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Determining the Potency of Fiscal and Monetary Policy for Sudan Economy Over the Period 1970-2010: An Econometric Approach

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Abstract

This paper attempts to formulate an econometric model bearing the salient features of the generalequilibrium IS-LM model to ascertain whether the monetary or fiscal policy wasmore powerful in influencing Sudan level of national income. The study hypothesizes that it is ratherdifficult to tell whichof the two policies is more powerful than the other due to specific factors.The methodology is basically quantitative in nature in order to obtain numeric estimates of the parameters of the key policy variables required for testing the hypothesis of the study and other variables related to specific structural aspectcentral for providing qualitative information useful in improving policy practice.The empirical results reveal the insensitivity of the demand for investment and the demand for real money balances to the rate of interestmaking it difficult to discern which policy is more potent in Sudan economy. Otherunderlyingfactors, namely: the type of exchange rate regime and thedegree of capital mobility can also be held responsible. Hence, some difficultiesarise from structural maladjustments and internal and external impediments hindering fiscal and monetary policiesimplementation and practice in Sudan economy. Based on the emerged results specific recommendations are suggested to improve both the effectiveness of monetary and fiscal policy for achieving the set of economic targets, in addition to enhancing the supportive structural policy needed to increase the economy's flexibility and its supply potentiality.

Key words: Monetary policy, fiscal policy, potency, investment, demand for real money balances, insensitivity.

(1) Introduction

This introductory section is divided into two subsections. The first one sheds light on the primary objectives of both monetary and fiscal policies over the reviewed period and challenges facing their realization. The second subsection gives a critical review of the implementation and practice of economic policies in Sudan, to serve as an historical background assisting in the pre-specification of the used model.

(1.1) Objectives of Monetary and Fiscal Policy in Sudan Over the Period 1970-2010

Monetary and fiscal policies in Sudan over the period 1970-2010 were intended to serve several objectives namely: to maintain the internal and external balance of Sudan economy, to promoteeconomic development and growth in order to increase the productive capabilities of the economy and to foster the strategy of poverty reduction through the pursuit of micro-financing, price stabilization, money and credit control.In addition, the monetary policy targeted advancement of banking technology,

Specifically over the period 2000-2010 and after. However, the emphasis of fiscal and monetary policies was laid on price stabilization and credit squeeze over the entire reviewed period. The high rates of unemployment, particularly among university graduates and underemployment in the traditional sector was another economic problem targeted by the monetary and fiscal policies. In addition, structural policy was implemented in a mutually supportive way to achieve and maintain efficient and better utilization of economic resources in the medium and long-term.

Towards the end of the reviewed period, attempts were launched to:

- Free monetary and credit policies.
- Establish and promote non- banking financial intermediaries.
- Foster the use of banking technologies and automatic payment systems.
- Regulate and promote the foreign exchange market.
- Accumulate the necessary foreign reserves to stabilize the exchange rate.

The fiscal policy in Sudan, like other developed and developing countries, was primarily aiming todiscipline public spending. It comprises government purchases, taxes and subsidies. A substantial portion of the annual budget is used to subsidize some basic commodities besides the finance of the chronic civil wars on the peripheries of the country causing a severe budget deficit over almost the entire reviewed period.

(1.2) A Critical Review of Economic Policy Practice in Sudan

Despite the fact that the instruments of monetary policy used in Sudan are similar to other developed economies, specific problems hinder their implementation, hence, crippling their efficacy. The discount rate policy to start with is quite ineffective due to excess liquidity that some Sudanese commercial banks are experiencing. Attributable to this fact, even if the discount rate is raised to reduce credit, commercial banks might not be responsive, and hence neither the cost nor the availability of credit will be influenced. Another reason why the discount rate policy is ineffectual is the limited size of the bill market in Sudan.

Further, Central Bank of Sudan uses the open market operations primarily to change the structure of liquidity. However, it is usually faced by some impediments, e.g. the market for government securities is narrow in size and not much diversified. Another problematic feature of the Sudanese banking system is the instability of the cash deposit ratio. It is quite noticeable that these ratios are considerably higher than the minimum legal requirements. This fact contributes in weakening the efficacies of the open market operations as a useful tool of monetary policy. This led to the frequent change of the reserve requirement ratio by the central bank over the reviewed period to absorb the excess liquidity characterizing some commercial banks as pointed out above. One criticism leveled against the effects of reserve requirement ratio as a monetary tool is that it is discriminatory, since it affects only the credit-creating ability of the commercial banks and not the non-banking financial intermediaries. However, given the composition of the Sudanese financial system, the non-banking financial intermediaries constitute small portion of it. Another problem is that the commercial banks that do not maintain excess liquidity will be most affected by it.

Central Bank of Sudan, in addition, used as a monetary policy tool selective credit controls in a form of import pre-deposit requirements. That is importers who are seeking foreign exchange are required to deposit a certain proportion of the total value of the goods need to be imported. This policy tool was intended to impose restrictions on luxuries.

To further explore the monetary and fiscal policies practice in Sudan certain economic events and specific implemented policies are highlighted in the remainder of this section as some- not all- of these events and policies adversely impacted economic activity. That is, they are pro-cyclical in nature accentuating rather than dampening economic volatility.For instance,almost the wholeof the reviewed period was characterized by fiscal deficits due to certain fiscal policies and it did not even fall in periods of increased growth - see table (1) in the Appendix.This indicates the weak effects of automatic stabilizers through government expenditure, in particular, implying pro-cyclical fiscal policy. The first of these events occurred in 1970, the beginning of the reviewed period of this study. The then government in power nationalized the whole banking system. Consequently, this led to the expansion of the public ownership of a substantial portion of the financial sector. This ideologically motivated act precipitated long-term adverse and chronic economic repercussions which were dragging on over time up to the initiation of the financial sector reform at the end of1989. The persistent fiscal deficit was partly used to be financed by the nationalized financial institutions as they were viewed as a source of public finance.

This undesirable state of affairs was characterized by wide spread financial repressionwhich led eventually to the initiation of the financial sector reform program to promote the quality of financial intermediation and to establish a sound market-based system of monetary management.

Further, Central Bank of Sudan once it assumed it's duties in 1960 imposed restrictions on foreign exchange loans, as alluded to above, to finance imports and other needs to reduce the exerted pressures on foreign exchange reserves. These restrictions were relaxed after a while, but another set of measures was implemented to maintain the foreign exchange reserves. However,this set of measures was generally unsuccessful in achieving the desired objectives.

To give a glimpse of these measures, they can be summarized as follows:

- Devaluation of the Sudanese pounds in the years 1978, 1981, 1982 and 1984.
- Abolition of nil value on imports.
- Restriction of government borrowing from the banking system by imposing a fixed ceiling.
- Encouragement of exports and restrictions on imports.
- Rescheduling of foreign debt which reached 7.454 billion US dollar in1983 (see Central Bank of Sudan Reports 1980-1990).

