improvement refers to statistically significant parameter estimates with the right *a priori* signs required by economic theory from Equation 4.1) in the sign relationship of the relevant variables as expected from economic theory. However, the income and the exchange rate variables appear to be statistically insignificant except for the interest rate, the error correction term, and the inflation rate, which are only significant at the one and five *per cent* levels respectively. The coefficient of the error correction term is found to be statistically significant and with the expected negative effect on real money balances in the short-term. This means that there is stability in the equilibrium relationship between real money demand and its determinants. The negative (but very small) coefficient implies that past excess money holdings induce smaller and smaller holdings of money in the current

[69] If the system deviates too far from equilibrium, forces are set in motion to return real money

period. Its numerical value implies a very slow adjustment back to equilibrium—approximately 6.1 *per cent* in the next quarter. Therefore, a long-term disequilibrium does influence the short-term behaviour of real money balances. Should there be an exogenous shock that pushes real money balances off its long-term path, about six *per cent* of the actual disequilibrium will be corrected in the next quarter. The biggest gain from the ECM estimation for the years 1994-2002 is the interest rate effect. Changes in the interest rate have a negative and statistically significant impact (as opposed to its positive and insignificant impact for the years 1988-2002), inducing a decrease in real money balances of about 0.1 *per cent* for a one *per cent* rise in the interest rate. Real income (GDP) remains with a positive but insignificant impact on real money balances (reduced to approximately 0.20 from 0.41 in the previous estimation). The exchange rate and inflation both have negative impacts on real money balances; however, the former is statistically insignificant while the later is significant. Inflation as shown in Table 4.5b is statistically significant at the five *per cent* level with a negative and numerically large coefficient (of about 0.198).

Here, the ECM is modelling Δ(m-p) in the long-term and short-term, although real money (and velocity) is being determined in the long-term through the error correction term. Such a relationship is consistent with Ericsson and Sharma (1996: 6) and Ericsson (1998: 297) who suggest that models of money demand, in which short-term factors determine movements in *nominal* money around desired bands, and longer-term factors (including the price level) determine the bands themselves. Our model over the years 1994-2002 has both short-term and long-term effects and the price level from the previous period determines the nominal money demand bands.

The model in this time period satisfies the necessary sign constraints given in Equation 4.1 although the R^2 is found to have reduced to 0.24035, although below the DW-statistic of 1.87 indicating that spurious regression is unlikely. Thus, we can say that our model exhibits parsimony with adequate goodness of fit. The error correction term is statistically significant and has the correct sign. In addition, the model moderately meets the outlined criteria necessary for a real money demand function to be stable although it is still worrisome that the income variable is statistically insignificant.

If we were to assume no stationary problems with the data, the coefficients of our stable real money demand function are the "true" values and the model's errors were drawn

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demand to equilibrium.

from a normal distribution (Figure 4.6) having the same variance as those of our final model (Table 4.5b), we can simulate (over 1000 repeated random samples) the sampling distribution of the income (GDP) coefficient. Using all our data we find the mean of the sampling distribution of the coefficient for real income to be 0.20, with a sample range of 0.12. So, although our estimate of this coefficient is not significantly different from zero, we use the simulation results as support for there being a probability of about one half that the real income coefficient lies above 0.2 but does not exceed 0.3, the later being the lowest limit acceptable on theoretical g.ounds.

Also, we have observed low elasticities for real money balances from each of the variables estimated. Overall, the above findings represent an improvement in the model estimates as compared to those for the whole sample period 1980-2002 and the previous period 1988-2002 (see Tables 4.4, 4.5a and 4.5b). Given that we have somewhat of a good fit, adequate parsimony, moderate readjustment back to equilibrium and our variables are encompassing of real economic activity (with the exception of income), our final model can be regarded as one that exhibits stability.

The model also performs fairly well on statistical grounds, as suggested by the diagnostic tests. The diagnostic statistics test against several alternative hypotheses—residual autocorrelation (Durbin Watson and AR) and autoregressive conditional heteroscedasticity (ARCH). A heteroscedasticity problem is evident in our error correction model for the years 1980-2002. Evidence from Table 4.4 shows that the coefficient estimates appear to be different from zero (except for real income) at generally accepted levels of statistical significance. However, the heteroscedastic statistic (53.747) in Table 4.4 (pp. 119) rejects the null hypothesis of no heteroscedasticity. This implies that the standard errors of the parameter estimates for the whole sample are incorrect and, thus, any inferences derived from them may be misleading. This is attributed to the inclusion of major policy changes, which ought to be accounted for over the sample period. As further error correction estimation is done, with the exclusion of the major policy changes for the period 1994-2002 (see Table 4.5b), the significance of the estimates is greatly reduced, with Δy_{t-1}, q_t and π_t becoming problematic. The heteroscedasticity statistic (0.739) is no longer significant at the 5 *per cent* level (see Table 4.5b). At the same time the D-W statistic, which tests for serial correlation is reduced from 1.9598 for the years 1980-2002

to 1.8677 for the years 1994-2002, however, this rise in serial correlation is not a major problem for our model.

Figure 4.6. The sampling distribution of the income coefficient based on Table 4.5b

