

## Causality between Money Supply and Economic Growth in Sudan

Mohamed Attaitalla Abdalla

Collage of Business Administration, University of Bahrain, Kingdom of Bahrain

\*Corresponding Author: Dr. Mohamed Attaitalla Abdalla; Email: [maamohammed@uob.edu.bh](mailto:maamohammed@uob.edu.bh)

**Abstract:** The current study aims at measuring the effect of real money supply on economic growth rate in Sudan economy during the period (1990-2012). The study adopts unit root, cointegration and causality testes. ADF test shows that the two series are integrated of order one I(1), while Granger Causality test shows there is no causality between the two variables under study. This means the real money supply had neutral effect on the real GDP growth in Sudan during the study period.

**Keywords:** Money, GDP, Cointegration, Causality, Sudan

### INTRODUCTION

There have been extensive theoretical and empirical researches examine the relationship between money supply and economic growth both in the context of developed and developing countries. Although the relationship between money supply and economic growth is an important one, the direction of causality between the two variables has continued to generate series debate among scholars.

The examination of the causal relationship between money supply and economic growth in Sudan is very important because it will provide useful information on which economic variable that the Sudan government and relevant policy makers need to control in order to attain the desired level of the targeted variable. For example, if the results of causality test indicate that money supply precedes and causes economic growth, then Sudan government and policy makers can design or employ policies that would promote the mobilization of money supply in order to achieve higher economic growth in Sudan. On the other hand, if econometric investigation reveals the reverse, then, efforts would be made to remove the obstacles to and accelerate economic growth in order to raise the level of money supply. Therefore, the purpose of this study is to investigate whether the direction of causality runs from money supply to economic growth or vice versa during the period (1990-2012).

The study employs two econometric models that are most frequently used by empirical studies of examining relation between money supply and economic growth in both developed and developing countries. The first econometric model examines the short run and long run relationship between real GDP and money supply by applying Johansen cointegration test and the associated Vector Error Correction Model (VECM), and the

second is the application of the Granger causality test to determine the direction of causality between the two variables.

The remainder of the study is organized as follows. Section 2 presents a short review of empirical literature. Section 3 presents an overview of the changes in money supply and economic growth in Sudan during the study period. Section 4 explains the study methodology and data. Section 5 presents data and empirical results, while section 6 presents the main findings of the study along with concluding remarks.

### REVIEW OF EMPIRICAL LITERATURE

Friedman M. and Schwartz A. [1] and Friedman, M. and Meiselman, D. [2] studies were the first applied statistical studies to test the relation between the two variables. Friedman and Schwartz tried to measure the relationship between the amount of money and output through studying the monetary history and the role of money in economic cycles in USA during the period (1867-1960). They argue that the sharp contraction that occurred during the great depression (1929-1933) was result of the large decline in money supply during that period. While Friedman and Meiselman's [2] focus was on the monetarist-Keynesian debates about the effectiveness of monetary and fiscal policies, they tested the Keynesian assumption about the stability relation between income and consumption, and the monetarists assumption about the stability of the money demand, and concluded that the monetarists model that link between spending and amount of money shows better description to determine the total spending, and it is stronger than the Keynesian model. In the study of Brunner and Meltzer [3], they argue that funding the increases in government spending by raising the money supply will increase the total expenditure; and thereby increase the nominal income that lead initially to

increase the real income and eventually to increase prices. Sims [4] study was the first study that applied the Granger causality approach, to determine the relationship between the amount of money and the output in USA. He found that the amount of money helps in the interpretation of output and not the opposite, which means that there is causality direction from the amount of money to GDP, a result which is consistent with Friedman and the monetarists' point of view.

Williams and Gowland [5] apply Sims model on UK, concluded that the direction of causality comes from the output to the amount of money (as opposed to the findings of the Sims). This is consistent with the Keynesian approach. Friedman, B. and Kutner [6] in their study on USA for the period (1960-1990), argue that the relationship between the amount of money and output becomes less strong with increasing time period. On the other hand, they found that the explanatory power of the interest rate has stronger impact than the amount of money in the interpretation of changes in output. Zapodeanu and Cociuba [7] try to study the relationship between money supply and GDP in order to construct a function which would explicit this connection for Romania, using data of money supply (M3) and of GDP over ten years through the ADF, They found that both series are non-stationary, and when they apply the Engle-Granger cointegration method, they concluded that there is cointegration between the two series. For studies on developing countries, Abbas [8] examines the causal relationship between money and output in some Asian countries, and found that there is mutual relationship between money and income in Pakistan, Malaysia and Thailand. In their study of West African countries, Kalumia and Yourogou [9] find strong causal relationship directed from money to income in five countries in West Africa, which means non-neutrality of money. In the study of Hussein and Abbas [10] test the causal relationship between money, income and prices in Pakistan, they found unidirectional relationship from income to money and not the opposite, which indicates that the real factors, but not nominal play effective role in the growth of national income in Pakistan. Abdul Raziq and others [11] test the impact of real GDP, government spending, price level, and international reserve on the money supply in Qatar. They found significant relationship between real GDP and money supply; this means that the changes in GDP in Qatar help in explaining the changes in money supply and not the opposite. Obaid [12] tests the causality relationship between money supply (M3) and real GDP in Egypt

