Thesis

By

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DEPARTMENT OF ECONOMICS
COLLEGE OF SOCIAL AND ECONOMIC STUDIES
UNIVERSITY OF JUBA
SUDAN

Stability of Demand for Money in Sudan: 1962-2002

2005

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B.Sc. Economics Honours University of Khartoum 1980
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A thesis submitted in fulfillment of the requirements of the degree of Doctor of Philosophy in Economics

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Dedication

To my great country Sudan. To my, Father, Mother, Children and my wife Raga who suffered during completion of the thesis.

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Acknowledgment

The researcher would like to thank the following institutions and persons: Firstly thanks should go to University of Juba for giving the opportunity to teach and complete this research, secondly for CODESRIA for funding the research, thirdly for University of Khartoum for providing supervision and examiner, and fourthly for Bank of Sudan for providing relevant references and data.

Thanks should go to Mrs. Lina Stanley Yuggu Oroya for typing the manuscript and for Ustaz Muslam Elamir for assisting in statistical analysis.

ملخص الرسالة باللغة العربية

إستقرار الطلب على النقود فى السودان

١٩٦٢ – ٢٠٠٢م

تهدف هذه الرسالة إلى :

أولا": معرفة إستقرار الطلب على النقود فى السودان خلال الفترة ١٩٦٢ – ٢٠٠٢م ٠

ثانيا: معرفة العوامل المؤثرة على الطلب على النقود وأهميتها خلال الفترة ١٩٦٢– ٢٠٠٢م

تعتبر هذه الأهداف مهمة جداً لأنها تفيد صانعى السياسة النقدية فى انتهاج سياسات نقدية رشيدة ٠

قامت الدراسة بإستخدام الـ Co integrati on كأحدث وسائل الإقتصاد القياسى فى قياس إستقرار الطلب على النقود ٠

توصلت الرسالة إلى :

أولا: إستقرار الطلب على النقود خلال الفترة ١٩٦٢ – ٢٠٠٢م ولكن بتقسيم الفترة إلى ١٩٦٢ – ١٩٩٥ و ١٩٩٥ – ٢٠٠٢م توصلت الدراسة إلى أن الفترة الأولى أكثر إستقراراً من الفترة الثانية رغم الإستقرار النسبى للفترة الأخيرة ٠

ثانيا: توصلت الدراسة إلى أن العوامل المؤثرة على الطلب على النقود فى السودان بالترتيب التالى :

أ. الدخل القومى

ب. سعر الفائدة أو معدل العائد

ج. سعر الصرف

د. التضخم

تعتبر النتائج التى توصلت إليها الدراسة متسقة مع النظرية الإقتصادية ومع الدراسات العالمية حول الطلب على النقود ٠

تعتبر الرسالة ذات قيمة للأكاديميين وصانعى السياسة النقدية، بالنسبة للأكاديميين تكون الرسالة قد قدمت جديداً حول تحليل الطاب على النقود بإستخدام وسائل حديثة Co integration، بالإضافة إلى أنها فتحت الباب لمزيد من الدراسات حول الطلب على النقود والمجالات المرتبطة بالنقود مثل سرعة دوران النقود. لصانعى السياسة النقدية فقد وصت الدراسة بإستقرار الطلب على النقود وبالتالى تسهيل مهمة السياسة النقدية فى تحديد كمية النقود فقط ٠

Abstract in English

The basic objective of this thesis is to examine stability of demand for money in Sudan and its determinants during 1960-2002. The research objective is necessitated by the fact the stability of demand for money is important for ensuring stable economic performance.

Moreover, the research is important because in Sudan studies on demand for money lag behind nowadays worldwide of studies using cointegration econometric techniques.

Thus, the study is carried using the cointegration technique for finding stable demand for money in Sudan to close the gap between Sudanese studies and international studies.

The thesis has succeeded in finding a stable demand for money during 1962-1995, less stability during 1995 -2002. Moreover, the thesis has arrived at the determinants demand for money in the following order of importance: 1- National income 2- Interest rate 3- Exchange rate 4- Inflation

The findings of thesis are consistent with economic theory and findings of worldwide studies. The thesis is of value to academics and policy-makers. To academics, the thesis is of value by enriching advance research on demand for money moreover opening the way for new research in the area and relevant areas e.g. velocity in circulation. For policy makers, the thesis is of value in advising about stable demand for money and thus facilitating determining optimum stock of money.

La Résume de la Message

La stabilité de la demande de pièces de la monnaie au soudan entre 1962 – 2002

Les Objectives de la Message :

Premièrement : connaître la stabilité de la demande d'écus au soudan pendant 1962- 2002.

Deuxièmement : connaître les facteurs effectuent la demande de l'argent et sa importance pendant l'époque de 1962- a 2002.

Ces objectives sont très importantes; parce que ils aident les personnes qui mettent la politique Monétaire, à poursuivre une politique Monétaire utile.

L'étude utilise la "co-intégration" comme un des moyens de l'économie standard pour mesurer la stabilité de la demande de l'argent

La Message Affirme les Points Suivants :

D'abord la stabilité de la demande des pièces de la monnaie entre 1962 à 2002. Mais en divisant l'époque pour 1962-1995 et 1995-2002 l'étude a affirmé que le premier époque étais plus permanent que le deuxième malgré, la stabilité proportionnelle de deuxième époque.

Secondement; l'étude a classifié les facteurs effectuent la demande au-dessous :

La revenue nationale

Taux d'intérêt

Cours du change

L'inflation

Les résultants de l'étude accorder la théorie économique et les études internationales de la demande des pièces de la monnaie.

Le message est utile pour les académiciens et les faisants de la politique monétaire pendant que; elle présente une novelle chose analyser la demande des pièces de la monnaie; utilisant des moyens modernes comme "co-intégration" pour les académiciens puis elle ouvert la porte pour les études que concerne la demande des pièces de la monnaie et les domaines reliés; comme la vitesse de cycle de argent. En a ce que concerne les faissants de la politique monétaire, l'étude a recommandé que la demande de l'argent doit être fixé et facilite la mission de la politique monétaire à déterminer la quantité des pièces de monnaie

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CHAPTER ONE

Introduction

1. Research Objectives

The main objective of this study is to examine the problem of stability of demand for money in Sudan. Solution to problem of stability is of great importance, because it indicates stability of the Sudan economy as whole. Another important objective is to disclose factors determining demand for money in Sudan. Understanding the problem of stability and factors determining them could be easy by resorting to economic theory.

2- Research Problem

Unstable demand for money leads to numerous economic complications. Firstly, because estimation or planning of optimum money stock is based on projection or estimation of demand for money, thus unstable demand for money complicates this process. In economic policy terms, unstable demand for money leads to irrelevant monetary policy design and execution with no achievement of objectives. Because unstable money demand prevents, money supply to have a predictable influence on ultimate monetary targets i.e. inflation, output, and stable value of currency etc.

Thus the most valuable objective of this research is to find out the factors which lead to stable demand for money in Sudan.

3. Importance of the study

Apart from facilitating conduct of monetary policy in any economy, the study of stability of demand for money in Sudan deserves

attention for the following reasons: In the first place the study about demand for money in Sudan is scant.

There are two articles about demand for money in Sudan. One of them used simple econometric technique (Elgoul 1976) i.e. partial adjustment model. While the other (Domoitiz & Ebadwi 1987) used the simple version of error correction model i.e. Engle and Granger (1986). Moreover the study excluded the impact of the interest rate on demand for money. The importance of this research is that it employs the modern econometric technique of cointegration i.e. JJ (1988-1992).

The second justification of carrying this study is to light the way for the provision of accurate yearly estimate of demand for money, so that an appropriate quantity of money may be issued. Under-estimation might lead to issue excess supply of money which could lead to inflation, while over-estimation, might lead to issue inadequate supply of money which might lead to depression by raising cost of finance.

A third justification of the study is to assess which is the most influential candidate variable or variables on the demand for money in Sudan i.e. income or cost of finance or inflation or exchange rate, that facilitates the control of the influential variable to control the demand for money and thus the control of money supply.

A fourth justification is that knowledge of variables influencing demand for money helps instituting stability of demand for money by controlling those variables.

4. Hypotheses of the Research

The researcher put three basic hypotheses which are: Firstly, due to imbalances in Sudan economy during certain periods i.e. inflation during the seventies and eighties and instability exchange rate of Sudan currency during the eighties, there might be instability of demand for money in Sudan during those periods.

Secondly, there are four basic variables influencing the demand for money in Sudan i.e. the level of national income, inflation rate, interest rate and exchange rate.

Thirdly, the demand for money is influenced by different factors due to difference in time selected and economic circumstances prevailing in the economy, for example interest rate on monetary assets i.e treasury bills had no influence on demand for money from the sixties upto mid nineties because of the small size of such monetary assets. After 1995 the issue of shahama certificate as a monetary asset and the establishment of Khartoum stock exchange as a market for monetary asset, interest rate has become an influential variable on the demand for money in Sudan. (1995 – 2002).

5- Methodology of the Research

The research will employ the advanced economic technique of cointegration which had been developed by JJ (1988-1992) for estimation of the demand for money in Sudan, the value of coefficients and elasticities and the stability of demand for money during (1962-2002). (more details about this technique and its merits over other techniques to be found in Chapter 5).

6- Limitations of Study

There are a number of limitations to the study. First a major limitation is centred around the data. The change of the system compilation of data by relevant bodies from fiscal to calendar year has created a difficulty but it has been overcomed by dividing the period into two phases that is 1961/62 – 1993/94 and 1995-2002. Furthermore compilation of data by different bodies revealed that there are differences in data for various variables, this lead to a doubt about accuracy of data.

A second limitation is the non availability of the advanced econometric computer packages used in estimation of demand of money for example PC Film (9) used to estimate demand for money by the IMF. Moreover, the facility for adjusting seasonality of data by Trans/Seat econometric computer package was not available for researcher.

7- Organization of the thesis

To investigate the issue of thesis the research is organized into eight chapters. Chapter one is an Introduction. Chapter Two is theoretical background. Chapter three is Empirical approaches to demand for money. Chapter four is survey of Empirical studies. These chapters 2, 3,4 provide the Literature Review of the thesis. Chapter five is an Overview of Sudan Economy Relevant issues. Chapter Six is A cointegration Model of demand for money for Sudan. Chapter Seven is Estimation and Discussion of Results. Summary of Findings and Recommendations, Bibliography and Statistical appendices are at the end of the thesis.

CHAPTER TWO

Theoretical Background

This chapter is concerned with surveying the different theories which explain why people hold money. That would be according to their historical appearance. Thus the order of examination of those theories will be as follows:-

2.1 The classical demand for money theory
2.2 The Keynesian demand for money theory
2.3 The monetarist demand for money theory
2.4 The neo-keynesian demand for money theory
2.5 Other developments in the theory for demand for money

Because the demand for money theory in each school mentioned in the previous list is part of economic thought of that school, it seems necessary to give a general framework of the general economic theory of each school before analyzing the demand theory for that school.

2.1 The classical Demand for Money Theory

The general classical economic theory rests on the following pillars:-

(a) output depends on availability of factors of production and their efficient use

(b) output is produced by a fully employed labour force that is to say unemployment is a rare phenomenon

(c) Prices and wages are flexible so that supply and demand in factors and goods markets are equated by movements in

prices and wages. Thus this assumption secures the non existence of unemployment.

(d) Discrepancy between supply and demand is ruled out by say's Law which also ensures full employment.

(e) The quantity theory of money explains movements in the price level by changes in money stock. In equation form:

$$MV = PT$$

Where M = money stock, V = velocity of circulation P = the general price level T = total output transacted.

The classical economists transform the equation (MV = PT) Into the quantity theory of money by making two assumptions: (i) velocity of circulation tends to be constant because it depends on factors which marginally change over time e.g. methods of payments; spending habits; transportation system and population size (ii) T is constant due to the fact that the output transacted is fixed in the short run because it is produced by fully employed factors. Thus by assuming V & T constant, change in the quantity of money leads to proportional change in the price level.

(f) The last pillar of the classical economic theory is that interest rate is determined by (i) availability of savings representing supply of money and (ii) investments opportunities representing the demand for money

So, there are two formulations of the demand for money in the classical theory.

1. The first one is the Cambridge formulation which puts the equation of the demand fur money as follows:

$$M = KPT$$

Where $K = \frac{1}{V}$ Where V = velocity of circulation and K is reciprocal of V.

In this equation the demand for money (M) is expressed as a proportion of national Income.

2. The second formulation of the demand for money is to be found in Fisher equation of exchange (MV = PT). In this equation Velocity of circulation or the number of times money changes hand, represents the demand for money because it is the reciprocal of Cambridge representative demand for money (K).

The fundamental principle of the classical theory of the demand for money is that it is assumed to be constant or stable. The assumption out of the stability demand for money of the classical theorists comes from the fact that they assumed the stability of K in Cambridge formulation and Constancy of V in Fisher formulation. Thus, by assuming V or K to be constant, the determinant of the demand for money in an economy by assumption remains to be the level of national income in aggregate. More specifically an individual demand for money depends on his level of Income.

Therefore the demand for money function of the classical economists can be written as follows:-

$$M_\partial = f(y) \qquad [1]$$

Where M_∂ = money demand

Y = Level of national Income

This conclusion of the classical economists of stability of the demand for money and its dependence on the level of Income is not peculiar, because of the contentions of the classical economists. That is to say classical conclusions follow from their assumptions. In nutshell the classics money is only a veil and serves as a medium of exchange or a payment device and does not affect real variables of the economy. Changes in money supply affect only prices.

But it would be doing injustice to the classics to understand from them that there is only one factor which affect the demand for money i.e. income. To do them justice, it would be appropriate to give their account of the factors affecting the demand for money.

The two formulations of the classical demand theory, recognize factors other than income which affect the cash balances people desire to hold.

The Cambridge formulation was more advanced than the Fisher formulation in recognizing other factors.

The Cambridge formulation (represented by Marshal and Pigue) recognized the effect of price level changes and expectations on the level of money holdings. Inflation or expectations reduce money holdings of individuals. This school also recognizes the effect of interest rate on holdings of money. Higher interest rate on bonds reduces money holdings.

Fisher formulation (represented by Fisher and Simon of Chicago[1] recognizes other factors for example interest rate fluctuations and price level changes and the development of credit systems.

However, in spite of the recognition of the other factors affecting the demand for money i.e. other than income, the classical economists represented by Cambridge School in Britain and Fisher School in USA believe that the effect of the other factors are of short run nature and that the effect of income on the demand for money is of a long run nature. Moreover, the nature of the other factors changes is that they occur infrequently.

Thus, the general conclusion of the classical theory of the demand for money is that the main determinant of the demand for money is the level of Income.

2.2 The Keynesian Demand for Money Theory

In section (a) the researcher shall outline the general Keynesian economic theory. In section (b) discusses the Keynesian demand for money theory

Section (a) The General Keynesian Economic Theory

Largely due to the great depression of the thirties of the past century, Keynes lost faith in classical teachings, particularly the matching of aggregate supply with aggregate demand most of the time and the absence of unemployment. Keynes rejected these principles of the classics on logical grounds that (1) wages were no longer flexible due to trade union powers to combat unemployment. (2) Business

[1] 1. Lawrence Harris (1985), Monetary theory, Published by McGraw Hills U.K.

expectations may be gloomy to undertake Investments even if interest rate were low (3) The existence of liquidity trap, that is to say, absolute desire to hold cash balances, a situation which occurred during the great depression.

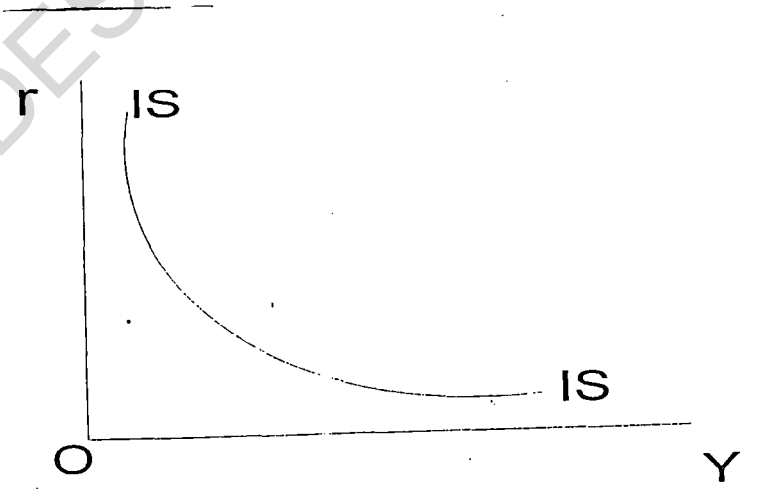
The above cases lead the Level of national income to be determined at a level below full employment output. The best device to show Income determination in Keynesian theory is the IS-LM curves. The IS represents equilibrium in the good market where I = S. I = ∫ (r) I = Investment r = rate of Interest

S = ∫ (y), S = Saving

Y = National Income

At equilibrium I = S

The IS curve can be drawn as a demand sloping curve from left to right showing an inverse relationship between the level of national income and interest rate.: Diagram No. 1 IS Curve



(Source: J.R. Hicks, Article Mr. Keynes and the classics, Shapiro Macroeconomics Analysis Chapter 12.)

On the other hand, the LM curve shows equilibrium in the money market where aggregate demandd for money equals aggregate money stock that is:

$$M_d = M_s$$

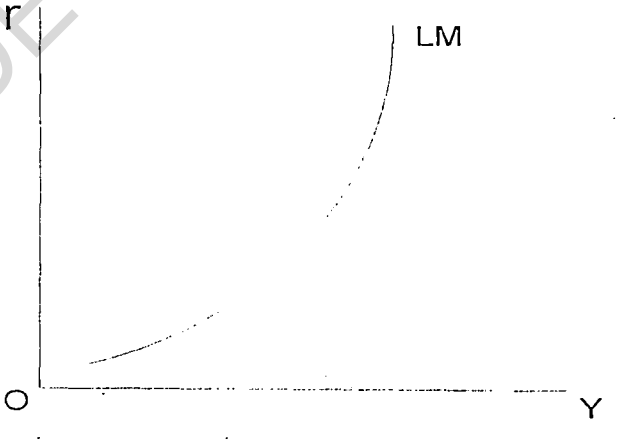
M_d representss aggregate money demanf by economics units which consists of (1) speculative money balances which are dependent on interest rate. (2) transactions money balances which are dependent on the level of national income.

$$M_d = f(r_1 y)$$

M_s represents money supply which is fixed by monetary authorities i.e. Central Bank its size depends on political factors unlike demand for money which depends on more or less on econoic factors.

The LM curve is shown in diagram 2 below:-

Diagram No. 2 The LM curve



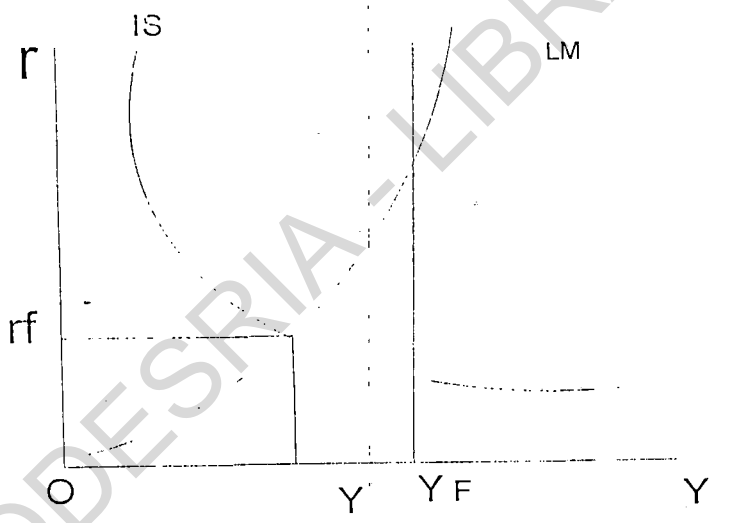
(Source: J.R. Hicks, Article Mr. Keynes and the classics, Shapiro Macroeconomics Analysis Chapter 12.)

Thus, at equililbrium in money market

Ms = Md

This equilibrium determines the market interest rate. Equilitbrium in the money market; is represented by LM curve which is a curve sloping upward from left to right, showing direct relationship between the levels of national income and interest rate. The equilibrium level of national income in the Keynesian theory is determined by the intersection of the LM and IS curves where equilibrium is established in the goods and money markets simultaneously. A situation which is shown in diagram 3

Diagram No. 3 Keynesian Income Equilibrium



(Source: J.R. Hicks, Article Mr. Keynes and the classics, Shapiro Macroeconomics Analysis Chapter 12.)

However the level of national income is determined at a level below the full employment output as diagram 3 shows the level income in Keynesian theory is Y and the level of full employment income is Y^F

Section (B) The Keynesian Demand for money theory:

The Keynesian demand for money theory which was named by Keynes as liquidly preference is an important element in the determination of the rate of interest and hence determination of the level of investment and through the multiplier the level of national income.

Keynes distinguishes between three motives for holding money:

(1) The transactions motive where people hold money to buy goods and services. For Keynes the amount of money people held for transactions depends on the level of their income as income increases the balances to satisfy transactions motive Increases i.e. there is direct Keynesian relationship between transactions demand for money and income.

(2) The precautionary motive: In addition to cash balances which people hold for transactions people also hold cash balances to meet future contingencies e.g. illness disasters etc. This amount of money has a direct relationship with the level of income.

(3) Speculative motive: This is the genuine theory of Keynes and it is different from classical teachings. People hold money for speculation purposes, that is to say, people hold money to generate more income from interest rate and capital gains if people put their money in bonds instead of the cash. Keynes believes that at higher interest rate people hold more bonds and less idle cash, on the other hand people hold more idle cash at a lower interest rates.

Thus there is an inverse relationship between the speculative demand for money and interest rate. Hence the Keynesian aggregate demand for money function stands as follow:

$$M_d = f(y,r)$$

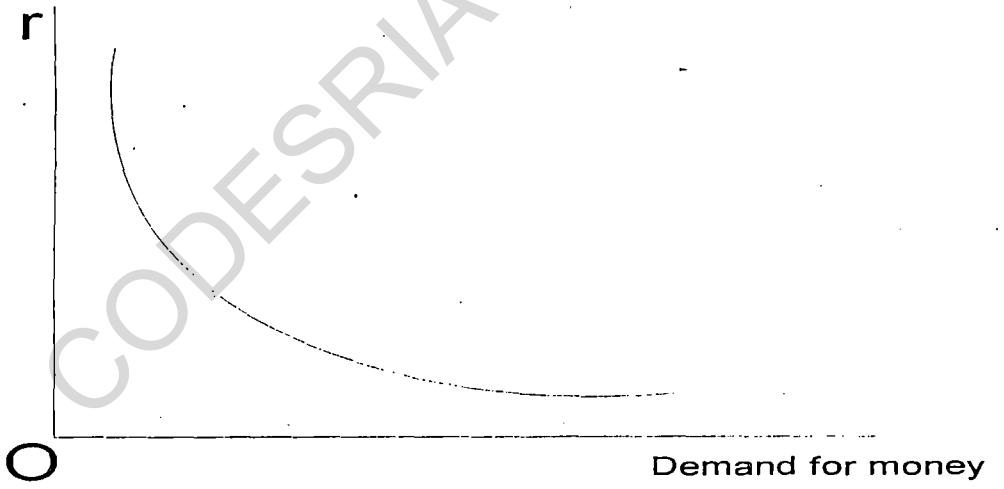
Where Md = demand for money

r = Market interest rate

y = level of income

Because the level of money which people hold for transactions and precautionary motives is a fixed proportion of income and greater balances people hold for speculative purposes, aggregate demand for money function takes the form of the speculative demand for money depicted below in diagram 4.

Diagram No. 4 Keynesian Demand for money



(Source: J.R. Hicks, Article Mr. Keynes and the classics, Shapiro Macroeconomics Analysis Chapter 12.)

Therefore, the Keynesian demand for money is a sloping curve from left to right showing an inverse relationship between the demand for money and interest rate.

The crucial point of the Keynesian demand for money is that it is unstable. The instability of Keynesian demand for money is attributed to its dependence on the market interest rate which changes most of the time.

The Keynesian conclusion of the instability of the demand for money is one of differences between Keynesian and classics. Another difference is that the classical demand for money depends on income in the long-run and on the interest rate in the short-run. The Keynesian demand for money depends largely on interest rate and the level of income has a minor impact on the demand for money.