As pointed out above, this set of policy measures was largely unsuccessful. As a consequence, it was replaced by a policy of credit squeeze in 1983/1984 which involved different measures to minimize the money supply growth rates. The measures used can be highlighted as follows:

- The export sector and the working capital for domestic industries were given priority for commercial banks credit.
- Restriction on imports of luxurygoods.
- A 10% reserve requirement was imposed to control the excess liquidity of commercial banks.
- A margin of 30% on advances was imposed against importation of specific commodities.
- Prohibition of credit facilities for speculative purposes.
- Commercial banks were required to extend 10% of their medium and long-term credit facilities to the productive sectors of the economy.

The monetary policy of credit squeeze succeeded in reducing the money supply from 26% to 17% in 1983, see Table (1). Nevertheless, there were still problems surrounding the external balance attributable to the persistent external deficits, in addition to the soaring of the overall price levels. This led to the introduction of another set of policy measures, namely:

- The reserve requirement was raised from 10% to 12.5% to reduce liquidity.
- Margins on advances were increased from 30% to 40% against imports of certain goods.
- Inter-bank lending was abolished.
- Funds due to foreign importers were required to be deposited with the Central Bank of Sudan.
- Withdrawals were confined only to demand by importers.
- Due allowance was made for commercial banks to finance imports of productive goods in foreign currencies to assist in promoting economic development.

Further, exchange rate taxes and subsidies were abolished by Central Bank of Sudan. The multiple exchange rate system was replaced by a dual exchange rate to stimulate the inflow of foreign exchange. A tight monetary policy was undertaken to reduce deficit financing by the banking system. This was attributable to the fact that large government borrowing requirements had led to formidable challenges for Central Bank of Sudan in coordinating debt management and monetary policy. A significant function of a central bank is to cope with persistent structural liquidity to facilitate smooth transmission of monetary policy actions.

New measures were imposed in 1987so that extended finance should account for more than 30% of total credit ceiling for exports and more than 25%for working capital. In addition, financing of local trade was restricted. After a while, fora more tight monetary policy, the reserve requirement was raised to 20%.

In 1987, medium and long-term credit policies were initiated for the sole purpose of serving and financing economic development. Furthermore, the credit policy of 1988 was focused on the legal reserve ratio; it was reduced from 20% to 18%. The primary target for the reduced reserve ratio was to boost credit advanced to the agricultural sector to cater for the adverse effects of the disastrous floods and heavy rains of 1988.

Despitethe economic significance of the cooperative sector in Sudan, this sector was long neglected, due attention was barely given to it by the Sudanese policy makers. However, realizing its importance the monetary authorities showed some interest in resolving the funding problems confronting this sector by boosting the credit advanced to it to alleviate the severity of poverty. Due government attention is still needed to promote the functioning of this important sector to mitigate the severity of poverty.

As one can observe from the preceding historical account, monetary policy prior to the year 1989 was intended to be confined into few monetary tools and it was less effective in achieving the set targets. To elaborate more, the Central Bank of Sudan up to the year 1990 had only direct control instruments to impact credit and liquidity. They were in the form of reserve requirements, liquidity ratios and interest rate ceilings accompanied by rational allocation of credit to priority sectors. This, in turn, contributed in worsening the financial repression plaguing Sudan financial sector. As pointed out above, these different types of monetary tools were adjusted frequently to achieve their ultimate objectives of stimulating economic activity.

However, as from February 1992, Sudan economy witnessed a remarkable change in economic policy. A domestic program for economic reform and liberalization was initiated in this year to serve several economic objectives. To facilitate achieving these economic objectives, the Central Bank of Sudan implemented specific monetary tools and instruments:

- To ensure unhindered prevalence of competitive prices, banking products prices were gradually liberalized.
- Exchange rate was liberalized in order to seek a method or system that assists in maintaining a rather stable real exchange rate.
- Reduction of the burden on government budget necessitated the use of direct and indirect subsidies.
- For fair distribution of credit among customers, quantitative control methods were reduced.
- Banks owned by the public sector were liberalized.

The credit policy pursued by the Central Bank of Sudan in 1995 was designed to achieve specific targets, namely: to promote priority sectors, to decelerate the inflation rate, to rationalize economic resources, equitable income and wealth distribution, assistance to commercial banks to adapt their positions according to the Adaptive Scheme Program of 1994. Further, the reserve requirement ratio was raised to 30% which was supplemented by 10% as internal liquidity to meet daily withdrawals by customers.

The Central Bank of Sudan opened a blocked account for commercial banksto transfer all foreign importer`s accounts to be kept in this blocked account. For commercial banks to keep deposits among themselves they have to seek approval from the Central Bank. Commercial banks were required to give priority to the productive sectors in advancing their credit with not less than 90% of total credit. Moreover, the agricultural sector should account for 40% of total credit.

To promote the banking system and to stabilize the exchange rate, a comprehensive banking strategy was designed to cover the period 1992 - 2002. It was intended to serve specific objectives -See Central Bank of Sudan Comprehensive Banking Strategy 1992- 2002 and Vargas (2011)

In October 1998, the official foreign exchange system was unified. It was replaced by a moving average of market rates. The exchange rate control was abolished and the multiple currency practice was eliminated. Moreover, all exchange restrictions associated with the current accounts were eliminated. A managed float exchange regime was formally adopted in 2003 to assist in maintaining the stability of Sudan economic activity.Accordingly, there was a shift in the management of monetary policy; the policy was made to target the growth of money supply instead of the exchange rate. This led the Central Bank of Sudan to establish a monetary operation unit to execute the policies designed by a joint High Committee involving the Ministry of Finance and National Economy as a partner. Besides this function, the committee was supposed to coordinate the monetary and fiscal policies as well.

During the last decade of the reviewed period (2000-2010) and in association with the implementation of monetary policy, advanced technological practices were introduced to facilitate the operation of Sudan banking system in achieving the posed monetary objectives.

Now, shifting the focus away from monetary policy practice to the fiscal policypractice over the reviewed period, it was noticeable that the fiscal performance of the government was rather weak as well over the period 1970-1996 judging by the slow growth in real GDP and the acceleratedmonthly inflation rate which skyrocketed to 166% by August 1996, the highest since Sudan achieved its independence in 1956. However, the annual average was reduced to 130.44% in 1996- as shown in Table (1). The persistence of inflation was directly linked to the growing budget deficit and the nature of how it's financed which rested on borrowing from the Central Bank of Sudan.A number of reasons were responsible for the budget deficit as well, namely:

- The huge decline in the share of the government revenue in GDP. It fell from 17.5% in 1976 to only 8% in 1989 attributable to the inelastic structure of the Sudan tax system.
- Unstable export proceedsin view of the volatility of the prices of primary products which constitute substantial portion of Sudan total exports, in addition to adverse exogenous shocks caused by natural disasters e.g. floods , drought ,desertification etc.
- The losses in government revenue generated from customs and excise tax as a result of the fact that they were based on the lower official exchange rate rather than the higher parallel market rate.
- The rather faulty trade policies pursued by the government as a result of its intervention in the domestic trade pricing policy and the restrictions imposed on trade.

The above points indicate the organic linkage between the fiscal policieson one hand and the external sector in Sudan economy on the other hand due to the fact that foreign trade taxes constitute a substantial share in the government revenue. Accordingly, any impedimentunderlying the behavior of the external sector might be reflected unfavorably on the government budget.

