# CHAPTER FOUR

# THE SUPPLY OF MONEY PROCESS IN THE SUDAN

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This chapter is divided into two parts, which are divided into many sections. In it, we shall follow the money multiplier theory of money supply to explain analytically as well as, empirically the behaviour of money supply in the Republic of the Sudan. In the first section an introduction is given, while the definitions of the money supply are discussed in the second section. Then, we discussed the endogeneity and exogeneity of money supply. Then the theory of high-powered money and the determinants of money multiplier are discussed. Also, we have discussed the money supply and the analysis of money supply in the Sudan. In part two, in brief, we summarised selective survey of literature reviewing the causality evidence of the relationship between the supply of money, output and the price level. Lastly, the relationship of money supply and its proximate determinants is empirically analysed in the Sudanese context.

## 4.1 INTRODUCTION

We are interested in money supply because of the view that the spending of people in the economic system is influenced by the amount of money they hold. Hence, before we take up the study of theory of money supply ($M^S$), it is necessary to understand the differences between two kinds of money, ordinary money (**M**) and high-powered money (**H**). The ordinary money is

partly the liability of the central monetary authority and the rest of the monetary system (commercial banks, etc.). In recent years money supply is empirically measured in various countries. In the Sudan, Bank of Sudan (**BoS**) as a central bank of the country and in its capacity as the issuing authority of currency, has specially recommended the money supply as broad money ($M_2$) for analytical precession, the large part of changes in ordinary money, are caused by what is popularly known high-powered money (**H**) or reserve money (**RM**). High-powered money is produced by Bank of Sudan and held by the public and banks, and Bank of Sudan calls it reserve money, high-powered money is the sum of (i) currency held by the public (**C**), (ii) cash reserve of the banks (**r**), and (iii) Other deposits (**ODs**) of Bank of Sudan.

## 4.2 DEFINITIONS OF MONEY SUPPLY

In the foresaid discussion, we have gone through the concepts of money supply; hence, here we focus on the definitions of money supply. Burgess (1927) and Riefler (1930) have set forth the early formulation of the money supply, [*Makinen, 1978; p. 300*].[1] The term '*supply of money*' is synonymous with such terms as: '*money stock*', '*stock of money*', '*money supply*', and '*quantity of money*' [*Jhingan, 2002; p. 99*].[2] The supply of money in the words Johnson (1962)[3]:

> "*The supply of money is virtually a newly-discovered area of monetary research. The general practice in monetary theory has been to treat the quantity of money as determined directly by the central monetary authority, without reference to the links intervening between reserves provided by the central bank on one hand, and the total of currency and bank deposits on the other.*" [*Johnson, 1962; p.357*].

Money is something measurable, once we have settled on its theoretical definition, empirically can be defined, [*Gupta S.B, 2001; p.15*].[4] There are so many alternative views regarding the definitions or measures of the money supply, here we have to look upon some of them. We have to note that the supply of money measures refers to its stock at any point of time, and the stock of money always refers to the money held by the public.

Table No. 4:1

**THEORETICAL DEFINITIONS OF MONEY (COMPONENTS OF MONEY)**

| AUTHORITIES DEFINING MONEY | CURRENCY | Demand Deposit | Time Deposit | Non Clearing Bank Deposit | Deposit of NBFIS | Credit Lines |
|---|---|---|---|---|---|---|
| Traditional School | + | + | - | - | - | - |
| Chicago School | + | + | + | - | - | - |
| Radcliffe Committee | + | + | + | + | + | + |
| Gurley and Shaw | + | + | + | + | + | - |
| Newlyn | + | + | + | + | - | - |
| Morgan | + | + | + | - | - | - |
| Yeager | + | + | + | + | - | - |
| Resek and Saving | + | + | - | - | - | - |
| Bank of Sudan | + | + | + | - | - | + |

**First View** of the traditional and Keynesian thoughts which stress the medium of exchange function of money, narrowly, they have defined the supply of money as only currency held by the public and demand deposits with the commercial banks, and as we know the currency consists of coins and paper currency, is the product of the central bank and the government, while demand deposits are the product of the commercial banks non-governmental profit-making and business organisation, [*Horvitz, 1979; p. 27*].[5]

**Second View of Chicago School**: this school is associated with the view of monetary theorists like Friedman, Meiselman, Cagan, Schwartz, David Fan and others. They broadly defined money's functions. Money has been

adequately defined, and the distinction between it and near money assets is never précised. Money ordinarily, consists of currency and demand deposits. However, this school, led by Friedman defines money supply in broad sense, and in the words of Friedman (1956),[6] defines the supply of money at any moment of time as:

> *"literally the number of dollars people are carrying around in their pockets, the number of dollars they have to their credit at bank in the form of demand deposits, and also commercial banks' time deposits,"* [*Friedman, 1956*].

Thus, his definition includes currency, demand deposits, plus time deposits of the commercial banks, this definition is known in the USA as $M_2$ and in the UK and India as $M_3$. This school points out that time deposits are close substitutes for currency and demand deposits.

**Third View** is of Gurley and Shaw, they have suggested that money supply should be defined as weighted sum of currency, demand deposits, plus deposits of saving banks building societies, loan allocation, and deposit of other credit and financial institution, but their method remains somewhat arbitrary. In the words of Shaw (1950): [7]

> *"The Supply of Money is the total of monetary liabilities owed by the monetary system at any moments. It is also the stock of the active and inactive cash balances held by individuals, firms, and government agencies that are not part of the monetary system. Money is the demand debt of the monetary system and the cash assets of the money-using public." [Shaw, 1950; p. 33].*

**Fourth View** presented by the Radcliffe Committee has defined money supply broadly and includes $M_3$ of the UK plus the non-clearing bank deposits of **NBFIs** and credit lines. The above mentioned brief definitions of money

supply and others i.e. $M_4$, $M_5$ etc. is an empirical matter, the current measures are denoted by:

(a) **M or $M_1$ = C + DD**

(b) **$M_2$ = $M_1$ + TD**

(c) **$M_3$** = **$M_2$** + Deposits of thrift institutions

The contents of the above-mentioned components of **M** to **$M_3$** are explained as follows: **C** stands for currency held by the public, **DD** stands for demand deposits of the commercial banks, **TD** stands for time and savings deposits held by the commercial banks, **$M_1$** is considered to be a narrow money definition, and **$M_2$** is considered to be broad money definition. The best definition among all is a matter of principle, and the matter must be resolved on the bases of its usefulness either for theory or policy. If money is regarded as a passive element, there is no use of constructing a money supply function model. Again if private spending is influenced by the rate of interest and not by liquidity, then there is no necessity of estimating the variables that determine the supply of money. According to some economists and economic writers, the supply of money will include the whole liquidity of the economy. There are conceptualizations regarding the supply of money, and still nebulous area of research in monetary economics, therefore, we should have different behaviour assumptions for determining the money supply function.

## 4.3 ENDOGENEITY AND EXOGENEITY OF MONEY SUPPLY

The money supply process can be decomposed into exogenous input of the central monetary authorities and the endogenous reaction of banks and public [*Brunner, 1973*].[8] The question of the endogeneity or exogeneity of money

supply is very controversial issue in monetary economics. The Classical-economists' School maintained that money supply is exogenous; while the Monetarists school focuses money supply is essentially endogenous. Monetarists also, in general, maintain that monetary authorities exercise effective control over the stock of money, while others, especially those who share the new view of monetary theory state that the determination of money stock is part of the simultaneous solution for all variables in the financial and real sectors of the economy. Monetarists do not necessarily deny this fact but, postulate that the behaviour of patterns of the public and banking system are stable and predictable which can enable monetary authorities to control the stock of money [*Park, 1973*].[9]

The behavioural analysis of money supply function has a more recent history, before 1960s there were very few studies conducted on the functional specification of money supply relationships *[Macesich and Tsai, 1982]*.[10] The usual practice was to assume money supply as exogenously determined by the monetary authorities. This assumption is rested on a mechanical analysis of determinants of money supply as money supply was related to monetary base by a multiplier determined by the reserve ratio and the currency ratio, but currency and reserve ratios which determine the value of the multiplier are neither technically determined nor legally fixed coefficients; they are behavioural relationships [*Johnson, 1978*].[11] Given the constancy of reserve ratio and currency ratio, money supply could easily be controlled by controlling monetary base, the liability of monetary authority itself. Hence, Keynes and most of the monetary theorists simply treated the supply of

money as exogenously given by monetary authority. In the popular **IS-LM** model, the supply of money is taken as an exogenously given variable.