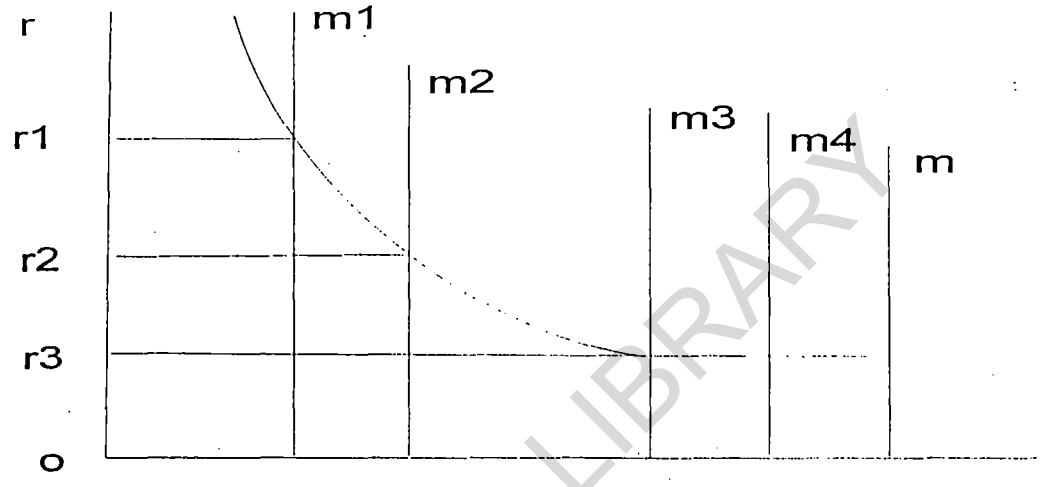
Instability of the demand for money and its peculiar behaviour in the period of the great depression, that is the instability of the demand for money to interest rate to the extent that people prefer absolute money holding, a situation which is known in economics literature as the liquidity trap. This liquidity of trap had led Keynes to lose faith in effectiveness of money supply to reduce interest rates and to activate the economy through raising investment because the demand for money schedule has become parallel to the supply axis where increase in money supply does not lead to reduction in interest rate.

The liquidity trap according to Keynes might be caused by psychological factor where people expectations about return investment in monetary assets are gloomy therefore they are not

responsive to money supply expansion which normally leads to reduction in interest rate and increase in investment monetary assets.

This can be shown by diagram 5:-

Diagram No.5 The Liquidity Trap



(Source: Shapiro , Macroeconomic Analysis, Chapter 11)

From the diagram above it is shown the increase in money supply which is represented by M_1 to M_5 could not lead to lower market interest rates because the demand for money is a liquidity trap one.

2.3 The monetarist demand for money theory

(The Modern Quantity Theory Demand for Money)

The modern quantity theory is at least an extension of the old quantity theory of money. In that, it holds the belief that changes of price level is explained by change in stock of money.

The development of the modern quantity theory of money was by the Chicago School, earlier by Henry Simon, Mints, Knight, and Viner,

and the final complete modern quantity theory was set by Milton Friedman at Chicago University follower of the above Chicago economists. (8)

The general Framework of the Chicago modern quantity theory of money is that of a classical setting. That is to say modern quantity 'theorists believe in ability of free market system to bring adjustment to the economy by itself in crisis without government intervention, if wages and prices are let to be determined by free market forces.

The modern quantity theory of money is a theory of a demand for money as developed by Milton Friedman.[2] Milton Friedman began his theory of the demand for money by treating money to economic units as a asset like houses or cars or shares – money to business firms is a capital good. To Milton Friedman the demand for money to households depends on three major set of factors (a) Total wealth to be held in various forms (b) The price of and return on this form of wealth and alternative forms (c) The tastes and preferences of house holds.

(a) Total wealth can be held on five different forms:

(i) Money (m) Interpreted as claims on commodity units that are generally accepted in payments of debts at a fixed nominal value (ii) bonds (B) (iii) Equities or shares (E) (iv) Physical form of human goods (v) human capital (H). In model form:

$W = M + B + E + Y + H$.

(b) The return on different forms of assets mentioned in (a) as follows (i) the return on money is measured by its command over

[2] Milton Friedman (1956), the quantity theory of money are statement. In Reading in Microeconomics edited by M.G. Muller published by Holt International

goods and services a different times, thus P the general price level is the measured as return on money.

(ii) The return on bond holder is the annual sum he would receive in addition he receives a capital gain or loss resulting from change in bonds prices. The first return is easy to calculate, but the latter return is difficult to calculate due to expectations. Thus the return on bonds can be measured by the following formula:-

$$r_b - \frac{1}{rb}\frac{drb}{dt}$$

Where r_b = in come stream of bond.

$\frac{1}{rb}\frac{rb}{dt}$ = change in price of bond

(iii) The return on equity consists of annual dividend on equity and the capital gain and loss resulting from rise and fall in the price of equity and change in the value of equity due to change in price level.

Thus the return on equities can be measured by the following formula:

$$r_e + \frac{1}{p}\frac{dp}{dt} - \frac{1}{r_e}\frac{dre}{dt}$$

Where r_e = in come stream of equity

$\frac{1}{p}\frac{dp}{dt}$ = change in value of equity as a result of change in price level

$\frac{1}{r_e}\frac{dre}{dt}$ = change in price of equity

(iv) The return on physical goods can be measured by change in price level using the following formula:

$\frac{1}{P}\frac{dp}{dt}$ = index measuring value of physical goods

(v) Non human wealth can be measured by the variable (w) which measures the share of human wealth to non human wealth.

(c) Tastes and preferences examples for them are that people desire to hold more cash balances when moving geographically or during wars.

Since business firms demand for money is similar to that of households and the variables affecting their demand for money are the same which affect house holds. Thus we can aggregate the demand for money for house holds with the demand for money for business firms to arrive at the aggregate demand for money for the whole economy which would be like the following:-

$$M = (\frac{Y}{r}\ W,\ P,\ \frac{1}{p}\frac{dp}{dt};\ r_b - \frac{1}{r_b}\frac{dr_b}{dt};\ re + \frac{1}{p}\frac{dp}{dt} - \frac{1}{re}\frac{dre}{dt};\ U) \quad (1)$$

Where the variables affecting the demand for money are

$\frac{Y}{r}$ which is wealth

W which the ratio of human to nonhuman wealth

P which is the price level

$\frac{1}{p}\frac{dp}{dt}$ which rate of change in the price level

$(r_b - I\ drb)$which is return on bonds
rb dt

$r_e + \frac{1}{p}\frac{dp}{dt} - \frac{1}{re}\frac{dre}{dt}$ which in return on equities

U which is tastes and preferences

Equation 1 could be rewritten in different forms by making the following hypothesis (i) The return on bonds are the same as the return on equities. (ii) Physical wealth could be measured by level of national income. (iii) We are concerned with the demand for real balances so we adjust the equation to take account of change in price level, equation 1 can be written as follows:

$$m/p = f\left(r_b, r_e, \frac{1}{p}\frac{-dl}{dt}, w, \frac{Y}{p}, U\right) \quad (2)$$

and this is the demand for real balances where r_b = return on bonds, r_e return on equities, 1/p = change in price w = human wealth, y/p = real income, U = Miscellaneous or residual variables

After establishing the demand for money function and its determinants Milton Friedman assumes the stability of this function. In his words "The quantity theorists accepts the empirical hypotheses that the demand for money is highly stable, more stable than functions such as the consumption function"

To Milton Friedman the demand for money is stable because the volatile factor affecting it i.e. interest rates have a minor impact on the desire to hold cash balances. This is because the effect of arise in interest rate in one sector of the economy is compensated by a rise in interest rate in another sector for example, interest rate on banks' advances require banks to offer higher interest rate to depositors to attract deposits.

Milton Friedman also assumes insensitivity of the demand for money to other factors than interest rates. Other variables are stable leading to insensitivity or stable demand. Prices are stable because they are free competition prices. Moreover level of income as a proxy for wealth is stable in the short period.

Milton Friedman has taken evidence to stability of the demand for money from history, a number of studies carried by Friedman confirm his hypothesis of the stability of the demand for money.

According to Milton Friedman the stability of the demand for money should not be understood as fixed. But stability means that the demand for money changes as the factor determining its changes. From the analysis of Friedman the stability demands of the money lead to valuable conclusions:-

(i) By assuming a stable demand function, the old quantity theory of money turns to be a theory of income determination, because change in money supply lead to change in money income. But by how much nominal income changes can not be determined. However, if output is at its maximum level, changes in money stock lead to increase in prices. If output is under its maximum level change in money stock may lead to increase in real output.

(ii) A stable demand for money function is useful in tracing the effects of change in supply of money. This means that it is useful only if supply is affected at least by some factors other than those regarded as affecting demand for money. Thus for monetary policy makers it is a relief to have a

stable demand for money function because they would concentrate on factor affecting supply. Policy makers would be bewildered if they are confronted by unstable demand function because they must give attention to supply and demand for money at the same time.

2.4 The neo-Keynesian Demand for Money Theory

The principal contributors of the neo-Keynesian demand for money theory are James Tobin[3] and W.J. Baumol. The contribution of James Tobin is found in his articles (i) the Interest elasticity of the transactions demands for cash and (ii) Liquidity preference as a behaviour towards risk. The contribution of Baumol is found in his article: the transaction demand for cash: An inventory theoretic approach. While the contribution of Tobin has covered the two motives of holding cash i.e. transactions and speculative motive, the contribution of Baumol has covered only the transaction motive.

The neo-Keynesian demand for money differs from Keynes liquidity preference theory in two respects: (i) neo-Keynesian believe that transactions balances may be influenced by interest rate changes while Keynes original proposition was that transactions balances are influenced by the level of aggregate income. (ii) neo-Keynesian's give different assumptions and points of view concerning the inverse relationship between demand for money and the interest rate, being originally developed by Keynes. We begin by examining the neo-Keynesian transactions demand for money and proceed to the examination of speculative demand for money.

[3] James Tobin (1987), Essay in Economics, Volume. I Macroeconomics Published by M.I.T. Press U..S.A.

1: Neo-Keynesian The transaction demand for money

The transaction demand for money theory was developed jointly by Baumol (1952) and Tobin (1956) in their articles about transaction demand for money mentioned earlier in this section. Baumol called his approach an inventoric theoretical approach to transactions demand for money because his analysis follows the approach which determines the inventory on stocks of goods; a firm should have in hand.

The principal finding of this theory is that the transactions balances, usually kept for exchange in Keynes original work, may be influenced by interest rate changes. In Tobin words "Many transaction have large enough balances so that holding part of them. "In earnings assets rather than in cash is a relevant possibility even though these holdings are always for short period, the interest earnings may be worth the cost and inconvenience of the transactions involved".

In what follows researcher would explain how this theory has reached a believe in the sensitivity of transactions balances to interest rate changes.

The Neo-Keynesian demand for money theory sets the followings assumptions as a basis for their theory:

(1) People do not suffer from money illusion that is demand is for real balances. That means a higher Inflation will lead people to hold a more nominal balances to compensate from the increase in Inflation

rate. This assumption guarantees that change in real transaction balances are only influenced by change in real income and interest rate excluding the influence of inflation.

(2) Transactions balances are not spent once and for all; people spread their expenditure over time that is there is no perfect synchronization between receipt of income and its expenditure. Thus, people can put those transactions in earning interest assets to receive income until the need for transactions balances arises. At the other extreme, people can keep transactions balances in cash.

(3) Keeping transactions balances in cash involves the cost of interest rate or income foregone. Moreover, keeping transactions balances in earning assets e.g. bonds involves the cost of brokerage fees in transforming bonds to cash when the need arises for that.

(4) People receive their income evenly or regularly e.g. monthly or yearly and payments are made or spread evenly. This assumption makes it possible to put the transactions demand in predictable formula.

(5) The number of transactions or the numbers of times moving from bonds to cash take a full number i.e. 1.2.3, i.e. fractional transactions do not exist.

On the basis of the above assumptions the transactions demand for money or the square root formula according to this theory is derived in the following manner.

Step One: First get individual average cash holdings. From assumption 4, an individual average cash holding can be deduced by the following equation:

$$M_i = \frac{Y}{2n} \text{----------(1)}$$

Where M_i = an individual average cash holdings, Y = Income received monthly or yearly n = number of transactions or number of times moving from interest earning assets into cash.

Step two: We obtain the optimum number of transactions that would minimize the total cost of holding transactions cash balances.

$$TC = an + i\frac{Y}{2n} \text{---------- (2)}$$

Where TC = total cost of holding transactions balances, a = brokerage fees chargeable on transferring bonds into cash, (i) = interest rate, Y = income received regularly, Y/2n = average cash holdings, n = number of transactions. Equation (2) says that keeping transactions balances either idle in cash or in an earnings asset involves total cost (TC). The total cost is divided into (i) brokerage fees which is (a) times the total number of transactions needed to transfer bonds into cash (ii) Interest rate time the average cash holdings, which is foregone in keeping transactions balances in cash (i.e. i Y/2n)

We obtain optimum number of transaction (n) by differentiating (TC) with respect to (n). Then we get the optimum number of transactions, which minimize TC of keeping transactions balances

$$\frac{\partial TC}{dn} = a + \frac{iy}{2} + \left(\frac{-1}{n^2}\right) = 0$$

$$n^2 = \frac{iy}{2a}$$

$$n = \sqrt{\frac{iy}{2a}} \text{ ----------(3)}$$

Where (3) or (n) the optimum number of transactions which minimize keeping transactions balances portfolio.

Step 3: In this final step we get the transactions demand for money by the square root formula. We get this by substituting equation (3) which is the optimum number of transactions (n) in equation

$$(1)\ m_i = \frac{Y}{2n}$$

We get the following equation: $mi = \frac{Y}{2\sqrt{\frac{iy}{2a}}}$ by rearranging

and canceling terms we get the transactions demand for cash made on the square root formula that is $Mi = \sqrt{\frac{ay}{i}}$

The aggregate transactions demand for money for all the economy would be:

$$Mdt = 2\sqrt{\frac{ay}{i}} \text{ ----------(4)}$$

Equation 4 can be put in the following form:

$$M_{dt} = 2\ a^{.5}\ y^{.5}\ i^{-.5} \text{ ----------(5)}$$

From this equation we arrive at the neo-keynesian transaction demand for money. That is the aggregate transactions demand for money increases with increase in income and its elasticity with respect to income equal to (0.5) The aggregate transactions demand for money decreases with an increase in interest rate and its elasticity

with respect to interest rate equal to (- 0.5). And the aggregate transactions demand for money increases with increase in the brokerage fees and its elasticity with respect to brokerage fees is equal to (0.5).

The striking difference between the neo-keynesian transactions demand for money theory and Keynes's is that in this theory transactions balances are influenced by income and interest rate while in Keynes theory transactions balances are influenced by income only.

2- Neo-Keynesian Speculative Demand for Money Theory

The neo-keynesian speculative demand for money theory is called the portfolio balance approach as developed by James Tobin in his article "Liquidity preference as a behaviour towards risk.[4] This theory was developed by Tobin to give reason to the inverse relationship between speculative demand for money and interest rate or the liquidity preference function as introduced originally by Keynes.

Keynes original speculative demand for money has been criticized on the grounds that certainty about expectations of interest rate that forms the basis for the inverse relationship between speculative demand for money and interest rate is unrealistic.

Thus Tobin portfolio speculative theory was developed to give another profound reasoning to Keynes Liquidity preference. In Tobin Words "These criticisms raise the question whether it is possible to

[4] James Tobin (1958) Liquidity Preference as behaviour or risks in M.G. Muller, Reading in Macroeconomics.

dispense with the assumptions of stickness in interest rate expectations without losing the implication that Keynesian theory drew from it. Can the inverse relationship of the demand for money to the rate of interest be based on a different set of assumptions about the behaviour of individual investors"

1. The Regressive Model of Speculative Demand for Money

Before outlining Tobin or the neo-keynesian speculative demand for money or portfolio balance approach, it is worthwhile to outline Keynes's original speculative expectations model of the speculative demand for money. The objective is to compare assumptions, more over to see the merit and defects of the two approaches.

The original speculative model as developed by Keynes put two implicit fundamental assumptions: Firstly, inelasticity of expectations in relation to interest rate or certainty regarding earnings from investing speculative balances in say bonds. That means the absence of risk in investing in bonds. Secondly there is only one financial paper i.e. bonds so that speculative balances are put in bonds or cash as an alternative.

On the basis of the above assumptions we shall derive: the regressive expectation models or Keynes original conception of the speculative demand for money in the following manner:-

We begin by calculating the total earnings to an individual investing his total speculative balances in bonds, which can be put in the following equation:

$e = r + g$ ----------(1)

Where e = earnings from investing in bonds

r = fixed interest on bond holding

g = capital gain or loss arising from changes in price of bonds

Since the price of bonds depends inversely on the rate of interest that is:

$P_b = y/r$----------(2)

Where P_b = Price of a bond

y = yield of a bond

r = market interest rate

Thus, expected increase in the market rate of interest would lead to capital loss to bond holders, conversely expected decrease in the market rate of interest wound lead to capital gain to bond holders.

Based on the above analysis we can put g in the flowing equation:-

$$g = \frac{P_b e - P_b}{P_b} \text{ ----------(3)}$$

Where $P_b e$ =expected price of a bond

The equation says that, g or capital gain arises when P_b^e is greater than current price of a bond.

Since $P_b = y/r$ we can put equation 3 in terms interest rate, after substitution and canceling we arrive at = r/re – 1 where r equal market rate of interest and re expect rate of interest

Substituting g = r/re - 1 in (1) we get:

$$e = r + r/re - 1 \text{ ----------(4)}$$

Where e = total earning in investing in bonds in terms of market interest rate and expected rate of interest.

1.1 Derivation of an Individual demand for Speculative balances

Since this model assumes fixed interest rate expectation and consequently fixed earnings from bonds, an individual will decide his demand for speculative balances by assuming that he relates his interest rate expectations to an equilibrium interest rate. If market interest rate is above this equilibrium rate an individual; expects it to fall and thus expects making capital gains resulting from higher bond price which is caused by the fall in interest rate, speculative balances decreases and bond holding increases. The opposite will happen when interest rate is below the equilibrium interest rate and the individual expects it to rise. Thus, there is an inverse relationship between speculative balances and interest rate arising from regressive interest rate expectations and this gives reason for naming this Keynesian model as regressive expectations model.

We can put the foregoing analysis in a formal form by going back to equation (4): e = r + r/re -1. Since market interest (r) and expected interest rate determine earnings from bond holding (e) and consequently speculative balances holdings against bond holdings. Thus there must be critical interest rate upon which an individual judges his speculative balances holdings and bond holdings. This critical interest rate re is the rate which would make an individual net earnings from bond holding (e) equal to zero that is:

$$0 = r + r/re - 1$$

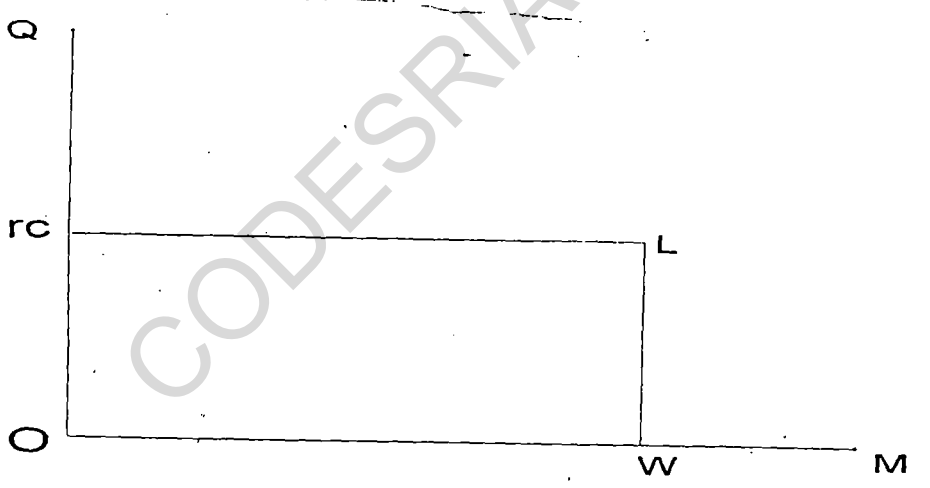
Therefore rc = re/ 1 + re ----------(5)

Where rc is the market interest rate that makes e = 0.

Now, the relationship between the individual demand for speculative balances and interest rate can be explained with the help of this critical interest rate as follows; when market interest rate (r) is greater than this critical rate rc) the individual put all his speculative balances in bonds. Conversely when market interest rate (r) is below the critical rate interest (rc) an individual keeps his speculative balances in cash.

On the basis of the above the individual demand for speculative balances will take the following shape:

Diagram No. 6 : Individual Demand for speculative balance in regressive model



Source: Rudiger, Dornbush, and Stanley Fisher, Macroeconomics, Chapter 7.

On the horizontal axis we have demand for speculative balance while on the vertical axis we have interest rate rc is the critical interest rate.

At market interest rate (r) above rc, an individual will keep all; his speculative balances in bonds, on the other hand at a market interest rate the below rc, an individual will keep all his balances in cash. At a market interest rate equals to the critical rate r = rc, and individual will be indifferent. Therefore an individual speculative demand for money takes step shape rc L W. This is the case because when r > rc, an individual expects the interest rate to fall thus making capital gains, on the contrary when r < rc an individual expects interest to rise, thus making capital losses. When r = rc at which e = 0 that earnings on bonds equal to the zero return on liquid cash balances. Thus, an individual is indifferent; the indifference is depicted by the horizontal line rcL.

The upshot of the preceding analysis is that there exists an inverse relationship between the speculative demand for money and interest rate. This conclusion had been originally stipulated by Keynes.

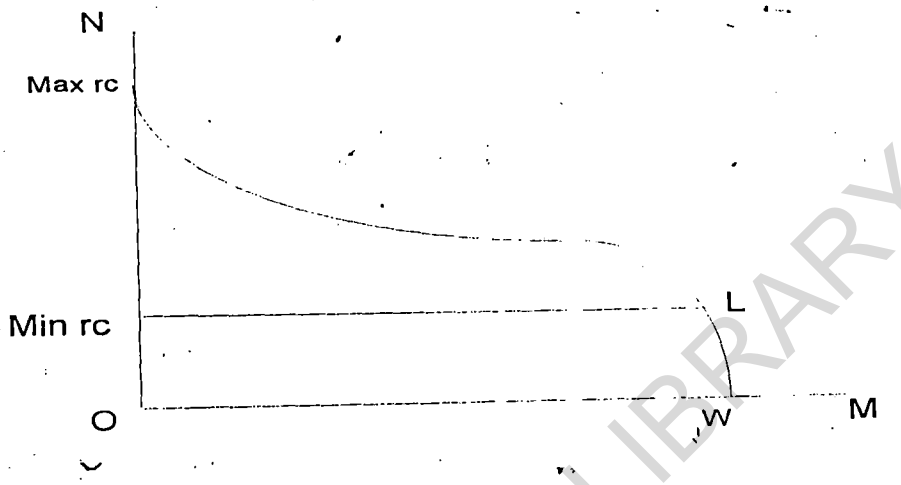
1-2 The aggregate speculative demand for money in the regressive expectation model.

The aggregate speculative demand for money can be derived by aggregating individuals speculative demand for money. But the following assumptions are necessary:

(1) On average individuals have in mind approximately similar critical interest rate. That means few individuals have extreme critical interest rate. (2) As market interest rate decreases individuals expect interest rate to decline and so move towards the critical interest rate. Thus, individuals gradually reduce their bond holdings and increase cash holdings. At the minimum critical interest rate, market interest

rate is no longer expected to decline so that speculative balances are kept absolutely in liquid cash.

Thus we can draw the aggregate speculative demand for money as follows: in diagram 7 below



Source: Branson, Macroeconomics Chapter 12

On the horizontal axis, we have the demand for speculative balances and on the vertical axis we have the interest rate. Point rc max shows the maximum critical interest rate, while point rc min shows the minimum critical rate interest rate. At a market rate of interest above rc maximum, individuals keep all their balances in bonds, where the highest capital gains are achieved by individuals, below rc minimum market interest rate have reached its minimum so that individuals expects capital losses, therefore individuals will keep their entire speculative balances in liquid cash. The curve between rc ands L shows that, as interest falls between rc and L individuals reduce their bonds holdings and increase their liquid cash holdings.

In a nutshell (Fig. 7) shows an inverse relationship between the speculative demand of money and the interest rate.

2- The portfolio Model of speculative Demand for Money

The basic difference between the portfolio model as developed by James Tobin and the regressive model is the unrealistic assumptions of the latter model. Assumptions of the regressive model were criticized on the following basis: Firstly it is unrealistic to assume certainity of earnings arising from interest rate fluctuations, that is to say inelastic expectations to interest rate. In terms of gains and losses this means the absence of losses on risks involved in investing speculative balances in monetary assets. Secondly if the money market remained in equilibrium for a long time, people should begin to adjust their expected interest rate to correspond to the actual prevailing interest rate, this would lead eventually to the adoption of the same critical rate of interests as time passes. Thus, the money demand curve will not be negatively sloping, instead it would be perfectly elastic, and apparently this demand curve is unrealistic.

The fundamental contribution of the portfolio balance is the realistic assumption and at the same time the inverse relationship between the speculative demand for money and the interest rate is maintained.

The realistic assumptions of the portfolio speculative demand for money are: (1) the possibility of acquiring risks in investing speculative balances in monetary assets (2) uncertainty regarding interest rate expectations and consequently uncertainty of gains (3) while the regressive approach analyses only one monetary asset i.e. bonds, the portfolio approach introduces in the analysis more than one monetary asset e.g. equities, shares, etc. Thus, in Tobin Words "it has the empirical advantage of explaining diversification, while

the regressive Keynesian approach implied that each investor will hold only one asset".

The portfolio balance approach derives a negative sloping speculative demand for money on the basis of the above assumptions, through the following: (1) Derivation of an individual constraint in maximizing return. (2) Determining an individual normal utility choice of return and risk (3) Derivation of the aggregate speculative demand for money in portfolio model.