In the sphere of direct taxes, the picture is quite gloomy. Over the period 1970 to 1996, its percentage share in GDP did not exceed 1%. This was mainly due to a wide array of weaknesseswhich encompass the following aspects: narrow tax base, poor tax administration system as manifested in tax estimation, collection, weak book - keeping and accounts, and lack of well trained staff.

All this led the government to initiate a major fiscal reform program over the period 1996 to 2000. The fiscal reform was intended to boost the government revenue by adopting a wide tax reform and rationalizing the public spending, particularly prohibition of extra budgetary activities, to achieve and maintain efficient resource allocation.

A new tax was introduced in 1999, namely, a 10% value added tax on all domestic sales, services and imports. The rate of the value added was increased gradually to 12% and later in 2007 to 15%. It was raised once more to 20% for the communication sector in 2009. A package of tax exemption was adopted to encourage investment despite the dangers associated with such tax holidays. In addition, on-petroleum exports were exempted with exception of animal raw skins.

Further, the multi-brackets custom duties system was revised in 2004-2005, the custom duties brackets were reduced from 13 to 5. There was a gradual decline in custom duties for the Free Arab Region imports in 2007 in accordance with a mutual agreement. The government adopted a preferential custom policy for the import of capital goods; which were totally exempted with zero tariffs. In addition, preferential policies were pursued for the importation of some basic food items, e.g. wheat and flour. The agricultural sector was totally exempted from taxes. The taxes imposed on the industrial sector were reduced to 10%. A gradual reduction policy was pursued in connection with the corporate profit tax for banks, private business enterprises and insurance companies. The corporate profit tax was reduced from 35% to 30% in 2007. In 2008 a unified corporate profit tax of 15% was imposed. To achieve equitable corporate profit tax, the exemptions which were given in accordance with the Company Investment Act were totally revised. All new exemptions given in 2008 were abolished and a 3% profit tax was imposed on those companies which were already exempted.

In addition, a 5% development tax was imposed. A production tax on the petroleum productswas, also, imposed. The higher- bracket personal income tax was reduced from 20% to 15% in 2008. Tax policies favoring the poor segment of the population were pursued. They involved the following:

- Food items and basic services were exempted from the value added tax e.g. health services, water, milk, meat etc.
- The compulsory financial contribution of the Sudanese working abroad was abolished.
- The lower limit was raised for those exempted from the personal income tax. This led to the inclusion of the majority of public sector workers within the exemption zone.
- The tax imposed on the estate rent was reduced to 10%.
- The services fees and the additional fees on imports were revised.

Another initiated fiscal reform which was intended to mobilize resources to finance the budget deficit was the introduction of a new government certificate, named"Musharaka"and a security called "Sarh" as fiscal instruments to make use of the private sector savings. The merit of private savings as a real source to finance the government budget, is entirely absent of any inflationary consequences.

Sudan economy over the period extending from the exportation of oil in 1999 up to the secession of south Sudan in 2011 can be considered as oil based economyattributed to the fact that oil revenue wascontributing, on average, 75%of the total export. Unfortunately, being oil-based precipitated certain complications to the fiscal policy as a consequence of the volatility in oil proceeds arising from shocks caused by the unpredictability of international oil prices. This posed a challenge to the design of an appropriate fiscal policy that is required to stabilize the budgetary expenditure and to insulate the economy from looming uncertainties. Further, the foreignexchange inflows resulting from oil revenue led to the appreciation of the real exchange rate and inflict external imbalances.

The ratio of tax revenue to the total revenue was fluctuating from year to year over the period 2000 to 2006. It was 48.8% in 2000 and it jumped to 51.5 % in 2001 but declined to 39% in 2006. The indirect tax revenue was most dominant compared with the direct tax revenue as a percentage of the total tax revenue as pointed out earlier. It was 82.5% in 2000 and jumped to 85.7% in 2002. It was over 80%, on average, during the period 2000-2010.

A noticeable feature of the Sudan government revenue was the meager contribution of the departmental fees as a source of revenue. To boost its contribution, this necessitates frequent revision of the quality of the different services rendered against the paid fees - seeMagzoub (2013).

(2) Methods and Data

Small scale econometric model is formulated to serve the objective of the study as indicated in the abstract.The model is well-documented in the macroeconomic literature. It bears the basic features of the general equilibrium IS-LM model. However, to make it more operational, the equations of the model are adapted to tracksome of the basic characteristics of Sudan economy. It consists of three blocks of equations. The first block is a set of three linear equationsrepresenting the goods market. The three linear equations are used to drive the IS equation that arises in the goods market.

The second block comprises one equation representing the money market. That is, the LM equation. The third block is derived on the basis of the first two blocks in order to obtain the aggregate demand equation.

Block (A):The IS equation

As pointed out above, the first block consists of three linear equations, two behavioral equations and an identity. Stochastic disturbance term is added to each behavioral equation to reconcile the predictability implied by algebraic deterministic relation to the complications in economic policy practices in Sudan. The first equation represents a consumption function namely:

$C_t = a_1 + a_2 DY + \mu_t$ …… (1)

Where,

$C_t$is consumption for both durable and nondurable goods, $DY = Y_t - T$ is disposable personal income and T is taxes. The parameter a_1 is the autonomous consumption$(a_1 > 0)$.

$a_2 = \frac{\Delta C_t}{\Delta Y_t^d}$ is the marginal propensity to consume (mpc):0<mpc<1

$\mu_t$is the disturbance term.

Due to the nature ofwealth holding in Sudan economy which is the mostly in form of gold or real estates, the equation excluded any influence of interest rates on consumption either directly or through the effects of wealth on consumption.

The second equation is the investment function:

$I_t = b_1 - b_2 r_t + b_3 Y_t + \mu_t$ …….. (2)

Where,

I_t is investment which comprises business fixed investment, residential investment and inventory investment.

r_t is the nominal rate of interest.

Y_t is the level of income used to measure the acceleration effect of output on investment . In the context of Sudan economy, there are other variables playing a role in explaining investment, for instance, the level of economic development and the market size, they are excluded to simplify analysis and ease derivation of the IS, LM and aggregate demand equations.

The parameters $b_1, b_2,$ and b_3 are each greater than zero.

The third equation is a GNP identity which can be written as follows:

Y_t = f (DY) + f (r_t, Y_t) + G_t …… (3)

Accordingly, by dropping the disturbances μ_1 and μ_2 and replacing f (DY) by equation (1) andf (r_t, Y_t) by equation (2), a simple algebraic manipulation gives an explicit algebraic formfor the IS equation as follows:

$$Y = \frac{a_1 + b_1}{1 - a_2 - b_3} + \frac{1}{1 - a_2 - b_3} G - \frac{a_2}{1 - a_2 - b_3} T - \frac{b_2}{1 - a_2 - b_3} r \quad \text{…….. (4)}$$

By assuming that the fiscal policy variables G and T are exogenous, the equation describes a negative relationship between the interest rate r and the level of national income Y.

Special emphasis will be laid on the magnitude of the coefficient of the interest rate, namely: $-\frac{b_2}{1 - a_2 - b_3}$ as it is indicative to whether the IS is steep or otherwise. If it happens that investment is highly sensitive to the interest rate, then b_2 has a large magnitude and income is also highly sensitive to the interest rate. The opposite is true if investment is less sensitive to the interest rate.