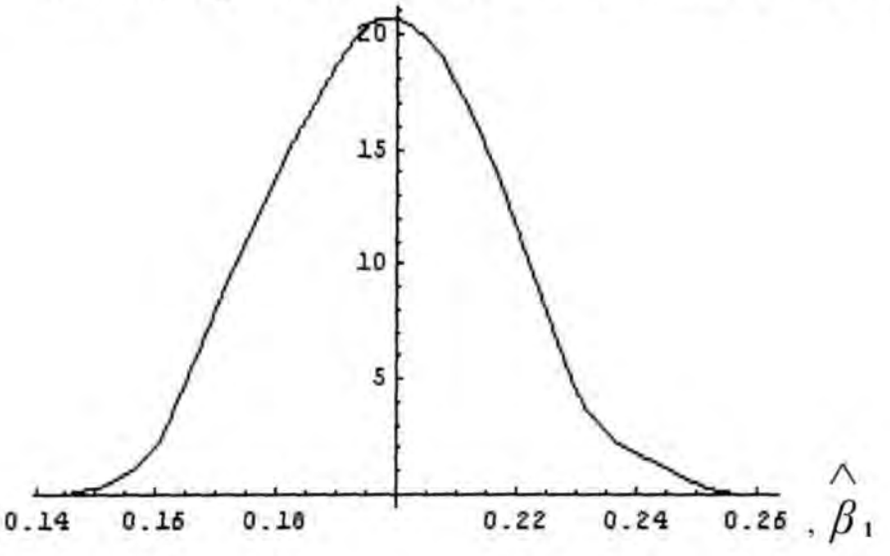

Table 4.5a. ECM Estimation of the $\Delta(m-p)_t$ Equation from 1988 to 2002

Regressor	Coefficient	Standard Error	T-Ratio	Probability (One-tail)
Intercept	0.0418	0.1326	0.3157	0.3767
Trend	0.0173	0.0038	4.5351***	0.0000
$\Delta(m-p)_{t-1}$	0.0179	0.1067	0.1675	0.4338
Δy_{t-1}	0.4098	0.1924	2.1300***	0.0187
ΔR_{t-1}	0.0003	0.0027	0.1257	0.4502
ECM_{t-1}	-0.3912	0.0726	-5.3896***	0.0000
q_t	-0.0146	0.0115	-1.2680	0.1049
π_t	0.2124	0.0393	5.4083***	0.0000
R-Squared		0.46955	R-Bar-Squared	0.39815
S.E. of Regression		0.07259	F-statistic F(7, 52)	6.5758 [0.000]
Akaike Info. Criterion		68.5313	Equation. Log-LL	76.5313
DW-statistic		2.1277	SBC	60.1539
			System LL	76.5313
Diagnostic Tests				
Test Statistics		LM Version	F Version	
A: Serial Correlation CHSQ(4)		7.5135 [0.111]	F(4, 48)	1.7178 [0.161]
B: Heteroscedasticity CHSQ(1)		17.1056 [0.000]	F(1, 58)	23.1295 [0.000]

Note: The 1, 5, and 10 *per cent* critical t-values are 2.390, 1.671 and 1.296 respectively taken from Gujarati (1995).

*** denote coefficient is significant at 1 *per cent* confidence level.

A: Lagrange multiplier test of residual serial correlation

B: Based on the regression of squared residuals on squared fitted values

$$ECM_{t-1} = 0.88198(m-p)_t + 2.1115y_t + 0.015472R_t$$

Table 4.5b. ECM Estimation of the $\Delta(m-p)_t$ Equation from 1994 to 2002

Regressor	Coefficient	Standard Error	T-Ratio	Probability (One-tail)
Intercept	2.1268	1.1179	1.9024**	0.0328
Trend	0.0146	0.0075	1.9468**	0.0299
$\Delta(m-p)_{t-1}$	-0.1771	0.1775	-0.9978	0.1627
Δy_{t-1}	0.2038	0.4983	0.4089	0.3426
ΔR_{t-1}	-0.0040	0.0018	-2.2048***	0.0172
ECM_{t-1}	-0.0606	0.0316	-1.9213**	0.0316
q_t	-0.0059	0.0089	-0.6645	0.2554
π_t	-0.1985	0.1203	-1.6502**	0.0541
R-Squared		0.24035	R-Bar-Squared	0.050432
S.E. of Regression		0.03155	F-statistic F(7, 28)	1.2656 [0.303]
Akaike Info. Criterion		69.8606	Equation. Log-LL	77.8606
DW-statistic		1.8677	SBC	63.5265
			System LL	109.3377
Diagnostic Tests				
Test Statistics		LM Version	F Version	
A: Serial Correlation CHSQ(4)		8.7731 [0.067]	F(4, 24)	1.9333 [0.137]
B: Heteroscedasticity CHSQ(1)		0.7396 [0.390]	F(1, 34)	0.7131 [0.404]

Note: The 1, 5, and 10 *per cent* critical t-values are 2.457, 1.697 and 1.310 respectively taken from Gujarati (1995).

***, ** denote coefficient is significant at 1 and 5 *per cent* confidence levels respectively.

A: Lagrange multiplier test of residual serial correlation

B: Based on the regression of squared residuals on squared fitted values

$$\mathbf{ECM_{t-1} = 2.3683(m-p)_t + 6.1440y_t - 0.056357R_t}$$

4.6.4. Summary of estimation results

This thesis analyses the real money demand function of Uganda using an ECM. We are able to draw several interesting conclusions. First, the findings of the present study concur with many earlier studies that the determinants of money demand are a scale variable (real income) and the opportunity costs of holding money: nominal interest rate, actual inflation and exchange rate. However, this study takes into account the periods of major policy changes in the estimation of the money demand function, as opposed to the earlier studies (i.e. Jean-Claude, 2001 and George, 2002) on money demand in Uganda, which do not account for periods of major policy reforms.

Second, we find that the long-term demand for real money depends upon real income with an income elasticity of approximately 0.30, which is less than the 0.5 suggested by Baumol. When comparing our results to previous studies, the income

elasticity is close to George's (2002: 9) estimate of approximately 0.24 but below Jean-Claude's (2001: 11) estimate of approximately 1.23. The long-term demand for real money is found to be somewhat sensitive to interest rates as the semi-elasticity is estimated at approximately -0.003 as compared to the 11.14 estimated by Jean-Claude and –0.03 estimated by George. In particular, our analysis suggests that monetary policy aimed at an own rate of return on money can be an effective means of influencing the demand for real money balances as individuals economise on cash balances with respect to the interest rate.

Third, the short-term dynamics of money demand are important, with income and interest elasticities having varying magnitudes as compared to the long-term dynamics, and this is more evident after the exclusion of major policy changes. In particular, the income elasticity for the years 1980-2002 is much smaller with the wrong sign in the short-term than in the long-term (approximately –0.02 in the short-term and 0.30 in the long-term). For the years 1994-2002, with the exclusion of major policy changes, the income elasticity remains smaller in the short-term than in the long-term but with an improved right sign (positive), where it is found to be approximately 0.20 and 0.30 respectively. However, it should be noted that the income variable is found to have no statistical significance in the model for the short-term dynamics for the years 1994-2002.