2.1 - Derivation of an Individual Constraint:

Since this model introduces the assumption of uncertainty regarding interest rate expectations, therefore we must introduce into analysis the risk arising from that. Suppose that B is the total income of an individual and g his capital gains in investing a unit of income in bond holding. If we assume that risk resulting from investing in individual income is measured by the standard deviation of the expected gain or (g). Thus, the total risk facing an individual; investing income of B can be shown by the following equation:

$6t = B\ 6g$ ----------(1)

where $6t$ = total risk

From our previous section (regressive expectations model.) Total return to an individual having income (B) can be shown by the following equation:

$Rt = B\ .\bar{e} = B.\ (r + g)$ ----------(2)

Where $\bar{e}$ = expected earnings adjusted subject to the risk involved.

g = expected capital gain adjusted subject to the risk involved

capital gain subject to the risk involved, r is the current market rate of interest.

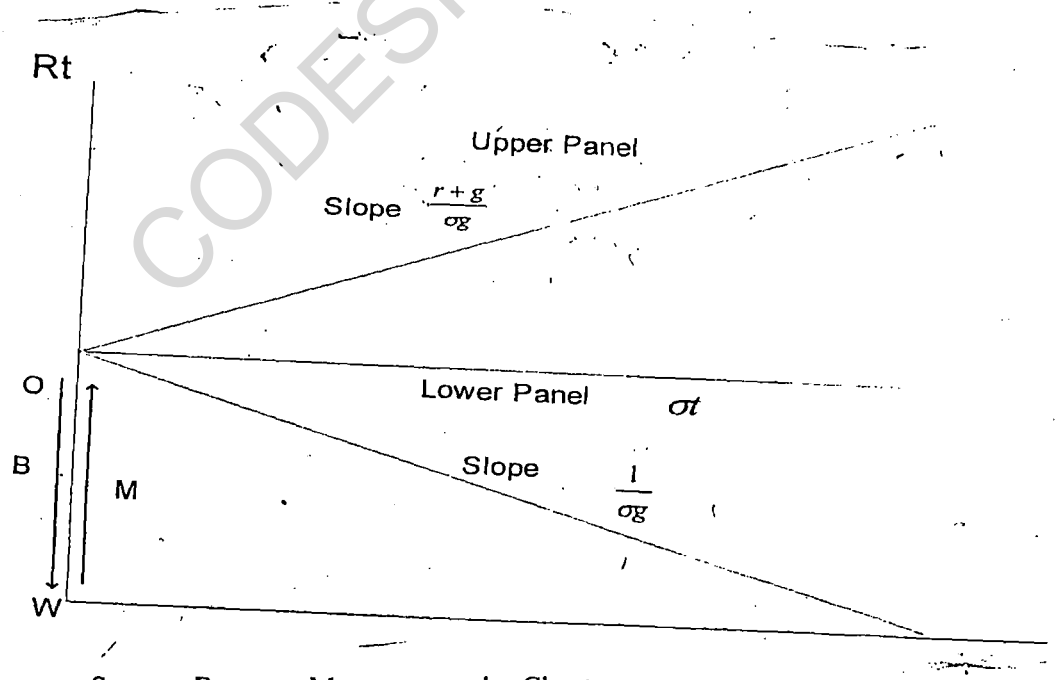
From equation (1) B = 1/6g 6t.....(3)

When we substitute 3 in (2) we get

$$Rt = 6t\left(\frac{n+g}{6g}\right) \text{----------(4)}$$

Equations (4) gives us the budget constraint facing the bond holder, along which he can trade increased risk 6t for expected return Rt. It also gives the bond holder a formula for deciding how much funds to put into bonds and how much to put into cash to achieve a given risk return mix along the budget constraint.

The budget constraint and the resulting bond – cash mix to an individual bond holder can be depicted in the following diagram: No.8 below



Source: Branson, Macroeconomics Chapter 12

The upper panel of the diagram shows the budget constraint with the slope = $\frac{r + g}{6g}$ (differentiating Rt with respect to 6t)

On the horizontal axis we have total risk 6t. On the vertical axis we have total return. Rt.

The lower panel of the diagram shows the bond-cash mix fixed to an individual by his budget constraint. Where the vertical axis shows the amount of bond and cash going down the vertical axis (B – W) measures increased bond holding, where going up the vertical axis measures increased cash holdings. The horizontal axis shows total risk 6t. The bond – cash mix is determined by the line with the slope 1/6g where from any given value of 6t we can determine the value of B by multiplying by 1/6g from equation (3)

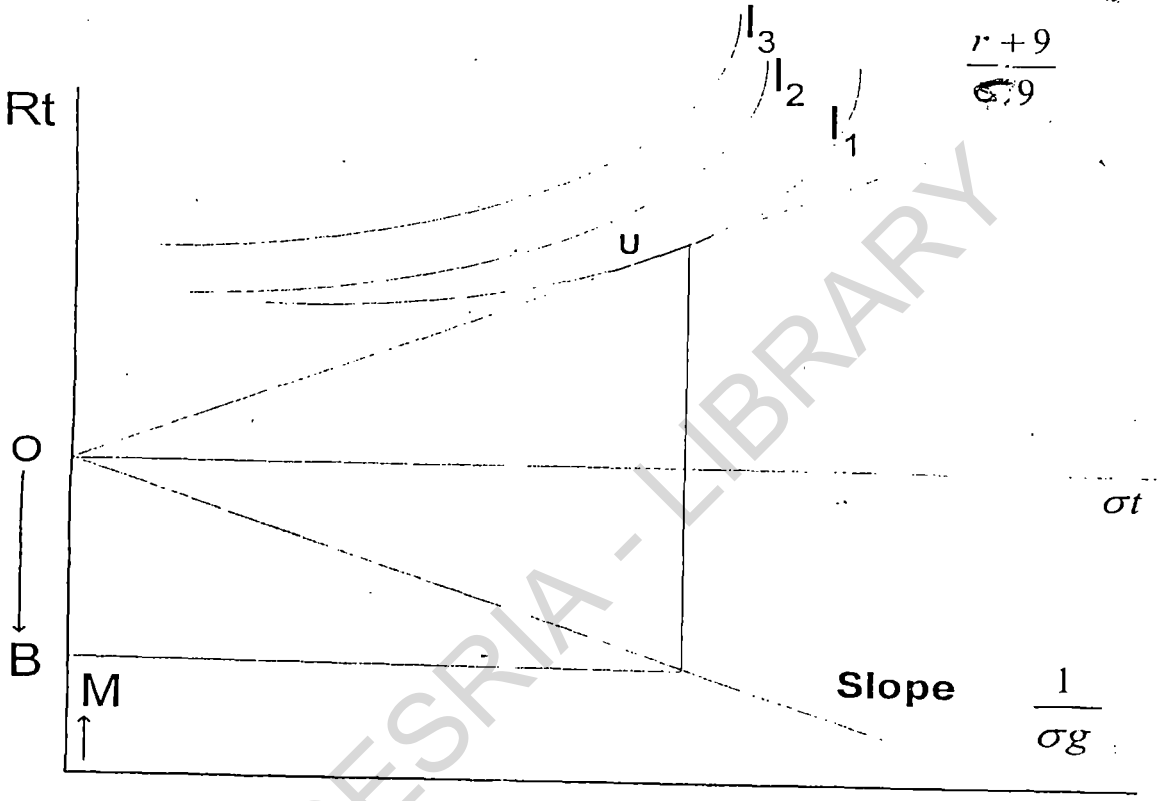
Thus once we determine an optimum earnings risk a long the budget line in the upper panel of the diagram knowing the value of risk by standard deviation 6t we can determine the corresponding portfolio mix of B and M in the lower panel of the diagram.

2-2 Determining bondholder utility choice of earnings and risk

Although individuals differ in their preferences to different mix of earnings and risk from investing in bonds. Few people are risk lovers who may invest all their income in bonds regardless of risks, few people are risk avoiders that is at the extreme they hold their income in cash, but normally people are risk diversifiers that is they keep their income in bonds and cash, or keep a portfolio with a mix of cash and bonds.

Thus by assuming individuals on average are risk diversifiers, and by employing indifference curves analysis as a measure of utility from investing in bonds, the shape of indifference curves of the individual diversifier will be positively sloping and concave upwards in the Fig, below.

Diagram 9 The diversifier portfolio selection return and risk

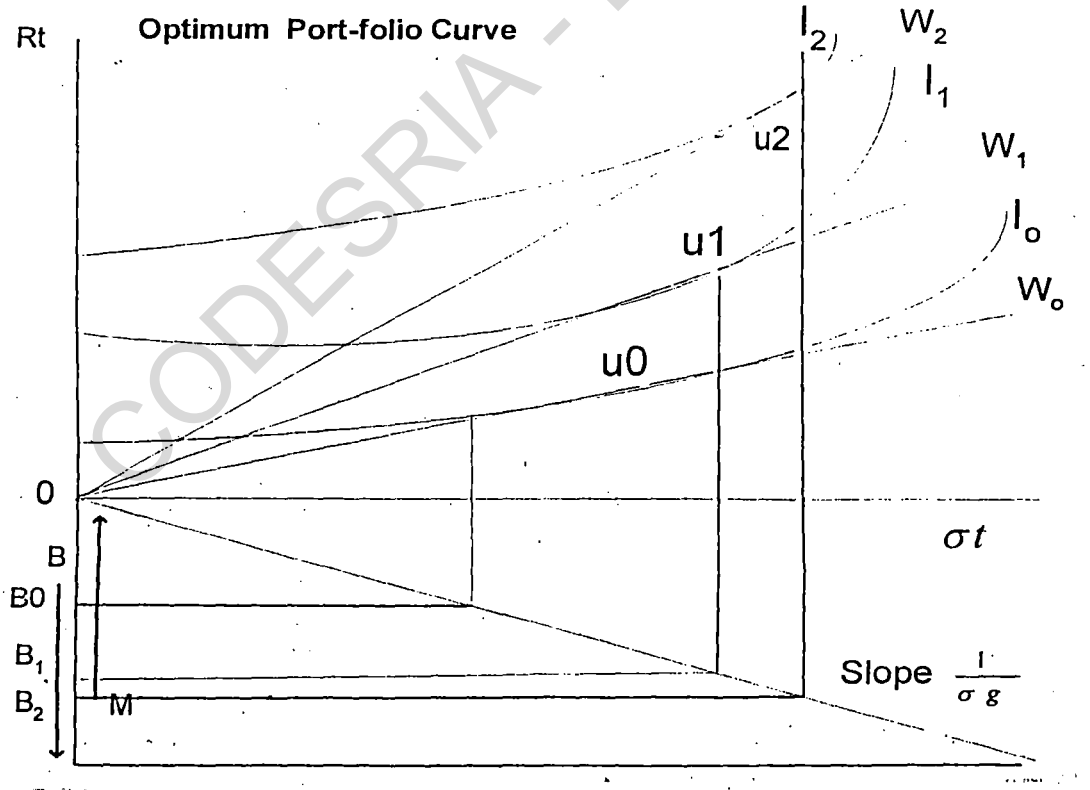


The indifference curves shown in (fig. 9) above are those of the diversifier of risk. As risk increases by equal increments the diversifier demands increasing increments of return, so that his indifference curves are convex to the budget constraint. As usual in this kind of analysis, the diversifier will attempt to reach as high an indifference curve as possible given his budget constraint. Thus the expected risk and return of his portfolio Rt, 6t will be determined by the point of tangency of the budget constraint line with the highest possible indifference curve. In the diagram this is point (4). Since

the shape of the indifference curve of the diversifier is convex his portfolio always consists of a mix of bonds and cash. Where the shape of the indifference curves of the risk lover is such that, his portfolio mix consists completely of bonds. On the other hand, the indifference curves of the risk avertor is such that his portfolio mix is completely of cash.

2.3- Derivation of the aggregate speculative demand for money in the Portfolio balance approach.

Normally in real world most individuals are diversifiers who keep mix of bonds and cash. Thus the aggregate speculative demand for money will be derived on the assumption that community consists of individuals who diversify risks. We can now draw a speculative demand for money by varying interest rate in Diagram 10.below



Source: Branson, Macroeconomics Chapter 12

Since the slope of the budget constraint is $\frac{r+g}{\sigma_g}$ increases in market

interest rate will shift the budget constraint upwards. The new budget constraints resulting from changes in interest rate touches higher indifference curves. The line connecting the tangency points (point of optimum return and risk combinations) is called the optimum portfolio curve in Fig 10. As r or (rate of interest) increases from very low level the diversifier tangency points move up and to the right increasing both expected return and risk.

As the rate of interest increases from r_0 to r_1 to r_2 resulting in higher return and risk points in the upper panel of the (fig.10), bond holding increases as shown in the lower panel of the (fig. 10) from Bo to B_1, to B_2. Increases in bond holdings amounts to the same as decreasing cash holdings. Thus, the portfolio balance approach established an inverse relationship between the market interest rate and the speculative demand for money as stipulated originally by Keynes.

Tobin analysis is not confined to only cash and bonds assets. The analysis could be extended to other monetary assets other than bonds i.e. a variety of non cash assets differing in maturity. The return R and risk 6g will then represent the average return and risk on a composite of those assets.

In summary, the portfolio balance is more superior in relation to Keynes original speculative demand for money by being based on realistic assumptions. Such as uncertainty of interest rate expectations, individuals keep a portfolio of assets rather than one type of assets; and the possibility of acquiring risks in investing in monetary assets other than bonds.

But the theory can be criticized on the grounds that (i) the issue of demand for money requires dynamic analysis while the theory provides a comparative – static analysis (ii) stability of demand for money is implicitly questioned as in the original Keynes analysis.

2.5 Other Development in the theory of Demand for Money[5]

Two important theories related to demand for money worth mentioning because these theories provide a rationale for investigating two important variables influencing the demand for money i.e. excepted rate inflation and exchange rate) The first theory is Cagan theory providing expected rate of inflating as crucial variable influencing demand for money particularly in period of hyper inflation. The other theory is Mundell theory providing exchange rate as important variable influencing the demand for money. (16)

In Cagan theory the effect of inflation on demand for money and the other effect is the effect of expected infation. The first type of effect does not influence the level for real balances, because increase in inflation lead to increase in nominal balances to offset the inflation effect. Thus the net effect on real balance will be zero.

On the other hand in the second type of effect of hyper inflation on demand for money people would expect inflation, thus they adjust their net holdings of real balances, so that, the demand for them is reduced and a shift will take place to holdings of other type of wealth.

[5] For more details see David Laider (1985) Demand for money theories and evidence

The other theory of Mundell provides exchange rate as an influencing factor in determining demand for money. In Mundell (1963) Words "The demand for money is likely to depend upon exchange rate in addition to interest rate and the level of income"

Mundell theory was supported empirically by Marques (1989) where the latter analysis of the demand for money in Venezuala suggested that foreign exchange considerations are important for modelling behaviour money demand

Conclusion:

The basic upshot of foregoing exposition of the theories of demand for money comes to two principal findings which form the theory behind this thesis, "Stability of Demand Money in Sudan 1962 – 2002".

Firstly economic theory in general, ignoring Keynesian criticism, believes in stable demand for money, moreover judgment of stability of money demand must be on the light of this principle. Secondly, economic theory has provided adequate factors influencing the demand for money that deserve empirical investigation: (i) the level of real income (ii) the rate of inflation (iii) interest rates (iv) the exchange rate.

CHAPTER THREE

Methodological Approaches to Money Demand

This chapter serves as theoretical background to empirical modeling of money demand. The chapter includes the following sections 1- Functional specification. 2- Empirical Methodology. 3- Statistical Tests.

Section 3.1 Functional Specification

3.1.1 Variable Selection

The earliest studies of the demand for money took interest rate as the only variable affecting the demand for money. This was because of the great influence of Keynesian theory of liquidity preference. Those studies: Brown (1939) for U.K. and Tobin (1947) [6]for U.S.A. They proved inverse relationship between the interest rate and demand for money. Those studies assumed the effect of income on the demand for money to be constant, because people keep fixed proportion of income, as a active balances. The studies related the remaining idle balances with interest rate.

Even after relaxing the assumptions of constant effect of income, studies carried on the demand for money established a negative relationship between interest rate and the demand for money such as studies of Allan Meltzer (1963), Brunner and Meltzer (1963), Laidler (1971). [7]

[6] See David Liader (1985)
[7] OP in 6

Recent studies mentioned confirmed negative relationship between interest rate and the demand for money. The existence of liquidity trap where there is high level of demand for money when interest rate is low was ruled out as just theoretical conjecture by Keynes by a host of studies: (1) Brunner and Meltzer and Mayer (1960), covering period of (1914 -1957), notice that the study was carried for the great depression period where liquidity trap was taking place. Other studies were Pifer (1969). Robert Brown (1971).

Few studies arrived at an instable relationship between demand for money and interest rate, e.g. Milton Friedman (1951), Laidler Parkin (1970 Bank of England 1970)

The other important variables which received studies were wealth and income. Wealth and Income are taken to measure the level of transactions in the economy influencing the demand for money.

Earliest studies took income or wealth as given or constant and gave more weight to interest rate Brown (1937), Tobin (1947).

Subsequent studies used G.D.P. as a measure of transactions in the economy and these studies relax the assumption of constant level of income. Most studies taking income as a variable influencing the demand for money reached the result that there is a direct relationship between the level of income and the demand for money.

Some studies prefer to take wealth or permanent income as a good measure of level of transactions that should enter as a variable in the demand for money function. Those studies were influenced by

Milton Friedman permanent income hypothesis. Milton Friedman viewed permanent income as a good proxy of wealth as it can be constructed based on current and future income whereas current income as measured by statisticians in subject to erratic fluctuations.

In spite of theoretical support for using wealth as a variable in the demand for money but most studies use G.D.P. as a variable representing wealth mainly because the data on income in general are readily available in addition it satisfies directly or indirectly both the income and wealth criteria.

Studies of the demand for money ignored the general price level as a variable. Because usually the demand for money function is poisted in real terms and the elasticity of the demand for money with respect to price level is unity. Thus the effect of movement in the general price level are taken account of in the demand function for money by dividing the demand for money by the general price level index and at the same time taking variables affecting the demand for money in real terms i.e. Income interest rates etc.

Expected rate of inflation was introduced in the demand for money as variable measured by a weighted average of current and past inflation rate, by Phillips Cagan in his study demand for money in hyper inflation (1956). The result of study was that expected inflation has a significant effect during hyper inflation.

Some studies taking expected inflation in the demand for money function and taking normal period i.e without hyper inflation suffered

from difficulty e.g. Shapiro (1973) Goldfield (1973).[8] Thus their result was not noticeable.

Most recent studies of the demand for money has taken expected inflation rate as a variable effecting demand for money and there exists, a negative relationship between demand for money and expected rate of inflation e.g. study of Laider and Parkin (1975. Crocut and Evans (1980) Eku and others, 1995. Expected Inflation is measured by historical growth of inflation in the economy i.e. annual or monthly rate of actual inflation. A study by Hanohan (1999) on Ghana used actual inflation in place of expected inflation with an argument that in a number of earlier studies the expected inflation was found to be highly correlated with the actual inflation.

In developing countries where the interest rate moves gradually, studies prefer to take rate of inflation as a measure of interest as cost of holding money (study of (Domowitz and Elbaddwi (SUDAN) 1987.

As more countries are moving towards free exchange rate, a number of studies have taken Exchange rate variations and, interests on foreign currency investments as variables influencing demand for money e.g. Darrt (1986) and Arize (1994), interest rate on foreign investments by Mohsen Oskooee and Margaret Malixi (1991)[9] for foreign exchange rate variations.

[8] See Laider

[9] Mohsen Oskooee and Margaret Malixi (1991) Exchange rate sensitivity of demand for money in developing countries, Journal of Applied Economics Volume 23, pp 1377-1384

In developing countries because the financial sector is weak and local interest rate rarely changes studies prefer to take interest rate on foreign deposits and exchange rate variations as variable representing opportunity cost of holding money e.g. Domowitz Elbadwi (1987)[10] for Sudan, Jean Claude (2001) for Cameroon. [11]

Own Rate of Return on Money has received attention recently as a variable influencing demand of money in developing countries. This means interest on demand deposits. Until the seventies where the studies of demand for money produced inconclusive results, researcher has begun to investigate the development in the financial system as responsible for the instability of the demand for money. It was held that the payment of interest rate on demand deposits as a new phenomenon might have led to that instability of demand for money

Thus studies had included own rate of return on money as a variable affecting the demand for money of Klen (1974), Starz (1979).

Recently most studies particularly in developed countries due to the mature banking and financial system, take own rate of return on money as an important variable Laidler (1993).

In developing countries because banking and financial systems are rudimentary on immature, researchers avoid taking own rate of return on money.

[10] Domowitz Elbadwi (1987) An error Correction Approach to the Money Demand the Case of Sudan Journal of development Economics Volume 26. Holland.

[11] Na cheya Jean Claude. (2001), A cointegration Analysis of Broad Money in Cameroon, IMF working Paper 01/26.

Nevertheless some studies in developing countries do take own rate of money as a variable in their demand for money formulations e.g. Claude (2001) Cameroon.

Other variables affecting demand for money e.g. brokerage fees, method of payments, development of the financial and banking systems, and risk involved received less attention in demand for money empirical studies.

Laidler have pointed to few of these studies e.g. Study by Dutton and Gramm (1973) on the effect of wage rate, Slovin and Sushka (1983) on riskness of bonds.

In summary variables influencing demand of money are (a) income and wealth (b) interest rate (c) inflation rate (d) exchange rate (e) own rate of money.

It should not go without mentioning that the modern research of the demand for money had divided the variables influencing the demand for money into three major set of variables (Laider 1985) Sriram (1999).

(i) Scale variables, which measures the level of transactions in the economy, because money is demanded for transactions purposes. Scale variables are wealth or income, but the most used measure of scale variables is income.

(ii) Opportunity cost variables, which measures the variables which influence people to depart with liquid money holdings, the higher the opportunity cost the least is likely the individual economic agent to

hold liquid money. Example of opportunity cost variables are interest rates, expected inflation, foreign interest rate and exchange rate.

(iii) Other variables are stochastic or random variables that they may influence the demand for money or not, monetary and banking developments, payments methods.

3.1.2 Measurement of variables (dependent and Independent in demand for money.

No doubt exact measurement of the variables determining the demand for money leads to good empirical results that is to say a demand for money that reflects what the demand for money must be as economic theory stipulated. Thus empirical studies have taken effort to use standard possible measures of the demand for money. There is a controversy around the appropriate measures of independent and dependent variables in the demand for money. Firstly there is a dispute around the appropriate measure of money supply used to measure the quantity of money demanded. Some studies have used (M_1) i.e. currency plus demand deposits as the appropriate measure of money supply (Laidler 1985). Whereas other studies have used broad money (M_2) currency and demand deposits plus time and savings deposits. Studies using M_1 in developed countries defended their view by pointing that broad money supply muddles the effect of the interest and rate on the demand for money. On the other hand studies using M_2 justified that by pointing to development in banking and financial system that make time and saving deposits easily convertible to liquid money (Sriram 1999).

Most studies in developing countries have used M_1 due to immature banking and financial system. Nevertheless some studies have used M_2 e.g. Claude (2001) for Cameroon.

In spite of the fact that different studies have used different measures of money stock, but the choice of different measures do not involve problems in results reached by these studies Laider (1985) and Sriram (1999). It is just an empirical issue depending on circumstances in developed and developing countries.

Secondly there is a dispute around the appropriate interest rates to be taken as independent variable. Some studies used a number of short term interest rates while other studies used long term interest rate. However, in spite of difference in the choice of interest rate studies have reached the conclusion that there is no difference in choosing between short term interest rates or a single long run interest rate.

However, there is a consensus that the choice of long term interest rate as a representative of all sets of interest rates will perform better in demand for money estimation (Sriram 1999).[12]

Thirdly, there is a difference in the use of the appropriate measure of transaction in the economy. Some studies have used permanent income reflective of past and current income as the appropriate measure. Other studies prefer using consumption Laider 1985) Sriram (1999). However, we have already mentioned in the previous

[12] Sriram Subramanian (199), Survey of literature on Demand fir money: theoretical and Empirical work with special Reference to Error Correction models, IMF working Paper 99/64.

section that real G.D.P in analysis of the demand for money is the most accepted measure in the economy.

Fourthly, dispute on the appropriate measure of expected inflation is shown by (Sriram 1999), he reviewed different studies giving different measures of expected inflation as follows:

(i) Calculated using adaptive expectation
(ii) Calculated using rational expectation
(iii) Setup as the weighted average from the past values
(iv) Using the lagged inflation values
(v) Equating the ex-post as the ex-ante value of inflation
(vi) Actual inflation because string correlation exists between actual and expected inflation

Some studies ignored taking expected rate of inflation in their demand for money function on the grounds that taking real interest rate in the demand function eliminated the need to take expected inflation because real interest rate is measured by expectation of inflation rate Laidler (1985).

In developing countries because of the rudimentary banking system and regulation of interest by the government have turned interest rate to be sticky and of no use in the demand for money functions. Therefore, studies make it important to use expected inflation as surrogate to interest rates (Arestis and Demetriades 1991).[13]

[13] Philip Arestis and Panicos O. Demetriades, (1991), Cointegration, error correction and the demand for money in Cyprus Journal of Applied Economic Volume 23 PP. 1417-1424

Lastly, there is no dispute as regards the measurement of Exchange rate variation and foreign interest rate on foreign investment.
Most studies of demand for money put the demand for money in real terms. Using nominal magnitudes is uncommon.(Sriram, 1999).