To Keynes, money supply is very much influenced by demand conditions and can be controlled by the central bank. Hence money supply becomes endogenous variable, though the authorities may be able to control money supply, they may act passively, in which case it can be argued that the money supply becomes endogenous. Various studies conducted from early 1960s' have revealed that money supply can be expressed as a function of a few variables. Particularly, the recognition of rate of interest as a determinant of the supply of money has not only proved the endogeneity of money supply but also questioned the reliability of money demand function estimated by the ordinary least square method using interest rate as one of the explanatory variables. The analysis of money supply therefore needs to be approached in terms of the followings: (a) measurement (b) mechanics through which money stock gets produced, and its influence on aggregate economy especially on output and prices. In this section we study the theory of high-powered money (**H**) and the money multiplier (**m**).

### 4. 3.1 THEORY OF HIGH-POWERED MONEY

A country's supply of money stock ($\mathbf{M^S}$) is usually defined as the sum of currency in the hand of non-bank public 'currency in circulation' (**C**), plus the total demand deposits (**DD**). The currency is issued by the central bank of the country, and is held partly by the public and partly by the banks on behalf of the public in the form of bank deposits, [*Gupta, G.S 2001, p, 199*].[12]

Thus we have: $$\mathbf{M^S = C + DD} \qquad (1)$$

The banking system will be in equilibrium in sense of having no need or incentive to contract or expand its deposits, when bank deposits are equal to $^1/_r$ times their reserves. That is when: $D = {}^1/_r RM$ (2)

Where 'r' is cash reserve ratio 'RM' is denoted as bank's cash reserve, which is equal to the total monetary base or reserve money (something referred to as the supply of high-powered money i.e. total currency plus bank balances at the central bank) minus that part which is in circulation with non-bank public.

That is: $RM = H - C$ (3)

Where, **H** is denoted to high-powered money for the sake of simplicity however, we shall assume that the public's desired currency holding are a constant proportion of the total money stock.

This may be written as: $C = cM$ (4)

Where, '**C**' is desired currency holding and '**c**' is the desired currency to total money ratio, and '**M**' is the total money supply.

Thus we have a four-equation model:

$$M = C + DD \quad (1)$$

$$D = {}^1/_r . RM \quad (2)$$

$$RM = H - C \quad (3)$$

$$C = c\,M \quad (4)$$

Equations (1) and (3) are definitional and equations (2) and (4) are behavioural. Some simple symbol manipulation will now enable us to derive an expression for '**M**' that is touched in terms of monetary base or high-powered (**H**). Substituting equation (4) into equation (3), and equation (3) into equation (2), we get: $D = \frac{H - cM}{r}$ (5)

Substituting equation (4) and equation (5) into equation (1), we get:

$$M = cM + \frac{H - cM}{r}$$

Multiplying both sides by 'r' gives:

$$rM = rc\,M + H - cM$$

Therefore: $rM - rcM + cM = H$ or $M(r-rc+c) = H$

Thus $$M = \frac{1}{(1-c) + c} \cdot H \qquad (6)$$

The fraction by which the monetary base is being multiplied in equation (6) usually is referred to as monetary multiplier and denoted by the symbol m.

Thus we have $M = m.\,H$

According to this explanation, the money supply expands on only three things namely:

(i) the public's currency ratio

(ii) the bank's cash ratio, and

(iii) the monetary base or the supply of high-powered money.

By assuming that two ratios are constant, changes in money supply depend only on changes in the monetary base. If, the monetary base is under the central monetary authorities, then the authorities have control over money supply, (making it exogenously determined however, though the authorities may be able to control money supply, they may act positively, in which case it can be argued that the money supply becomes endogenous), [*Pierce and Shaw, 1979; pp. 142-145*].[13]

### 4.3.2 MONEY MULTIPLIER

Base on the writings of Friedman and Schwartz (1963)[14] and Cagan (1965),[15] the money multiplier approach builds on the standard analysis in money

banking textbook. Often, monetary analysts to explain the money supply variations over a period of time use the money multiplier approach. And to develop a simple money stock determination, we use key variables, the currency – deposits ratio, the reserve deposits ratio, and high-powered money. The total demand for high-powered money comes from the public who want to use it as currency, and the banks which need it as reserves, because the public has preferred ratio currency to deposits, we can calculate the total money stock that can be supported by any given stock of high-powered money. The money stock and high-powered (**H**) both are related by money multiplier (**m**). In the words of Dornbusch and Fischer: "*the money multiplier is the ratio of the stock of money to the stock of high-powered money*", [*Dornbusch and Fischer, 1990; p.390*].[16] Thus, the money multiplier is the reciprocal of reserve requirement ratio.

According to Friedman and Schwartz, the nominal money stock is determined by changes in ratio of deposit to reserve money (reserve assets are the monetary liabilities of the central bank), well known as high-powered money, and the money multiplier. Economic theory predicts close connection between reserve money and total stock of money. According to the theory of high-powered money and money multiplier, money stock is positively related to level and changes in reserve money and the relationship between them may be explained as: **M = m. H.** The money multiplier is determined by, and adversely related to reserve requirements on time and demand deposits, currency ratio and time deposits ratio. Thus, money supply is determined by a number of factors such as follows: (a) currency deposits ratio, (b) required

reserve ratio, (c) excess reserve ratio and (d) high-powered money. Here money supply ($M^S$) can be expressed in the form of the following equation:

$$M = \frac{1}{r(1-c)+c} . H$$

It shows that supply of money (**M**) is a function of high-powered money (**H**) and variable **c** and **r** (**c** currency-deposits ratio, **r** = reserve-deposits ratio) this expression

$= \frac{1}{r(1-c)+c}$. it gives the value of what known as the money multiplier (**m**).

Then, this equation can be more simply written as **M = m. H.** from this equation, we

can work out for **m** also - $m = \frac{M}{H}$ or $m = \frac{M}{RM}$

With help of this equation we can find out the value of money multiplier in the Sudanese context and the changes therein. In the Sudan, Bank of Sudan has assumed that the money multiplier is stable. Hence, changes in money supply ($M^S$) are largely attributed to reserve money (**RM**) variable constant of currency in circulation (**CU**) plus commercial banks reserves (**CBRs**). This regression results of equation **m= M/H,** are reported strongly support our contention both for short-term as well as long-term analysis.

$$\text{Money Multiplier (m)} = \frac{\text{Stock money } (M_2)}{\text{Reserve money (RM)}} \quad \text{or} \quad \frac{M_2}{RM}$$

Money multiplier (**m**) is the ratio of narrow money ($M_1$) or broad money ($M_2$) to reserve money and is calculated on a point-to-point basis. Money multiplier (**m**) tells us the nature of the effect on $M_1$ or $M_2$ as a result of a change in **RM** (**H**). Table 4.4 shows the calculation of money multiplier. It is easy to find out the total money supply in an economy, suppose the value of money multiplier

and high-powered money is given, but we have to keep in mind that the money multiplier is neither constant nor exactly predictable.