The coefficient of G in equation (4), namely: $\frac{1}{1 - a_2 - b_3}$ represents the government purchase multiplier. Consequently, the greater the magnitude of the mpc and the coefficient measuring the acceleration effect, the greater the multiplier and the great the shift in the IS curve as a result of a change in fiscal policy.

Block (B): The LM equation

It consists of only one equation representing the money market. It is known in macroeconomic literature as the LM equation in which the demand for real money balances is a function of the interest rate r and the level of income Y. Sudan economy being a developing economy necessitates the use of a third explanatory variable in the demand for real money balances function, namely the expected rate of inflation π^e. As alluded to above, this can be justified on the ground that wealth holders in Sudan have no much choice; they can either hold real commodities e.g. gold, land building etc. or money. Hence, one can use the expected rate of inflation as a proxy for the opportunity cost of holding money. One common practice is to assume thatexpectations are rational and derive a proxy for expectations on the basis of deviations of inflation from specific target. However, this is not possible in case of Sudan economy due to the complete absence of annual inflation targets. Instead, a backward-looking expectation is used by assuming that the CPI inflation is a two-year moving average. As the two-year moving average is based on lagged values of the inflation rate, they might serve additional purpose, namely, it might capture the effect of sluggish adjustment attributable to rigidities and inertia. Hence, the equation for real money balances can be stated in a linear stochastic form as follows:

$\frac{M_t}{cpi} = c_1 Y_t - c_2 r_t + c_3 \pi^e + \mu_t$ …….. (5)

Where

M_t is the money supply defined for our purposes as M_2 including : currency, demand deposits and savings deposits.

Cpiis the price level measured by the consumer price index.

From the sign of the coefficient ofr_t, one can notice that the real money balances ($\frac{M_t}{cpi}$) are inversely related to the interest rate. To facilitate analysis, one can arrange the terms in equation (5) to make r_t be the dependent variable by dropping the disturbance term**.** That is**:**

$r_t = \frac{c_1}{c_2} Y_t - \frac{c_1}{c_2} \pi^e - \frac{1}{c_2} \frac{M_t}{cpi}$ …… (6)

By holding both M_t and cpiconstant, equation (6) gives a positive relationship between the rate of interest rate $r_t$and the level of incomeY_t.

Two important aspects emerge: firstly, the negative sign of the real money balances($\frac{M_t}{cpi}$) sheds light on the outcome of monetary policy, increases in real money balances shift the LM curve to the right. The opposite is true in case of a decreased real money balances. Secondly, the magnitude of the coefficient of income $\frac{c_1}{c_2}$ indicates whether the LM curve is steep or flat.

Block (C): The Aggregate Demand Equation

The aggregate demand equation can be derived on the basis of the above two equations (4) and (6) representing respectively the goods market and the money market through finding by simple algebraic manipulation the level of income Y that satisfies both equations, namely:

$Y = \frac{(a_1+b_1)}{1-a_2} + \frac{G}{1-a_2} - \frac{a_2}{1-a_2} T + \frac{b_2 c_1}{c_2 (1-a_2)} \pi^e + \frac{b_2}{c_2 (1-a_2)} \frac{M}{cpi}$ …… (7)

Equation (7) describes the aggregate demand equation. Hence,this derived equation facilitates achieving the objective ofthe study. It illuminates the fact that the level of income Y depends on the fiscal policy variables G and T and the monetary policy depends on the money supply, M, apart from the price level cpi and the expected inflation rateπ^e as additional explanatory variables. It is obvious from the last term on the right hand side of equation (7) that an increase in the price level cpi reduces the real money balances $\frac{M_t}{cpi}$ and hence reduces the level of income Y indicating a negative relationship between Y and cpi. Further, an expansionary monetary policy shifts aggregate demand curve to the right and raises income.Furthermore, an expansionary fiscal policy shift the aggregate demand curve to the right and raises income as well.

From the above developments, it is clear that the model involves seven equations. Given such a model, the central questionis how a policymaker judges whether a fiscal or monetary policy is more effective in influencing the level of national income.

A preliminary answer to this question hinges on the nature of the slope of the IS equation and the slope of the LM equation. That is, whether the slope is steep or flat. For instance,invoking the IS equation (4), it is apparent that its slope depends on two parameters, namely b_2 the coefficient of the rate of interest in the investment equation (2) which indicates the sensitivity of investment to the rate of interest, and a_2 the marginal propensity to consume in the consumption equation (1). If the sensitivity of investment to the interest rate is high, which means that b_2 is large; and at the same time that the marginal propensity to consume a_2 is large, this leads to almost flat IS curve. Consequently, the monetary policy is more powerful than the fiscal policy. This is attributable to the fact that shifts in the LM curve as a result of changes in the supply of money causes considerable changes in the level of national income.

Conversely, if the sensitivity of investment to the rate of interest is small and the marginal propensity to consume is small as well, the IS curve is nearly vertical and under such circumstances, the fiscal policy is more potent compared with the monetary policy. This is in view of the fact that in the LM curve following changes in money supply causes a limited change in the levels of national income.

On the other hand, when the demand for real money balances is less sensitive to the rate of interest, the monetary policy is more powerful in influencing the level of incomethan the fiscal policy. The responsiveness of the demand for real money balances to the rate of interest is measured by the parameter c_2 in equation (5). If the value of this parameter is small, this indicates that the fiscal policy has negligible impact on the level of income which means that the LM curve is almost vertical. Consequently, when the value of the parameter c_2 is small, changes in the money supply precipitate substantial impact on the level of national income.

A rather conflicting situation might arise in a less developed economy when both investment and the demand for real money balancesare less sensitive to the rate of interest. This is the fundamental motivation for this empirical study as the paper attempts to explore whether such a situation could arise in case of Sudan economy and what are the possible underlying reasons that might explain it. As a matter of fact a large body of empirical studies offer mixed evidence for the sensitivity of investment to interest rate even for advanced economies - see Sharpe and Suarez (2013).

The data employed to estimate the parameters of the model are entirely of secondary nature. Both internal and external sources of data are used. However, the internal sources of data and information are sometimes not easily accessible or readily available for some fiscal and monetary variables due to specific factors.

(3)Estimation of the model and Discussion of the Obtained Results

An experimental approach - originated in the works of Denis Sargan - is used to search for the best fit and most adequate specification. All equations of the model are estimated by employing a single equation method either the Least Squares or the Limited Information Maximum Likelihood estimation methods. Before starting estimation, the various variables of the model both dependent and explanatory are subjected to a unit root test to guard against spurious regression. Six variables are found to be stationary at theirlevels while four variables are stationary at their first differences. The only variable which is stationary at its second difference is the consumer price index (cpi) - see table (2) in the Appendix. This variable (cpi) is used as a divisor to transformother variables in the model into real terms, that is to eliminate the effects of price changes for the estimation of certain equations.