3.1.3 Functional Forms and Demand for Money

Studies of the demand for money have used three functional forms of the demand for money: (i) Linear additive (ii) log linear (iii) linear non additive. There is consensus; however over the log linear version as the most appropriate functional form (Srinam, 1991)

Generally speaking there have been three types of model formulation to test the demand for money by researchers. Those models are (i) partial adjustment models PAM (ii) Buffer stock models BSM (iii) Error Correction models. ECM (Co-integration money). More detailed analysis of these models is given in the following section

3.2 Empirical Methodology

In this section the researcher shall examine the two different methodological approaches to demand for money. In the first section treatment of the traditional methodology will be given while in the second section treatment of the cointegration methodology will be given.

Historically the first methodology dominated up to 1987[14] when the earliest cointegration model was developed by Engle Granger. The

[14] Engle R.
F. & C.W. Granger, Cointegration and Error Correction Representation, Estimation and Testing Econometrical 55

second methodology which is applicable by researcher now has appeared since 1992[15] by J. and J

3.2.1 Traditional Methodology

Traditional Methodology consist of partial adjustment model and Buffa stock models.

Historically PAM and BSM dominated studies of the demand for money up to late eighties. However beginning from late eighties up to now the most accepted model for testing the demand for money are the Error Correction Models. (Cointegration models)

Criticisms on the these models are the following:

(1) Failure of PAM to explain or help understanding the instability of demand for money in the seventies in advanced countries. The failure of the model have been reflected in the low short run elasticities for income about: (1) Only elasticity of interest rate (-.05) around -0-5 (Sriram, (1999).

Moreover theoretically the PAM as shown by the equation below does not take account of the dynamics of variables involved. Thus leading to misleading results.

The PAM Model:

$M_t = da_o + da_1 y_t + da_2 i_t + (1\text{-}d)m_{t-1}$

Where Mt = actual money balances in real terms demanded in period t.

[15] Johansen S. and K. Jueslius (1992) Testing Structural Hypotheses in a Multi Varite Cointegration Analysis Journal of Econometrics 53

i = Interest in period t

da_1 = Short run elasticity of demand for money with respect to income

da_2 = Short run elasticity of demand for money with respect to interest rate

d = Partial adjustment coefficient to capture the lag effect on demand for money

M_{t-1} = Lagged balances of money

The PAM was developed because adjustment of actual money holdings to desired levels is assumed to take place through a partial scheme. Thus, in the framework of PAM, actual money balances adjust to the gap between the desired or long run demand for real money balances and the previous period holdings of money balances.

Thus, by its nature (described above), the PAM restricts the lag structure excessively at the beginning of empirical investigation as it assumes that the adjustment could be captured in a very specific simple fashion. However, the PAM Models may result in autocorrelation or heteroscedasticity due to omission of important lagged variables.

2- Failure of BSM models also to provide empirically stable demand for money. The buffer stock models have been developed to work instead of PAM for conclusive money demand estimation. The theoretical economic principles behind BSM is that people hold idle balances to be as a buffer or cushion or a reserve to meet precautionary situations or emergencies.

The BSM assumes that (i) money stock is essentially influenced by open market operations and (ii) loan expansion of the banking system and a disequilibrium real balance effect.

Since the BSM has relied on the shock effects of money supply, it conceived with the transmission mechanism of monetary policy in the short run. Eventually the BSM addresses the short run dynamics of the demand for money.

There are two major differences between PAM ands BM (i) Monetary shocks are incorporated as part of money demand whereas monetary shocks are ignored in PAM determination (ii) the lag involved in BSM is more complex than in BSM.

The advantages of BSM over PAM are: Firstly, the BSM captures the effect of monetary innovations which have resulted in excess cash balances in the hands of economic units. Secondly, the complicated nature of the monetary transmission is much more realistically dealt within BSM modeling. Third, the treatment of money stock in the money demand function by BSM removes the bias of PAM by ignoring money stock changes.

There are three types of BSM:

(i) The model of the first types uses the following PAM equation:

$$Mt = d_{ao} + da_1 {}^{y}_{t} + da_2\, i + (1\text{-}d)M_{t\text{-}1}$$

As a semi reduced form equation.

This type of model is called single equation disequilibrium money demand models. However, the above mode is criticized on the

grounds that the equation of model could be formulated by researchers differently, thus there is no accepted type of modeling.

(ii) Complete disequilibrium monetary model

This type of BSM is given by the equation below:

$$\Delta x_t = f(Zt) + \pi (L)m^s_t - m^d_t)$$

Δx_t = A set of real on nominal variables e.g. output, prices exchange rate

Zt = A set pf pre determined equilibrium variables

Mdt = Long run demand for money

π (L) = Lag polynomial

This model is criticized on the grounds that as the money disequilibrium term appears in more than one equation the model is subject to restriction. In addition empirically the model did not perform well in flexible exchange regime as it did in closed economies.

(iii) Shock absorber models

In general the shock absorber model formulates the demand for money as follows:

$$(M - P)_t = B_o + B_1 y_t + B_2 i_t + b3\ (M_{t-1} - P)_{t-1} + a(m_t - m_t^{\Delta}) + E_t$$

$$m_t = a\ Z_t + E_c$$

The first part of the stock absorber models is a partial adjustment model equation with addition of items i.e. (Mt – Mt) where Mt = anticipated money supply and (Mt – M) is unanticipated money stock.

Z = a set of variables affecting of money supply as assumed by agents

A = vector of coefficients of variables in the Z term affecting the demand for money

E = error term.

The shock absorber model as developed by car and Darby (1981) [16]is the most widely used BSM. This type of model directly estimates the demand for money function by incorporating money supply shocks in an otherwise conventional demand for money function. The model has appeared as a result of the inadequacy of partial adjustment models, to provide an explanation of short run money demand in areas in which money supply shock occurs.

It should be noted this model is the most used type of BSM. In spite of the superiorly of BSM over the PAM they are suffering from number of defects.

Firstly, although the short run dynamic is much more sophisticated in BSM over PAM but they are still is restrictive in treating dynamics.

Secondly, the model assumes that the exogenous money supply influence the demand for money whereas money demand may influence the supply of money e.g. in Switzerland money stock is a dependent rather than an exogenous variable.

Empirically, the BSM did not give satisfactory results (Milborne 1987).[17] So, both PAM and BSM have suffered from theoretical and

[16] Laidler op

[17] Serletis Apostolos (2001). the demand for money theoretical and Empirical Approaches, published by Kluwer Academic Publishers Boston London Chapter 8

empirical problems that led to the appearance of method correction models as the appropriate tool for modeling demand for money. We shall go in detail in ECM in Part II because the researcher will employ it in his estimation of demand for money for Sudan.

3.3 Cointegration Methodology

3.3.1 Theoretical Background

Earlier studies of demand for money had inadequate analysis of the relationship of demand for money in the long-run. Recent cointegration and error correction models provide adequate analysis of the long run and short-run of demand for money.

Long-run relationship of demand for money is signaled by positive unitary elasticity of demand for money with respect to income, and negatives less than unity elasticities of opportunity cost variables (i.e. Inflation, Interest rate and exchange rate coefficients of variables in the demand for money function).

The contention of economic theory that, long run relationship between demand for money and variables influencing it has prompted the cointegration test to find the existence of this fixed long run relationship

The earliest cointegration test was developed by Engle and Granger 1987. But this test has number of defects. 1. It is a two stage methods. In the first stage we drive residuals and in the second stage we estimate coefficients of residuals. This is un desirable because errors in the first stage are carried in the second stage. 2. This method is suitable for large sample which is not available in economic data.

The mostly recent cointegration test is the Johansen & Juseluis Test (1988- 1992). The striking evidence of cointegration is to find out that at least one vector of variables in the demand for money is non zero. The existence of cointegration among variables proves the fixed long run relationship suggested by economic theory.

The econometric theory being cointegration is that although time series variables are non stationary but are cointegrated, if a linear combination of these variables is stationary. In other words if variables among demand function are cointegrated they will be conistrained to an equilibrium relationship in the long-run. While variables possibly deviate shortly from equilibrium they will come back to equilibrium.

Cointegration requires times series data to be stationary. Stationary test is given in section 3.3.3.1

The long-run demand for money is poisted in a log linear form as follows:

$$L\,md = a_o + \alpha\, LG + B_oF. + B_1E + B_2\, R + U$$

Where Lmd = Logarithm real money balances in real terms

a_o = Intercept

α = Long run elasticity of demand for money with respect to income. LG = Log GDP in Long run

B_o = Long run elasticity of demand for money with respect to inflation while F = Inflation rate

B_1 = Long run elasticity of demand for money with respect to exchange rate R = effective real exchange rate

B2 = Long run elasticity of demand for money with respect to interest rate E = Interest rate

U = residual term

Cointegration test on the basis of the above long run demand for money relationship is conducted by means of a method developed by (JJ) (1988-92). This method applied maximum likelihood estimation to determine the presence of cointegration vectors in non stationary time series. This method detects the number of cointegration rectors and allows four tests of hypotheses regarding elements of cointegrating vectors. If a non zero vector or vectors is indicated by the test a stationary long run relationship does exist Osterwaloo Lenum (1992)[18] provides the appropriate critical values required for the test i.e. Trace and maximum eigen critical values.

The number of lags applied in cointegration test are based on that: as in unit root tests, lags are not omitted if their exclusion introduces serial correlation. For longer period eight lags are indicated and for shorter period four lags are appropriate.

Since there seems to be a linear trend in all the non stationary series, cointegration tests are conducted with the inclusion of deterministic trend.

The final exercise of cointegration tests is to normalize on real money balances, the normalized equation shows signs which have specific

[18] Enders Walter (1995) Applied Econometric time series, New York John Wally and sons Inc., U.S.A. Chapter 6

meanings in economic theory the researcher has passed through at the beginning of this section.

3.3.2 Examining Short run demand for Money (Error Correction Model:

Economic theory believes that in the short run the demand for money deviates from the long run.

In the short run factors influencing demand for money i.e. income, inflation, interest rate and exchange rate move and bring disequilibrium in the money market.

However, economic theory believes that the disequilibrium is apt to come back to its normal path in the long run. The impact of short run deviations is weaker than long run. Therefore, elasticity of variables influencing demand for money in the Short-run are weaker than the elasticity of the variables in the long run and should have ordinarily negative signs.

Until mid eighties short run demand for money was modeled by PAM and BSM which performed badly that had led to the development of ECM to Model estimate short run demand for money. The ECMS have proved to be one of the most successful tools in applied money demand research. The failure of PAM and BSM is attributed to that they relied on economic theory long run belief on equilibrium and believed in fixed dynamic of demand for money variables. (fixed lag structure). These models failed to understand the lag structure or lag given by actual data.

The ECM have handled both short run and long run in one model. The ECM constrained information on long run elasticities as well as short run elasticities. Thus, are guided by economic theory belief in long run equilibrium and at the same time gives weight to short run dynamic of the data.

To illustrate short run and long run relationships in ECM consider the following demand for money ECM money equation:

$$\Delta Y_t = B_0 + B_1 \Delta_t X_t + \pi (X_{t-1} - Y_{t-1}) + u_t$$

This equation is the simplest form of error correction model. It relates the change in one variable to changes in another variable plus the gap between the two variables in the previous period, the term $B_1\Delta_t X$ represents long term demand for money relationship while the term $(X_{t-1} - Y_{t-1})$ represents short run demand for money relationship. The short run term also reflects short run deviation or disequilibrium. A test on π is the test on this disequilibrium.

The earlier ECM on money demand tended to be based on bivariate cointegration relationship between money and the chosen scale variable as developed by Engel and Granger (1987). However, further research suggested that multivariate cointegrating vectors encompassing a broader number of variables provided a fuller characterization of the long-run determinations of demand. The specification of such multiple cointegrating vectors between non stationary variables primarily employs the procedures developed by Johansen (1988) and Juseluis 1992 and which make the original Engel and Granger framework a special case

Thus, the recent method to estimate the ECM is the method developed by Johansen & Juseluis (1988-1992) which the researcher shall employ in this research. The following equation represents the model developed by Johansen (1988) and Juseluis (1992)

$$\Delta X_t = U_t + {}^{k=1}\Sigma\, r\, \Delta\, X - \Pi X_{t-k} + \Sigma_t$$

Where ΔX_t = demand for real balances

U = Intercept

Σ r ΔX term represents the long run relationship of the demand for money where elasticities or coefficients in the long run and ΔX are variables to be estimated in the long run

Π X represent the short rum demand for money

where $\Pi = \alpha$ B'. α matrix of cointegration vectors and B' a matrix of error correction parameters

The long run demand for money model or coitegration model and short run model error correction could be estimated by using the most advanced econometric software package P.C. Film Give 9.0 for windows.

3.3.3 Test of Statistical adequacy of the models

3.3.3.1 Unit Root Test

Unit root test is designed to test whether time series data are stationary or not. Stationary times series data have the following characteristics: 1. Constant mean (ii) finite variance i,e, time invariant (iii) the correlogram diminishes as Lag length increases. While non stationary times series have the following characteristics (i) No Longrun mean (ii) Variance is time dependent (iii) Correlogram dies out slowly.

Stationary times series have no unit roots because their residuals coefficients are not equal to one. That if the following equations represents times series residuals

$$y_t = (a\ )y_{t-1} + e$$

$$a = (\propto - 1)$$

If $\propto$ not equal 0 then the residuals of times series are stationary and have no unit roots

If $\propto$ is equal 0 then the residuals are non stationary and have unit roots. Dickey and Fuller have design special distribution to test

3.3.3.2 Stability Test

This is the most crucial exercise in this research because the main objective of this research is to find out the existence of stable demand for money in Sudan during 1962 – 2002.

Stability means that the behaviour of the demand for money is fixed and can be predicted. (Fixed) should not be understood to mean that there is no change in demand for money, but it does mean that this change occur regularly and does not occur randomly or violently.

Economic theory gives crude evidence to stability through elasticities of demand for money with respect to variables influencing it. A stable demand for money in long rum means a positive unitary elasticity of demand for money with respect to income and less than unity negative elasticities of demand for money with respect to opportunity cost variables i.e. interest rates, inflation rate and exchange rate. Elasticities in econometric words are coefficients of

variables in the demand for money functions. Specifically, elasticity of demand for money with respect to interest rate should be in the range of –0.4 to 0-6.

In the short-run, a stable demand for money according to economic theory means a weaker elasticity of variables with respect to demand for money. Moreover, short-run deviations or equilibrium should come bank to the long-run disequilibrium demand for money.

Econometrically, elasticities are coefficients of variables in the demand for money function. A test on stability of demand for money is a test on significance and size of coefficient in the short and long run demand for money functions.

Two tests are used to determine the stability of demand for money an old one and a recent one. The old test is the Chow tests (1966). (7) The recent is the recursive residuals test where the coefficient are tested against significance levels, recursive coefficient should be the same throughout the period of investigation to conclude a stable demand for money.

The recent recursive test was developed by Stock and Watson (1993), which will be used in this research.

3.3.3.3 Examination of the causality Relationship between Variables of Money Demand

Examination of causality is crucial because it involves disclosing the causation line, that is to say, whether the variables (independent) e.g. GDP or inflation, cause change in money demand or the money

demand itself affects the variables, that is the existence of feedback effect. The existence of line of causation i.e. from money demand, to independent variables blur the analysis demand for money and lead to undesirable results. Thus, it is important in the analysis of demand for money to find out the line of causation.

Granger (1986) and Engel and Granger (1987) provide a test of causality, which takes into consideration the information provided by the cointegrated properties of the variables. According to these studies as long as variables are cointegrated, causality has to exist at least in one direction, specifically this test considers the possibility that past levels of a variable Y may help explain the current change in other variable X even though the past changes in Y do not exist.

All this is conditional on the assumption that X and Y are cointegrated and thus share a common trend. To test for causality when variables are cointegrated, the following error corrections equation is applied:

$$\Delta X_t = \alpha_o + B \Delta Y_{t-i} + \Sigma \pi \Delta X_{t-}i + \alpha EC_{t-1} + e$$

Where X α Y are variables that are cointegrated and stationary after difference, EC is the lagged error term from the cointegration equation. According to equation provided above Y causes X When the B are jointly significant or if the coefficient of EC (α) is significant. Thus this test is superior to standard Granger causality test because it allows for finding that Y causes X even though the coefficient of lagged Changes in Y are jointly significant.

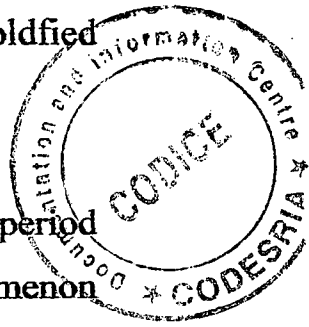
CHAPTER FOUR

SURVEY OF EMPIRICAL STUDIES ON DEMAND FOR MONEY

This chapter tries to convey the general empirical work on demand for money in present time and in the past. The chapter includes the following sections Section 4.1 Historical Background section 4.2 survey of recent international Studies Section 4.3 Survey of Sudanese Studies

4.1- Historical Background.

Up to the seventies the empirical studies on demand for money resulted confidently in that it was a stable function of interest rate with inverse relationship between the two variables. Income being directly related to it, expected inflation being negatively related to it. For example, studies on Britain by Brown (1939) of United State by Tobin), study by Allen Meltzer, (1963), study by Karl Brunner, Meltzer (1963), Laidler (1960 and 1971), and study of Goldfied (1973).[19]



However, instability of the demand for money, for the period between mid 70's late 80's has been reported and this phenomenon has been termed missing money episode. For example, the Federal Reserve of U.S.A. which was projecting annual demand for money for U.S.A. taking G.D.P. and nominal interest rate as variables determinants has obtained increased demand for money projections.

[19] Laidler op

Studies confirming instability were to be found in studies by Goldfield (1976) USA.

Many studies have attempted to provide an answer to the instability of the demand for money, for example: Study of Judd & Scadding (1982), which attributed instability to misspecification of variables determining demand for money notably national income. Another study attributed misspecification in the rate of interest to be taken in the demand for money function, study of Heller and Khan (1971). Another line of studies attributed instability to institutional developments in banking and financial systems e.g. study of Enzlar Pauny and Johnson (1976), Garcia and Park 1979. Lastly studies have shown that the instability might be due to deficiency in econometric models. That is to say, the econometric models used failed to capture the time lag effects of variables affecting demand for money. This reason of instability is to be found crudely in the studies of (Carr and Darby 1981), Laidler 1980)

It should not go without saying that stability experienced up to mid seventies and the instability discovered afterwards in late seventies, was proved to be true for a large number of countries.

Beginning from late eighties new econometric modeling for the demand for money has appeared i.e. Cointegration Error Correction Models. The partial adjustment model used earlier was discarded largely due to its failure to take care of time lag involved in demand for money model and the apparent misleading results obtained by these models in the period between mid seventies up to mid eighties i.e. era of missing money.

The use of error correction models for modeling demand for money has resulted in stability in a number of countries. The main advantage of error correction model over partial adjustment model is that this type of modeling allows economic theory to specify long term equilibrium while at the same time data characteristics permit analysis of short term dynamics. Thus, time lag is taken account of.

The main defect of (P A M) is that they depend solely on economic theory without thoroughly examining the data or the time element. Thus, the error correction models proved a stable demand for money in the past as well as in recent time. If error correction model were used instead of (P A M) models during the changing period of the seventies, it would result in a stable demand for money function.

Most studies since mid eighties up to the date of writing this thesis (2003) have reached a stable demand for money both in developed and developing countries. All studies have employed cointegration and error correction models. Earlier studies employed Engel and Granger (1987) methodology while later studies employed Jahansen (1988) and Julius (1992) maximum likelihood methodology. The latter method has proved to be sharp and accurate in results.

4.2 Survey of recent International Studies

An extensive survey of the recent empirical studies of the demand for money in both developed and developing countries is found in

(Sriram 2001).[20] The survey has covered studies carried during 1990s, using error correction econometrics techniques.

The studies covered by the survey represent a worldwide state of empirical studies on demand for money up to the end of the nineties. Fortunately, the studies have proved the correctness of economic theory in holding that in the long run the elasticity of demand for money will respect to income would be positive and unitary, and that elasticities for demand for money with respect to opportunity cost variables are negative.

The selection of the studies from the survey (table below) depends on the closeness of the results to economics theory projection.
Table 3.1 below shows the results of a Sample of cointegration and error correction studies based on the criterion that has been put (previous Para).

Countries chosen are representing a mix of developed and developing countries thus enabling understanding the beviour of demand for money in different economic circumstances. Candidate influencing factors on demand form money are income interest rate and inflation in the survey.

Table 4.1 Sample Results of Cointegration and Error Correction Studies World wide

Name of Researcher and Country	Method used	Date	Income elasticity	Other elasticity

[20] Sriram Subramanian (2001) A Survey of Recent Empirical Money Demand Studies, international Monetary Fund Staff Paper /volume 47 pp. 334-366

Drake & Claystal	JJ	1994	1.04	Inflation -.37
U.K				
Mcnoun & Wallace	JJ	1997	.987	Interest rate -
U.S.A.				-2.8
Eriksson & Sharma	JJ	1998	1.2	Inflation -3.3
Creece				
Sriram Malaysia	JJ	1999	1-036	Inflation -4.7
Moosa India	EG	1992	0-87	Interest 0.1
Moosa India	JJ	1992	0.98	Interest 0-2

JJ represents Johansen Soren, Katrina Juselius. Cointegration Methodology (1990).

EG represents Engle Robert and Granger, C.W.J. – Cointegration Methodology (1987).

Source: Sriram IMF Staff paper Volume 47 Number 3 2001

Studies have been carried during the new millennium have confirmed the stability of the demand for money. For example the study by Nachega Jean Claude for Cameroon (2001) reached a long run function taking the following values.[21]

$m/p = a_o + 1.1y - 1.5\ DP - 0.8\ DC - 12\ FMMR + 7.7\ DEPO$

Where m/p = Demand for real balances

a_o = constant

y = level of national income

DP = Inflation Rate

Dc = Exchange rate Depreciation

FMMR = Money market interest rate

[21] Na Cheya Jean Claude. (2001). A Cointegration Analysis of Board Money in Cameroon IMF working Paper 01/26

DEPO = Deposit Rate or Own Rate of return on money

Clearly, the value of coefficient and their signs indicate economic theory projection of demand for money.

Another study in the new mellenium by Defne Mutluer and Yasemin Barlas for Turkey (2002[22]) reached a long run demand for money for taking the following form.

Log m/p = 1-004 log GDP +-023dr - .006trR – 1-7π

Where m/p = money demand in Real value

GDP = Gross National product in Red value

dR = deposit interest rate or own rate of interest of money

trR = Government Treasury bills interest rate

π = Inflation Rate

Evidently the long run demand for money has the correct values and signs of coefficients that indicate the long run economic theory projection.

4.3 Survey of Empirical Sudanese Studies

The researcher shall divide the study of the demand of money in Sudan into four headings:

(1) The study of Elgoul (1977) which has covered the period (1958 – 1973)

(2) The study of Domotiz and Elbadwi (1987) which has covered the period (1958 – 1982)

[22] Mufluer D. and Barlas Yasmin (2002) Modeling demand for money in turkey, Central Bank of Turkey Review volume 2 No. 2

(3) Studies by Scholars i.e. M.Sc and Ph.D dissertation

(4) Studies by Bank of Sudan staff

(1) The Study of Elgoul (1977)[23]

Elgoul began his study "The demand for money in Sudan (1958 – 1973) (6) by giving the theoretical possible factors that effect the demand for money in Sudan, he contrasted these factors with the factors affecting demand for money in developed countries. He argued that current income is more important in Sudan than permanent income in developed countries, because the time horizon is short in Sudan because per capita income is low and people mainly live in subsistence sector. He also argued that inflation rate is more important in Sudan than other opportunity cost variables e.g. interest rates because interest rate since 1958 have changed twice. Moreover, the financial sector is rudimentary in Sudan. Although interest rate were constant in Sudan but Elgoul put it in his demand function as an influential variable.

Elgoul used the partial adjustment model to estimate the demand for money in Sudan. He tested the following four equations which are versions of PAM. Using Koyock transformation scheme:

$$m = b + b_1 y + b_2 r + b_3 m\text{-}1 \qquad (1)$$

Where $b = aA$

$b_1 = aB$

$b_2 = (aD)$

[23] Elgoul Abdalla Elsharif (1976) Demand for money in Sudan ESRC Publication No. 76/58

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$b_3 = (1- a)$

Where M = desired money balances

Y = real measured income per capita

r = The rate of interest

B = The elasticity of the demand for money with respect to income

D = The elasticity of the demand for money with respect to interest rate

A = The elasticity of the actual money balances to desired one.

(1 - a) = speed of adjustment or the time lag involved

Equation (2) is derived by assuming (a) to be equal to one where the money balances are always in equilibrium. Thus equation (1) is transformed to equation:

2. $M = A + BY- + Dr$ ..... (2)

Equation (3) the data is put in real terms and not in nominal; terms as equation 2. i.e. $\frac{M}{P} = A + \frac{BY}{P} + \frac{Dr}{P}$ ... (3)

Equation (4) in this equation the rate of inflation is introduced and the data in real terms.