Four, for the years 1980-2002, the interest semi-elasticity is found to be much bigger (-0.012) in the short-term than in the long-term (-0.003), comparing Table 4.4 (pp. 119) with Table 4.3 (pp. 111). The short-term effect is statistically significant with the correct expected sign. With the exclusion of major policy changes for the years 1994-2002, the interest semi-elasticity is larger (-0.004) in the short-term than in the long-term (-0.003). However, the main highlight is that there is found to be a general decline in the interest semi-elasticity in the short-term from –0.012 for the years 1980-2002 to –0.004 for the years 1994-2002, particularly, because of the exclusion of major policy changes. But after liberalization in 1994 real money demand is more responsive to interest rate changes as the interest rate coefficient is significant and negative at –0.004 in Table 4.5b (pp. 125).

Turning to the impacts caused by both the exchange and inflation rates in the short-term dynamics of real money balances after accounting for the major policy changes, it is found that the inflation variable induces a 0.1985 decrease in real money balances from any inflationary changes as compared to 1.2 and 5.4 reductions induced in real money balances

estimated by Jean-Claude (2001: 17) and George (2002: 10) respectively, although our effect is just outside the bounds of a five per cent level of significance.

One important finding, is that the real money demand relationship in Uganda for the whole sample period 1980-2002 is unstable. Evidence for this comes from the fact that the interest rate, error correction term and the exchange rate are the only parameter estimates with the expected signs and are statistically significant. Both the income and the inflation rate are found to have the wrong signs thus not satisfying the necessary sign constraints given in Equation 4.1 and also, implying that the two are not representative of spending and economic activity in the real sector. In addition, the R^2 is found to be very low at 0.2534, although below the DW-statistic of 1.96 indicating that spurious regression is unlikely. However, the error correction coefficient is found to be statistically significant and negative as expected approximately –0.9209. This implies that after any move away from equilibrium, caused by shocks to the demand for real money balances, approximately 92 *per cent* will be corrected in each quarter to bring the system back to equilibrium (see Table 4.4: 119).

Breaking our sample into periods of major policy changes there is evidence of significant variation in the short-term error correction effect. After structural adjustment in 1988, the rate of adjustment to shocks in the demand for real money balances reduces to about a negative 39 *per cent* in each quarter (see Table 4.5a: 124). Demand for real money balances is found to remain unstable for the period 1988-2002. Evidence for this comes from the fact that the income variable, the error correction term and the exchange rate are the only parameter estimates with the correct expected signs and only the first two of these are statistically significant. However, both the interest rate and the inflation rate are found to have the wrong signs, thus, not satisfying the necessary sign constraints given in Equation 4.1. The R^2 is found to have improved to 0.4695; this represents an improvement in the model estimates as compared to those for the whole sample period (see Tables 4.4 and 4.5a). However, given that we have somewhat of a good fit, moderate readjustment back to equilibrium but with inadequate parsimony, and our variables unable to fully encompass real economic activity, our model from 1988 is regarded as one that exhibits instability.

After the final policy changes in 1994, a stable money demand relationship in Uganda is found to exist, regardless of the reduced magnitude of the rate of adjustment to

shocks in the demand for real money balances as the error correction term is found to be approximately –0.061 (6.1 *per cent* in each quarter) as opposed to the much larger effect found for the whole sample (see Table 4.5b). Evidence for this is from the fact that all the relevant parameter estimates are found to have the expected signs and most are statistically significant (except for the income and the exchange rate that are not statistically significant). The model in this time period satisfies the necessary sign constraints given in Equation 4.1 although the R^2 is found to have reduced to 0.24035, and below the DW-statistic of 1.87 indicating that spurious regression is unlikely. Thus, we can say that our model exhibits parsimony with adequate goodness of fit. The error correction term is statistically significant and has the correct sign. In addition, the model moderately meets the outlined criteria necessary for a real money demand function to be stable although we found that the income variable remained statistically insignificant with a coefficient not exceeding 0.3, the later being the lowest limit acceptable on theoretical grounds. Our conclusion in light of the above findings is that once we break our sample into periods of major policy and macroeconomic structural change, a stable real money demand relationship does emerge after 1994 (see Table 4.5b: 125).

We are therefore confident that real money demand is stable at the later period 1994-2002 as we found only *one* long-term relationship with short-term movements back to equilibrium. Our error correction results are consistent with Jean-Claude (2001: 17) who found an error correction term estimate of approximately –0.3 (and concluded that the money demand function is stable) and not consistent with George (2002: 10) who found an error correction term estimate of approximately –2.5 (but concluded that the money demand function is unstable). It has to be mentioned that both studies did not account for periods of major policy changes and hence, comparing the findings of this chapter with major policy change accountability, we conclude that indeed there exists a stable real money demand function in Uganda for only one time period 1994-2002.

4.7. Summary and conclusion

This chapter investigates whether the real demand for money in Uganda is stable. Although, stability can mean different things to different economists, we have found in the literature (see Judd and Scadding, 1982: 993) a precise classification of stability. In Section 4.6, we note that stability means the equation to be estimated is a function of a few

variables informed by economic theory, the estimated model must provide a good fit to the data and the variables should be descriptive of actual economic behaviour in the Ugandan economy. We feel this is a workable definition of stability and thus employ it in this chapter. It does have one weakness in that it does not deal with out of equilibrium behaviour of real money demand. To this end, we add our own additional requirement that any disequilibrium be corrected in subsequent months for the function to be considered stable.

In order to assess stability as outlined above, we needed a real money demand specification to test using Ugandan data. The specification had to have been used in the literature to test models of real money demand and to be based on traditional money demand theory. One specification that satisfies these two considerations, and addresses our overall concern for stability is the model of Ericsson and Sharma (1996: 6) and others who have real money demand being a function of real income, an own interest rate, the rate of inflation and the change in the exchange rate. The exact nature of this relationship we discuss in Section 4.2 of this chapter and Chapter Two provides a theoretical basis for its constituent variables.

Knowing that we had a practical definition of stability and a well-specified model of real money demand, quarterly data on the required variables was obtained for the Ugandan economy starting in 1980 and ending in 2002. We did not want to bias our results by collecting data over too short a time period. Instability is only going to reveal itself over many time periods. In addition, we had prior information that our sample period contained two major policy changes. But before we used this information, we applied our model to the whole sample.