### 4.3.3 DETERMINANTS OF MONEY MULTIPILER

The central monetary authorities issue fiat money and determine the conditions under which the financial intermediaries operate. The public allocates its money holdings between fiat money and the claims of financial intermediaries, which acquire securities issued by the public and central monetary authorities, and supply their own liabilities in return. Two major approaches have been developed to analyze interrelationship, these approaches are the high-powered money and the money multiplier, [*Lewis and Mizen, 2000, pp.324-325*].[17] The first view of the theories of determination of money supply is that, the supply of money is determined exogenously by the central monetary authorities i.e. the central bank of the country. While the second view is that the supply of money is determined endogenously by change in the economic activities, which affect the general public's desire, to hold currency relative to deposits and other. Thus, the determination of money stock is seen as a process of general portfolio adjustment in response to relative rate of return changes. The time path of the process depends on the relevant speeds of adjustment of various sectors to relative price changes, rather than the mechanistic process embodied in the money-multiplier approach. The operational utility of this approach is limited in the context of a developing country (our case of study), [Jadhav, 1994; p. 120]. The exogeneity and endogeneity determinants of money supply can be described

as the minimum cash reserve ratio, bank reserves and the desire of the people to hold currency relative to deposits.

### (i) Currency-Deposit Ratio (C/DD)

Since the stage of financial development in the Sudan is rudimentary, currency constitutes a major means of transaction and holding financial savings. The money function of demand deposit is limited by the paucity of sufficient banking services and banking habit of the people. As a result, currency performs predominantly both medium of exchange and store of value functions of money. The public decides the division of money supply between demand deposits and currency. The monetary authorities along with the commercial banks make no explicit effort to influence or interfere with the decision. On pain of insolvency, the monetary system is obliged to maintain interconvertibility at par of all forms of money. The monetary system complies with what the general public demands of money. The currency system is elastic in the sense that the monetary authorities and banks can maintain free interconvertibility and they can prevent the appearance of a premium or a discount on currency in terms of demand deposits [*Shaw, 1950; p. 71*]. The coin and paper money is a popular vehicle of personal saving and are an inexpensive and convenient medium for consumer expenditure. The supply of currency is always less than the supply of demand deposits. There are many changes in composition of money supply such as: secular; cyclical; seasonal and random changes in the ratio of money supply. The ratio must be as the public wants it, but it is also important that shifts in relative demand should not cripple the ability of the monetary authorities to adjust the supply of money as

a whole to overall economic situations. The composition of money supply changes is not very interesting, but the magnitude of its changes is a matter of concern to economists [*Shaw, 1950; pp.70-77*].

Hence, the currency-deposit ratio (**C/DD**) is determined by the behaviour of the public, which decides in what proportion to hold currency and deposits. Currency-ratio (**C/DD**) is affected by not only the shift currency (**C**) and demand deposits (**DD**) but also to the shift out of either of these to other assets-real and/or financial. So, in order to examine the factors affecting currency-ratio, it is imperative to identify the factors causing shift between currency (**C**) and demand deposits (**DD**) as well as shifts between either of these two variables and other assets. Here, we have some of the determinants of currency-ratio in the Sudanese context (i) Income, (ii) availability of Banking Services, (iii) inspectoral distribution of income, (iv) rate of return, (v) monetisation (vi) inflation etc. But due to absence of data or irrelevance of the variables, we are not going to either of them as explanatory variables in our estimating equation that stands as follows:

$$log\ C/DD = a_0 + a_1 Y + a_2 Bo + U \qquad (1)$$

Where, **C/DD** is currency-ratio, **Y** stands for (**GDP**) income, **U** stands for dummy variable, and **Bo** is bank branch-office.

**(ii) Reserve-Deposit Ratio (r=R/DD):**

The reserves of the banks can be classified into required reserves and excess reserves. It is commonly accepted that excess reserves are sensitive to rate

of return. Empirical studies done by economists and economic writers and researchers substantiated this proportion [*Gupta, 1979; p.12*]. [18] Banks do hold excess reserve and also borrow from the Central Bank in the form of the so call discretionary finance or discount loans. When a bank decides to hold excess reserve, it does not lend them out and hence, they create no deposits. If the Central Bank injects reserves into banking system and they are simply held as excess reserves for whatever reason, there will be no effect on deposits or on the money supply. In other words, excess reserves in banking system could be regarded as an idle component of reserves that are being used to support any deposits. This implies that such reserves should be subtracted from the reserve money so as to focus on the amount that is actually supporting money supply. In opposite direction, the ability of banks to borrow from the Central Bank requires modification to the model [*Jadhav, 1994; p.112*].[19]

The reserve money ratio (**R/DD**) that reflects the behaviour of banks is jointly determined by required reserve with the Central Bank (**BoS**), which is empowered to impose statutorily cash reserve ratio. The cash reserve ratio (**CRR**) is revised upwards; the banks are required to hold larger reserve with the Central Bank than before for the amount of the liabilities (demand deposits). This amounts to an increase in reserve-deposits ratio (**R/DD**), which lowers the multiplier. Banks may not want to hold excess reserves beyond the level of required reserve. In deciding upon this amount are guided by the same principles affecting the precautionary demand for money. The commercial banks hold excess reserves to meet the demands of cash, if they do not meet these demands, they will have to borrow from the Central Bank.

Explicit cost of such borrowing is the bank rate (**BR**). The higher Bank rate, the more excess reserves, banks are likely to hold. So we have included rate of return, excess reserve ratio and deposits shifts only as the explanatory variables. So the estimating equation is:

$$log\ R/DD = a_0 + a_1\ rB + a_2\ ID/DD + a_3\ ER/DD_{(-1)} + U \qquad (2)$$

Where, **R** is reserves, **DD** is total deposits, **rB** stands forc ommercial loan rate of return of the commercial banks, and **ID** is investment deposit (equivalent to time deposits), the expected signs of the coefficients are: $a_1 > 0$, $a_2 < 0$, $a_3 >$ or $< 0$.

**(iii)Time Demand Deposit Ratio TD/DD**

Demand deposits are known to be the most important source of finds for commercial banks, but this has changed in recent years. The rapid growth of time deposit and saving deposit has, in fact, been the most significant in the Sudanese commercial banking since the introduction of Islamic banking. Table 4.7 shows where commercial banks have obtained the funds and how this has changed in recent years. Savings deposits are convertible into demand deposits or cash. According to the Islamic banking, small portion of profit to be paid as compensation to the holders of savings accounts since these accounts do not to get the prohibited rates of interest. Investment deposits are the major traditional source of funds for Islamic banking; they work according to the agreed upon conditions between banks and the customers. Following the commercial banks to seek investment deposit funds through *musharakah* and *mudarabah* instruments, the volume of outstanding

certificate has grown rapidly. There has been a gradual increase in investment deposits ratio under the Islamic banking (**PLS**), specifically after The year 1992, factors affecting this ratio are identified as rate of return, income, banking services expansion, innovation of new financial instruments and expected rate of inflation. The estimating equation is thus specified as:

$$log\ T/DD_t = b_o + b_1 Y + b_2 R^{12} + b_3 P^e + b_4 BO + U \qquad (3)$$

Where, **Y (GDP)** stands for income at current prices, $R^{12}$ stands for one year rate of profit, $P^e$ is the expected rate of inflation, **BO** is the number of banking branch officers and **U** is dummy variable. The expected sign of the coefficients are **b1> 0, b2 >0,b3<0,b4>0.**

## 4.4 SUPPLY OF MONEY IN THE SUDAN

The Bank of Sudan as the central bank of the country uses two measures of the supply of money. They are designated as **M** or $M_1$ and $M_2$. The constituents of each measure are as follows:

**M or $M_1$ = CU + DD, and**

**$M_2$ = $M_1$ + QM**

Where are $M_1$ consists of currency (**C**) notes (Sudanese pound replaced by Dinar) and coins (Piastres) held by the public, demand deposits (**DD**) product of the commercial banks, while, Quasi Money (**QM**) consists of savings, time deposits, and margins on letters of credits, [*BoS, 2000; p. 28*].[20] Thus **M** or $M_1$ consists of currency and demand deposits; it is also called narrow money measure of money supply, but from 1980 to 1991 other deposits were also

included with narrow money ($M_1$) $M_2 = M_1 + QM$, this measure is called broad measure of money or aggregate monetary resources.