$\frac{Mt}{P} = A + \frac{BY}{P} + \frac{Dr}{P} + K(dp/dt - 1/p)$.....(4)

The result of Elgoul study was unsatisfactory because (1) he has got a positive income elasticity which is higher than one that is approximately (1.5).

(2) He has got a positive elasticity of demand for money with respect to inflation and interest rate. Compared to empirical studies the results are illogical because income elasticity is normally equal to or near one and that price and interest elasticity of demand for money should be negative.

In spite of the misleading results of Elgoul but he speculates that inflation in Sudan led people to increase holdings of liquid money because he argue that grain merchants avoid the risk of inflation by accumulating reserves of crop.

There are a number of criticisms to be put against Egoul study which some of them can be taken as the reason for leading him establishing a stable demand for money in Sudan.

(1) The model used a PAM which has suffered from restrictive lag effect.
(2) The time period covered was short 15 years
(3) The study should take real GDP instead of per capita income
(4) The government interest rate should not be taken as a measure of interest rate as an opportunity cost of holding money because it is constant in nature.
(5) Failure to introduce the exchange rate as a factor influencing the demand for money in Sudan.

Thus, Egoul study over emphasized the effect income and inflation as variables effecting the demand for money. In spite of the defects of Elgoul study but it has its merits being the first study to investigate

factors affecting the demand for money in Sudan, moreover the first study to model and test demand function for money for Sudan. Justice would be done if we consider that the study was carried in a period where the appropriate model for testing demand for money i.e. Error Correction was not yet. developed

2- Study of Domowitz and Ibrahim Elbadwi

This study was completed in (1987). [24] It has covered the period 1956 – 1982. What is the new about the study in addition of being the second important study of the demand for money in Sudan, the study is the first to use the modern Error Correction Model in money demand analysis in Sudan.

Theoretically, the study has recognized three important variables influencing demand for money in Sudan

(i) National income (ii) Inflation (iii) Exchange rate variations

The study ignored interest rate as a variable influencing the demand for money in Sudan. The justification for the omission of interest rate is that " the recorded interest in Sudan changed only twice during the period of study". Moreover financial assets do not constitute good substitutes for cash balance in a country such as the Sudan where the financial markets are disorganized and not easily accessible."

The inclusion of exchange rate was justified on the grounds that during eighties and late seventies exchange rate fluctuations appeared in Sudan. Thus, failure to include such effect would bias

[24] Domewitz Ian and Ibrahim Elbadwi (1987), An Error Correction Approach to the Money Demand the case of Sudan Journal of Development Economics Volume 26. Holland

the results of the model. The joint study by Domowitz and Elbadwi has used the earliest version of the error correction model which subsequent studies of ECM have shown that is a special case of the model developed by JJ (1992).

The model used was specified as follows:-

$$\Delta M_t = B_o + (B_1 + B_7)\ \Delta P_t + (B_2 + B_6)\ \Delta y_t + (B_3 + B_8)\ \Delta e_t + (B_4 + B_9)\ \Delta^2 PtMt + (B_{5-1})M_{t-1} - P_{t-1} - y_{t-1}) + B_3 e_{t-1}$$

ΔM_t = Change in $M_t = M_t - M_{t-1}$

Where Mt = equilibrium money holdings

M_t -1 = Actual money holdings

P_t = The general price level

ΔP^2 = The rate of change of price level

Δe = Change in Exchange Rate

β_1 β_2 β_3- = β_g= coefficients of the model or elasticity of demand for money with respect to income inflation and exchange rate change. It is a apparent that this type of the model is more efficient that PAM, because long run and short run elasticity could estimated. Moreover, the lag effect has been treated properly. The full lag effect of this model is captured by the term:

$+(\ \beta_5 - 1)\ (M_t - {}_1 - p_{t-1} - y_{t-1})$

Result of model

The model estimated over the period 1956 – 1982 based on annual data using (OLS) . The estimated model is as follows:

Mt = -0.7 . 58 0. 03 Δpt +0.575Δy_t + .02)Δe_t

(0.607) (0.243) .225 .146

$-0.125(m - P - y_{t-1}) - 0.155e_{t-1} - 0.488\Delta P_{t-1}$

$R_2 = .57$ DW $= 2.15$ $Q(12) = 9.67$

The results of the model are nearly statistically satisfactory and in line with economic theory. The results confirm economic theory in that the model gives a direct relationship between income and the demand for money, elasticity being around .55%. A negative relationship between the demand for money and inflation rate and exchange rate were found.

The study refuted Elgoul study (1977) of high income elasticity and being the only important variable determining the demand for money in Sudan.

Stability tests of the model proved that stable demand for money in Sudan exists.

In spite of the good results of the study and its superiority over Elgoul study (1977) in using ECM and reaching sensible results. But the study can be criticized on the following grounds:-

1. Theoretically the study omitted an important variable influencing the demand for money in Sudan that is the interest rate on the grounds that it is almost fixed during the study and the financial and banking sector was narrow.

The fixing of interest rate is not a logical justification to exclude it as a variable influencing the demand for money in Sudan. Because the exchange rate which was taken as a variable was also

fixed during the study, historically exchange rate was officially fixed at U.S.A. $ 1 = 0.3 Sp. until 1978 where the first devaluation took place. Thus exchange rate was variable only during 1978 – 1982, of the study, which was a short period to justify the inclusion of exchange rate as a variable effecting demand for money and to exclude interest rate from the analysis.

Interest rate must be taken as variable in demand for money on the following grounds:

(i) Interest rate fixed by the government is not reflective of the real interest rate on money in Sudan during 1956 – 1982.

(ii) Monetary and banking and financial development in Sudan since 1982 up to researcher study necessitated the inclusion of interest rate as a important variable influencing the demand for money in Sudan. An important financial development was the establishment of Khartoum stock Exchange in 1994 where shares are bought and sold. Another financial development was the establishment Sudan financial services corporation (1998). This corporation is responsible for the issue of Government security Certificate. (Shahama)

Another important development is the abolition of interest rate in dealings by the Bank of Sudan and giving commercial banks the freedom to fix the profit margin on its deposits.

All the above developments increase the importance of taking the interest rate or profit margin on financial assets as a variable influencing the demand for money in Sudan.

2- Another criticism of Domowitz Elbadwi study is that the study has used a simple version of error, correction model. More advanced studies used sophisticated versions e.g. JJ (1992).

3- Another criticism is that low elasticities were found due to the use of the simple version of ECM.

Although the study suffered from the above mentioned draw backs: (i) omission of interest rate (ii) using simple version of error correction model (iii) Low elasticities of the Model, but the study is an excellent work that reflects the economic theory behind the demand for money and that produce sensible result.
The researcher will use the Domowitz and Elbadwi study a basis for his study with the following: adjustment:s:-

(1) Including the interest rate as a variable affecting the demand for money in Sudan during the period 1962 – 2002.
(2) Using the most sophisticated method for demand for money modeling and estimation i.e. JJ maximum likelihood model (1992)

It should not go without saying that the deficiencies in Domowitz and Elbadwi study are out of their hands and they are not to be blamed because:

(1) Using simple error correction model was justified on the grounds that the modeling of the demand for money is recent and serious research using them has appeared only in the late eighties. Thus Domowitz and Elbadwi could be grouped among the first to use the ECM.

(2) The failure to take interest rate in the study of Domowitz and Elbadwi was justified due to narrow financial sector (1956 – 1982). The development of financial sector in Sudan has taken place since mid nineties.

3- Scholar studies on Demand for Money in Sudan

The researcher has surveyed the theses on demand for money in Sudan which are found in Sudan Library of University of Khartoum. The researcher has taken them as a sample indicating the scholarly work in Sudan.

The first study by Ahmed Khalid Zakaria (1993)[25] entitled: The determinants of the demand for Money in Sudan An empirical investigation, covering the period 1981-1992. The thesis has used Friedman demand for money, theory as a theoretical basis. Thus the following equations were formulated representing demand for money in Sudan.

$$M/P = a_1 + a_2 (y/p) - {}_{a3} (r-P).....(1)$$

$$M/P = a_1 + a_2 (y/p) - a_3 r - a_4 P .....(2)$$

[25] Zakaria Ahmed Khalil, (1993) the determinants of the Demand for money in Sudan. An empirical investigation, unpublished M.Sc. these University of Khartoum under the supervision of Late Dr. Mustafa Zachariah Associate Professor of Economics, U.K.

In Equation (1)

Where M/P = Real money Balances

a_1= Constant

a_2 = elasticity of demand for money with respect to income

y/p = Real G.D.P. or income

a_3 = elasticity of demand for money with respect to real interest rate

(r – p) – real interest rate = nominal interest rate minus rate of Inflation

In Equation (2)

a_4 = elasticity of demand for money with respect to inflation

p = inflation rate

Equation (1) is identified to equation (2) However in Equation (2) the real rate of interest is split into nominal rate of interest (r) and rate of inflation (p)

The results of the study were that:

a_2 = .14 using m_1 a_2 = 0.4 using m_2

a_3 = -624.6 (r-p) a_3 = -793 (r)

a_4 = -10.18

The model was estimated by (OLS) and Lag effect was overlooked, although the elasticity of income was found relatively to be high (.4). However other elasticities were abnormally high.

The study could be criticized on the following grounds. Firstly the model overlooked the lag inherent in demand for money variables and thus the shortrun was not captured. Such static models are formed for Longrun only. Even the simple dynamic model e.g. PAM

was not used to capture the lag influence in demand for money variables. Secondly, the elasticities of demand for money with respect to inflation and real and nominal interest rates were found abnormally high. Thirdly, the model, failed to take exchange rate as a variable influencing demand for money in Sudan. Thus the model was a closed economy model. Moreover interest rate was omitted as a variable influence demand for money.

The second scholar study by Mushair Mohamed Elamin (1998)[26] entitled determination of optimum Liquidity in Sudan (in Arabic). The Study has covered the period (1970-1998). The study has used a demand for money model as a vehicle to determine optimum supply in Sudan.

The Study had formulated the following model of demand for money in Sudan:-

$$\text{In } m_d = a_1 R + a_2 Y + a_3 m_{dt-1}$$

Where in m_d = change on money demand (real)

a_1 = elasticity of demand for money with respect to real lending rate which had been developed by researcher as a proxy to real Interest rate

R = real Lending rate

a_2 = elasticity of demand for money with respect to G.D.P.

Y = G.D.P. (real)

a_3 = Coefficient of speed of adjustment of current demand for previous demand for money

[26] Mushair Mohamed Elamin (2001), Determination of optimum supply of money in Sudan economy 1970-1998 Unpublished M.Sc. theses University of Khartoum under supervision of Mustafa Zakaria ?Associate Professor of Economics U.K. (in Arabic)

m_{dt} = demand for money for previous period

The study has used the partial adjustment model where specific pattern of adjustment of the Lag was assumed. The study has defined money supply to be (m_1)

The estimation results of the model were as follows:

$a_1 = .00037$ $a_2 = .015$ $a_3 = 1.01$

Where elasticity of demand for money with respect to real lending rate; a_2 elasticity of demand for money with respect to Income; a_3 elasticity of adjustment of Lag.

The study could be criticzed on the following: Firstly the study used the partial adjustment mechanism which suffers from inherent defect of failure to capture short run dynamic. Secondly the elasticities although have correct signs but their size are insignificant. Moreover the elasticity of adjustment should be below unity.

The third study was by Safa Mohamed elhassen (2003)[27] entitled: Estimation of demand for money in Sudan (1990 – 2001).The model employed Engle and Granger methodology (1987) for estimation of Error correction models.

The researcher employed a two models and four equations system:

Model (1)

Equation (A): $R_{mdt} = a_o + a_1R_1 + U_t$

[27] Safa Mohammed Elhassen, (2003), Estimation of demand for money in Sudan (1990-2001) Unpublished M.Sc. thesis University of Khartoum under supervision of Mustafa Zakaria Associate Professor of Economics U.K. (in Arabic)

Equation (B): $DRmd = -a_1 DR_1 + a_2) [RMd_1(-1)] - a_1 R1 (-1) + \sum$

Where Equation (A) is the long-run model

Whereas Equation (B) is the short-run model

Model (2)

Equation (A): $Rmd1 = a_o + a_1 D1 + U_t$

Equation (B): $DRmd_1 = a_1 D_1) + a_2 \ Rmd_{t-1} - a_1 D_1(-1) + \sum$

Equation 'A" the long-run

Where

Rmdt = Real money demand

R_1 = Lending rate

D_1 = Return on Investment deposit

a_1 = Coefficient of lending rate or elasticity of demand for money with respect to lending rate

a_2 = Coefficient of return on investment deposits or elasticity of demand for money with respect to return on investment

U α E are error terms

The two models used narrow money and real quarterly data, the first model used the lending rate (nominal adjusted lending rate of Islamic banks minus Inflation rate) as the only factor influencing the demand for money whereas the second model employed the return on investment deposits as the factor influencing the demand for money.

The result of estimated model was model (1) $a_1 = -0.41R_1$ elasticity of lending rate

Model (2) $a_1 = -0.40D$ elasticity of return on investment

Although the coefficients or elasticities are correct (negative) but the study has suffered from a number of defects: Firstly, the model has employed the Engel and Granger methodology (1987), which suffers from a number of defects which has led to the adoption of JJ methodology (1992). Secondly the study concentrated on the influence of one variable and demand for money depends on a number of variables that deserve consideration.

4- Bank of Sudan Studies on Demand for Money in Sudan

The first study by Haroun (1996)[28] for the period (1960-1995). The study has employed the partial adjustment model for estimation of the demand for money. The study has taken two variables influencing the demand for money in Sudan i.e. the level of GD.P. and inflation rate. (M_1) was taken as a measure of demand for money in Sudan. The period under study was divided into two period (1960-1984). (1985-1995).

The model was built as follows:

$L_n m_d = D_1 \text{ Ln} + B_2 \text{ Ln P1} + B_3 \text{ Ln M}_{t-1} + e$

Where B_1 = elasticity of demand for money with respect to income

Ln = national income

B_2 =elasticity of demand for money with respect to inflation

P_1 = inflation rate

B3 = elasticity of adjustment

M_{t-1} = previous balances for money demanded

The estimation result was as follows:

[28] Haroun Hamad (1996) Demand for money in Sudan Elmasrufi magazine issued by Bank of Sudan. Issue No. 8

Elasticities of the period 1960-1984 = B_1 = 0-33

B_2 -.03

Elasticities of the period 1985-1995

B_1 =.17

B_2 =.11

The results of the estimation was logical elasticities of income and inflation and speed of adjustment that are consistent with economic theory being negative for inflation and positive for income and less than one for adjustment. But elasticities for income and inflation were small in size.

The study could be criticized on the following:
Firstly, it employed partial adjustment mechanism with its apparent defects outlined earlier. Secondly, the study has taken only two variables influencing the demand for money and neglecting such variables as exchange rate and interest rate.

The second study of Bank of Sudan was by Husssen and Sidding (Jan. 2003)[29] entitled demand for money using cointegration in Sudan. The study has employed (JJ) methodology (1990) for building and estimation the demand for money model in Sudan. It is now well known that this method (JJ) (1990) is the adequate econometric technique widely in use for treatment of demand for money in advanced and developing countries.

[29] Yahia H. and Osman S. (2003) Demand for Money in Sudan using cointraration Unpublished Department of Research Paper, Bank of Sudan

"SFS" is holding the shares foe the beneficial interest of owners with all rights to manage and wind up, if necessary the "SES", while class "A" capital gives its owners only the right to the value of their undivided interests in the 'SFS" pool of investments that is the shares if common stock of commercial banks donated by the BOS and Ministry of Finance "SFS". This value includes dividends and capital appreciation.

The role of 'SFS' can be summarized in the following:-

a/ carrying out the auctions.

b/ Acceptance of award money.

c/ Transfer of the tender amount to BOS, to successful bidders

d/ Issue of CMSs, on the authority of BOS, to successful bidders.

e/ Maintain books and records particularly, issue register

- auction wise and register of holders.

f/ Transfer of certificates on receipt of duly executed transfer from successful bidders.

g/ Periodical balancing of issue registers and register of holders.

To facilitate and prompt transfer of award to BOS and same day settlement therefore, the SFS is permitted to maintain a current account with the BOS.

The company's revenue consist of 1% commission of the total amount to "CMCs" charging on cash type of transactions i.e. sale and purchase of "CMSs", in addition to 2% Commission of the total amount of Government Musharaka certificates "CMCs" sales.

Dealings in CMCs and GMCs seem to be very profitable to investors in these certificates as the First issue, the Second issue and the Third issues have attained net profits of 34.2%, 33.3% and 32.1% respectively.

In order for BOS to be able to use CMC and GMC as an effective, market-based, monetary policy tool, a reasonably well functioning and liquid secondary market in CMSs and GMCs will need to be developed.

Hence, BOS is planning now to introduce the system of Market
- Makers to develop and inter-bank secondary market in CMCs and GMCs

The BOS is keeping on reforming its monetary instruments, firstly to improve its abilities to implement its monetary policy at minimum resources cost and secondly to develop its financial system to catch up with the developed financial markets. BOS is now carrying out studies to introduce a new monetary Islamic instrument like Ijara certificates, Securities in a Mortage Refinance Fund, Salam Sukuk, Commodity Musharaka Sukuk etc…

Due to the establishment of SFS described above the market for government securities was enlarged since 1998 by issuing CMC or government Musharaka certificates or shahama certificate. The certificates were not available for individual only but banks also, thus the market for government securities has evolved since 1998 and create influence on the demand for money which motivates the

researcher to take the profit margin on shahama certificate as a candidate variable influencing the demand for money in Sudan

5.2.2. Monetary and Banking operations 1960-2002

Firstly we trace the operations of commercial bank and their impact on the economy then secondly we trace the impact of monetary policy as a central bank main activity to direct the economy.

Operations of Sudanese commercial banks were not insignificant with respect to bank's money creation the ratio of bank's to total (M_1) was equal to 45%. The ratio of advances to real GDP and ratio of deposits to GDP were equal to (5%) and (6%) respectively in 2002.

However operations of commercial banks were suffering from a number of drawbacks: (1) Advance of Commercial were short-term I nature (2) Deposits as a reflection of savings were low (3) Concentration of banking operations in urban centers

It should be said before closing the issue of banking operations, that Bank of Sudan regulating and supervising commercial banks as the central bank of the country, has issued the decree of Reform and restructuring of banks since 2000 the objective is to promote banking operation to meet international banking standards.

The Banking System Re-structuring and reform Programme

This programme primarily aims at creating large-scale financing units capable of withstanding the challenge of the international banking competition in the contemporary era of economic globalization. The major components of that programme are the following:-

The study followed the usual course involved in cointegration. and proved the non existence of unit root among variables. The following Long-run demand for money relationship was established and estimated:

$$Rm_t = B_1 R_t + B_2 INF_t + B_3 DEPR_t + B_4 Int_t + BD + U$$

Where B_1^{+U} = elasticity of demand for money with respect to real national income

R_1 = Real National Income

B_2 = Elasticity of Demand for money with respect to inflation

INf_t = Inflation rate

B_3 = Elasticity of Demand for money with respect to Exchange rate depreciation

DEPR = Exchange rate depreciation

B4 = elasticity of demand for money with respect to Rate on Investment deposits

Int_t = Rate on Investment deposits

B = elasticity for dummies

5-7

D= Dummies

U = Error term

The estimation of the above model using cointegration proved a non zero vectors among variables thus a long run relationship among variables exists.

The best equation representing the long-run relationship has the following elasticities: B1 = 1.4 B2 = 0.28 B3 = 1.27 B4 = 1.91. Elasticity of income B1 is both positive and around unit which is consistent with economic theory. However, other elasticities are

inconsistent because they should be negative. The study puts the following justification for the positive elasticity of inflation: Inflation rate expectations lead people to accumulate more money balances in developing countries.

The study designed a short-run model and its estimation proved that elasticities are less that the long-run model. Other tests were carried e.g. stability and other statistical significant tests which proved consistent statistical results.

Although the study could be credited to be the first study using cointegration in its most advanced version JJ (1992). But the following defects should be outlined:

Firstly, the finding of positive elasticities of opportunity cost variables reflects the inherent defects in either specification of the model or in data used.

Secondly, the study employed EV (2) as software for estimation. The most capable software is P. C Fim L-9 for Windows. The use of the most advanced software may lead to better results.

In summary studies related to demand for money in Sudan were not satisfactory. Some studies used the PAM which are inferior to cointegration models. Some studies used the old generation of cointegration and error correction models i.e. E & b (1987). Some studies omitted important variables influencing the demand for money. The single study which has used the new generation of

cointegration and error correction has not achieved a successful result (positive opportunity costs variables.)

Thus, the researcher study is looking for achieving better results by using the new generation of cointegration and error correction models JJ (1992) and employing the PCFilm9-0 for Windows as the adequate software.

CHAPTER FIVE
AN OVERVIEW OF SUDAN ECONOMY

It is crucial to give a brief description of Sudan economy [30] particularly its monetary and financial aspects in order to get better understanding of the message this research. The researcher would give a broad review of all aspects of Sudan economy in section one. Section two would examine monetary and financial sectors (1962-2002) of Sudan economy.

5.1 General Review of Sudan Economy

Sudan is the largest country in Africa with different climatic zones ranging from rainy equatorial climate to desert. As, such the country is rich with arable land, livestock minerals, and vegetation and Nile resources. Relative to the large size Sudan is thinly populated. Total population is 30.3 million, according to latest census. Land per head is equal to 10.2 square kilometer.

Sudan is an agricultural country where the contribution of agricultural sector average (45.6) at (2002). However, since late nineties the government effort of exporting petroleum resources succeeded to boost the petroleum exported to reach 80% of total exports. Thus, the economy has been transformed to oil producing and exporting from being primarily dependent on agriculture.

Although oil exports outpassed all individual agricultural crop exports but agriculture remains to be the leading sector in Sudan.

[30] Data Sources are Bank of Sudan Annual Reports and Ministry of Finance Economics Surveys

The table below shows the relative importance of Agriculture to other sector of the economy.

Table 5.1

Contribution of Economic Sectors in Gross Domestic Product (GDP)

For the Period 2001-2002

	2001	2002
Sectors	% Share	% Share
Agriculture	45.5	46.2
Industry, Manufacturing and Mining	16.6	16.6
Electricity and Water	1.7	1.7
Construction	4.5	4.7
Government Services	31.7	30.9
G.D.P.	100.0	100.0

Source: Bank of Sudan Annual Report (2002)

The table shows the development of industrial sector as a result of the development of oil industry in Sudan; this claim is supported by the increase of industrial sector share from a 9% in 1990 to 16.6 to GDP in 2002.

To get a clear picture of the Sudan economy we shall outline some important characteristics of Sudan economy, along with some of its problems.

1. Characteristics of Sudan Economy:

Firstly the low per capita income in Sudan to label the Sudan as one of the less developed country characteristics of less developed countries are present in Sudan economy such as dependence on

agriculture activities as a source of income, weak industrial sector; dependence on export of raw materials; high death; and low mortality rate (age); absence or inadequate social health and education services; poor infrastructure e.g. roads and electricity and water supplies.

Secondly the Sudan economy has transformed into an oil producing and exporting economy as a result of late discovery and heavy investments in petroleum extraction and its exports. The export of oil has become the major source of foreign exchange resources. Cotton has ranked number five of major exports of the country.

A third characteristic of Sudan economy is recent liberalization policies of the economy which has taken place since the beginning of the nineties. The liberalization policies have included: measures of lifting of subsidizes, privation of public corporations; lifting of price controls; freeing of foreign exchange market, and permission of inflow foreign of private investment. Thus, the economy has been transformed to a state acceptable to liberals outside and inside the country. Due to political reasons, the Sudan was abandoned by International organization for a period starting by the eve of salvation government (1989), but now due to political change that has been conducted by the salvation government; the relationship between Sudan and International organization has been resumed. Now International co-operation between Sudan and International organizations and Individual countries is firmly established.

2. Problems facing Sudan Economy:

Some of the Sudan problems which are always headache to economic policy (1) Inflation (2) external debt (3) deterioration in value of Sudanese currency 4) unemployment (5) Rising government expenditure.

The first problem of Sudan economy is inflation, inflation has been a major threat to Sudan economy since seventies but the economic authorities have succeeded to reduce inflation rate in Sudan in the period of the late decade from (121.9) in 1991) to (4.9) in (2001). However, inflation rate has begun to threat the economy since (2002), the inflation rate has risen from (4.9). In (2001) to 8.3 in (2002). The reason behind inflation was the shift in economic policy objectives in 2001 to fight recession accompanied by unemployment. The tools used have led to expansion in money supply.

The second problem of the Sudan economy is the large size of external debt relative to the economic size of the economy. The size of external debt stands now at USA $ 21 billion. The reason behind the Sudan accumulated debt was the development effort and the expenditure of the May regime (1969 - 1985). The external debt deserves attention because it siphoned a sizeable amount of foreign exchange earnings to repay principal and accumulating interests, moreover stoppage of repayments means further accumulated interest rates thus increasing the volume of external debt. Now Sudan is in the trap of external debt unless accumulating interest rates are relieved.

A third problem of the Sudan economy is the increasing rate of unemployment.[31] The table below shows the increasing rate of unemployment in Sudan.