Block (A) involves three equations, namely: the consumption function, investment function and the IS equation which is derived on the basis of the first two functions. The use of nominal values of the variables in the consumption function produced inadequate results. That is, the estimated coefficients arenot statistically significantand the adjusted coefficient of determination $\overline{R^2}$ is negative whichis a rather absurd result. When the variablesof the consumption function are transformed into constant terms, the estimated coefficients are statistically significant but the estimated equation is characterized by high$\overline{R^2} = 0.95$ and low d-test which is equal to 0.45. - see table (3a) in the Appendix. The high value of $\overline{R^2}$ and the low value of Durbin-Watson is indicative to spurious regression. Hence, the equation is re-estimated by using the stationary values of the variables involved expressed in real terms.The estimated coefficients are statistically significant and the intercept term, representing the autonomous consumption, produced a negative signwhich is consistent with the characteristics of a developing economy consumption function implying dissaving in order to satisfy the basic needs. This is substantiated by the high estimated value of the marginal propensity to consume which exceeds one i.e.$a_{2=}$1.5. The d-value is now 1.88 and $\overline{R^2}$is 0.77- see table (3b). The adjusted coefficient of determination$\overline{R^2}$reduced from 0.95 to 0.77 but this seems reasonable given the fact that only one explanatory variableis used to estimate the consumption function.

The second equation of block (A) is the investment function.First, the rate of interest is introduced as the sole explanatory variable to ascertain its contribution in explaining investment and to ease the derivation of the IS function. However, this simplified specification produced poor results when the variables of the functions are expressed in nominal values, judging by the adjusted $\overline{R^2}$ which turned out to be only 0.09, in addition to incorrect positive sign for the coefficient of the interest rate.Alternatively, employing the real values of the variables, the specification fit does not improve. This low contribution of the rate of interest might be indicative to some specification error due the exclusion of some important variables.

This is the primary reason for introducing the level of income Y in the investment function as a second explanatory variable to measure the acceleration effect of output as pointed out above. The overall fit of the investment equation improved to a considerable extent i.e. $\overline{R^2} = 0.76$.The estimated coefficient of the interest rate is statistically insignificant andproduced the correct negative sign. However, the small magnitude of the interest rate, which is (-0.016) and its statistical insignificance indicates that investment is less sensitive to the rate of interest. This might be attributable to the fact that most business firms in Sudan are financed to a large extent by retained profit in view of the underdeveloped nature of financial markets. The insensitivity of investment to the interest rate implies that the level of national income is insensitive to the rate of interest as well - see tables (4) and(5)in the Appendix.

The last equation of Block (A) is the IS equation. All variables are expressed in constant terms. All coefficients are statistically significant with exception of the taxes coefficient, which produces the correct negative sign and its value is almost zero - see table (6) in the Appendix. This reflects the fact that taxes as a fiscal policy variable play a limitedrole in view of the regressive nature of the Sudan tax system which is characterized by the dominance of the indirect tax rather than the income direct taxes. Accordingly, taxes have negligible impact on private consumption which is an essential component in the national income. This, in turn, indicates the impotency of taxes as a fiscal policy tool. However, the government expenditure coefficient is significant and produces the correct positive sign. It represents the government purchases multiplier. As pointed out earlier, in connection with the consumption function, the marginal propensity to consume is so large, it exceeds one, implying large government purchase multiplier as well, and hence inducea greatershift in the IS curve. Nevertheless, the estimated value of the rate of interest is small, it is -0.206, implying almost vertical IS curve which indicates impotent monetary policy.

Now, let us focus on Block (B) which consists of only one equation representing the money market, as pointed out before. It is the LM equation. This equation is rearranged to make the interest rate (r) the dependent variable - equation (6) in section (3). By holding both the money supply and the price level [represented by the consumer price index (cpi)]constant this equation gives positive relationship between the interest rate (r) and the level of income (y).

To facilitate further analysis, the LM equation, i.e. equation (5) and the derived equation (6) will both be estimated. Let us start by the LM equation, using nominal values for the explanatory variables; all coefficients are found to be statistically significant and the rate of interest produced the correct negative sign i.e. c_2 = -0.062 and the adjusted $\overline{R^2}$ =0.54 - see table (7) in the Appendix. On the other hand, the nominal values of the dependent and explanatory variables, with exception of money supply which is expressed in real terms, are used to estimate the parameters of the derived equation (6). All estimated coefficients are statistically significant; the expected inflation variable produces the wrong positive sign, the real money balances produce the correct negative sign. The estimated coefficient of income (y) is almost zero. The adjusted $\overline{R^2}$ = 0.76 - see table (8) in the Appendix. This negative sign of the real money balances shifts the LM curve to the right and the opposite is true in the case of a decreased real money balances. Hence, judging by the small value of the coefficient of interest rate in the LM equation which is -0.062, as pointed out above, it seems that the LM curve is steep indicative to potent monetary policy in comparison with the fiscal policy contradicting the IS equation results that the fiscal policy is the most powerful.

Lastly, Block (C) consists of the aggregate demand equation, equation (7) in section (3). It indicates that the level of national income depends on the two fiscal policy variables, namely: the government expenditure (g) and taxes (t) in addition to a monetary policy variable namely: the money supply (m2). To estimate the equation, all variables, in both sides of the equation, are expressed in real terms. All coefficients with theexception of the intercept term arefound to be statistically significant and they produce the correct signs. The adjusted$\overline{R^2}$ is equalto 0.81 - see table (9) in the Appendix. The obtained result revealed again that taxas a fiscal policy variable play a negligible role judging by the smallest magnitude of its coefficient, it is almost zero (i.e.− 0.004). This is, as pointed out earlier, due to the regressive nature of the Sudan tax system as it is mostly dominated by indirect taxes. On the other hand, the government expenditure on its own as a fiscal policy tool has a significant impact on the real level of national income.

The question that should be addressed is how this conflicting situation, as far as Sudan economic policy is concerned, can be justifiably explained. As the empirical results reveal, the apparent contradiction is mainly caused by the insensitivity of both investment and the demand for real money balances to the rate of interestin Sudan economy. This insensitivity could be attributed to the followingfactors:

- The underdeveloped nature of the Sudan financial markets in terms of size, type of instrument and investor base diversity - see Gaswami and Shama (2011). For instance, Khartoum Stock Exchange was established in 1994 but up to the end of 2017 the number of registered companies did not exceed 67- see KhartoumStock Exchange Annual Report (2017). On the other hand, Khartoum Stock Exchange Index (KSE 30) was launched in the year 2003 in collaboration with the Arab Monetary Fund (AMF).
- Reduced household private savings evidenced by the large marginal propensity to consume, it exceeds one in the case of Sudan economy as indicated earlier.
- Hoardings habits, particularly in form of real commodities e.g. gold.

- Lack of financial inclusiveness. The geographical spread of financial intermediaries leaves much to be desired.

In addition to the above- mentioned factors, the manner in which economic policy was practiced in Sudan economy can also be held responsible for the difficulty of discerning which economic policy was more powerful as will be explained in the following concludingremarks and recommendations section (4).

(4)Concluding Remarks and Recommendations

The primary conclusion of the study over the period 1970-2010 is the difficulty of discerning whether the monetary or fiscal policy is more effective in influencing Sudan level of national income. This is consequential upon the insensitivity of both investment and the demand for real money balances to the rate of interest attributable to a host of factors as pointed out in the preceding section.