Given recent developments in the econometrics literature, one cannot perform regression analysis without substantial preparatory analysis of the data. Typical tests (t and F) and measures of fit (R^2) are only reliable if the data at hand is stationary. To ensure this, we test our data looking for whether it wandered without returning to a particular level. We found that indeed most of our variables were not stationary and had time trends that could make unrelated series appear related. Even though series may be individually non-stationary, a combination of them may indeed be stationary. We used an econometric method- cointegration- to look for this effect, not forgetting our overall concern with stability of real money demand. The details of exactly how this is done are presented in

Section 4.4.2 (pp. 108). An advantage of using the idea of cointegration is that we obtain the long-term determinants of real money demand as well as the short-term dynamics of real money demand. We do this in Section 4.5 (pp. 111).

Given that we had overcome the problem of stationary variables, we now could proceed with estimating our specified equation. In Section 4.6.1 (pp. 117), we present the results of this analysis for our entire sample period. The inflation rate and income variables performed poorly, the R^2 is low and although there is a return to equilibrium after a shock, these results suggest that (in terms of our stability requirements) real money demand is not stable over the whole sample covering the years 1980 to 2002.

We then broke our sample into two sub-sections. Armed with our prior knowledge that there were two major policy changes in Uganda in 1987 and 1993, we re-estimated our model. First, we looked at removing just the first policy change. When we did this we had some improvement in our model in terms of stability: the fit improved but two variables still had the incorrect sign. On this basis, we concluded that despite taking out one policy change real money demand was still unstable.

We then proceeded to do a second re-estimation but removing the effect of the second policy change (and thus, also the first) and were pleased to note that all variables now had the correct sign in terms of economic theory, although real income and the exchange rate were statistically insignificant. Given that our model conforms to economic theory and the adjustment to equilibrium is in the right direction, even though the R^2 was a modest 0.24 (with $\overline{R}^2$ of 0.05), we were of the opinion that our final estimation was one that exhibits stability.

The findings of this chapter emphasize that an error correction approach to real money demand in Uganda is appropriate, and it provides the basic structure to study the properties of real money demand. One possible item for future research is to determine how well the model (presented in Table 4.5b: 125) forecasts future real money balances. We also conclude from a monetary policy perspective, based on the stable real money demand found here, that an inflationary targeting regime is feasible in Uganda whereas other targeting regimes (i.e. an exchange rate targeting regime) might be less effective. Given the high inflation elasticity of real money demand as opposed to the interest semi-elasticity and exchange rate elasticity (costs of holding money), it can be concluded that monetary policy

in Uganda must target the inflation rate, but also monitor the impacts of changes in interest rates and the change in the exchange rate on real money demand.

In the 1980's, Uganda experienced a severe financial disintermediation crisis, as real money balances declined in response to rising inflationary and devaluation pressures, and to a declining Treasury bill rates. This can be seen in Table 4.5a (pp. 124) where the inflation effect is positive, thus, reducing real money balances, the devaluation effect is negative thus reducing real money balances and the interest rate effect is positive so as the interest rate fell so did real money balances. This development was reversed in the late 1980's and early 1990's, as a result of the re-orientation of macroeconomic and financial policies, a fall in inflation, and sustained growth led to a marked rise in real money demand. There is evidence for this in Table 4.5a as the inflation effect is positive for a sustained fall in prices, and the income coefficient is positive. In addition, we found that the income variable plays no role (has no statistical significance) in the demand for real money balances for the years 1994-2002, this could be as a result from: One, that there is no measurement of permanent income in Uganda unlike in other countries that are developed and therefore we used actual income (GDP at current prices) as a proxy for permanent income. Two, Uganda still depends so much on international aid to boost economic development, which does not necessarily transform into permanent income. Three, a large proportion of the government budget is allocated to the defence ministry; this is due to its commitment to ending the civil war in northern Uganda, which has increased poverty in the region for the last 18 years. From the later, the population in the northern region has no income or had any development leading to absolute poverty.

We conclude, that greater participation in the financial sector and the decline in broad money velocity (or an improved stability of real money demand) experienced by Uganda in the 1990's is mainly due to the liberalization of domestic interest rate markets and the decline in foreign interest rates in an environment of low domestic inflation and exchange rate stability.

CHAPTER FIVE

5.0. Summary and conclusions

The money market plays a critical role in virtually all theories of income determination and is, as a result, one of the keystones of econometric modelling (see Lieberman, 1980: 44). Most economists use macroeconomic models, which assume that money demand is consistently related to a number of predetermined variables, for example income and interest rates (see Hafer and Hein, 1982: 555). That is, the aggregate money demand function links a relationship between transaction activity and the opportunity cost of holding real money balances. The central proposition of these models has been the proposition of a stable long-term aggregate demand function (see Hoffman, Rasche and Tieslau, 1995: 317). As mentioned before, an econometric relationship is stable if the parameters in such a relation are not subject to permanent changes over time (see Laumas and Spencer, 1980: 456).

The central bank of Uganda (Bank of Uganda) relies on a money demand function both as a means to identify medium-term growth targets for the money supply, but also to manipulate interest rates and reserve money for the purpose of controlling total liquidity in the economy. The relation between the demand for money and its determinants is a key element in most theories of macroeconomic behaviour. In addition, the demand for money is a crucial component in the formulation of monetary policy. The usefulness of a money demand function in the conduct of monetary policy depends essentially on its stability. In the absence of a stable money demand function, monetary growth targets might be inconsistent with developments in the real economy, interest rate manipulations may be out of line with the planned growth of the money supply and targeted monetary aggregates might not be an appropriate reflection of total liquidity in the economy. In addition, price stability (inflation targets) may not be effectively achieved and hence, the macro-economic objectives set by the Bank of Uganda may be out of reach.