Table 5.2

Unemployment Rate in Sudan

Year	Unemployment (%)
1973	5
1983	13.4
1993	17
1996	16.6
1997	18.1
1998	18.2

Source: Economic survey (Up to 1998) of Ministry of Finance and National Economy)

The problem of unemployment has not received attention until (2001) where monetary policy was geared to ease credit to investments and increasing money supply. The cause of unemployment is the economic policy which was design to combat inflation adopted up to late nineties. Such policy although it succeeded to fight inflation but it reduced money supply with the consequent increasing cost of finance leading to reduction in investment and consequently unemployment. Labour market institutions (trade unions) were not responsible for creation of unemployment because trade unions pressure was ineffective to raise wage rate and therefore causing unemployment.

[31]For more detail see Mustafa Abdelsalam (2002) Economic Policy and unemployment in Sudan 1970 – 2000 Seminar DSRC University of Khartoum

A fourth problem of Sudan economy is the deterioration in the value of Sudanese currency. In 1960 the USA $ = 3.55p in 2002 IUS$ = 2700sp. So there is a temendous deadline in the value of the Sudanese currency relative to foreign currencies. However economic policy in this decade (2000) in Sudan has succeeded to provide stability in the value of Sudanese currency. The package of economic policy which have succeeded in providing stability to Sudanese currency includes (1) creating market for foreign exchange and closing the door for black market (2) reducing volume of credit leading reduction of money available for foreign currency speculation (3) inducing inflow of immigrant transfers into Sudan by freeing the market for foreign exchange leading to increase the supply of foreign exchange a factor important in stabilizing Sudanese currency.

A fifth problem of economy is the increase in government expenditure due to the civil war in the Sudan and of building of new federal government administrative system. The increase in government expenditure has its repercussion in leading to inflation by increasing more money supply.

A sixth problem of Sudan economy is poverty; however no studies are available measuring poverty. But some clues exist. Moreover the lifting of subsides and liberalization is aggravating the poverty problem.

5.2 The Monetary and Financial System in Sudan (1962 – 2002).

In this Section we will trace and investigate the important financial and monetary characteristics and developments in Sudan during the period 1962-2002. This exercise is necessitated by the relevance of monetary and financial structural developments to the stability of demand for money in Sudan (1962-2002). It is accepted in economic literature that variables influencing the demand for money are influenced by financial and monetary structure particularly interest rate where long-term interest rate is determined in financial capital market and short interest rate is determined in money market.

This section is divided in three subsections (5.2. 1) monetary and financial system 5.2.2 working of monetary policy 1960-2002 5.2.3 Actual Estimation of Demand for Money in Sudan.

5.2.1 Monetary and Financial System

Monentary and financial structure in Sudan is composed of the Bank of Sudan established (1960) as the central bank of the country, (2) commercial banks with different numbers due to political environments in Sudan, commercial banks number have reached including branches of foreign banks; (40), (3) insurance companies pension and social security institutions, (4) the non existence of financial investment companies in the monetary and financial structure.

The following characteristics of the monetary and financial system can be presented:-

1- The banking structure of Sudan is basically a colonial creation where commercial banks appeared with the eve of colonial rule (1899).

After Independence (1956) the banking system developed and a central bank was established in the place of once a foreign bank (Ebank Elahli). In (1960) a national Sudanese bank (Sudan Commercial Bank) appeared in (1962). A number of specialized banks were established: agricultural bank of Sudan (1957) Estates bank 1963 Industrial bank (1961).

The banking system shrank during (1970-1973) due to nationalization of commercial bank by the May regime (1969). However shortly after this period rationalization measures were lifted and branches of foreign banks were allowed to work.

The banking system is currently composed of government and private venture banks and branches of foreign banks along with the previously mentioned specialized banks.

2- Relative importance of the banking system to other forms of financial institutions. That is the size of non banking financial institutions e.g insurance companies is small in operations and number of institutions.

3- The adoption of Islamic practices in banking and other financial dealings. In 1989 the interest dealings was abolished in banking system. Islamic method of deposits and credit dealings were introduced.

The basic principle of Islam in economic dealings of sharing of profit and losses was to be instituted in financial and banking dealings. Therefore methods of lending such as Murbha, Mudaraba etc were introduced to take place instead of interest dealings. Deposits interest rate was substituted by profit to be given to depositors.

Other banking financial institutions have to apply the principles of Islamic economic dealings in their transactions.

Now the monetary and financial systems in Sudan could be safely called Islamized monetary and financial systems

4- The concentration of banking and financial institution in urban areas. Thus leading to the dictomy of organized and unorganized money market. Organized market exists in urban centers where financial and banking institutions are available for lending and receiving deposits. Unorganized money market exists in rural areas. If we measure size of unorganized monetary sector by the non existence of banking and financial services such as lending and receiving deposits then the size of this unorganized market is vast. However other measures such as size of currency to total money supply are incorrect in conveying the picture of unorganized money market in Sudan.

The significant impact of unorganized money market is the disproportional large demand for loanable funds associated with inelastic supply of fund. The reason of the existence of unorganized

money market is the backward stage of the development of the Sudan economy where the development is taking place in urban centres.

5- The limited size of capital market i.e. stock exchange where share holding capital could be raised. Although share companies in Sudan exist however the establishment of Sudan stock exchange was recent (1994).

The Khartoum Stock Exchange which is the capital market of the country (1994) was established to promote raising capital by issuing new shares and creating market for already existing companies' shares. Although KSE is a land mark but its performance (1994-2002) was not significant. Total number companies registered in the KSE not exceeding.The size of shares bought and sold is insignificant.

Thus the role of K5S is limited in manipulating capital. The total capital raised in the KSE relative to GDP was insignificant as measured by a real average shares transacted in KSE.

6- The narrow market for government securities up to 1998, and consequently their rate of interest did not influence the demand fore money in Sudan.

The adoption of the Islamic monetary and financial system in Sudan was one of the reasons of dismantling market for government societies.

However, in 1998 the issue of government securities was promoted by the establishment of the Sudan Financial Service Co. "SFS'. In order to facilitate the Central Bank monetary policy, which is intended to vary the liquidity in the economy, the Central Bank established a special purpose vehicle.... A private limited company owned and controlled by it. It is called Sudan Financial Service Company (SFS).

The SFS is a holding company established at arm's length from Bank of Sudan to purchase the BOS'S and government's holding of shares in commercial banks and to issue "CMSs" with total nominal value equal to the book value of these shareholdings

Its structure is therefore similar to that of close-ended mutual fund. The SFS is owned by BOS (99%) and the Government of Sudan (1%) through the Ministry of Finance.

The company is registered with the Register – General under the Company Act of 1925.

The company has class "B" capital (initial cash capital) of SD 2 million contributed by BOS and Government, and class "A" capital which is equivalent to a fixed number of Musharaka Certificates value equivalent to the first value of the banks portfolio of holding in banks, i.e. BOS and government contributed their investment holdings in commercial banks to SFS as class "A" capital.

In other words BOS and Government have transferred their holding in each bank in favour of SFS at the fair value of shares. The

(i) Banks' Merger

In that concern it is decided that banks' mergers would be optional and Bank of Sudan will offer the necessary technical assistance in deciding the determinants and indicators in that banks of similar or uniform goals or of similar corporate ownership of capital could be merged together.

(ii) Minimum Capital Requirement

The other alternative for banks to strengthen their positions in the context of the programme is to raise additional capital. The minimum capital for each bank was decided to be SD 3 billion and to be paid in full during the period of the programme (2000 -2003).

(iii) Public Sector Commercial Banks

All the mentioned arrangement for the banks mergers will be applied to the public sector commercial banks and in that respect bank of Sudan has submitted to the ministry of finance and national planning some proposals for consideration.

(iv) The Specialized Banks

All the specialized banks are government owed banks. They are namely the Agricultural Bank Real Estate Bank and the and saving Social Development Bank, Bank of Sudan and the Ministry of Finance and National Planning now are considering issuing separate comprehensive re-structuring and reform policy for those banks.

(v) Foreign Banks' Branches

Also in the context of the comprehensive banking policies of Bank of Sudan for enhancing the prudency of the banking system the foreign banks' branches in Sudan will be subjected to separate tailored restructuring arrangements.

(vi) The Non-performing loans in the Banking system

The non-performing loans from the total finance of the banking system registered a ratio 16% by the end of December 2000 compared to 24% by the end of December 1999. That decrease in the ratio of the non-performing loans is attributed to the efforts exerted by Bank if Sudan and banks measurements in intensifying the processes of loans-repayments. One of the major solutions for resolving the issue of the non-performing loans still under consideration by Bank of Sudan is the option of applying the Malaysian experience of establishing specialized corporation to administer that concern.

(vii) Measures and Incentives envisaged for Implementing The Banks' Re-structuring Programme

Bank of Sudan in collaboration with the Ministry of Finance and National Planning adopted the following incentives and measure effective implementation of the re-structuring programme:-

1- Offering of total or partial business-profit tax exemption to bank during the merger period

2- Total tax exemption for the overall activities of the corporation will be established for administering the non-performing loans of banking system

3- Offering priority for resolving the non-performing loans of banks embark early in the re-structuring programme

4- Certain measures will be set for resolving the problem of labour force that might be sacked off as a result of the execution of the progamme

5- Administrative and financial penalties will be imposed on banks that fail to adhere to the stipulations of the programme

So far Sudan Commercial banks have gone far in implementing the rehabilitating and restructuring regulations.

Performance of Monetary Policy 1960-2002

Due to the length of the period under consideration, we shall divide the period into four sub-periods.

1- The period 1960-1965

Before 1960 there was no central bank to conduct monetary policy.[32] The decision making regarding monetary policy was diffused among a number of institutions. Therefore, there was no monetary policy as such, but the monetary authorities diffused as the were, adopted restrictive credit measures when there were bad exports to prevent foreign exchange reserves from falling down and adopted expansionary policy in the reserve case.

In 1960 the Bank of Sudan was established as the designer and executor of monetary policy. That development was crucial to

[32] For more detail see Mustafa Abdelsalam (1985), Monetary Policy in Sudan 1960-84, Unpublished M.Sc. thesis University of Khartoum

eliminate the diffusion in the responsibility in the preceding period, for easy implantation of monetary policy.

During the period 1960-1965, the government began the execution of the Ten-Year Plan 1960/61 – 1969/70 that led to the depletion of foreign exchange reserves and increased government expenditure. The above disequilibrium might have caused the Bank of Sudan to undertake monetary policy measures but there was none.

Although the above period had not witnessed the adoption of monetary policy measures, the Bank of Sudan began to undertake certain measures for the exercise of monetary policy in the future. These measures were the transfer of Board's deposits from commercial banks to the Bank of Sudan, and the introduction of the discount rate as a n instrument of monetary policy. The first measure was important because it made it possible for the Bank of Sudan to affect cash reserves of commercial banks and consequently, their cordite. Moreover, these measures strengthened the tool of discount rate by forcing commercial banks to come to the bank of Sudan for borrowing.

2 The period (1965- 1970)

During this period balance of payments deficit and inflationary pressures had led the government to approach the I.M.F. for borrowing. The above problem resulted from increased government expenditure on development initiated by the Ten-Year Plan and increased government borrowing from the banking system.

The I.M.F. with its financial assistance to Sudan over the periods of three fiscal years of 1966/67, 1967/68 and 1968/69, obliged the Sudanese monetary authorities to implement three successive stabilization programmes which can be taken as monetary policy measures that were undertaken during the period under consideration. The stabilization programmed believed that the above economic problems of the Sudan were the result of excesses money stock, therefore the programmes suggested the reduction of money supply through reduction of commercial banks' credit to the private sector, and government borrowing from the banking system. Moreover, the Bank of Sudan discount rate and commercial banks lending rates ere raised by 2% to discourage borrowing from commercial banks and thus reducing the volume of advances.

However, these stabilization programmes were not successful in redressing Sudan's financial problems. The main factor might have been the violation of the ceiling imposed on government borrowing from the banking system and the consequential increase in money stock.

3. The period 1970 - 1978

At the beginning of this period, the nationalization Act was put into effect. Monetary policy measures as shaped by the spirit of the Nationalization Act were designed to encourage the productive sectors of the economy and to discourage unproductive activities. Thus the Bank of Sudan during this period required commercial banks to extend credit to productive sectors of the economy i.e. industry, agriculture and export and to abandon loans for personal use

and importation purposes. However, the above policy measures were not adhered to by commercial banks.

In 1972/73 the economic situation in the Sudan became worse i.e. balance of payments deficit and inflationary pressures such that the Sudan concluded an agreement with the I.M.F. According to the agreement gave Sudan a certain amount of loan to solve its balance of payment problems provided that Sudan should adopt a specified stabilization programme. Among the measures of the stabilization porgramme, exchange rate devaluation was the prominent. The Sudanese pound was deliberately devalued for the first time by 15% from LS1= US $ 2.87 to LS1 = US $ 2.5; in 1972. The purpose of devaluation was believed to boost exports by making them cheaper in the international markets and to reduce imports by making them dearer. The other measure of the stabilization porogramme was the ceiling of commercial banks advances to the private sector and the government borrowing from the banking system, However, the above stabilization measures were not successful particularly devaluation because balance of payments situation was worser than before, and also the inflationary pressures persisted. The deficit in the balance of payments was (USA $ 133) million in 1975.

From 1973/74 up to 1977/78 there was no resort to the I.M.F. and monetary policy measures mainly consisted of ceilings on commercial banks credit and government borrowing from the banking system. Moreover, commercial banks were asked to extend credit to the productive sectors of the economy. However, the above measures were not adhered to.

4. The period (1978 -1984)

During this period the balance of payments deficit and inflationary pressures were worse than before, so that the Sudan Government concluded with the I.M.F. an agreement for financial assistance. According to the agreement, the Sudan was given and extended fund facility but provided that, Sudan had to implement stabilization programme which has come to be known as the programme of revitalization and economic stabilization. The objective of the above progamme was to redress the balance of payments problems and inflationary pressures. The programme of revitalization and economic sytabilization contained several measures to achieve its objectives. One of the outstanding measures of the programme was the devaluation of the Sudanese pounds. Devaluation was undertaken in 1978, 1979, 1981, 1982 and 1984 with the objective discussed in the earlier section. A second measure of the programme was the removal of subsidies on basic commodities and the continuing effort to reduce government expenditure. A third measure was the abolition of Nil value Import. A forth measure was the fixation of ceiling on government borrowing from the banking system and commercial banks' advances to private sector. A fifth measures was to continue effort to boost export by encouraging them and reducing imports.

A sixth measure was the rescheduling of Sudan's foreign debt and observing the policy of setting a limit on short-term and long-term foreign borrowing. The basic contents of the above measures was the generation of an equilibrium exchange rate which brings exports and imports into balance, and reduction of the rate of expansion of money stock to reduce inflationary pressures. However, the programme of revitalization and economic stabilization did not bring any solution to

the worsening problems of balance of payments deficit and inflationary pressures. The devaluation of the Sudanese Pound had not brought any adjustment in the balance of payment, and the objective of reducing the stock of money supply had failed. The objective was to reduce the growth rate of money supply by 20% in 1982/83, but the rate of growth of money supply was 39% in 1982/83.

It is worthy to note that in 1980, Bank's Credit Consultative Committee was established. The main purpose of the committee was to control the amount of advances to the private sector. To achieve this objective commercial bank receiving applications for loans exceeding LS150 thousand should submitted to the committee for scrutiny.

Mainly due to the failure of the programme of revitalization and economic stabilization, Bank of Sudan initiated a programme credit squeeze in 1983, and 1984 to reduce the stock of money supply with the objective of redressing the balance of payments deficit and inflationary pressures.

The Programme of credit squeeze of the year 1983

The objective of this programme was to reduce the growth rate of money supply by 26% through the adoption of the following credit squeeze measures.

(1) Commercial banks should give priority to the extension of advances to the export sector and especially to marginal exports.

Furthermore, advances to exports should be charged a preferential interest rate of 17%.

(2) Commercial banks should give priority to the extension of advances for working capital of industries. Furthermore, advances for working capital should be charged a preferential interest rate of 17%.

(3) To restrict luxury imports, the Bank of Sudan increased the margin requirements for opening letters of credit of non-essential imports form 40% to 100%.

(4) Impose a 10% reserve requirement on all banks' deposits to be kept with the central bank.

(5) Instruct bank to transfer the counterpart of all customer payments of local currency against foreign settlements to a blocked account with the Bank of Sudan.

(6) Abolition of inter-bank lending and deposit keeping between banks unless approved by the Bank of Sudan.

(7) Foreign branches of banks and joint venture and Islamic banks are to assign 10% of their credit facilities to medium and long-term lending for the productive sectors of the economy.

(8) Impose a margin of 30% on advances against pledging of certain goods.

(9) The banning of credit extension for speculative purposes, i.e. land and real estates purchases, foreign currency purchases and personal loans.

(10) Bank of Sudan raised the limit imposed on loan application to the Bank of Sudan from LS100 thousand to LS150 thousand to be scrutinized by the Bank pf Sudan credit consultative committee.

Although the policy of credit squeeze achieved its objective of attaining a lower rate to growth of money supply i.e. "envisaged rate of growth was 26% in 1983/1984 whereas actual rate of growth was 17%. However the above does not indicate the success of credit squeeze because balance of payments disequilibrium and inflationary pressures were still persistent. Moreover, the fall in money supply might be due to slackening business conditions due to low level of productions achieved in the year 1982/83.

The programme of Credit Squeeze of the year 1984

The policy of Credit squeeze adopted in 1983 was carried on in the year 1984, but with specific changes to reduce the stock of money supply. To avoid repetitions new measures will be reproduced.

1) The reserve requirement on all banks' deposits was raised from 10% to 12%.
2) The margin on advances against pledging of food was raised from 30% to 40%.
3) Funds due to foreign importers should be deposited with the Bank of Sudan and only withdrawn when the amounts are demanded by importers.

4) Commercial banks were allowed o finance importation of goods in foreign currencies by any sources managed by their clients.

5) A free market for foreign exchange was introduced and Sudanese exports were transferred to it except cotton and gum Arabic and essential imports. The free market exchange rate was fixed initially at LS1 = US dollar 0.47.

Analysis of the Tools of Monetary Policy in the Sudan1960-1984

a- Open Market Operations

According to the Bank of Sudan Act (1959) amended June (1983), the Bank of Sudan has got the power to use this tool. But the Bank of Sudan was not successful in the use of this weapon due to the narrowness of the market for bill i.e government securities. For example, the total value of bills a t the end of 1983 was LS73 million. Furthermore, investors were reluctant to invest in buying and selling of bills.

b- The Bank Rate

According to the Bank of Sudan Act (1959) amended June (1983), the Bank of Sudan has got the power to used this weapon. Although the Bank of Sudan's rate pf discount was revised upwards on a number of occasion, but it was ineffective. It is generally known that the Ban rate is ineffective in the Sudan as in other developing countries. The main reason is the narrowness of the financial markets in developing countries and the existence of the unorganized financial sector. All these make the transmission of effect of the bank rate quite difficult reaching different sectors of the economy.

c- Interest Rates

The Banks of Sudan has used the instrument of interest rates as a tool of monetary policy to reduce aggregate demand during a number of periods. The statistical appendix shows the development in interest rates charged by the Bank of Sudan and commercial banks. This statistics shows the number of times interest rates had been revised upwards as a stool of monetary policy. The upward revision of interest rates on commercial banks advances was mainly directed to reduce advance of commercial bans to the private sector and consequently aggregate demand. Likewise, the upward revision of interest rates on deposits of commercial banks was designed to reduce aggregate demand by increasing savings and reducing consumption. However, there is no conclusive evidence theoretically and statistically about the effect on interest rates on aggregate demand which cast doubt on the efficiency of interest rates as a tool of monetary policy.

d- Reserve Requirements

Section (44) of the Bank of Sudan Act gives the Bank the power to use the weapon of reserve requirements as a monetary policy tool. The above section reads as follows:-

> "The Bank of Sudan may require commercial Banks to keep cash balances in the form of deposits with the Bank of Sudan provided that these balances are specific rate to liabilities of these banks".

The weapon of reserve requirement may be considered as one of the strongest potential weapons of monetary policy in Sudan at this

period due to the inapplicability of the discount rate and open market operations and their latter abolition by the introduction of Islamic banking system. Furthermore, reserve requirement acts directly on advances of commercial banks.

The tool of reserve requirement was used by the Banks of Sudan as a tool of monetary policy only recently in 1984. In 1983 commercial banks were required to keep with the Bank of Sudan a cash ratio of 10%. In 1984 the cash ratio requirement was raised to 12½%. Inspite of the effectiveness of reserve requirement as a tool of monetary policy, it was not effective in Sudan because commercial bans kept high cash ratio for instance, in 1982/83 and 1983/984 commercial banks cash ratio to deposits were 44% and 45% respectively.

e- Credit Ceilings

Credit ceilings a tool of monetary policy was derived from the power of the central bank to issue directives to commercial banks. Credit ceilings fall into two parts. Quantitative credit ceilings and selective credit ceilings in this sub-section, quantitative credit ceilings will be discussed, and in the next sub-section selective credit ceilings will be discussed too. Quantitative credit ceilings mean the numerical percentage fixation of total advances of the commercial banks with the objective of reducing the rate of growth of money.

The theory behind credit ceilings is that, liberal expansion in the advance of commercial banks may lead to incases in money stocks by the swell known process of multiple credit creation which in turn may lead to undesirable economic disturbances e.g. balance of payments

difficulties and inflationary pressures. Therefore, to set a break on the advances of commercial banks means setting a break on money supply and the avoidance of disequilibrium in the economy.

Credit ceilings on private sector stands as a major tool of monetary policy in Sudan. The Bank of Sudan has used this tool since the sixties and it still wielding it. Credit ceilings are determined by the consultation of the Sudanese monetary authorities and the I.M.F. in the framework of the stabilization programme recommended by the latter. Let us explain how credit ceilings are determined. Credit ceilings on private sector credit are determined in the following process. Due to insufficient data, econometric models are generally unavailable to facilitate the determination of credit ceilings so that the I.M.F. uses national income and flow of fund identities and statistical estimates. Financial flows are developed within a monetary survey of the banking system as how below:-

Table 5:3 Illustrative Monetary Survey

Net Foreign Assets	50
Cosmetic Credit:	200
Net Claims on Government	50
1. Net Claims of Private Sector	150
2. Liquidity Money + Quasi- money	250

The double entry accounting principles underlying the survey require that assets equal liabilities so that net feign assets plus domestic credit is equal to total liquidity of the economy. The above can be put in the following identity:-

$$NFA + DC = L$$

The I.M.F. uses the above identity to determine credit ceilings following these steps:-

(1) For the accounting identity to become useful as an economic tool, a behavioural assumption i.e. a stable demand for money, is introduced. The stability of the demand for money means that demand for money of predictable, that is, it can be determined numerically by statistical estimates. Therefore, estimate is made for the demand for money and quasi-money equations. The determination of the demand for money and quasi-money i.e. liquidity, enables us to determine the left hand aide of the equation that is net foreign assets and domestic credit.

(2) The second step is to determined domestic credit, this is obtained by subtracting net foreign assets from the right hand side of the equation. Net foreign assets arte forecasted by taking into account a number of variables i.e. exports and imports forecasts, foreign debt service capital flows.

(3) The final step in the determination of ceilings on private sector credit is to subtract claims of government on the banking system from total domestic credit. The determination of the government borrowing form the banning system is determined by taking into accounts the size of non-banking finance of budget deficit and external finance.

After determining the overall ceilings on private sector credit, it is submitted to the monetary authorities of the relevant country to be distributed to individual commercial banks. In Sudan the Bank of Sudan distributes the aggregate credit ceilings fixed to the private sector among the commercial banks. the bank of Sudan distributes the ceilings for each commercial bank using the following criteria:-

1) The outstanding balance of loans and advances extended by each bank and the banks estimates of the needs of their clients.
II) The total resources of each bank (mainly deposits and capital.

III) The degree of cooperation of the bank with the Bank of Sudan in executing its directives and instructions.

It is worthy to note that violation of credit ceilings by commercial banks make them liable to financial fines calculated at a rate of interest five per cent over the highest discount rate of the Bank of Sudan.

The Bank of Sudan had been wielding the tool of credit ceilings as a major tool of monetary policy because it is easy to operate and gives valuable results, in addition to the ineffectiveness of other tools of monetary policy.

In the following lines, the operation and effectiveness of credit ceiling will be discussed. Although credit ceilings had been used in different periods, discussion will concentrate in the period between 1978/79 to 1983/84 because it was the longest that witnessed the effective application of cordite ceilings.

However, it could be concluded that commercial banks were violating the ceilings fixed by Bank of Sudan. There were to reasons which led commercial banks to violate the ceilings. Firstly, the penalty of violation of the ceilings was put into effect only recently n 1982/83. Secondly, the penalty which was 19.5% interest rate on the excess amount of advances was less than commercial banks lending rate of 21.5%. Thus the tool of credit ceilings was rendered ineffective by commercial bans violation of the prescribed ceilings.

f- Selective Credit Ceilings

Selective credit ceilings mean the direction of commercial banks to extend credit to certain sectors of the economy, usually industry, agriculture and export sectors and the productive sectors of the economy. Therefore, the tool of selective credit ceilings has a strong effect on output and employment if it is applied. The Bank of Sudan Act gives the Bank of Sudan the power to use this weapon. Bank of Sudan has been continuously persuading commercial banks to extend credit to productive sectors of the economy but in vain. For instance, advances for crop production were still very small in 1983/84. Therefore the tool of selective credit ceilings was ineffective.