**Trends**: During the period of our study, the money supply in the Republic of the Sudan has substantially increased; it has increased at an annual average rate of about 50.91% from 1980/81 to the year 2001, but slightly decreased to 48.79 % in the year 2002 still this average is too high. As in December 2000, the total $M_1$ in the country was SDD 234,587 millions, quasi money was SDD 112,084 millions and broad money was SDDr 346,955 millions, while in 2001, M1 was SDD 271,387 million, quasi money stood at SDD 160,826 million and broad money registered SDD 432,213 million. (i) The overgrown of monetisation in the economy is an indicator of increasing money supply in the Sudan, and has been caused by the expansion in (2000 in 2002). Monetary base and changes in money multiplier is not significant (1.61 in 2000). (ii) Composition of money supply has changed: (a) increasing monetisation (b) effective role-played by banks, (c) rise in income. In the Sudan, the proposition of currency to broad money ($M_2$) was as high as 44.85% in the year 2000 and decreased to 36.49% in the year 2002 and, (iii) Composition of all types of deposits too has been changed recently, investment deposits have been increasing at faster rate than demand deposits.

### 4.4.3 Factors Affecting Money Supply in the Sudanese Economy

Monetary survey may find summary of a system, monetary analysis and money factors that influence money supply in economy emanate from the government as also from the private sector. High-powered money is money

that is produced by the central monetary authorities namely Bank of Sudan and the government and held by public in the form of cash or demand deposits with banks, and which is consisting of coins and reserve money. The balance sheet identity of banking sector can be written in the following form:

**Monetary Liabilities + Non-monetary liabilities= Financial Assets + other Assets.**

Where as net non-monetary liabilities is the excess of non-monetary liabilities over other assets. Thus, in our analysis, we focus upon reserve money as a dominant component that is responsible for the observed changes in high-powered money, [*Gupta, S.B. 200; p.303*]. Bank of Sudan shows that there are sources which contribute to the aggregate monetary resources in the Sudan, we describe these factors necessitating expansion of money under the following basic heads: (i) Net Foreign Assets (ii) Net Domestic Assets, and (iii) Revaluation Adjustment. Bank of Sudan provides them its credit, acquires its financial assets and creates reserve money (**RM**) in the process. Each of these factors has been explained briefly below:

(i) **NET FOREIGN ASSETS:** The Factor net foreign Assets of **BoS** is one of the major sources of the supply of money in the Sudan acquired by the banking system, that is, **BoS** and other banks. Suppose that a Sudanese exporter earns Dollars for his exports and he surrenders the same to **BoS** and gets an equivalent amount of Sudanese currency. In other words, whenever **BoS** or any other bank acquires foreign exchange or foreign assets, it will have to distribute equivalent amount of Sudanese currency within the country. Correspondingly, whenever Sudanese importers have to pay foreigners through buying foreign exchange from **BoS**, two things will happen: firstly,

foreign exchange with the banking system will decline and secondly, the volume of money supply in the country will also decline. Accordingly, when we consider net foreign exchange assets of the banking system, we take the gross foreign exchange assets minus foreign liabilities of the banking system. Thus, net foreign exchange assets of the banking sector are equal to net foreign exchange assets of **BoS** plus foreign assets of other banks. This can be clearly seen from the following supply of money identity:

$$M^s = FABS + FACBs + NCREDP + NLG + O \qquad (4)$$

Where, $M^s$ is money supply, **FABS** is for foreign assets of **BoS, FACBs** stands for foreign assets of commercial banks, **NCREDP** is net credit operations of the private sector, **NLG** is net lending to the government, **O** is other influence which include special drawing rights (**SDRs**) allocation. Due to the fact that the net foreign assets liabilities always exceeds the foreign assets, the net foreign assets continued to have a contractionary impact on the money supply, despite the realised accumulation in the foreign exchange reserves. In the case of our study, the foreign assets accumulation decelerated the contractionary effect from SDD 747,866 million in the year 2000 to SDD 777,250 Million in the year 2001. Table 4.3 below shows the **BoS**'s balance sheet designed to illustrate the sources of monetary base the way in which **BoS** creates high-powered money and uses they are put on.

**Table No. 4:2 Design of Balance Sheet of Bank of Sudan:**

| **Assets (Sources)** | **Liabilities (Uses)** |
|---|---|
| Government's currency to the public. | Currency held by the public. |
| Net reserve credit to the government. | Cash with Banks. |
| Net Reserve Credit to Banks | Bank Deposits. |
| Net Foreign Assets of Bank of Sudan | Other Deposits. |
| Net Non-monetary liabilities to BS | |
| Monetary Base (Sources) | Monetary Base (Uses) |

**(II) NET DOMESTIC ASSETS**

Normally, the central government finances its current expenditure through current revenue. In case, tax revenues are inadequate the government restores to borrowings. Borrowings of government from the general public will have the effect of reducing the money supply with the people – for money is transferred from the people to the government. But when the government borrows from the central bank i.e. Bank Sudan by providing Government Musharakah Certificates (**GMCs**), government securities or I owe you (**IOU**) to bank of Sudan – the government receives the loan from Bank of Sudan. In this case, the money supply is not immediately affected, but the government receives funds from the central bank. It is against the government securities that bank of Sudan prints and issues currency notes and coins. This means that every increase in government securities will have the direct effect of increasing the issue of currency notes and coins in the Sudan and thus, increasing the money supply in the country. Now, Bank of Sudan extends credit to the government (federal and states); it has also claims on the government, as against these, the government keeps its cash balances with bank of Sudan as deposits. Accordingly, the calculation of net **BoS** credit to the government will involve:

> **Bank of Sudan's claims on Government minus Deposits of the Government with bank of Sudan equal Net Bank of Sudan Credit to the Government.**

A part from **BoS**, other banks too extending credit to the government, and net credit will be composed of: (a) net **BoS** credit to the government, (b) other banks' credit to the government.

The second source of money supply and monetary resources in the Sudan is the bank credit to the public corporations (commercial sector). Here, we mean by the public corporations sector all types of production and trade; in fact, it is for all type of non-governmental activities. One major credit of the commercial banks is to make advances and loans to the commercial sector. When a bank lends to a customer, it allows him to withdraw the sum by cheques. These cheques come back to the banking system as fresh deposits. Through giving loans the banks multiply deposits. This quite significant, for the banking system can expand the volume of deposits through granting more loans. Such deposits created at the initiative of the commercial banks are known as derivative deposits or secondary deposits, these are significant, because (a) they constitute money and, (b) they influence the level of economy activity in the country. More banks loans mean more investment, more production and trade, more employment etc.

**Table No. 4:3**

**Deposits by Type 2000-2001**

(millions of Dinars)

| Deposits | December 2000 Current, Savings, Investment, Accounts | December 2001 Current, Savings, Investment Account |
|---|---|---|
| Federal and States Government | 7,697 | 8,482 |
| Public Corporations | 8,566 | 9,975 |
| Private Sector & other financial institution | 189,071* | 265,731* |
| Grant Total | 197,224 | 274,1874 |

(*)Foreign Currency = 76,003 and 110,874.

Source: Bank of Sudan Annual Report (2001).

The net domestic assets witnessed a noticeable increase by (SDD246, 923 million) during 2000, this increase was due to growth in claims on the private sector from SDD 43,937 million by the end of the year 1999, has increased to SDD 73,571 million in 2000, on increase of 67% which indicates a positive

response by the commercial banks to the measures adopted to boost credit to the private sector. Moreover financing of public enterprises increased significantly by 127% (SDD 8,176 million to SDD 18,576 million) in the year 2000. On the other hand, other items net increased by (SDD 31,083 million in 1999 to SDD 46, 581 million in the year 2000) 50%. Therefore, its impact on the money supply was expansionary.