In this thesis, we estimate a money demand function for the Ugandan economy over the period 1980-2002 using quarterly data. This period is characterised by major financial sector reforms. Key elements of the reforms are; the structural adjustment program approved in June 1987, which succeeded in restoring fiscal and monetary discipline, while simultaneously removing domestic price distortions and promoting the liberalization of

trade, payments, and the exchange rate. The other major reform was the liberalization of interest rate markets and the introduction of more market based instruments of monetary policy. The main objective of the thesis is to study the stability of the money demand function over the sample period. We consider real demand for broad money (M2), real income, and the interest rate on Treasury bills, actual inflation and the exchange rate as the central endogenous variables in the model. The specification of our model is based on similar models used by Ericsson (1998: 297) and Ericsson and Sharma (1996: 6). The choice of variables is supported by the theoretical suggestions from Cagan (1956), Ericsson (1998: 298), Friedman (1956: 11), Laidler (1993) and Sriram (1999b: 23).

Economic theory as reviewed in Chapter Two, suggests that the demand for money is related to the use of money as a medium for transactions, and a set of opportunity cost variables which determine portfolio demand for money as an asset (see Baumol, 1952; Barro and Fischer, 1976; Cuthbertson and Barlow, 1991; Laidler, 1993; Sriram, 1999b; and Tobin, 1956). Opportunity cost variables for Uganda include the interest rate on Treasury bills, the actual inflation rate (the opportunity cost of holding money relative to real goods) and the exchange rate (the opportunity cost of holding money relative to assets denominated in foreign currency). The transactions demand, or scale variable is income proxied by gross domestic product (GDP). Theory suggests that the elasticity on the scale variable should be unity for the quantity theory of money and one half suggested by Baumol. However, in general, the elasticities on the opportunity cost of holding money will have a negative sign: as other assets exhibit, or are expected to exhibit, higher returns, then the quantity of demand for money is reduced. The results obtained from this study show that all the variables have the right anticipated signs.

The theoretical foundations of our testing and results are based on Dickey and Fuller (1979: 427), and Engle and Granger (1987: 270) for the unit root tests for time series properties, and Johansen (1988: 231), and Johansen and Juselius (1990: 169) for the statistical analysis of cointegration vectors. In this thesis, we tested for unit roots using the standard ADF test procedure. We conclude, that the actual rate of inflation and the exchange rate do not have unit roots at the level form and thus they are stationary. On the other hand, real money, real income and the nominal interest rate on Treasury bills have unit roots at the level form. However, they are stationary at the one *per cent* level of significance, after first differencing. We then estimate an unrestricted VAR from which we

can derive and identify a long-term equilibrium condition, relating real money demand, real income and the nominal interest rate on Treasury bills, the actual rate of inflation and the exchange rate. We tested the VAR for its various properties. We conclude, that there is one cointegrating vector in the system. The trace statistic rejects the null hypothesis of no cointegration at the five *per cent* significance level. However, the null hypotheses of at most 1 and 2 cointegrating vectors could not be rejected, since the test statistics are less than critical values. The existence of cointegration suggests that there is a stable long-term equilibrium relationship between real income, the nominal interest rate on Treasury bills and real money demand over the sample period 1980-2002.

We tested the stability of the long-term cointegration vector by addressing the short-term dynamics. We conclude, that the model shows some instability during the whole sample 1980-2002 and the first sub sample period 1988-2002. The instability is probably due to the economic policy reforms undertaken in 1987 and 1993 respectively. Consequently, the sample study was broken into sub-samples 1988-2002 and 1994-2002. The estimates for 1988-2002 still exhibited instability due to the inclusion of 1993 policy reforms. However, on estimating the final sub sample 1994-2002, this after the major policy reforms there was evidence of stability. We conclude, that there is a stable real money demand function for Uganda only in one time period, 1994-2002. Interpreting the long-term cointegration vector, we find that the real income elasticity is less than the 0.5 elasticity suggested by Baumol (1956). This result is probably due to lack of permanent income data in Uganda. We also find that the real income elasticity (approximately 0.20) is smaller in the short-term than in the long-term (approximately 0.3).

The interest rate elasticity on real money demand is bigger in the short-term (approximately -0.004) than in the long-term (approximately -0.003). The study finds that the short-term demand for real money is somewhat sensitive to Treasury bills rates as observed from the empirical results in Chapter Four: Table 4.5b (pp. 125) for the period 1994-2002. Changes in the interest rates on Treasury bills have a negative and statistically significant impact, inducing a decrease in real money balances of about 0.4 *per cent* for a one *per cent* rise in the interest rate. We conclude, that monetary policy aimed at an own rate of return on money can be an effective means of influencing the demand for real money balances as individuals economise on cash balances with respect to the interest rate. Since the inflation coefficient is rather high (approximately -0.20) from the short-term

dynamics in the sub sample period 1994-2002 in Uganda, it seems that the decrease in money holdings are necessary to achieve a better allocation of goods among consumers. Consequently, in Appendix I, Plot C (pp. 160) shows that the CUSUMSQ for period 1994-2002 stays within the five *per cent* critical bounds, further confirming the stability of parameters and thus the overall model. Given that our model conforms to economic theory and the adjustment to equilibrium is in the right direction, even though the R^2 was a modest 0.24 (with $\overline{R}^2$ of 0.05), we conclude, that our final estimation is one that exhibits stability of the Ugandan M2 money demand function for the period 1994 through 2002.

We also conclude, that other factors might influence real money demand. In the long-term real income and the nominal interest rate on Treasury bills are relevant. In the short-term the nominal interest rate on Treasury bills and inflation are both relevant with negative effects on real money demand. However, it is inflation that has the largest significant effect on real money demand. Therefore, an inflationary targeting regime is feasible for successful monetary policy management in Uganda. There is no significant influence of real income and the exchange rate on monetary conditions in the short-term for the period 1994-2002.

The model presented in this thesis can be a first step as an instrument to monitoring monetary conditions in Uganda. Monetary authorities should be aware of the relevant transactions variables in case of any shortage. On the other hand, the stability of the relationship between real money demand, real income, and the nominal interest rate on Treasury bills, the actual inflation rate and the exchange rate can be used to pursue a monetary policy focused on domestic intermediate monetary targets such as, inflation. A stable monetary demand relationship, like the one presented in Chapter Four: Table 4.5b (pp. 125), is a prerequisite to pursue such a policy. In such a case money can serve as an intermediate targeting variable. .