The empirical results revealed, in addition, that the government expenditure component of fiscal policy had greater influence on the level of national income while the taxes component exerted minimal influence. This was attributable to the nature of Sudan tax system which is characterized by the dominance of indirect taxes over the direct income taxes. Consequently, since it seems that the former fiscal reform is not sufficient; one recommendation of the study is that the government should initiate a revision program for the whole tax structure. A tax structure with flexibility and revenue generating capability is highly advocated. The government should shift emphasis from indirect taxes, which accentuate poverty, to income direct taxes which are acknowledged by their high income elasticity; equitability and built-in flexibility. In addition, the whole fiscal structure of Sudan economy necessitates a comprehensive and a deep structural reform including not only the tax structure but also expenditure prioritization, prudent expenditure management, intergovernmental relations, and close monitor and tracking of the itemized budget to prevent extra budgetary spending. Such rather long-term reforms will lead eventually to fiscal transparency necessary for more reliable and credible fiscal policies - see, Farhan, (2005).

A rather debilitating feature of the practice of fiscal policy in Sudan is the extra budgetary spending as alluded to above. This practice is quite harmful and should be curtailed. It is one problem that impedes the effectiveness of fiscal policy in achieving the set economic targets. Another debilitating aspect of the Sudan fiscal policy is the lack of financial control over all revenue generated by the different activities of government units, a major proportion of this revenue is siphoned out escaping proper channeling and ending up outside the auspices of the Ministry of Finance and National Economy. Such practice should be completely prevented as pointed out above- seeElsheikh andElsheikh (2020). On the other hand, the government revenue over the period 1999-2000 used to depend, to a considerable extent, on the oil revenue; the share of oil revenue to total revenue exceeded 90%. However, it declined immediately after the secession of South Sudan in 2011. Hence, economic policies that promote sources of non-oil revenue are urgently required.

On the front of monetary policy, the period preceding 1999 witnessed the imposition of severe monetary restrictions and regulatory measures. The restrictions were intended to ensure fair credit opportunities and to encourage establishing a more market-based system of monetary management. However, as from 1990, attempts were made by Sudan Central Bank:

- To ease the monetary and credit policy.
- To establish and promote non-bank financial institutions.
- To encourage the use of advancedbanking technologies and payments systems.
- To regulate and promote foreign exchange market.
- To build the necessary foreign reserves that stabilizes the economy-see Magzoub (2003).

However, despite these concerted actions, Sudan banking system is still technologically weak and under-capitalized. It needs much to be desired. Massive efforts are still required to facilitate the implementation of monetary policy through strengthening its transmission channels in order to achieve the set objectives. To cite specific examples, the free monetary policy advocated since 1999 precipitated adverse effects on the credit shares of the priority productive sectors of the economy. The credit offered by the banking system to the agriculture sector dropped from 30.4% in 1999 to 15.2% in 2010 while that offered to the industrial sector dropped from 14.2% in 1999 to 9.2% in 2010 of the total credit advanced by the whole banking system. To give a quick glimpse over the period 1999-2011 see Table (9) in the Appendix.

Two important factors play a significant role in adversely affecting the potency of monetary policy in Sudan economy; one is related to the mobility of capital inflow and the other to the exchange rate regime. In connection with capital mobility, while private capital inflows to developing countries are rising over time, the share of Sudan has been quite low due to poor infrastructure, inefficient labor force and implementation of excessive government restrictions. The situation was aggravated even more in 1993 in view of the designation of Sudan as State Sponsor of Terrorism, in addition to the imposition of economic sanctions by USA government in 1997 under Executive Order 13067. The economic sanctions were expanded on 27 April and 13 October 2006 under the Executive Orders 13400 and 13412 respectively. These politically motivated actions by USA government have impeded the mobility of capital inflow to a considerable extent. The slow mobility of the capital inflow over time adversely impacted the potency of the monetary policy.

Despite the exerted efforts made by the central bank to unify the exchange rates, still multiple exchange rates were prevalent over most part of the reviewed period. The existence of multiple exchange rates was exacerbated even more by currency speculation. Abrupt change in foreign exchange speculators confidence impacts the behavior of the foreign exchange, hence, precipitating strong volatility in the free market (or the so-called parallel or black market) exchange rate. Accordingly, the rather unclear nature of the exchange rate regime and its unstable behavior over time plays a significant role in impeding the effectiveness of monetary policy in Sudan economy as well.

Moreover, there was a shift in the management of monetary policy during the period 2002-2003 dictated by the choice of the monetary framework; central bank of Sudan was made to choose the growth rate of money supply as its operational target instead of the rather volatile exchange rate. However, given the uncertainty and volatility of the demand for money in Sudan prompts the legitimate question: what is the right annual liquidity size required for smooth functioning of Sudan economy? To the best of our knowledge, Central Bank of Sudan has no concrete and reliable rule or model that can be used to determine the appropriate size of money supply. Central Bank of Sudan authority used to follow, at least during the reviewed period, general criterion based on the targeted annual growth rate of the Gross National Product (GNP) and the associated inflation rate.

The use of the growth rate of GNP is insufficient as a criterion for determining the right size of money supply in view of the fact that it is an endogenous variable composed of various components and each component is impacted by an amalgam of other economic variables. The inflation rate, on the other hand,depends on different variablessuggested by varioustheorieseach is attempting to explain the phenomenon of inflation from specific perspective. Different empirical studies for inflation in Sudan suggested various variables - see, for instance, Elsheikh andElsheikh (2019) for a recent study attempting to explain the possible variables responsible for inflationary pressures in Sudan. Hence, which set of variables is more relevant in the context of Sudan economy needs thorough investigation.Moreover, the correlation matrix presented in Table (11) reveals weak correlations pairwise between the annual GNP growth rate and the annual money supply growth rate on one hand, and the annual inflation rate and the annual money supply growth rate on the other hand. In addition, no discerned systematic pattern can be observedamong those growth rates in light of their behavior over the reviewed period.

Moreover, to explain why the relationship between the three variables is not sufficient in determining the growth rate of money, one can write the equation of exchange [M.V=P.GNP]in terms of change in variables instead of their levels to establish a link between the three variables used by the Central Bank of Sudan: the annual growth rate of money$\frac{\Delta M}{M}$, the annual inflation rate$\frac{\Delta P}{P}$ and annual GNP growth rate$\frac{\Delta GNP}{GNP}$as follows:

$$1+\frac{\Delta M}{M} = (1+\frac{\Delta P}{P})(1+\frac{\Delta GNP}{GNP})/\ (1+\frac{\Delta V}{V}) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (8)$$

From the appearance of equation (8) it might seem thatthis linkage between the three variables makes it possible to estimate easily the growth rate of money$\frac{\Delta M}{M}$, given the growth rate of GNP, the inflation rate.However, the presence of the velocity of money (V)signals an impending problem as one cannot claim stable velocity of money for Sudan economy.Stable and predictable velocity of money is a basic requirement for one to estimate the growth of money that is consistent with the growth rates of inflation and GNP.Velocity is not stable in Sudan economy as a result of the rather recent bank institutional and technological advances such as cash machines, credit cards and electronic transfer of deposits and other factors.