**(III) REVALUATION**

All the foresaid factors have to be added in order to arrive at the volume of broad money. However, there is one item, which has deducted before we could arrive at the volume of broad money in the country. We refer here to revaluation factor, which includes other items. The changes in the revaluation accounts which emanate from the exchange rate movements had a very slight impact on money supply, because the exchange rate was some what stable through out the year 2000/2001; there was an increase of 0.4% in the year 2000 as compared to 9% in the year 1999.

## 4.5 MONEY SUPPLY, OUTPUT AND PRICE RELATIONSHIP

A theoretical foundation from output, employment and income generation point of view, money is considered to be the most strategic variable. In presence of stable money demand function in the economy, change in money stock would initially disturb equilibrium of the economy to attain stabled equilibrium with high output employment and income. Monetary changes would contribute to the growth of output with price stability, if idle resources

exist in the economy, an objective that cherished by the central monetary authority in our case study of **BoS**. Money, as much, by aiding division of labour, encourages large scale of production and consequent industrial expansion and rapid economic progress. Rightly, as Walters said: "*Money serves as a factor of production*", [Walters, p.95].[21] According to Patinkin money is an economic variable that causes economic system to function in different manner to rudimentary (*barter system*) economy. People hold money for transaction purpose, and utility derived from its services, it is a unified theory within a static framework focuses attention on a limited range of assets/debts, wealth, interest rate and its policy. Developing economies with evolving monetary system provide a sort of laboratory for examining the effects of finance on production, trade, investment and capital intensity, and there are large number of empirical studies that support the point that an efficient evolving financial sector makes a major contribution to economic growth. Historically and popularly the quantity theory of money is known as a theory of price (**P**) and it assumes money (**M**) as exogenously given – that means money is policy determined, while modern theory of money supply shows clearly money supply ($\mathbf{M^s}$) is an endogenous variable.

In this section we are going to examine the general behavior of the main macroeconomic variables of the Sudanese economy, and to study the causal relationship between money supply, output and prices, against the background of the widely discussed classical monetarist Keynesian debate. The interrelationships between money, output and prices have remained an area of controversy despite a lot of research works that have been done in this direction [*Jadhav, 1994; p.122*]. The quantity theory of money has important

influence on the course of prices, rate of return, output and other economic variables, [*Gupta, 2001; p.202*]. One of the crucial factors governing the price level in any developing economy is the supply of money. Normally, any increase in supply of money, if not simultaneously compensated by an increase in output results in rise of pries (inflation will take place). Conversely, a decrease in supply of money, if not accompanied by decrease in output, results in decrease behaviors of prices (deflation).

Macroeconomic stability is the demand of the day, needs the achievement of acceptance rising of prices (positive and reasonable rate of inflation), optimal growth of output, respectable value of currency and favourable balance of payments, this can be achieved through the interaction of economic variables such as money supply, rate of return and budget deficit. The Schools of economic thought have provided us by so many versions to explain the relationship among money supply, prices, and rate of return and output in the economy. Basically, according to the classical-monetarist school of thought, output is supply determined, while prices are demand determined. The Keynesian School to this thought however postulates that output is determined by aggregate demand while prices are determined by supply, and the Keynesian theory emphasis the role of autonomous expenditure and fiscal policy variables in determination of money income (**Y**).

## 4.6 BRIEF SURVEY OF CAUSALITY EVIDENCE

Developing economies with evolving monetary systems provide a sort of laboratory for examining the effects of finance on production, trade,

investment and capital intensity. There are a large number of empirical studies that support the point that an efficient evolving financial sector make a major contribution to economic growth and development, this occurs through the contribution to the efficiency of the production and exchange sector of the economy, accumulation of savings and their allocation among project and priority sector of economy. Money, as much, by aiding division of labour, encourages large scale of production and consequent industrial expansion and rapid economic progress. The unsolved debate, whether or not there exist a relationship, this analysis, of course, is not adequately rigorous to draw any firm conclusions. Indeed, there is prolific literature systematically investigates the interrelationship among money supply, prices and output [*Jadhav 1994; pp 121-123*]. The scores of different schools of thought can be settled on empirical grounds. In the words of Laidler (1991)[22]:

> "*In short, the quantity theory of money is, and has been for more than two centuries, a theory of the behaviour of the general price level which identifies variations in the quantity of money as the key (but not the sole) factor causing it to change. If it is to be empirically satisfactory, two things must be established: first that, with due allowance being made for the influence of explicitly specified 'other things', there can indeed be observed a proportional relationship between money and prices; and second that causation indeed can be shown to run from money to prices and not vice versa. Just as the quantity theory has exited in recognizable form more than two hundred years, so have its critics denied one or both of the foregoing propositions for nearly as long, as we shall now see*" [*Laidler, 1991; p. 291*].

He has gone further and explains the main argument is about the role of money supply:

> "*One more there is considerable continuity among the accounts that quantity theorists have offered over the years of the transmission mechanism whereby monetary causes have price level effects, and among the objections that their opponents have raised*" [*Laidler, 1991;p. 299*].

In this section we would review the causality works of different economic writers for developed as well as developing countries:

**Sims (1972)** [23] has developed his own statistical technique for testing whether there was evidence of unidirectional casualty within a two-variable system, he has used **Granger(1969)** [24] causality lest and, applied to three variables viz. US nominal **GNP** (industrial production), money ($\mathbf{M_1}$ and monetary base) and wholesale price index (**P**), and the data coverage were from $1949Q_3$ to $1968Q_4$. His study has two purposes: to examine the substantiated question: Is there statistical evidence that money is 'exogenous' in some sense in the money-income relationship? The second is to display in a simple example some time-series methodology, [Sims, 1972, p: 54]. He carried on stating that:

> "*the main empirical finding is that the hypothesis that causality is unidirectional from money to income agrees with the post-war US data, whereas the hypothesis that causality in unidirectional from income to money is rejected'.* [*Sims, 1972, p.54*].

Accordingly, he concluded that money stock is exogenous to income in post-war, in his wards:

> "*Application of this test to aggregate quarterly data on US GNP and money stock variables show that one clearly should not estimate a demand money relation from these data, treating GNP as exogenous with money on the left-hand side; no evidence appears to contradict the common assumption that money can be treated as exogenous in regression of GNP on current and past money*". [*Sims, 1972, p. 550*].

In his **1980's**[25] paper, using Vector-Auto-Regression (**VAR**) method, he tested the monetarist claims set forth by Friedman and Schwartz, he has used the monthly data for the same variables of his 1972 study, with two separate periods; post-war 1948-1978 and inter-war 1920-1941 were considered. His

study shows that changes in output (industrial production) and money stock were mostly attributed to common responses to changes in interest rate in post-war period, and changes of production was not due to changes in money stock. In his conclusion, he stated that:

> *"The foregoing small-scale example should have made clear that one can obtain macroeconomic models with useful descriptive characteristics, within which tests of economically meaningful hypothesis can be executed, without as much of a burden of maintained hypotheses as is usually imposed in such modeling"*, [*Sims, 1980,p. 33*].

**Williams, Goodhart and Gowland (1976)**[26] have sought to explain the Money-nominal Income in quality in terms of the conduct of monetary policy in the UK. They adopted the following procedures: Apply **OLS, t-Test, $R^2$**; and investigate the autoregressive prosperities, and they have concluded that:

> *"The evidence indicating the direction of causality between money and income in the U.K is much less clear-cut than that which Sims found in his examination of U.S. data.... A negative result still leaves open the possibility of simultaneous causality...We found for the U.K some evidence of Uni-directional causality running from nominal incomes to money but also some evidence of uni- directional causality running from money to prices."*[*Williams, et al, 1976, P.423*].

***Pathak (1978)***[27] in his research paper, has examined the behaviour of central monetary authority i.e. Reserve Bank of India, in the context of money stock determination; his study strongly support the view that money supply in India is deemed to be endogenously determined through the process of market adjustment, and government's fiscal operations in conjunction with the state of the balance of payment to determine money income.