In summary, as Uganda proceeds with reforms of its financial sector, the stability of the demand for money would have to be re-examined and instruments of the Bank of Uganda modified periodically to ensure an effective control of the monetary base and the implementation of monetary policy. Furthermore, given that our model conforms to economic theory and the adjustment to equilibrium is in the right direction, we conclude, that an inflationary targeting regime is feasible in Uganda. This is on the basis of estimates obtained for the one time period 1994-2002. We found the inflation variable to be

statistically significant at the five *per cent* level, inducing a decrease in real money balances of about twenty *per cent* for a one *per cent* rise in inflation rate. This thesis recommends that one possible item for future research is to determine how well the real money demand model presentea in Chapter Four: Table 4.5b forecasts future real money balances. The other item for future research is to develop an effective methodology for measuring permanent income in Uganda and thus, use the data to examine its impact on the stability of real money demand in the economy.

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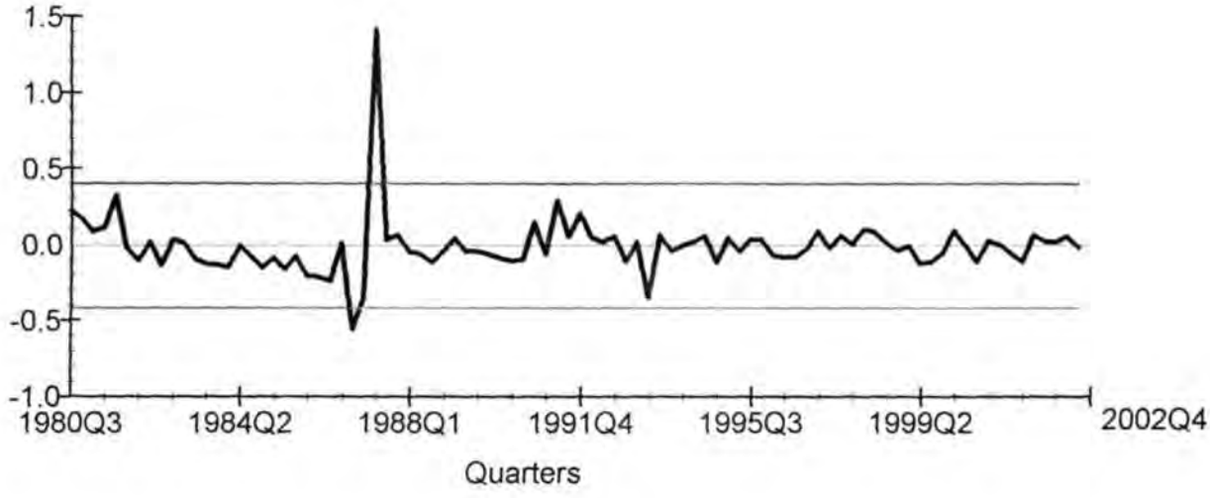
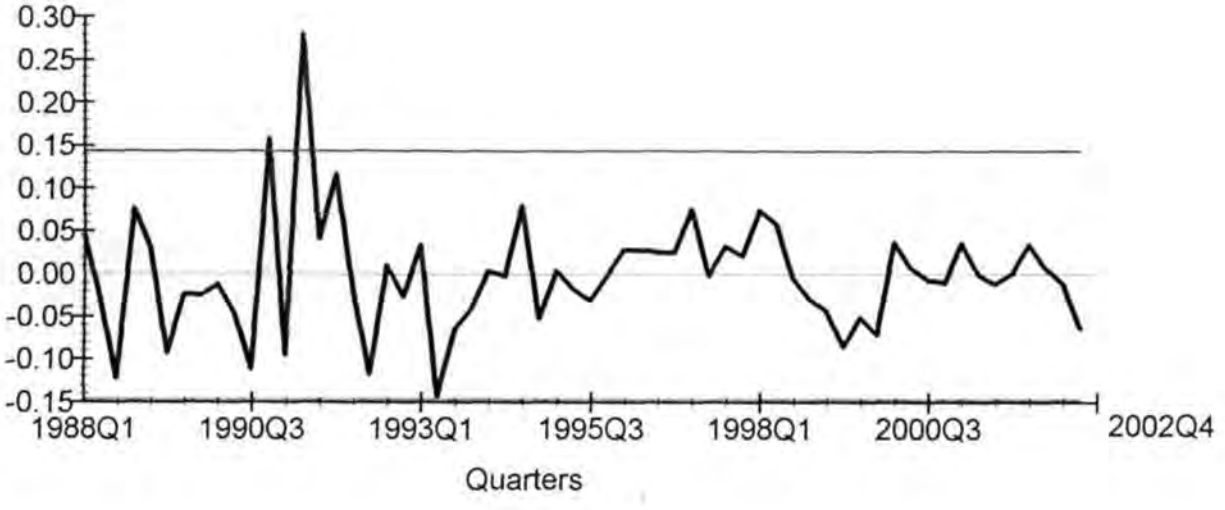
Appendix I

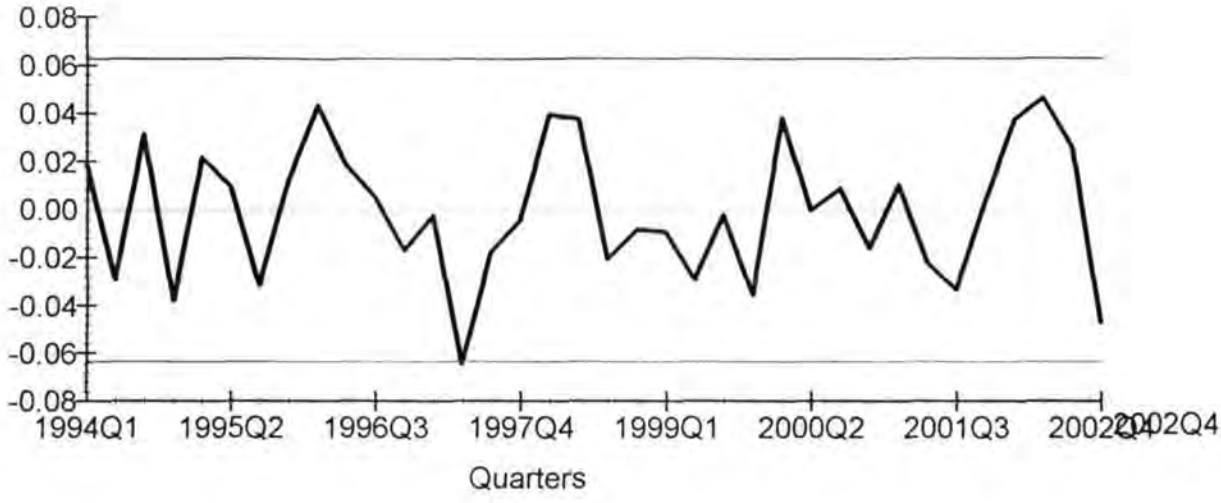
Plot A: CUSUMSQ (residuals) and two standard error bands for the period 1980-2002