Consequently, the instability of the velocity of money necessitates an urgent need for designing an appropriate monetary policy based on a valid theory that recognizes the various characteristics of Sudan economy - as policy cannot be designed without an underlying theory. Such a theory can be translated into an operational methodology or elaborate policy-oriented dynamic econometric model in order to determine, for instance, the right quantity of money for Sudan economy. Most central banks around the world follow such practices- see Adolfson (2007) and Gouvea (2008).

Another problem that must be confronted is the complete absence of a unified body or unit for implementing the appropriate fiscal policy with regards to the collection of fees and charges. This transcends, sometimes, even to the trade policy e.g. some ministries behave in a pragmatic way by issuing permissions and collect fees for the importation of certain products. This problem stems from the lack of coordination among the different levels of government: the federal government, state and localities, insofar as the fiscal policy are concerned. The interrelationships among these governmental levels should be clear with regard to the design and implementation of the fiscal policy. Hence, a regulatory frameworks or a unified body should be established to coordinate, supervise and follow-up the implementation of the fiscal policy to prevent contradictory actions that might reduce its efficacy.

Moreover, fiscal discipline is urgently required to guard against extra budgetary spending, as pointed out earlier, by use of some fiscal rules but not at the expense of prudential fiscal discretion and flexibility, see Daban and others (2003) and Kopits and Symansky (1998). The effectiveness of fiscal rules requiresstrict political commitment.

Furthermore, the monetary and fiscal policies need to be coordinated with one another to avoid inconsistences, contradictory macroeconomic frameworks, possible tradeoffs among different objectives and the used instruments. They need; also, to be closely linked with both a long-term comprehensive strategic national plan and the short-term economic programs that mightemerge or emanate from these strategic plans in order to facilitate achieving their set targets and objectives in a cohesive andconsistent manner.However, for these objectives to be achievable, they should be modest not overly ambitious and strongly grounded in reality.

Last but not least, lack of information and constraints imposed on the availability and accessibility of reliable data are prone to the danger of providingmisleading macroeconomic analysis and forecasts, hence, a premature or incorrect economic policy recommendations based on such improper analysis and forecast or projection. On the other hand, expectations and reaction times of policymakers are critical in the policymaking process in order to identify the sources of looming vulnerabilities at the right time. This, in turn, requires informed insight and judgment based on reliable data.Consequently, the study recommends that statistical units concerned with economic data, in particular, fiscal and monetary data should be strengthened in terms of staffing, funding, and the basic infrastructure for data collection and dissemination in order to foster the economic policymaking process in Sudan. Appropriate monetary policy, in particular, should be forward-looking and should react to changes in economic activity to mitigate the adverse effects of current shocks on future levels of income.To implement such policy successfully depends largely on the quality and reliability of the associated economic analysis and forecast as alluded to above. Moreover, fiscal data and fiscal information about the manner in which the annual budget is prepared, executed and the way it is practiced by different governmental units is central to the potency and success of fiscal policy.

APPENDICES

Table (1): Some key macroeconomic indicators.

Year	Real GNP (billion SDGs)	Inflation Rate	Money Supply (m2)	Fiscal Deficit	Growth Rate of real GNP	Growth Rate of money Supply
	(1)	(2)	(3)	(4)	(5)	(6)
1970	61.4	1	13	-0.024	-	-
1971	58.2	0.97	13.8	-0.64	-0.05212	0.061538
1972	64.2	10.09	16.5	-0.207	0.103093	0.195652
1973	64.8	16.06	20.4	-0.288	0.009346	0.236364
1974	66.9	25.42	26.7	-0.307	0.032407	0.308824
1975	74.2	22.65	31	-1.058	0.109118	0.161049

1976	73.3	1.7	38.1	-0.97	-0.01213	0.229032
1977	88	17.18	53.2	-0.4323	0.200546	0.396325
1978	95.1	18.32	70.6	0.0579	0.080682	0.327068
1979	99.9	33.91	93.7	0.4226	0.050473	0.327195
1980	83.7	26.09	123.2	-0.079	-0.16216	0.314835
1981	80.9	22.56	157	0.0325	-0.03345	0.274351
1982	82.4	27.69	216.1	-0.3337	0.018541	0.376433
1983	91.7	31.13	277.5	0.1461	0.112864	0.284128
1984	95.3	32.45	326.1	-0.5206	0.039258	0.175135
1985	88.6	46.33	601.8	-0.7003	-0.0703	0.845446
1986	78.8	29.04	775.6	-2.751	-0.11061	0.2888
1987	80.4	24.98	1040..7	-2.5909	0.020305	0.3418
1988	116	49.14	1421	-1.344	0.442786	0.365427
1989	114.5	74.08	2270.9	2.518	-0.01293	0.5981
1990	101.2	67.38	3164.5	12.3422	-0.11616	0.3935
1991	81.7	122.52	5269.6	10.3613	-0.19269	0.665224
1992	64.2	119.24	141.6	-25.838	-0.2142	-0.97313
1993	63.5	101.18	268.6	-13.706	-0.0109	0.896893
1994	71	115.93	405.4	-36.535	0.11811	0.509308
1995	65.2	68.97	705.9	481.8	-0.08169	0.741243
1996	86.8	130.44	1166	-210.29	0.331288	0.651792
1997	90.9	47.19	1597.1	-195.28	0.047235	0.369726
1998	96.7	17.01	2069.5	-162	0.063806	0.295786
1999	103.3	16.16	2579.2	-217	0.068252	0.246291
2000	113.5	8.02	3466.7	-182	0.098742	0.344099
2001	114.7	4.92	4322.1	-534	0.010573	0.246748
2002	150.6	8.3	5632.7	-456	0.31299	0.303232
2003	156.7	7.7	7340.9	-326	0.040505	0.303265
2004	167.7	8.46	9604.5	-799	0.070198	0.308355
2005	178	8.5	14031.4	-1663	0.061419	0.460919
2006	189.1	7.2	17871.8	-3178	0.06236	0.2737
2007	212.2	8.1	19715	-2508.6	0.122158	0.103135
2008	224.6	14.3	22933.2	1983.1	0.058435	0.163236
2009	266	11.2	28314.5	-980.3	0.184328	0.234651
2010	288.1	13	35497.9	-3424.2	0.083083	0.2537

Source: compiled by authors from different Central Bank of Sudan Reports.

Table (2): Types of 113.5stationarity for the varibles of the specified model.

Source: compiled by authors from the E-Views output.

Types of stationarity / **Variables**	**Level**	**First difference**	**Second difference**
Consumer price index(CPI)	-	-	Stationary
Disposable income (dy)	-	Stationary	-
Expected inflation (expinflation)	-	Stationary	-
Government expenditure (g)	Stationary	-	-
Investment (i)	Stationary	-	-
Inflation	Stationary	-	-
Money supply (m2)	Stationary	-	-
Taxes (T)	Stationary	-	-
Rate of interest (r)	-	Stationary	-
Private consumption (PC)	Stationary	-	-
National income (Y)	-	Stationary	
The variables are stationary at 1% with exception of taxes , stationary at 5%			

Table (3): Estimated parameters of the consumption function.