**Hsiao (1979)**[28] the purpose of his paper was to study the strategy for fitting a Vector autoregressive model for Canada. He has reinforced Barth and Bennet (1974) findings by applying [Final Prediction Error **'FPE'**] **FPE** criterion and ratio test he uses both $\mathbf{M_1}$ and $\mathbf{M_2}$ as alternative measures of stock of money, and the data of **GNP** from 1955 QI to 1977 QIV. It is found that a bivariate feedback model for $\mathbf{M_1}$ and **GNP**, and round one-way causal relation from **GNP** to $\mathbf{M_2}$. He has concluded that:

> *"The approach is applied to Canadian Money and income data. In the course of fitting the multivariate autoregressive process, we found that between $M_1$ and GNP a bivariate feedback model fit the data best, between $M_2$ and GNP a one causal Model from income to money Performed better."* [*Hsiao, 1979; P: 531*].

**Saini (1982)**[29] has studied six Asian countries, which contain low and moderate/high inflation cases; the out-come of his empirical analysis shows that the growth of money stock was not cause of inflation in six countries. He found that the failure of monetarist model to explain the behaviour of prices in these countries may be due to monetisation and impact of various domestic and external cost pressures, in his words:

> *"...monetization – i.e. expansion of the scope of the monetary economy – in the course of economic development may have endogenized the growth in money supply...cost and/or exogenous pressure may account for the rise in prices experienced in Asian countries."* [*Saini, 1982; p. 879*].

He has found that import price variable is not significant in explaining inflation. His empirical results support the monetarist model, which is augmented by the inclusion of import prices that are widely alleged to have intensified inflationary in moderate inflation countries.

**Ize and Salas (1985)** [30] have used the yearly data, in the Mexican context, for the period 1961-1985, they have tested the classical-monetarist model and the Keynesian-structuralist model by using broad monetary aggregate ($M_4$) definition with the help of Cobb-Douglas production function and also ordinary least squares, $R^2$, **DW**. In their studied paper that estimates and compares four alternative models of price and output, the study found a structuralist type model with working capital is found to dominate its monetarist and Keynesian counterparts. They concluded that: "*an explanation of price inertia based on the existence of working capital rather than simple price stickness or delayed adjustments by firm.*" [*Ize and sales, 1985,p. 198*], another relevant finding, however is that changes in foreign ***Peso*** prices find to have impact on internal prices, money could have seemingly permanent impacts on output was found and the disturbing finding is that the inflationary process seems to be on an upwards finds, possibly due to some factors.

**Moore 1988)**[31] has placed the following inquiries: Surely the high-powered base and bank reserves are the liabilities of central bank? If so; surely the central bank can directly affect the total of its liabilities by the open market (operations) purchase and sale of securities? Further more, he puts this question: surely the ratio of banking system reserves to banking system total deposits exhibits considerable stability overtime? And then, the central bank ability to control the supply of money appears to be amply self-evident. Moore argues that the central banks cannot control the supply of credit money (control over money growth). His paper seeks to make the case that, we have to look at the relation between base money and deposit money in another way, in his words:

*"...even through the supply of credit money endogenously credit driven as described above, exposit the high-powered base multiplier will always appear to be fully confirmed". [Moore, 1988; p 384].*

**Rangarajan and Arif (1990)**[32] have examined interrelationships between money, output and prices causality using data from 1961/62 to 1984/85 in the Indian context, their model has both linear and log-linear equations, ordinary least square (**OLS**) Statistical Criteria Coefficient Determination ($R^2$) and Durbin-Watson (**DW**) statistics, Standard errors and **T-test**. They have tried to establish the link between the fiscal, monetary and real sector of the economy, when the money supply was changing endogenously with fiscal deficit. They have concluded that:

*"The model shows that prices are highly sensitive to monetary shock. Because the trade-off in terms of inflation is extremely high, sustained monetary consequence of the variable policy tool. As a consequence of the strong inflationary spiral, the impact of the policy on real output gets weakened in the long-run". [Rangarajan and Arif, 1990; p.851]*

**Pollin (1991)**[33] empirically, has tested two theories of money supply endogeneity. He has argued that a key feature of the accommodative endogeneity is the notion of proportionality in relative to loan movements and reserves. According to him some of the reasons for the absence of proportionality among variables could be the practice of liability management emerging in financial liberalisation scenario implying lending growth of reserves and in fact that the interest rates are not governed by the central bank intervention.

**Friedman and Kuttner (1992)**[34] have examined the role of quantity of money in influencing national income, prices and other aspects of economic activity.

They considered the quarterly data of the USA for three-sample period viz. 1960:2–1979:3, 1960:2–1990:4 and 1970:3–1990:4. They considered monetary base, $M_1$ and $M_2$, credit **GNP** and interest rates. The main aim of their study was to show how the passage of time, particularly since 1980's had altered familiar empirical relationship, which supported the central role for money in the monetary policy process. Autoregressive tests and forecast error variance decomposition were used to establish whether fluctuations in money or interest rates were useful for predicting subsequent fluctuations in income or prices. It was found that there was a sharp deterioration in the money income relationship.

**Friedman and Kuttener (1993)**[35] in their study, they have extended the analysis of **Stock** and **Watson** (1989)[36] by increasing the sample size and using an alternative interest rates variable. They also report that the commercial paper rate has no impact on future output. As the **ARCH** effect can obscure the causation relationship between money and output. They find the money variables are not jointly significant, that is, money does not affect output, their result is contrary to the one reported in Stock and Watson[34] (1989). Thus, once the **ARCH** effect is allowed for, the money output causality documented by Stock and Watson (1989) actually robust to the extension of the sample period and the use of an alternative measure of the interest rate variable. In their conclusion, they found that, the effect of money and the way money affects output are crucial to the understanding of the role of monetary policy and business cycles. The empirical money-output causality regression typically has lagged output as one of the regressors. Given the simulation

results, we know that it will be difficult to uncover the monetary effect if there is conditioned heteroskedaticity.

**Thoma (1994)** [37] has devised a regression equation to test for asymmetries in the effects of positive and negative changes in money growth and differential effects of money growth over the business cycles. He has used the sample period of 1950:01 to 1989:12 and variables $M_1$ and consumer price index (**CPI**). The results are that, negative monetary shocks, but not positive ones, affect the future output growth. However, the diagnostics suggest evidence of **ARCH** effects, the maximum likelihood (**ML**) technique estimation with an **ARCH** error confirms the presence of **ARCH** effects.

**Zaki (1995)**[38] in his article investigates the money supply control through the multiplier, monetary base frame-work in Egypt would have been possible between 1952 -1990 [*Zaki 1995; p. 100*], he has used data of monetary base, net foreign assets, net claims on government, and claims on private sector. He has used **BJ** techniques and **ARMA** model for analyzing the data, and reached to conclude that the financial needs of the Egyptian government dictated changes in high-powered money and that in turns the main contributor to increase money supply. For the period 1991-1993 the aggregate forecasting provided satisfactory result with less government interference and greater reliance on market system. Predictability and stability of money multiplier both have to increase

**Fackler and Rogers (1995)**[39] have estimated a small open economy macro model for Bolivia and Brazil, those who undertook stabilisation programmes to

control inflation. In their study, they used the quarterly data 1983: I to 1990: IV of Bolivia, and the monthly data 1983:1 to 1990:9 of Brazil to establish the source of fluctuations in output and inflation. The variables, which considered in their study were government pending/tax ratio, output, inflation rates, real exchange rate and real money balances. In the first process, an unconstrained vector autoregression **(VAR)** was estimated. In the second process, a just identified structural model of **VAR** residuals from the first stage has been specified and then estimated using a method of moment estimator. From the estimated impulse response functions, their study concluded that the responses of output were similar in Bolivian and Brazilian economies. Increase of money supply is identified as the cause of demand pull-inflation, the effect of output on budget deficit is negative, and also output is affected by changes in government spending, and monetary changes affect output only after a lag.