Plot B: CUSUMSQ (residuals) and two standard error bands for the period 1988-2002



Plot C: CUSUMSQ (residuals) and two standard error bands for the period 1994-2002



Appendix II

Time Period	CPI	TB's Rate	Broad Money-M2	Change in the Exch. Rate	Income (GDP)	Real M2	Real GDP	Ln Real GDP	Ln Real M2	Ln of change in the Exch. Rate	Ln Inf. Rate
1980i	0.41	5.08	0.09	0.07	0.65	0.22	1.57	0.45	-1.52	-2.66	-2.66
1980ii	0.51	5.08	0.09	0.07	0.83	0.18	1.63	0.49	-1.74	-2.66	-1.63
1980iii	0.57	5.08	0.1	0.07	1.08	0.17	1.89	0.64	-1.74	-2.66	-2.22
1980iv	0.62	5.08	0.11	0.07	1.31	0.18	2.11	0.75	-1.73	-2.66	-2.56
1981i	0.78	5.08	0.12	0.08	1.72	0.15	2.2	0.79	-1.87	-2.53	-1.59
1981ii	0.84	5.08	0.14	0.31	2.27	0.17	2.7	0.99	-1.79	-1.17	-2.62
1981iii	0.97	5.08	0.22	0.81	2.55	0.23	2.64	0.97	-1.48	-0.21	-2.03
1981iv	1.06	9	0.23	0.81	2.73	0.22	2.58	0.95	-1.53	-0.21	-2.47
1982i	1.2	9	0.21	0.86	2.22	0.17	1.84	0.61	-1.75	-0.15	-2.1
1982ii	1.34	9	0.23	0.89	1.87	0.17	1.39	0.33	-1.76	-0.12	-2.29
1982iii	1.48	10	0.22	0.99	1.83	0.15	1.24	0.21	-1.91	-0.01	-2.34
1982iv	1.63	11.33	0.25	1.02	1.99	0.15	1.22	0.2	-1.88	0.02	-2.38
1983i	1.77	12	0.28	1.12	2.71	0.16	1.53	0.43	-1.84	0.11	-2.57
1983ii	1.83	12	0.3	1.29	3.79	0.16	2.07	0.73	-1.81	0.25	-3.4
1983iii	1.89	12	0.32	1.66	4.77	0.17	2.52	0.92	-1.78	0.51	-3.37
1983iv	2.02	12.67	0.34	2.09	6.88	0.17	3.4	1.22	-1.78	0.74	-2.74
1984i	2.16	14	0.37	2.56	6.33	0.17	2.93	1.07	-1.77	0.94	-2.76
1984ii	2.41	14	0.46	2.97	7.16	0.19	2.97	1.09	-1.66	1.09	-2.26
1984iii	2.71	22	0.54	3.71	7.65	0.2	2.83	1.04	-1.61	1.31	-2.22
1984iv	3.93	22	0.64	5.15	11.89	0.16	3.03	1.11	-1.82	1.64	-1.17
1985i	5.26	22	0.86	5.49	22.52	0.16	4.28	1.45	-1.81	1.7	-1.38
1985ii	5.98	22	1.02	5.98	18.53	0.17	3.1	1.13	-1.77	1.79	-2.12
1985iii	6.76	22	1.29	6	21.58	0.19	3.19	1.16	-1.65	1.79	-2.15
1985iv	8.12	22	1.51	9.42	19.27	0.19	2.37	0.86	-1.69	2.24	-1.78
1986i	11.64	22	1.97	14	35.59	0.17	3.06	1.12	-1.78	2.64	-1.2
1986ii	13.87	30.67	2.26	14	44.99	0.16	3.24	1.18	-1.81	2.64	-1.83
1986iii	16.64	35	3.09	14	54.79	0.19	3.29	1.19	-1.68	2.64	-1.79
1986iv	30.28	35	3.51	14	104.54	0.12	3.45	1.24	-2.16	2.64	-0.8
1987i	41.42	35	4.32	14	140.98	0.1	3.4	1.22	-2.26	2.64	-1.31
1987ii	6.63	35	4.61	37.37	23.33	0.7	3.52	1.26	-0.36	3.62	-2.79
1987iii	7.51	28	6.4	60	27.23	0.85	3.63	1.29	-0.16	4.09	-2.14
1987iv	10.5	24	9.48	60	31.64	0.9	3.01	1.1	-0.1	4.09	-1.26
1988i	13.83	28	11.36	60	55.48	0.82	4.01	1.39	-0.2	4.09	-1.42
1988ii	18.34	28	12.39	60	70.4	0.68	3.84	1.34	-0.39	4.09	-1.4
1988iii	25.87	38	15.64	150	94.1	0.6	3.64	1.29	-0.5	5.01	-1.23
1988iv	26.05	38	19.18	154.54	90.07	0.74	3.46	1.24	-0.31	5.04	-4.98
1989i	30.63	39.67	25.36	173.89	116.16	0.83	3.79	1.33	-0.19	5.16	-1.9
1989ii	38.44	43	30.79	200	151.15	0.8	3.93	1.37	-0.22	5.3	-1.59
1989iii	43.41	43	34.99	200	179.38	0.81	4.13	1.42	-0.22	5.3	-2.17
1989iv	47.52	43	41.35	318.48	182.12	0.87	3.83	1.34	-0.14	5.76	-2.45
1990i	48.82	43	49.09	377.16	202.59	1.01	4.15	1.42	0.01	5.93	-3.63
1990ii	50.83	43	55.83	382.81	211.26	1.1	4.16	1.42	0.09	5.95	-3.23
1990iii	56.97	39	61.55	449.06	233.8	1.08	4.1	1.41	0.08	6.11	-2.23
1990iv	44.27	39	67.06	506.4	178.95	1.51	4.04	1.4	0.42	6.23	-2.79
1991i	47.71	33.67	74.94	585.4	198.79	1.57	4.17	1.43	0.45	6.37	-2.63
1991ii	50.39	31	124.72	662.8	211.39	2.48	4.2	1.43	0.91	6.5	-2.93
1991iii	53.33	35	150.58	792.4	242.25	2.82	4.54	1.51	1.04	6.68	-2.9
1991iv	56.96	37	185.82	895.4	267.47	3.26	4.7	1.55	1.18	6.8	-2.75
1992i	66.99	37.33	201.93	993.3	297.62	3.01	4.44	1.49	1.1	6.9	-1.9
1992ii	81.95	38.53	223.58	1162.1	369.62	2.73	4.51	1.51	1	7.06	-1.7
1992iii	84.18	42.77	257.42	1182.8	379.42	3.06	4.51	1.51	1.12	7.08	-3.63