Dependent Variable: PC/CPI
Method: Least Squares
Date: 10/06/20 Time: 02:40

Sample: 1970 2010
Included observations: 41

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-13.11417	1.790702	-7.323480	0.0000
DY/CPI	1.087521	0.037813	28.76029	0.0000

R-squared	0.954973	Mean dependent var	31.79544
Adjusted R-squared	0.953819	S.D. dependent var	26.11686
S.E. of regression	5.612462	Akaike info criterion	6.335406
Sum squared resid	1228.489	Schwarz criterion	6.418995
Log likelihood	-127.8758	Hannan-Quinn criter.	6.365845
F-statistic	827.1541	Durbin-Watson stat	0.457429
Prob(F-statistic)	0.000000		

Source: compiled by authors from the E-Views output.

Table (4): Estimated parameters of the investment function.

Dependent Variable: I/CPI
Method: Least Squares
Date: 10/06/20 Time: 02:57
Sample: 1970 2010
Included observations: 41

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.898942	0.919758	5.326339	0.0000

r-INFLATION	-0.055542	0.026926	-2.062757	0.0458

R-squared	0.098369	Mean dependent var	5.864197
Adjusted R-squared	0.075251	S.D. dependent var	5.272392
S.E. of regression	5.070137	Akaike info criterion	6.132163
Sum squared resid	1002.545	Schwarz criterion	6.215752
Log likelihood	-123.7093	Hannan-Quinn criter.	6.162602
F-statistic	4.254965	Durbin-Watson stat	0.780082
Prob(F-statistic)	0.045840		

Source: compiled by authors from the E-Views output.

Table (5): estimated parameters of the investment function.

Dependent Variable: I/CPI
Method: Least Squares
Date: 10/29/20 Time: 02:12
Sample: 1970 2010
Included observations: 41

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.311392	0.831787	-2.778826	0.0084
R-INFLATION	-0.015786	0.014301	-1.103868	0.2766
Y/CPI	0.182210	0.017323	10.51842	0.0000

R-squared	0.769493	Mean dependent var	5.864197
Adjusted R-squared	0.757361	S.D. dependent var	5.272392
S.E. of regression	2.597098	Akaike info criterion	4.817022
Sum squared resid	256.3070	Schwarz criterion	4.942406
Log likelihood	-95.74896	Hannan-Quinn criter.	4.862680
F-statistic	63.42682	Durbin-Watson stat	1.234583
Prob(F-statistic)	0.000000		

Source: compiled by authors from the E- Views output.

Table (6): Esimated parameters of the IS equation.

Dependent Variable: Y/CPI
Method: Least Squares
Date: 10/06/20 Time: 03:23
Sample: 1970 2010
Included observations: 41

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	21.51681	7.786520	2.763342	0.0089
G/CPI	5.101648	0.615897	8.283285	0.0000
T/CPI	-0.000684	0.001213	-0.563796	0.5763
r-INFLATION	-0.206023	0.087878	-2.344420	0.0245

R-squared	0.687561	Mean dependent var	43.36333
Adjusted R-squared	0.662228	S.D. dependent var	24.57874
S.E. of regression	14.28470	Akaike info criterion	8.248723
Sum squared resid	7549.952	Schwarz criterion	8.415901
Log likelihood	-165.0988	Hannan-Quinn criter.	8.309600
F-statistic	27.14105	Durbin-Watson stat	0.815092
Prob(F-statistic)	0.000000		

Source: compiled by authors from the E-Views output

Table (7): The estimated parameters of the LM equation using nominal values for the explanatory variables.

Dependent Variable: M2/CPI
Method: LIML / K-Class
Date: 10/06/20 Time: 03:43
Sample: 1970 2010
Included observations: 41
Covariance type: IV
Instrument specification: Y R EXPINFLATION
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.250533	0.261190	8.616463	0.0000
Y	1.33E-07	2.32E-08	5.714069	0.0000
R	-0.061537	0.020814	-2.956568	0.0054
EXPINFLATION	0.009959	0.005263	1.892217	0.0663

R-squared	0.572553	Mean dependent var	1.891962
Adjusted R-squared	0.537895	S.D. dependent var	0.884671
S.E. of regression	0.601384	Sum squared resid	13.38151
Durbin-Watson stat	0.264957	LIML min. eigenvalue	1.000000

Source: compiled by authors from the E-Views output.

Table (8): estimated parameters of the equation representing the interest rate as a function income, expected inflation and the real supply of money.

Dependent Variable: r
Method: Least Squares
Date: 10/09/20 Time: 06:56
Sample: 1970 2010
Included observations: 41

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	14.97820	2.070670	7.233504	0.0000
Y	4.12E-07	2.16E-07	1.909889	0.0639
EXPINFLATION	0.202494	0.020619	9.820701	0.0000
M2/CPI	-3.105518	1.050379	-2.956568	0.0054

R-squared	0.774681	Mean dependent var	17.16927
Adjusted R-squared	0.756412	S.D. dependent var	8.656133
S.E. of regression	4.272206	Akaike info criterion	5.834605
Sum squared resid	675.3144	Schwarz criterion	6.001783
Log likelihood	-115.6094	Hannan-Quinn criter.	5.895482
F-statistic	42.40383	Durbin-Watson stat	0.743569
Prob(F-statistic)	0.000000		

Source: compiled by authors from the E-Views output.

Table (9): Estimated parameters of the aggregate demand equation using real variables.

Dependent Variable: Y/CPI
Method: Least Squares
Date: 10/09/20 Time: 07:00

Sample: 1970 2010
Included observations: 41

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.602069	7.416932	0.755308	0.4550
G/CPI	6.530930	0.509812	12.81047	0.0000
T/CPI	-0.004008	0.001180	-3.396336	0.0017
EXPINFLATION	0.165358	0.061899	2.671425	0.0113
M2/CPI	14.07416	2.493236	5.644938	0.0000

R-squared	0.831367	Mean dependent var	43.36333
Adjusted R-squared	0.812630	S.D. dependent var	24.57874
S.E. of regression	10.63922	Akaike info criterion	7.680820
Sum squared resid	4074.946	Schwarz criterion	7.889792
Log likelihood	-152.4568	Hannan-Quinn criter.	7.756916
F-statistic	44.37031	Durbin-Watson stat	1.408815
Prob(F-statistic)	0.000000		

Source: compiled by authors from the E-Views output.

Table (10):Bank credit to the agricultural and industrial sectors of Sudan economy as a percentage of total credit

Year	Percentage of the agricultural sector	Percentage of the industrial sector
1999	30.4	14.7
2000	22.5	10.5
2001	17.7	14.8
2002	14.3	12.0
2003	12.4	11.4
2004	10.5	11.5
2005	6.5	14.8
2006	11.9	9.3
2007	9.4	9.9
2008	10.7	9.3
2009	12.0	8.0
2010	15.2	9.2
2011	13.2	10.2
Average	13.2	11.2

Source: Sudan Central Bureau of Statistics, and Sudan Ministry of Finance and National Economy.

Table (11): Matrix of correlation between the growth rate of GNP and money supply and inflation.

	GRGDP	**GRM2**	**INFLATION**
GRGDP	1	0.1433903	-0.176070
GRM2	0.14339036	1	0.1845101
INFLATION	-0.17607076	0.18451017	1

Source: compiled by authors from the E-Views output.

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