**Cochrane (1998)**[40] has investigated a fundamental issue underlying the Vector Autoregression (**VAR**) approach, the implications of identifying restrictions on money-output causality test results. He has argued that a reasonable assumption specifying the relative effects of anticipated and unanticipated money should be used to study the effect of money on output.

**Mudabber (2002/03)**[41] the main purpose of his paper has been to investigate the issue of causality among key aggregate macro-variables, for his empirical study, he uses $M_2$ as broad money, price, **GDP** and interest rate for Bangladesh ($1974Q_2$-$1998Q_4$), India ($1967Q_1$-$1996Q_4$) and Pakistan ($1972Q_1$-$1997Q_2$). He has applied Vector-Auto-Regressive (**VAR**) model and used ratio

test, Akaike's Information Criterion (**AIC**) and Bayesian Inflammation Criterion (**BIC**). In his investigation, the causality test suggested that the interest rate, though controversial in developing countries, deserves to be a good policy variable to Bangladesh and Pakistan, While money deserves to be a good policy variable for India. A bi-directional causality exists between money and price in Bangladesh and Pakistan (increase in money stock fuels prices), multivariate causality test suggested interest rate and money do cause output in case of Bangladesh but not the case in other two.

## 4.6 MODELS SPECIFICATIONS FOR OF MONEY SUPPLY

These models are for the analysis of the supply of money in relation with the income, prices, and inflation using the Sudanese data for the period from 1980/81 to 2001.

### 4.6.1 MONEY-INCOME RELATIONSHIP

The empirical studies, of Friedman and Meiselman (1963), Tobin (1970), Modigliani (1963), Moroney and Mason (1971) and other of the Monetarist School, on one hand and, the works of Anderson and Carlson (1970) and other economists of St. Louis on the other hand. They have revealed mainly two types of models used for examining the relationship between money and income; economists who favoured the Keynesian type of transmission mechanism were biased towards structural model and those favouring Monetarist proposition were biased towards reduced-form single equation model. Nevertheless, the choice between structural or reduced-form equation

is to be made on the basis of the economic structure of the country, we are going to study (the Sudan in our case), and the availability of data, if some statistical parameters are to be estimated. In a developing economy like the Sudan where financial system (financial markets are not developed) is at a rudimentary stage, there is money on one hand, physical assets on the other one, the substitution between money and physical assets, and the cost of capital channel that works through changes in the rate of return and relative yield on various financial assets has nothing to do with the real sector of the economy.

Further, some of the behavioural relationships of the economic variables inspire us to choose the Monetarist type equation rather than neo-Keynesian type of equation for examining the money-income relationship. They are (i) the demand for money function in the Sudan has been found to be stable, (ii) interest elasticity of the demand for money has been found insignificant and was prohibited, (iii) high-powered money is found as a variable that can be controlled by the monetary authorities to a large extent, (iv) money supply is determined predominantly by high-powered money and money multiplier. These features of the economy are very much likely to satisfy the condition for the monetarist type of specification of money-income relationship, and the quantity theory of money can be manipulated for a theory of income determination. The corresponding estimating equation based on the above analysis, the equation for income is expressed as:

$$GDP = f(M^S)$$

$$\log GDP = f(M^S)$$

$$\log GDP\ (Y)_t = a_0 + a_1 Y_{t-1} + a_2 M_{t-1} + U_1 \qquad (5)$$

The behaviour of the model is quite monetarist. However, as the degree of indexation falls, the output effect becomes dominant. On the other hand, the impact on output of autonomous changes in costs depends on the degree of monetary accommodation. In particular, if one wants to stabilise output, increases in nominal costs should be fully accommodated.

### 4.6.2 MONEY-PRICES RELATIONSHIP

This section, which explains and presents the money prices relationship along with model of price determination, inflation and expected inflation, we start it by the following inquiries: Is it true that money can affect the Sudanese price level substantially? So long as exports and imports can be made freely, so long as the exchange rate is fixed and no stringent exchange controls are imposed, is it not the case that the Sudanese price level depends mainly on the behaviour of prices in rest of the world? The relationship between money supply and prices is usually established through classical quantity equation $MV = PT$, where the money stock ($M$) time velocity ($V$) equals volume of output ($T$) times the price level ($P$), as quantity theory is a theory of price determination, it is assumed that volume of real output is determined independent of money stock. Hence, given the level of output and income velocity, any change in $M$ is supposed to have a proportional effect on **P** in the same direction. The modern quality theory however, views that the relationship between changes in money supply and in the price level may not necessarily be proportional [*Friedman 1969*].[42] It is hypothesised that the impact of monetary impulses will initially be observed on output and velocity as well as the price level. The modern quantity theory model suggests that if

money supply rises more than its demand, then excess money spills over into the financial assets and goods market, thereby, increasing the price level. This increase in price level reduces the level of real money balance and hence, brings about equilibrium in the money market by equating the demand for money with the supply of it.

**PRICE DETERMINATION**: the proposition that money causes prices is unambiguously supported by the works of Granger (1969) and Sims (1972; 1980) and other economic writers, as it has been shown in the survey of literature. In order to determine prices, we first formulate the demand for real money balance as a function of the level of real income and the opportunity cost of holding assets in form of money. As far as the econometric modeling on the subject (money-prices relationship) is concerned, the underlying model is typically on the following functional relational, [*Heller, 1980 p 746*]: [43]

$$\log P/M = f(Y,\pi)$$

Therefore, since we are interested in the price level, we take the obtained equation from the work of Aghevli and Khan (1978) [44] as follows:

$$\log P_t = \lambda\alpha - \lambda \log Y_t + \lambda\alpha_2\pi_\tau - (1-\lambda)\log (M/P)_{t-1} + M_t \qquad (6)$$

Where $P_t$ denotes price level, **Y** is the price level of income; $\pi$ is the expected rate of inflation. **M** stands for the stock of money balances, while $\lambda$ denotes the coefficient of adjustment, $1 > \lambda > 0$.

**Expected Inflation**: Expectations of inflation, $\pi$ are assumed to be generated by the adaptive-expectations model of Cagan (1956), in which these expectations are revised proportionally to the difference between the actual

rate of inflation in the previous period and the rate that was expected to prevail in that period [*Khan and Knight, 1981; p.15*].[45] This expectations mechanism has certain theoretical problems and does not fit easily into the currently popular rational-expectations framework developed by Sargent and Wallace (1973) and Barro (1977; 1978), among others; but it is still the most commonly used because of its inherent simplicity, a property that is considerable importance given the limited availability of data for developing countries (e.g. the Sudan). For this reason, we have also used this approach to modeling expectations, from the work of Aghevli and Khan (1978; p. 393). Hence, the model for the expected inflation as follows:

$$\pi_t = \beta \Delta \log P_t + (1-\beta)\pi_{t-1} \qquad (7)$$

Where, $\Delta$ measures the extent to which the previous of expectations responds to the error, and where, $P_t$ denotes the price level, $\pi$ expected rate of inflation,

## 4.7 ) RESULTS OF THE ANALYSIS

The followings are the out come of the statistical analysis for money-income-price relationship

### (a) Money- Income Relationship-

$$\log Y_1 = \underset{(1.900)}{M\ .409548} + \underset{(1.835)}{Y\ .395695}$$

**$R^2$ = .53091 F = 9.6200 Significance F = .0016**

**DW = .95036**

(b) Money-Price Relationship

$log\ P_1$ = M .403124 +M/P -.391173 +Y .294447
(2.951) (-3.299) (2.085)

$R^2$ = .83353 F = 28.37384 Significance F = .000

DW = 1.27833

$log\ M_1$ = P 0.944926 +Y -.054599 +INF -.034428 + Xr .08607
(2.730) (-.348) (-.700) (.258)

R2 = .96807 F = 121.2546 Significance F = .000

DW = 2.11504

$log\ P$ = M .40312 + Y . 29444 + M/ P -.39117
(2.951) ( 2.085) (- 3.299)

$R^2$ = .83353 F = 28.3738 Significance F = .0000

DW = 1.27833

(c) CU/DD)

$log\ CU/DD_1$ = Y .707649
(4.366)

$R^2$ = .50077 F = 19.05835 Significance F = .0003

DW = 1.95907

(d) TD/DD)

$log\ TD/DD_1$ = Y .704654 + INF - .019864
(4.098) (-.116)

$R^2$ = .49791 F = 8.42940 Significance F = .0029

DW = 1.95907

The reporting results of the above regressions estimates, we typically reproduce the **t** value for each individual regression coefficient in part theses individual below it. The equation data quite well as indicated by the values of $\mathbf{R^2}$, **F** and **DW**. The above regression results strongly suggest that the there is positive correlation among the variables, with significant at 5%, and DW at more that 2.