1992iv	84.55	37.31	276.08	1197.1	408.92	3.27	4.84	1.58	1.18	7.09	-5.44
1993i	81.81	21.35	289.11	1217.2	354.76	3.53	4.34	1.47	1.26	7.1	-2.79
1993ii	82.21	22.87	301.97	1210.2	410.36	3.67	4.99	1.61	1.3	7.1	-5.31
1993iii	85.47	22.88	334.92	1192.1	440.81	3.92	5.16	1.64	1.37	7.08	-3.27
1993iv	87.51	18.1	352.33	1160.6	455.38	4.03	5.2	1.65	1.39	7.06	-3.76
1994i	91.17	20.85	387.25	1079.7	494.56	4.25	5.42	1.69	1.45	6.98	-3.21
1994ii	94.42	15	402.6	978.4	508.83	4.26	5.39	1.68	1.45	6.89	-3.37
1994iii	90.76	7.99	427.78	936.4	496.62	4.71	5.47	1.7	1.55	6.84	-2.79
1994iv	93.20	6.26	440.9	923.2	531.51	4.73	5.7	1.74	1.55	6.83	-3.64
1995i	98.09	7.39	487.43	925.9	569.39	4.97	5.8	1.76	1.6	6.83	-3
1995ii	99.72	9.13	504.43	944.6	588.26	5.06	5.9	1.77	1.62	6.85	-4.11
1995iii	99.31	8.56	494.21	972.2	596.51	4.98	6.01	1.79	1.6	6.88	-2.79
1995iv	104.2	9.94	535.61	1033	645.33	5.14	6.19	1.82	1.64	6.94	-3.06
1996i	105	10.61	582.67	1021.8	653.45	5.55	6.22	1.83	1.71	6.93	-4.87
1996ii	106	11.7	609.04	1024.3	673.01	5.75	6.35	1.85	1.75	6.93	-4.66
1996iii	107	11.72	633.64	1065.9	685.15	5.92	6.4	1.86	1.78	6.97	-4.67
1996iv	110	12.8	658.25	1072.3	713.11	5.98	6.48	1.87	1.79	6.98	-3.6
1997i	110	11.18	686.01	1034.3	716	6.24	6.51	1.87	1.83	6.94	-2.79
1997ii	116	10.74	705.67	1059.8	757.47	6.08	6.53	1.88	1.81	6.97	-2.96
1997iii	114	10.35	721.92	1094.4	758.73	6.33	6.66	1.9	1.85	7	-2.79
1997iv	118	10.09	780.01	1143.5	796.86	6.61	6.75	1.91	1.89	7.04	-3.38
1998i	117	9.46	838.98	1151	800.21	7.17	6.84	1.92	1.97	7.05	-2.79
1998ii	115	7.97	873.18	1209.7	790.87	7.59	6.88	1.93	2.03	7.1	-2.79
1998iii	112	6.6	856.59	1254.7	781.95	7.65	6.98	1.94	2.03	7.13	-2.79
1998iv	115	7.06	889.74	1345.8	807.48	7.74	7.02	1.95	2.05	7.2	-3.65
1999i	119	5.14	933.83	1375.9	879.94	7.85	7.39	2	2.06	7.23	-3.39
1999ii	121	7.04	941.67	1472	903.93	7.78	7.47	2.01	2.05	7.29	-4.1
1999iii	122	7.25	962.92	1466.9	933.5	7.89	7.65	2.03	2.07	7.29	-4.8
1999iv	127	10.29	989.35	1504.5	1013.8	7.79	7.98	2.08	2.05	7.32	-3.23
2000i	123	9.88	1012.6	1519.6	992.96	8.23	8.07	2.09	2.11	7.33	-2.79
2000ii	123	12.83	1025.6	1557	1000.9	8.34	8.14	2.1	2.12	7.35	-2.79
2000iii	124	16.84	1061.1	1681.1	1020.1	8.56	8.23	2.11	2.15	7.43	-4.82
2000iv	132	13.22	1119.2	1820.2	1095.8	8.48	8.3	2.12	2.14	7.51	-2.8
2001i	128	18.28	1150.6	1775.7	1065.8	8.99	8.33	2.12	2.2	7.48	-2.79
2001ii	130	7.33	1185.6	1774.7	1105.0	9.12	8.5	2.14	2.21	7.48	-4.17
2001iii	127	11.2	1209.3	1743.1	1081.8	9.52	8.52	2.14	2.25	7.46	-2.79
2001iv	127	7.19	1246.5	1729.1	1090.1	9.81	8.58	2.15	2.28	7.46	-2.79
2002i	126	3.76	1354.5	1750.4	1086.6	10.75	8.62	2.15	2.37	7.47	-2.79
2002ii	126	4.66	1443	1795.7	1098.0	11.45	8.71	2.16	2.44	7.49	-2.79
2002iii	126	6.18	1509.0	1809.3	1100.3	11.98	8.73	2.17	2.48	7.5	-2.79
2002iv	132	8.82	1538.1	1834.8	1160.7	11.65	8.79	2.17	2.46	7.51	-3.09

Source: The International Financial Statistics-IMF.