5. Monetary Policy 1985-1989

This period witnessed internal and external imbalances. There were high budget deficits, with a higher balance of payments deficit. Inflation during this period was persistent.

One of the distinguishing feature of monetary policy during this period was the abandonment of IMF stability programmes. The

reason was the democratic national government (1985-1989) political sentiments against foreign dominance associated with IMF package porgramme.

A national monetary policy was designed under the framework of a comprehensive economic program 1986-1989.

The tools wielded to fight inflation and external and internal imbalances as monetary policy objectives were:-

(1) The increase in reserve requirement from 12.5% to 18% in 1988.
(2) Credit ceilings on commercial banks advances to private sector.
(3) Extension of 80% of total credit of commercial banks to priority sectors i.e. industrial, agricultural and export sectors.

However the outcome of monetary policy during this period was a failure inflation was increasing and external and internal imbalances continues aggravated by continuous decline of the value of Sudanese currency against foreign currencies.

(6) Monetary Policy during the period 1989-1999

At the beginning of this period the economic situation was similar to that of the previous period. A distinguishing feature of monetary policy during this period was the continuation of the abandonment of the IMF stabilization prgrammes ad the design of national economic policies. Two reasons may be given (1) The National sentiment of the salvation government taking over the country 1989. (2) The stoppage of repayment of loans to the IMF freeze the relationship between the Sudan and the IMF.

A second distinguishing feature of monetary policy during this period was the working of monetary policy in a climate of Islamic economic practices particularly in the banking financial sector. Interest rate dealings were abandoned and the issue of monetary asserts bearings interest rate ere abandoned. Thus in theory two tools pool of monetary policy were rendered obsolete i.e. Bank rate and open market operations.

A third characteristic of monetary policy during this period was the adoption of liberalization policies and the privation of public sector.

A fourth characteristic was the stoppage of deficit financing to the government. The objectives of monetary policy during 1999 were:-

(1) Reduce inflation rate
(2) Deepening of banking and financial Islamic practices
(3) Restructuring of the banking system
(4) Equitable income destruction

(5) Increasing the contributions of self resources in the process of development.

Tools of monetary policy wielded during this period were:-
(1) The continued increase in reserve requirement up to 28% in 1999
(2) Minimum ratio of credit to be extended to priority sectors was set to 95% in 1989-1999
(3) The minimum murabaha margin was set high during this period ranging between 20% to 30% and its size should not exceed 30%

(4) Under musaraka finance there should be a relative high share of clients to banks share.

Monetary policy during this period 1989-1999 was successful. Inflation rate was reduced form a sky level i.e 125% in 1992 to 17% in 1999

Monetary policy was successful because (1) Tools monetary policy tools were carried effectively to reduce inflation rate i.e. reserve requirement and the directives set to commercial banks on domestic credit to private sector. (2) Government borrowing from central bank was stopped during this period a factor which always aborted monetary policy in Sudan.

Analysis of tools during 1989-1999

The success of monetary policy during this period required the analysis of tools used. Monetary authorities were unable to wield open market operations and Bank rate as tools of monetary policy during 1989-1999 due to narrow market for securities as far the first tool is concerned and the adoption of Islamic banking practices prevented adoption of the latter tool.

The tools which had been wielded effectively to reduce money supply were the reserve requirement and the directives. Evidence of success of monetary policy could be found in the decline rate of inflation and the parallel decline in the rate of commercial banks credit to private sector.

6. Monetary Policy during 2000 -2002

Beginning from year 2000 the monetary authorities largely satisfied with the decline of the fall of the rate of inflation had commended a monetary policy with different objectives. Increasing production and productivity, stabilizing the exchange rate.

The pursuits of different objectives were emphasized in 2001 party due to the decline in rate of GDP and the rise in the rate of unemployment.

Tools used during this period were:-

1) The reserve requirement was reduced to 12% of total deposits in 1999. It was 25%.

2) Reducing Murabha margin to a minimum of 12%.

3) Abolition of directives regarding finance of priority sectors leaving to banks the choice to finance whatever sector they choose. However finance should be geared to achieve economic development.

It is early to judge the monetary policy of 2000- 2002. But the increase of inflation rate in January 2002 to 8% is not a good sign of this new monetary policy.

5.2.3 Estimation Methods of money demand in Sudan 1960-2002

Estimation of money demand as macro variable on which light total money supply is determined was carried by ministry of finance and Bank of Sudan.

Two methods were used to estimate money demand in Sudan. The first method was used during 1960-1996. The second method was used during 1996 up to now.

The first method

This method depends on the classical theory of demand for money where the velocity of circulation is assumed to be fixed. Fixity of velocity amounts to the same thing as fixity of demand for money. This money demand was estimates as:

$$M_d = \frac{PY}{V}$$

Where M_d = money demand

P = Price level

Y = Real income

V = Velocity

Thus gross in money demand were estimated as dependant on growth on nominal income in Sudan.

The second method 1996

Although this method has relied on the classical monetary theory as a frame work, but in this method account was given to change in velocity. Thus in this method rate of growth in money demand is estimated according to this formula:-

$$\Delta M_d = \Delta P + \Delta Y - \Delta V$$

Where ΔM_d = Change in money demand

ΔP = Change in inflation rate

ΔY = Change in level of income

ΔV = change in velocity

Apparently these methods are traditional in relation to advanced methods used now which employ advanced econometric techniques which are leading to accurate results by distinguishing factors responsible for changing money demand and the degree of influence of these factor elasticities.

CHAPTER SIX

Cointegration Model of Demand for Money in Sudan

The researcher employs the advanced econometric technique of cointegration developed by J, and J (1988) (1992), to find out stable demand for money in Sudan. The merits of this technique have been emphasized in Chapter (3)

This chapter contains the following sections:

6.1 Selection of Variables Demand for money in Sudan.

6.2 Frame work of models

6.3 Data Issues.

6.1 Selection of variables:

Economic Literature of demand for money suggests grouping variables influencing demand for money under two heads:

(1) Scale variables e.g. G.D.P. (2) Opportunity cost variables e.g. interest rate or inflation rate or exchange rate. The researcher takes real G.D.P. as scale variable. Lending rate or (interest rate); inflation rate; and exchange rate as opportunity cost variables.

The researcher has excluded own rate of return on money as a variable influencing demand for money in Sudan, because banks in Sudan do not give return on current deposits. Interest rate on Sudanese foreign deposits has been excluded because Sudanese deposits abroad seem to be insignificant as foreign deposits are kept locally.

There is a dispute among monetary economists over whether to take narrow money (M_1) i.e. currency plus demand deposits or broad money (M_2) (34) i.e. currency plus demand deposits plus savings and investment deposits plus local counter part of foreign deposits, as a measure of demand for money.

The researcher does not take either side of dispute. However M_1 is taken for the period 1961/62 – 1993/94 on the ground that the banking and financial system was rudimentary or immature during this period resulting in low levels of savings and investments deposits. M_2 is taken for the second period due to the relative development of savings and investments deposits and foreign deposits which is reflected in the increase of the size M_2.

Moreover taking M_1 or M_2 might resolve the dispute over selection of either M_1 or M_2 and enable empirically testing the right selection of either M_1 or M_2.

6.2 Framework of Models

There are three principal reasons which may justify using two models for Sudan. The first one captures the period 1961/62 – 1993/94. The second one captures the period 1995-2002. The first reason is that there is statistical structural break in 1994 /95, this break indicated by the sharp increase in monetary values of money demand variables of money in Sudan. The second reason is the importance of M_1 (Narrow money) in the first period and the arising importance of M_2 in the second period.

The third reason is the change in method of official data presentation from fiscal year presentation to calendar year presentation in 1995. Due to short period of the second mode (8 years), the researcher has taken Quarterly observation to increase their size to facilitate statistical and econometric analysis.

6.2.1 The framework of the long-run model of the first model 1961/62-1993/94.

The usual form of Long-run model for the period 1961/62 – 1993/94 is the log linear form and can be poisted as follows:-

$$\text{Log}\,(M_1 - P) = a_o + a_1\ \text{Log}\,(\text{GDP real}) + a_2\ \text{Log}\,(E) + a_3\ \text{Inf} + a_4 R$$

Where:

$(M_1 - P)$ = Demand for real balances

Where M_1 = narrow money and P = price index to adjust M_1 into real M_1 as a measure of demand for real balances

a_o = Constant

a_1 = Elasticity of demand for money with respect to real GDP

GDP real = Gross Domestic Product in real term as adjusted by SCPI (Sudanese Consumer Price Index).

a_2 = Elasticity of demand for money with respect to exchange rate (E)

E = Exchange rate of Sudanese currency (Pound, Dinnar).

a_3 = Elasticity of demand for money with respect to Inflation (Inf.)

a_4 = Elasticity of demand for money with respect to Lending rate (Interest Rate) (R)

R = Lending Rate or Interest Rate.

Elasticities are longrun ones

6.2.2. Framework of the short-run model of the First model is as follows:

$$\Delta (M_1 - P)_t = a_o + \Delta a_1 GDP_t \text{ real} + a_2 \Delta GDP_{t-1} \text{ real} + a_3 \Delta E_t + a_4 \Delta E_{t-1} + a_5 \text{ Inf} + a_6 \Delta \text{Inf}_{t-1} + a_7 \Delta R_t + a_8 \Delta R_{t-1} + a_9 Ec + a_{10} \Delta (M_1 - P)_{t-1}$$

Where a change in real money balances in the current period is a function of current and one year lagged change in G.D.P. real; Exchange rate; Inflation rate; and lending rate (Interest rate.); one year Lag of real balances are Lagged change in Error correction (one year) lag

6.2.3 Framework of the long-run model of the second model:

Bearing in mind notations of variables are the same with difference in taking M_2 (Broad money) rather than (M_1) narrow money in this second model and that the time period of this model from 1995 to 2002 Quarterly observations. Thus the long-run model of the second model (1995-2002) can be put as follows:-

$$\text{Log } (M_2 - P)_t = b_o + b_1 \text{ Log GDP real} + b_2 \text{ Log E} + b_3 \text{ log Inf} + b_4 \text{ log R}$$

b_1, b_2,b_3,b_4 are long-run elasticties of the second model.

6.2.4 Framework of the short-run model of the second model 1995 – 2002)

$$\Delta (M_2 - P)_t = b_o + b_1 \Delta GDP_t + b_2 \Delta GDP_{t-1} b_3 \Delta E_t + \Delta b_4 E_{t-1} + b_5 Inf_t + b_6 Inf_{t-1} + b_7 R_t + b_8 R_{t-1} + b_9 Ec + b_{10} \Delta (M_2 - P)_{t-1}$$

Where a change in real money balances in the current period is a function of current and one year of lagged changes in GDP real, Exchange rate, Inflation rate, Lending rate or Interest rate, one year lagged change in real balances and the Error correction term (EC).

6.3 3. Data Issues

Data Sources are different issues of Bank of Sudan Annual Reports; Ministry of Finance Economic Surveys; International monetary Fund, International Financial statistics and unpublished data of department of statistics.

Difference in data from various sources was resolved by taking the most reliable source. Lack of data by the source was resolved by taking available data by other sources. For example Department of Statistics has begun compiling data of consumer price index (CPI) in 1970. Therefore the researcher has relied on (IFS) of the IMF for (CPI) statistics for the period before (1970).

The thesis covers the period (1962 -2002) and consequently data are from this period. The year 1962 has been taken as the beginning period because it was a near date of Bank of Sudan inception and consequently the beginning of organized monetary variables publication e.g. the first Bank of Sudan Report appeared in 1961.

Data for the period 1962-2002 was divided into two periods: (1962 - 1994 and 1995 -2002. There are two reasons for this division. Firstly the development of the financial market such as the establishment of Khartoum stock Exchange in 1994 has necessitated taking broad money (M_2) rather then M_1 as a measure of demand for money. Secondly Sudan official data presentation has changed form fiscal year to calendar year in 1995. Therefore data consistency requires the division of data into two periods i.e. 1961/62 – 1993/94 and 1995-2002.

The thesis applies yearly data for the period 1961/62 -1993/94 because the period was long and that enabled the researcher to get an appropriate observations (33) that are consistent with statistical and econometric analysis. For the second period the researcher has taken quarterly data for the period 1995 -2002 in order to get sufficient observations (32) consistent with statistical and econometric analysis.

Data for relevant variables have not created problems except interest rate variable. This was due to the adoption of Islamic economic practice including banking and financial practices which abolished interest dealings in 1983 – 1985 and 1989 till the date of this thesis.

The researcher has resolved the problem of interest rate by taking[33] nominal interest rate and compensationary return for the period 1962/62 – 1988/89. Where during this period interest rate was not removed and compensationary return was a surrogate to interest rate which was adopted by the democratic Government of Elsadig Elmahdi during 1985-1989.

The year 1983/84 witnessed the adoption of Islamic practices and consequently interest rate was abolished, however due to shortness of period this year was treated as the years of the period 1961/62 – 1988/89.

During the period of adoption of Islamic practices and consequently the abolition of interest rate the researcher has taken the nominal Murabha Lending rate as a measure of interest rate during; the period 1988/89 – 1998. For the period 1998-2002, Shama certificate return (Government Security) has been taken as a measure of interest rate on a alternative earning, assets. This is justified by the sizeable volume of shama certificate as an alternative way of holding money bearing income.

All data series are seasonally unadjusted because it is held that seasonal adjustments weaken the power of unit roots and cointegration tests. Dummy variables were not used because of absence of structural breaks in data. Data for the variables for the two models are shown in tables 17 and 18 in the statistical appendix.

[33] Abdalla Mustafa Zakaria (1994), theoretical principles for Determining optimum stock of money Elmugtasid Journal ISSUED Tadamon Islamic Bank issue No. 7 in Arabic

CHAPTER SEVEN

Estimation and Discussion of Results of Cointegration Model

7.1 – Unit Roots Tests Results

Unit root tests for the variables of two models i.e. first (1961/62 – 1993/94) and second model (1995 – 2002), have been applied using augmented Dickey Fuller Test. The results of the tests for the two models are shown in table (3) and (9) (statistical appendix) respectively.

Table (3) Shows that all the five variables of the first model (1991/92 – 1993/94) are stationary time series (do not have unit roots) at 1% significance level when are measured in their first difference especially under the assumption of no constant and no trend.

Table (9) Shows that all five variables of the second model (1995 – 2002) are stationary (do not have unit root at 1% significance level) when are measured in their first difference under the assumption of constants and no trend.

Thus unit root tests have reached the desirable results and enabling carrying the appropriate cointegration test because all variables are of the same order of integration (0) i.e. absence of unit roots.

7.2 Estimation Results of the First Model

7.2.1 .Cointegration Test of the first Long-run Model 1961-62 - 1993/94.

It has been found that the order of interaction of variables of demand for money for Sudan is 1 (0). Once this condition is satisfied; a

cointegration test on the basis of first model framework in section (2) of this Chapter could be carried.

The cointegration test to find out the Long-rung demand for money for Sudan, is based on method developed by Johansen (1988) and Johansen and Juelius (1990), using maximum likelihood Estimation. The researcher has employed (EV) software test results are presented in table (4) and (5). (statist$_1$ical appendix) Table (4) (cointegration analysis of Sudan's Demand for money for the period 1961/62 – 1993/94) shows that cointegration test had found three cointegration equations at 5% significance level.

Table (5) shows the normalized equation for the period 1961/62 – 1993/4 where variables are in logs except inflation and interest rates. The normalized equation is the best equation representing the Long-run demand for money in Sudan during the first model period of 1962/2 – 1993/4 among the three cointegration equation. The Long – run demand for money of the First model 1961-62 – 1993/94 deduced from the normalized cointegration equation, can be written as follows:-

Log (M –P) = -1.425 + 1.031 Log G.D.P + 0.321 Log Exchange Rate - .00082 Inflation – 5.592 Interest; Rate.

Where : (a_o) constant = -1.425

(a_1) Long-run elasticity of demand for money with respect to real G.D.P. = (+ 1.031)

(a_2) Long-run elasticity of demand for money with respect to Exchange = (+ 0.321).

(a3) Long-run elasticity of demand for money with respect to Inflation Rate = (- .00082)

(a4) Long-run elasticity of demand fort money with respect to Interest Rate = (-5.592)

The estimation results of Long-run elasticities of demand for money for Sudan are compatible with economic theory behind demand for money. Elasticity of demand for money with respect to income is quite satisfactory being positive and approximately equal to (one). Elasticity of demand for money with respect to interest rate is compatible with economic theory being negative but rather higher than other elastiicities of opportunity cost variables.

The higher interest elasticity is not peculiar for Sudan relative to other developing countries. In Sriran (2001) Survey of current empirical money demand studies, interest elasticity for Indonesia (1994) has been found (-8.4) and for Cameroon (-8.9) which are higher than those for Sudan.

The reason behind higher interest rate elasticity in Sudan and other developing countries could be explained by economic theory which puts higher weight to interest rate as an opportunity cost variable relative to other opportunity cost variables such as inflation etc. Moreover the researcher believes that people in developing countries adjust their money demand relative to interest rate as a return on money rather than other opportunity cost variables such as inflation and exchange rate which their change do not bring income to holders but depreciation or appreciation in their money holdings.

The positive Long-run elasticity of exchange rate is due to fixity of exchange rate in Sudan during the period 1961/62 – 1976/77 and during the year 1979/80 and the years 1987/88 and 1988/89 and 1989/90 (see table). This fixity of Exchange rate has led to positive elasticity instead of being negative. Hence positive elasticity is justified and exchange rate influence on demand for money in Sudan could be excluded during the period 1961/62 -1993/94.

The weak Long-run elasticity of inflation rate during the period 1961/62 – 1993/94 was due to powerful impact of interest rate which was taking the impact of inflation.

7.2.2. Short-run Estimation Results of the First Model

The short-run model elasticities or coefficients measure the speed of adjustments which are taking place, when short-run deviation of variables are allowed to take place. A one year Lag was applied.

The results of the short run of the First Model are shown in Table (6). The results of the short-run model are summarized in the following equation: -

$$\Delta (M - P)_t = .048 + .32\ GDP_{t-1} - .06\ (\text{Exchange rate}) - 1.9\ R_{t-1} - .35\ (M - P)_{t-1} - .48\ EC_{t-1}$$

The equation shows that short-run elasticity of demand for money with respect to G.D.P. is equal + .32; short-run elasticity of demand for money with respect to exchange rate is equal to = (-.06); short run elasticity of demand for money with respect to interest rate is equal to (-1.91); short-run elasticity for demand for money with respect to

inflation is very small in short-run . Elastcity of demand with respect to previous balances holding, is equal to (-.35) and short-run elasticity of the error tern (EC) which measures speed for adjustment is equal to (-.48).

The results of the short-run model of the First model are consistent with economic theory. Elasticities in the short-run are less than elasticities in the Long-run applying one year Lag. For Comparison see table 4, 5, 6 (statistical appendix).

The negative and significant size of elasticity of error correction term (EC) (-.48) supports cointegration results and consistent with economic theory.

7.2.3 Statistical Adequacy of the First Model

Basically the first model does not suffer from statistical problems. Absence of serial correlation or unit roots are tested by employing Augmented Dicky Fuller tests. See table (2) Statistical Appendix. Stability test is shown in Fig. (1) (Statistical appendix) where reclusive coefficient estimation of the error correction term has been carried. The recursive coefficients have taken its normal shape indicating stable coefficient of demand for money throughput the period 1961/2 – 1993/4.

Other supporting statistical tests are shown in table (13) of the statistical appendix.

7.3 Estimation Results of the second model 1995

7.3.1 Cointegration Results of the second model 1995 – 2002

Unit Root test has found the order of integration of variables of the seconds model is 0f order (0), therefore it is appropriate to carry cointegration test using JJ Methodology which was applied for the first model. Results of cointegration test are shown in table (10) and (11) (statistical appendix) for the second model.Table (10) cointegration analysis of Sudan's demand for money for the period 1995 – 2002 shows that cointegration test has found two contegrating equations at 5% significance level.

Table (11) show the normalized cointegration equation where variables in logs except inflation and interest rate. This normalized equation is the best among the two cointegration equations representing Long-run demand for money for the period 1995 – 2002

The cointegration equation is shown at the bottom of table (11) statistical appendix and can be written as follows: -

$$\text{Log } (M - P)_t = 151 - 87 + .835 \text{ GDP} - 19{,}31 \text{ Exch.} - 0.07 \text{ Infl} - .025R$$

Where:

a = Constant = 151.87

a_1 = Long-run eslaticity of demand for money with respect to GDP = +.835

a_2 = Long-run elasticity of demand for money with respect to Exchange Rate = -19.31.

a_3 = Long-rum elasticity of demand for money with respect to Inflation rate = (-.07).

a_4 = Long=run elasticity of demand for money with respect to Interest rate = .02

Elascitities bear the correct signs positive for income and negative for all others.

The size of income elasticity is nearly one however; elasticity of Exchange rate is significantly higher than other opportunity cost variables elsticities i.e. Interest rate and Inflation rate which are (.02) and (.07) respectively.

The high Exchange rate elasticity of the second model is peculiar, because studies on demand for money particularly emphasizing exchange rate variable, have not reached such higher exchange rate elasticity. For example Sriram (2001). A survey of current studies of demand for money has registered the highest exchange rate elasticity as (-8.1) Moreover study of Bohami and Malixi (1991) entitled "Exchange rate sensitivity of the demand for money in developing countries, has registered a highest Exchange rate elasticity for Brazil and Portugal as (-2.4)

The reason behind high Exchange Rate elasticity of the long-rum second model period was instability in the foreign exchange market in Sudan during the first half of the second model specifically 1995 - 1998. Instability was due to freeing the feign exchange market where the value of Sudanese currency witnessed a continuous depreciation.

Although long-run elasticities of Inflation and Interest rate carry the expected signs, but their size are small. This could be attributed to the

strong elasticity of exchange rate which was taking the impact of other opportunity cost variables.

7.3.2 Short-run model of the Second Model 1995 -2002

The results of the short-run model of the second model are shown in table (12). (Statistical appendix)The results of the short-run model are less significant and misleading than the short run model the first period. This is explained by the shorter period of the second model.

Short run elasticites generally are less than the longrun elasticities see table (10, 11, and 12) in Statistical appendix. Elasticity of the Error term is negative and significant (-.98) which confirms cointegration results.

7.3.3 Statistical Adequacy of the Model

Again as for the first models the second model basically does not suffer from statistical problems. Absence of serial correlation is detected by employing Dickey Fuller test see table (9 and 10) statistical appendix, where units roots were removed. Stability is found by employing Recursive Coefficient estimates of Error Correction Model. The recursive coefficients estimates have taken its normal shape, indicating stable coefficients of demand for money during the period of the second model 1995/2002, see Fig. (2) Statistical appendix. Other supporting statistical tests IV are shown in table (14) of the statistical appendix.

7.4 Discussion of Results

The first model with its short-run and long-rung version is performing better than the second one. This is indicated by firstly the

nearer long-run elasticity of income of the first model to one being (1.03) than the second model elasticity of income being (.83). Secondly long-run exchange rate elasticity of the second model is peculiarly high. Thirdly short run results of the first model are more consistent than the results of the second model.

The reasons behind the superiority of the first model are: (1) Firstly the period has been covered by the first model is longer than the period which has been covered by the second model. i.e. 1961/62 - 1993/4 and 1995 -2002. Apparently the longer period has led to better results statistically. Secondly, the first model period has witnessed relative stability of variables influencing demand for money in Sudan i.e. GPD, interest rate; inflation rate; and Exchange rate, relative to the second model variables, specifically exchange rate instability.

In spite of the superiority of the first model relative to the second one, but the second model has the merit of conveying the impact of instability of foreign exchange market in Sudan on demand for money.

We can conclude that the two models are complementary in the sense that they reflect demand for money in Sudan during the period of the two models i.e. 1961/62 -1993/94 and 1995 -2002. This conclusion is based on the fact that variables influencing demand for money in any country are changing through time. Therefore the successful models are the ones that capture changes in variables impact on demand for money through time. The researcher models have done

the above process if they are taken together to represent demand for money in Sudan.

It should not go without mentioning that the research results are consisted with economic theory. That is to say scale variable elasticity is positive and nearly equal to one.

Opportunity cost variable elastiticities are negative with the exceptions of high Exchange rate elasticity. But this is justified by the economic condition in Sudan during 1995-1998 i.e. Instability in foreign Exchange markets. If economic conditions in Sudan are stable throughout the research study period, results of elasticity of exchange rate would be normal taking a negative reasonable size.

7.5 Coincidence of stability of Velocity of Circulation with Stability of demand for Money in Sudan 1961/62 - 2002

Income velocity of circulation is the reciprocal of demand for money. Thus stability of velocity is indication of stability of demand for money. Table (15) (statistical appendix) shows a statistics for velocity of circulation in Sudan from 1961/62 – 2002.[34] The average velocity of circulation during the period was 7.5. Most of the period particularly upto 1991/92 velocity is below this figure and could be stable. However during the period 1992-2002 velocity had risen and had become instable.