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**Table No. 4:4**

Money Multiplier and Velocity of Circulation (Point-to-point):

1980/81 – 2001

(in millions of Sudanese Dinars)

| Year | Narrow Money $M_1$ | Broad Money $M_2$ | Reserve Money (RM) | $M_1$ / RM | $M_2$ / RM | GDP / $M_2$ | Change in ($M_2$) |
|---|---|---|---|---|---|---|---|
| 1981 | 153.09 | 179.50 | 121.15 | 1.263 | 1.481 | 3.564 | 41.98% |
| 1982 | 209.10 | 253.41 | 158.19 | 1.321 | 1.601 | 2.651 | 41.17% |
| 1983 | 233.61 | 311.04 | 174.02 | 1.342 | 1.787 | 2.950 | 22.74% |
| 1984 | 2,764.0 | 3,719.0 | 2,444.1 | 1.130 | 1.521 | 3.041 | 19.56% |
| 1985 | 414.46 | 610.81 | 394.95 | 1.049 | 1.546 | 2.227 | 64.24% |
| 1986 | 584.88 | 781.28 | 561.50 | 1.041 | 1.391 | 2.577 | 27.90% |
| 1987 | 786.83 | 1,066.38 | 716.02 | 1.098 | 1.489 | 3.420 | 36.49% |
| 1988 | 1,121.80 | 1,416.38 | 944.72 | 1.187 | 1.499 | 3.303 | 32.82% |
| 1989 | 1,889.90 | 2,171.60 | 1,751.50 | 1.079 | 1.239 | 3.801 | 53.32% |
| 1990 | 2,765.90 | 3,230.20 | 2,333.80 | 1.185 | 1.384 | 3.408 | 48.74% |
| 1991 | 4,283.23 | 5,269.55 | 3,460.80 | 1.280 | 1.563 | 3.559 | 63.13% |
| 1992 | 9,650.20 | 14,159.45 | 8,800.00 | 1.017 | 1.483 | 3.231 | 168.70% |
| 1993 | 16,041.00 | 26,858.34 | 14,400.0 | 1.087 | 1.837 | 3.585 | 89.68% |
| 1994 | 24,7378.1 | 40,535.29 | 20,212.0 | 1.224 | 2.006 | 4.641 | 50.92% |
| 1995 | 41,649.69 | 70,586.69 | 35,725.0 | 1.166 | 1.977 | 7.833 | 74.13% |
| 1996 | 77,249.90 | 116,599.9 | 64,936.0 | 1.193 | 1.802 | 8.859 | 65.18% |
| 1997 | 101,648.9 | 159,713.7 | 87,183.0 | 1.165 | 1.831 | 10.499 | 36.97% |
| 1998 | 130,861.6 | 206,951.3 | 112,805.0 | 1.160 | 1.834 | 11.063 | 29.57% |
| 1999 | 169,613 | 257,918 | 152,414.0 | 1.112 | 1.692 | 10.088 | 24.62% |
| 2000 | 234,587 | 346,671 | 221,526.0 | 1.058 | 1.564 | 8.343 | 34.41% |
| 2001 | 271,387 | 432,213 | 229,791.0 | 1.181 | 1.880 | 7.498 | 24.67% |

Source: (1) Bank of Sudan Annual Reports.
(2) International Financial Statistics (IMF).

**Table No. : 4.5**

**Factors Affecting Money supply**

**(In millions of Dinars)**

| Item | 1981 | 1982 | 1983 | 1984 | Dec. 1985 | Dec. 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Money Supply M2 | 179.50 | 253.41 | 311.04 | 371.98 | 610.81 | 781.28 | 1,066.38 | | 2,171.60 | 3,230.20 | 5,269.55 |
| A-Foreign Assets (Net) | -108.2 | -154.3 | -238.6 | -236.6 | -357.2 | -141.6 | -141.6 | 1,416.38 | -981.9 | -1,214.7 | -2,494.6 |
| B-Offsets | -14.9 | -4.9 | 153.2 | 153.2 | 2909 | 3118 | 3118 | -960.6 | 864.9 | 1,011.0 | 26464 |
| C-Net Domestic Assets(1+2+3) | 287.7 | 407.8 | | | 3 | | | 8064 | | | N.A. |
| 1-Claims on Public Sector (Net) | 237.8 | 276.1 | 357.4 | 427.2 | N.A. | 11.9 | 11.9 | N.A. | N.A. | N.A. | N.A. |
| 2-Claims on Private Sector | N.A. | N.A. | N.A. | N.A. | N.A. | N.A. | N.A. | N.A. | N.A. | N.A. | N.A. |
| 3-Other Items Net | 49.9 | 131.7 | 18.5 | 29.6 | 198 | 13 | 13 | 416 | 1002 | 765 | 730 |
| Total A+B+C = M2 | 179.5 | 253.41 | 311.04 | 371.98 | 610.81 | 781.28 | 781.28 | N.A. | N.A. | N.A. | 5269.55 |

**Source: Bank of Sudan Annual Reports**

**Table No. : 4.5-B**

## Factors Affecting Money supply

**(In millions of Dinars)**

| Item | Dec. 1992 | Dec. 1993 | Dec. 1994 | Dec. 1995 | Dec. 1996 | Dec. 1997 | Dec. 1998 | Dec. 1999 | Dec.2000 | Dec.2001 |
|---|---|---|---|---|---|---|---|---|---|---|
| Money Supply M2 | 14,159.5 | 26,858.3 | 40,535 | 70,587 | 116,598 | 159,714 | 206,951 | 257,918 | 346,671 | 432,213 |
| A-Foreign Assets (Net) | -16651.1 | -56991.7 | -223,899 | -391,025 | -391,025 | -492,815 | -670,043 | -722,706 | -678,023 | -696,627 |
| B-Offsets | 19325.7 | 62,853.9 | 115,778 | 233,682 | 409,833 | 529,305 | 731,140 | 796,126 | 777,555 | 766,300 |
| C-Net Domestic Assets(1+2+3) | 11467.9 | 20,979.3 | 33,111 | 60,804 | 97,790 | 123,224 | 145,854 | 184,498 | 247,139 | 362,540 |
| 1-Claims on Public Sector (Net) | 8011.1 | 14,449.8 | 17,756 | 26,658 | 49,570 | 59,352 | 74,645 | 109,478 | 128,896 | 161,232 |
| 2-Claims on Private Sector | 3176.1 | 4491.6 | 8918 | 13,193 | 32,124 | 39,711 | 44,764 | 43,937 | 73,571 | 102,284 |
| 3-Other Items Net | 280.7 | 2037.9 | 6420 | 20,936 | 16,079 | 23,987 | 25,922 | 31,083 | 44,671 | 99,024 |
| Total A+B+C = M2 | 14,159.5 | 26,858.3 | 40,535 | 70,587 | 116,598 | 159,714 | 206,951 | 257,918 | 346,671 | 432,213 |

**Source: Bank of Sudan Annual Reports**

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