Results analysis of velocity in Sudan is compatible with Results of cointegration analysis of demand for money in Sudan. During the

[34] Income Velocity is calculated by dividing Nominal Income over M_1

period 1961/62 -1993/4 cointegration analysis has found stable demand for money see chapter (5) and during this period velocity was stable. During period 1995 – 2002 Cointegration analysis has resulted in a relatively less stable function for demand for money. Similarly velocity analysis resulted in instable velocity during 1992-2002.

Therefore, it couid be concluded that the results of cointegration and velocity analysis of the thesis are not contradictory and support the claim of stable demand for money in Sudan.

It should be noted that analysis of velocity could not be taken to measure a stable demand for money. Because variable influencing the demand for money are not the same as the factors influencing demand for money. Velocity is influenced by nominal income and price level whereas demand for money is influenced by several factors i.e. income, inflation, interest rate, and exchange rate.

In Researcher analysis of velocity estimating partial correlation between velocity and Inflation, the researcher has found a positive relationship between inflation and velocity during the period 1962-2002 see table (16) (statistical appendix) elasticity of velocity to inflation was equal to (. 45) which is relatively significant. However other elasticities results were positive for income and negative for interest rate and exchange rate. Those elasticities were bearing incorrect signs. Correct signs of elasticities or coefficients should be as follows negative for income and positive for other opportunity cost variables.

Elasticity of Inflation is the only meaningful result being positive and relatively high.

Where inflation has a significant impact on velocity during the period In concluding our analysis of velocity, we should give the suggestion that analysis of velocity deserves a separate research agenda and we shall elaborate this recommendation in Chapter (8).

Summary of Findings and Recommendations

Summary of Findings

The researcher has put the following objectives of the thesis: (1) finding stable demand for money in Sudan and (2) which variables influence the demand for money in Sudan and their relative impotence (3) finding correct elasticities of variables influencing the demand for money I.e. elasticity of income to be positive and around one, elasticity of opportunity cost variables to have negative elasticities and of reasonable size relative to empirical studies carried and economic conditions of country under study.

On the above frame work the researcher summarizes his findings:

1- A stable demand for money has been found for Sudan as indicated by the first model of 1961/62 -1993/94. Stability tests confirm this finding. The second model shows less stable function of demand for money; this is justified by the instability in foreign exchange market during the second period for the second model 1995 – 2002. If the foreign exchange market had been stable during this period, the demand for money would have been stable like the first model.

2- The study used the most advanced technique of cointegration to find a stable demand for money in Sudan. Simple analysis of velocity reinforced the researcher finding of stable demand for money in Sudan.

During the period of the first model velocity is relatively stable compared to the period of the second model. The reason for instability of velocity is same as the reason for instability of demand for money during the period 1995-2002 i.e. instability in foreign exchange market in Sudan during 1995-2002.

Another reason for finding a relative instability in demand for money during the second period is the short period taken 1995-2002 relative to the first period 1961/62 – 1993/94. Thus it could be concluded that the first model is representing the demand for money in Sudan (see chapter 5). However interest rate elasticity was high but this was due to economic condition prevailing in Sudan giving importance to interest rate as opportunity cost variable during the period 1961/62-1993.

2. A second major finding of the thesis is that the major factors influencing demand for money in Sudan are income, interest rate inflation, and exchange rate. Interest rate is the most important opportunity cost variable in influencing demand for money in Sudan. This is confirmed by a glance to elasticities or coefficients of the first model table 5 statistical appendix where elasticities of interest rate was higher than those of inflation and exchange rate, noting that we excluded the second model for comparison because of the special case of instability of foreign exchange market has prevented it to represent the demand for money in Sudan.

3. A third major finding of the research is the finding of elasticities of demand for money to be compatible with economic theory. The researcher has found elasticity of demand for money with respect to

income equal to 1.03 where its approximately equal one and bear positive sign. Other opportunity cost variables elasticities are negative and of reasonable size.

Therefore the first model may be taken as representing the demand for money in Sudan. A number of reasons could be put to substantiate the above point of view.

Firstly because interest is the most important opportunity cost variable in Sudan during the first period and foreign exchange rate holdings against cash holdings was not determined by the exchange during the first period.

Secondly instability of foreign exchange market and the continuous depreciation of Sudanese pound had led people to reduce their money holdings and increase foreign exchange holding and this is reflected in the high elasticity of demand for money with respect to exchange rate (-19). However this is special case and does not justify assigning a significant influence of exchange rate over interest rate on demand for money in Sudan.

Thirdly the higher elasticity of interest rate in the first model relative to elasticity of inflation rate is in line with economic theory which emphasizes the importance of interest rate over inflation on their relative impact on demand for money.

Further more the researcher believes that people in developing countries are not like people in developed ones in their expectation and taking inflation as a determinant of their money holdings against

other monetary and physical assets. People in developing countries give more weight to return on money rather than to its value in the future. This fact is reinforced by the absence of a good orderly statistics of inflation in Sudan as a developing country.

Recommendations

The researcher recommendations fall into two parts. The first part of the recommendation is for scholars in economics and the other part for policy makers shaping monetary policy.

Theoretical recommendations:

a- The researcher recommends studies of demand for money deserve the consideration of scholars in their research agenda, because it helps monetary authorities to determine money stock.

b- Scholarly research of demand for money should use the most advanced techniques to reach exact results.

c- Assuming the demand for money does not depend of on country's economic circumstances, the researcher recommend that demand for money to be taken a stable with demand for money elascticty with respect to income around one and interest elasticity (- .5). Thus this researcher recommendation has come from his believe of the correctness of economic theory projection.

d- The researcher recommends further research on stability of velocity because it supports the existences of stable demand for money. The research should take a longer period like the study of

monetary history of U.S.A. carried by (Mitton Friedam and Anna Shwartiz).

e- Finally the researcher recommends that research on demand for money in any country should take into inconsideration economic condition prevailing this helps in taking the appropriate variables. and correct interpretation of results. For example the researcher does not take rate of return on idle money as a variable influencing demand for demand in Sudan as in Sudan. because commercial banks in Sudan do not give return on demand deposits for the former.

2.2 Policy Recommendation

Those recommendation are for monetary authorities i.e. the central bank authorities who design monetary policy i.e. determination of the optimum money stock and other monetary targets e.g. cost of finance and size of loans.

The recommendations are as follows:-

1- Monetary authorities should carry advanced studies on monetary issues such as demand for money because it helps determining the optimum size of money that lead to stability of the economy i.e. absence of inflation and unemployment

2. Monetary authorities of developing countries should make use of advanced methods of estimation of demand for money and must seize determining money stock by simple version of quantity theory. Advanced methods using econometric models lead to a accurate results. For example our great country Sudan may make use of estimation of money demand of this thesis where elasticity of demand

for money is around one and where elasticity of demand for money with respect to interest rate is relatively high (-5-0).

3. Monetary authorities should give adequate weight to factors influencing demand for money especially when those variables are instable. In Sudan attention should be given to the level of interest rate, exchange rate and inflation rate as factors which their change may lead to instability in demand for money.

The above fact is indicated by the instability of exchange rate of Sudanese pound which had led to instable demand for money in Sudan during 1995 -2002.

4. Determination of money stock by monetary authorities should be determined through cointegration techniques. That is to say projection of money stock should be through demand for money equation in the long run period has been estimated through cointegration techniques.

For example in Sudan the demand for money long-run equation is as follows: - (Over looking elasticity of Inflation and exchange rate due to their small size).

Log M = 1.03 Log Y – 5.0R -

Monetary authorities projection of appropriate money stock is just a mere substitution of expected values of Y = income, R = Cost of finance in the above equation to get the optimum money stock.

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Statistical Appendix

Main statistics of the Series for the Period 1961-1993

Variables	Mean	St. Dev.	Max	Min	Skewness	Kurtosis
Real Demand for Money	173.20	346.97	1642.2	6.8	3.19	12.76
Real GDP	1287.47	3171.20	16218	46.1	3.82	17.23
Inflation Rate	32.54	36.00	122.52	0	1.43	3.95
Nominal Interest Rate	0.11	0.090	0.33	0.02	1.11	3.07
Exchange Rate	19.89	60.28	310	0.34	3.89	18.06

Table 2.

Unit Root Test: Augmented Dickey-Fuller (ADF) Test for Levels, 1961-1993

Variable	No Constant & Trend		Constant		Constant & Trend	
	t-Test Statistics	Lag Length	t-Test Statistics	Lag Length	t-Test Statistics	Lag Length
Real Demand for Money	1.394	7	2.475	8	3.056	5
Real GDP	0.676	7	2.604	7	2.503	7
Inflation Rate	0.881	0	-0.023	0	-1.898	0
Nominal Interest Rate	1.534	0	0.122	0	-1.854	0
Exchange Rate	-0.352	6	1.892	6	-0.914	5

Note: All the five variables are non-stationary time series (have a Unit Root) even at 10% significance level when are measured in their levels.

Table 3.

Unit Root Test: Augmented Dickey-Fuller Test for the First Differences, 1961-1993

Variable	No Constant & Trend		Constant		Constant & Trend	
	t-Test Statistics	Lag Length	t-Test Statistics	Lag Length	t-Test Statistics	Lag Length
Real Demand for Money	2.763***	6	2.678*	9	2.383	9
Real GDP	3.141***	6	2.937**	6	2.617	10
Inflation Rate	-6.375***	0	-6.728***	0	-7.021***	0
Nominal Interest Rate	-5.172***	0	-5.701***	0	-5.791***	0
Exchange Rate	2.748***	0	7.117***	1	5.780***	1

Note: Variables are measured in their first differences. Three, two, and one asterisks denote statistical significance at 1%, 5% and 10% levels respectively. All the five variables are stationary time series (do not have a Unit Root) at 1% significance level when are measured in their first differences especially under the assumption of no constant and no trend.

Table 4.

Cointegration Analysis of Sudan's Demand for Money for the Period 1961-1993

Null Hypothesis	Eigen-value	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
r = 0	0.721372	102.9732	68.52	76.07	None **
r ? 1	0.654773	67.19262	47.21	54.46	At most 1 **
r ? 2	0.624622	37.41311	29.68	35.65	At most 2 **
r ? 3	0.213839	9.978079	15.41	20.04	At most 3
r ? 4	0.109317	3.241473	3.76	6.65	At most 4

**(**) Denotes rejection of the hypothesis at 5%(1%) significance level.*
L.R. test indicates 3 cointegrating equation(s) at 5% significance level

Table 5.

Normalized Cointegrating Coefficients for 1961-1993

LOGM	LOGGDP	LOGE	INF	NINTER	C
1.000000	-1.030700	-0.322609	0.000816	5.591672	1.424659
	(0.08840)	(0.09569)	(0.00739)	(3.25049)	
Log likelihood	-83.21615				

The Long Run Money Demand Function Cointegrating Vector for 1961-1993:

$$Log(M) = 1.425 + 1.031*Log(GDP) + 0.323*Log(Exch) - 0.00082*Inf - 5.592*Ninter$$

Table 6.

Short Run Model of Demand for Money, 1961-1993

Variable	Coefficient	Std. Err.	t-Statistics	Prob.
Constant	0.0489154	0.114833	0.426	0.674
$\Delta\log(M_{t-1})$	-0.3514566	0.2679397	-1.312	0.204
$\Delta\log(GDP_t)$	0.7593199	0.0963501	7.881	0.000
$\Delta\log(GDP_{t-1})$	0.3243806	0.2055031	1.578	0.129
$\Delta\log(Exch_t)$	0.1237979	0.2849558	0.434	0.668
$\Delta\log(Exch_{t-1})$	-0.0656778	0.2748056	-0.239	0.813
$\Delta\log(Inf_t)$	-0.0000416	0.0073696	-0.006	0.996
$\Delta\log(Ninter_{t-1})$	-1.946716	3.582204	-0.543	0.593
EC_{t-1}	-0.4813537	0.3422776	-1.406	0.174
F(8, 21) = 13.44		Prob > F = 0.0000		
R-squared = 0.8366		Adj R-squared = 0.7743		

Note: Dependent Variable $\Delta\log(M_t)$

Table 7.

Main statistics of the Series for the Period 1995I – 2002IV

Variables	Mean	St. Dev.	Max	Min	Skewness	Kurtosis
Real Demand for Money	196689.3	244053.2	743706.6	4298.3	1.037	2.625
Real GDP	233759.7	211881.3	671100	33068	0.890	2.437
Inflation Rate	36.63	43.22007	155.3	1.3	1.534	4.345
Nominal Interest Rate	20.80	9.89	42	7	0.213	2.008
Exchange Rate	1999.45	707.66	2635	510	-0.803	2.305

Table 8.

Unit Root Test: Augmented Dickey-Fuller (ADF) Test for Levels, 1995I – 2002IV

	No Constant & Trend		Constant		Constant & Trend	
Variable	t-Test Statistics	Lag Length	t-Test Statistics	Lag Length	t-Test Statistics	Lag Length
Real Demand for Money	-0.318	1	-1.160	1	-3.156	1
Real GDP	-0.022	0	-0.959	0	-1.978	0
Inflation Rate	-1.239	0	-1.113	0	-1.646	0
Nominal Interest Rate	-1.522	0	-1.359	3	-1.336	3
Exchange Rate	0.962	1	-2.485	2	-0.694	0

Note: All the five variables are non-stationary time series (have a Unit Root) even at 10% significance level when are measured in their levels.

Table 9.

Augmented Dickey-Fuller (ADF) Test for the First Differences, 1995I - 2002IV

	No Constant & Trend		Constant		Constant & Trend	
Variable	t-Test Statistics	Lag Length	t-Test Statistics	Lag Length	t-Test Statistics	Lag Length
Real Demand for Money	-3.222 ***	2	-9.796 ***	1	-9.692 ***	1
Real GDP	-2.821***	2	-5.319***	0	-5.223 ***	0
Inflation Rate	-3.041***	8	-4.441***	7	-5.207 ***	7
Nominal Interest Rate	-27.49***	2	-26.99***	2	-28.52 ***	2
Exchange Rate	-3.376***	4	-3.417**	0	-4.753***	0

Note: Variables are measured in their first differences. Three, two, and one asterisks denote statistical significance at 1% and 5% levels respectively. All the five variables are stationary time series (do not have a Unit Root) at 1% significance level when are measured in their first differences especially under the assumption of no constant and no trend.

Table 10.

Cointegration Analysis of Sudan's Demand for Money for the Period 1995I - 2002IV

Null Hypothesis	Eigen-value	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
r = 0	0.930112	120.8728	68.52	76.07	None **
r ? 1	0.735274	49.02952	47.21	54.46	At most 1 *
r ? 2	0.325549	13.14492	29.68	35.65	At most 2
r ? 3	0.080960	2.510783	15.41	20.04	At most 3
r ? 4	0.008530	0.231287	3.76	6.65	At most 4

*(**) Denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 2 cointegrating equation(s) at 5% significance level

Table 11.

Normalized Cointegrating Coefficients for 1995I - 2002IV

LOG(M)	LOG(GDP)	LOG(Exch)	INF	NINTER	C
1.000000	**-0.834800**	**19.31114**	**0.070465**	**0.025065**	**-151.8699**
	(0.40309)	(4.70782)	(0.01562)	(0.03266)	
Log likelihood	-123.1897				

The Long Run Money Demand Function Cointegrating Vector for *1995I - 2002IV*:

Log(M) = *-151.87 + 0.835*Log(GDP) - 19.31*Log(Exch) - 0.0705*Inf - 0.025*Ninte*

Table 12.

Short Run Model of Demand for Money, 1995I - 2002IV

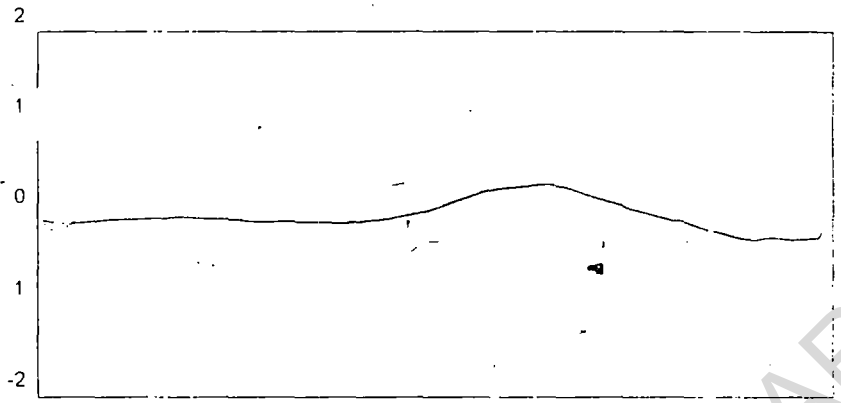
Variable	Coefficient	Std. Err.	t-Statistics	Prob.
Constant	0.0161673	0.2104486	0.077	0.939
$\Delta\log(M_{t-1})$	-0.0743898	0.174479	-0.426	0.674
$\Delta\log(GDP_t)$	0.9666992	0.4773031	2.025	0.055
$\Delta\log(Exch_t)$	1.139417	2.769271	0.411	0.685
$\Delta\log(Inf_t)$	-0.0177611	0.0113155	-1.570	0.131
$\Delta\log(Ninter_{t-1})$	-0.0000132	0.0111079	-0.001	0.999
EC_{t-1}	-0.9840362	0.243776	-4.037	0.001
F(6, 22)	= 8.56	Prob > F	= 0.0001	
R-squared	= 0.7002	Adj R-squared	= 0.6184	

Note: Dependent Variable $\Delta\log(M_t)$

Figure 1.

Diagnostic Tests of Short Run Model for the Period 1961-1993

Recursive Coefficient Estimates of the ECM Term for the Period 1961-1993



Coefficient of the ECM Term Confidence Limits

Table 13.

Breusch-Godfrey Serial Correlation LM Test (Lag:2):

F-statistic	1.609120	Probability	0.224909
Obs*R-squared	4.158249	Probability	0.125040

Chow Breakpoint Test: 1985

F-statistic	1.433393	Probability	0.275229
Log likelihood ratio	21.89948	Probability	0.009203

Ramsey RESET Test:

F-statistic	3.676468	Probability	0.069581
Log likelihood ratio	5.062481	Probability	0.024449

Figure 2.

Diagnostic Tests of Short Run Model for the Period 1995:1-2002:IV

Recursive Coefficient Estimates of the ECM Term for the Period 1995:1-2002:IV

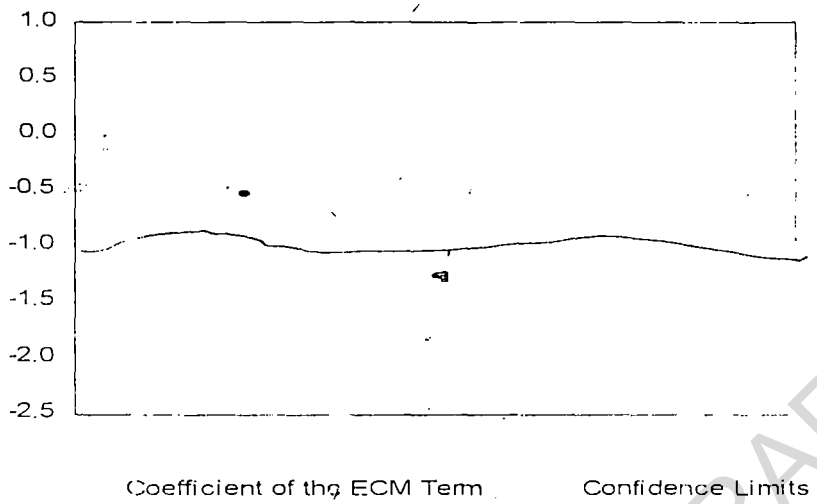


Table 14.

Breusch-Godfrey Serial Correlation LM Test for the Period 1995:1 - 2002:IV

Lag: 1	F-statistic	0.626130	Probability	0.437625
	Obs*R-squared	0.839622	Probability	0.359505
Lag: 2	F-statistic	0.373409	Probability	0.693083
	Obs*R-squared	1.043905	Probability	0.593361
Lag: 4	F-statistic	0.176230	Probability	0.947737
	Obs*R-squared	1.092903	Probability	0.895397

Ramsey RESET Test for the Period 1995:1 - 2002:IV:

F-statistic	0.358366	Probability	0.555818
Log likelihood ratio	0.490712	Probability	0.483610

Chow Breakpoint Test: 1997:4

F-statistic	0.581618	Probability	0.760650
Log likelihood ratio	6.963935	Probability	0.432645

Table 15
Velocity of Circulation in Sudan (1962-2002)

Year	Velocity
1961/62	9.3
1962/63	8.8
1963/64	8.4
1964/65	8.2
1965/66	6.9
1966/67	6.6
1967/68	6.8
1968/69	6.2
1969/70	6.1
1970/71	6.4
1971/72	6.8
1972/73	5.5
1973/74	4.9
1974/75	6.0
1975/76	4.4
1976/77	5.7
1977/78	3.8
1978/79	4.0
1979/80	4.8
1980/81	4.3
1981/82	4.8
1982/83	4.9
1983/84	5.2
1984/85	4.3
1985/86	4.1

1986/87	5.1
1987/88	5.1
1988/89	5.6
1989/90	4.9
1990/91	5.8
1991/92	6.3
1992/93	7.9
1993/94	9.9
1995	9.9
1996	13.2
1997	15.6
1998	16.4
1999	14.4
2000	12.6
2001	12.4
2002	9.6

Table 15.

Partial correlation of log (Velocity) with:

Variable	Partial Correlation	Significance
Log (GDP)	0.3560	0.058
Log (Exch)	-0.0297	0.878
Inflation	0.4558	0.013
N_Inter	-0.5404	0.002

Table 17

Variables for the First Model Fiscal Year (1961/62 -193/94)

Year	Real M^1 in Billions	Real GDP in Billions	Nominal Interest Rate %	Inflation Rate %	Sudanese Exchange per Rate per US Dollars
1961/62	8.7	81	2	5.0	,34
1962/63	9.8	89	2	5.0	,34
1963/64	10.6	90	2	5.0	,34
1964/65	56.3	458.1	2	-4.0	,34
1965/66	67.0	461.1	4	0.0	,34
1966/67	7.1	47.2	4	10.0	,34
1967/68	6.8	46.12	4	11.0	,34
1968/69	89.6	555	4	-11.0	,34
1969/70	26.0	162.2	4	4.0	,34
1970/71	109.6	712	4	0.0	,34
1971/72	7.6	51.9	4	15.0	,34
1972/73	10.0	55.4	6	15.0	,34
1973/74	9.6	56.5	6	20.0	,34
1974/75	10.0	59.8	8	23.0	,34
1975/76	15.4	979.4	8	1.7	,34
1976/77	21.4	123.2	8	17.18	,34
1977/78	26.7	41.8	8	18.32	,39
1978/79	20.4	95.6	8	33.9	,79
1979/80	31.6	153.0	8	26.09	,79
1980/81	51.8	225.0	10	22.56	,89
1981/82	53.7	251.4	10	27.69	1,2
1982/83	63.3	309.3	13	31.13	1,8
1983/84	71.1	346.0	14	32.45	2,1
1984/85	77.2	333.8	14	46.83	3,0
1985/86	171.4	697.2	14	29.04	4,0
1986/87	295.23	1459.2	14	24.98	12,1
1987/88	186.3	955.0	14	49.14	12,1
1988/89	199.6	1115.7	22	74.08	12,1
1989/90	332.5	1643.4	29	67.38	12,1
1990/91	270.9	1579.2	28	122.52	29,7
1991/92	560.9	3544.7	33	119.24	99
1992/93	1184.5	9390.5	27	101.18	148
1993/94	1642.2	16218.0	28	115.93	310

Table (18)

Variables of the Second Model Calendar Year Quarterly Data 1995-2002

Quarter		M^2 in Billions	Real GDP in Billions	Interest Rate %	Inflation Rate %	Exchange Ra per US Dolla
1995	1	5186.4	56916	7	65.0	510
	2	5768.5	57914	14	59.6	522
	3	6513.4	58912	21	60.6	735
	4	6740.0	59910	28	70.6	835
1996	1	5334.9	75038	7.5	10.1	998
	2	4298.3	76219	15	155.3	1421
	3	5028.2	77392	22.5	153.3	1454
	4	7678.2	78570	30	112.3	1454
1997	1	10280.1	33068	10.5	88.6	1515
	2	22381.3	33508	21	42.0	1590
	3	38307.1	34108	31.5	27.3	1645
	4	35887.5	341628	42	31.6	1712
1998	1	93029.0	107459	9.1	13.7	1805
	2	75719.9	109146	18.2	17.2	1950
	3	86136.0	110833	27.2	16.0	2190
	4	187923.2	112520	36.6	8.3	2370
1999	1	83067.5	146269	8.5	18.9	2463
	2	105604.8	148564	17	16.6	2570
	3	143403.0	150759	25.2	13.0	2580
	4	116357.2	153759	34.2	16.6	2570
2000	1	142353.3	354886	8.3	14.3	2567
	2	743706.6	359444	16.6	3.0	2571
	3	279189.2	365002	24..9	8.4	2567
	4	725997.2	370560	33.3	3.7	2562
2001	1	483231.7	640962	8	1.3	2573
	2	384451.9	650968	16	7.7	2574
	3	666897.8	661039	24	4.6	2585
	4	434228.3	671100	32.1	7.4	2614
2002	1	352828.0	416784	7.7	9.7	2600
	2	576039.6	417236	15.4	6.3	2620
	3	390833.3	423688	22.1	9.9	2625
	4	520566.2	430140	31.3	8.0	2635