during the period (1970-2006), by using Granger test. He concludes that there is no causality between the nominal money supply and nominal GDP during the study period, while when he used the real money supply and real GDP, he found that there is mutual causality relationship between real money supply and real GDP in Egypt (non-neutral money), and thus the monetary policy is an effective policy on the real GDP in Egypt, the mutual causality relationship could help to forecast the GDP behavior within assumed volume of money supply by the economics policy making in Egypt. And finally, Ogunmuyiwa and Francis [13] investigate the impact of money supply on economic growth in Nigeria between 1980 and 2006, by applying econometric technique OLS, causality test and ECM for time series data, the results revealed that although money supply is positively related to growth but the result is however insignificant in the case of GDP growth rates on the choice between contractionary and expansionary money supply. To the best of our knowledge, only one study attempted to study the relationship between money supply and output level in Sudan. Ahmed and Suliman [14] attempt to study the long-run relationship between money supply, real GDP and price level for the period 1960-2005, where they find no causality between real GDP and money supply during this period, while causation runs from money supply to prices. Our study differs from this study by using recent data and covering the period after the peace agreement that ended the civil war, leading to the separation of the country into two countries. It is clear from the analysis of previous studies as presented in this section, that the relationship between money supply and output or income (expressed in different measures) is still controversy subject in the empirical studies (in both developed and developing countries), as well as theoretical framework, whether in the short run or long run.

### **An Overview of Money supply and Economic Growth in Sudan**

Sudan economy is basically an agricultural economy, with agriculture currently accounting for about 33% of total GDP in 2012. This contribution, however, decreased considerably since independence in 1956 when agriculture was noted to contribute 61% to the GDP. The change in the structure of the economy was a result of increasing importance of services, industrial and oil sectors. Oil exports started late 1999. Table (1) gives a summary of the main feature of the Sudan economy for the period 1990- 2012.

**Table 1: Structure of GDP 1990-2012**

Sector	1990/1995	1996/2001	2002/2007	2008/2012	1990/2012
Agriculture	35.6	47.2	36.0	32.6	38.1
Oil	-	2.6	8.3	7.7	4.5
Industry	16.6	14.8	9.6	8.5	12.5
Services	47.8	35.4	46.1	51.2	44.9

Source: Average calculated based on Central Bank of Sudan "Annual report", different issues.

Oil exports in 1999 boosted both the GDP and government revenue. Oil exports accounted for about 87.7% of total exports in 2010, making an average of 80.07% of total exports for the period 2000-2010. Oil revenue, on the other hand, contributed 81.42% of government revenue in 2010, averaging a contribution of 69.56% for the period 2000-2010. However, because of the secession of the South Sudan in July 2011, Sudan lost almost all oil production and oil exports as well as oil revenue, which went to South Sudan. Central Bank of Sudan [15]. In 2012 oil revenue was only 19.5% of total government revenue, while tax revenue accounted for about 70.2% of total government revenue. The government budget deficit accounted for 3.5% of GDP in 2012, with 70.4% of this deficit being financed from domestic sources, and only 3.5% from external sources. This led to an increase in inflation rate to reach 44.4% in 2012

Sudan has a long history of political instability and change in governments from civilian democratically elected governments to military governments. It also has the longest civil war in Africa, which ended in July 2011 by the secession of South Sudan, and the country became two countries. This has brought about a very volatile growth rate in the economy, with GDP growth rate being negative in some years and positive in some other years. Ali and Elbadawi[16] were able to identify four major periods of economic growth which are alternating periods of negative growth, (1960 – 1973) and (1984 – 1994) and periods of positive growth, (1974-1983) and (1995-1998).

Since its coming to power in June 1989, the present government attempted to adopt some economic and institutional reforms and policies which affected both the supply of money and the performance of the economy. To start with, the government adopted an Islamic financial system, which prohibits interest rate, and uses Islamic finance modes like Msharaka, Mudaraba, Murabaha and Salm. In 1992, the government adopted the Structural Adjustment Programs (SAPs), aiming at management of budget deficit through cutting of government expenditure and

increasing revenue sources, especially from taxes. The program also adopted policies of trade liberalization, freeing of prices from administrative control, privatization of public enterprises and floating the Sudanese pound against foreign currencies. These policies, however, resulted in large devaluations of the Pound and high inflation rates. In 1991, for example, inflation rate was about 123.7%, and continued to register three digit rates until 1995 where it decreased to 68.4% then increased to reach its maximum rate of 132.7% in 1996, with an average rate of 109.9% for the period 1991-1996. Central Bank of Sudan [17]. To ease this pressure, a new currency, Sudanese Dinar, was introduced to replace the Pound, and was set as 1 Dinar equal 10 Pounds. However by that time the government realized the need for economic and price stabilization, and so introduced the 1997 – 2001 reform program to compact inflation, control the budget deficit and enhance the economic growth of the economy. This program was strengthened by the production and export of oil in 1999. In 2005 the Comprehensive Peace Agreement was signed between the government and the Sudanese People Liberation Army (SPLA) which ended the war between the government and south Sudan, paving the way for the secession of the South in July 2011. In January 2007, the government introduced a new currency, the Sudanese Pound in place of the Dinar, and was set as 1 Pound equal 100 Dinars (1000 of the old Pound). Releasing the fall in oil revenue after the secession of the South, the government introduced the second Five-Year Strategic Plan 2012-2017, aiming to diversify the economy away from oil and controlling the government expenditure. To adjust for the decrease in oil revenues after the secession, the 2011 budget was readjusted to focus on cutting government spending, increasing tax revenues and removing subsidies.

These policy actions defiantly affect the performance of all economic variables in the economy. Despite the high inflation rates in early 1990s, real GDP growth rates were positive in many years since 1990. Growth rate of money supply, as measured by M2, was also positive during this period. Figure 1 below show the growth rate of real GDP and money supply for the period 1990-2012.

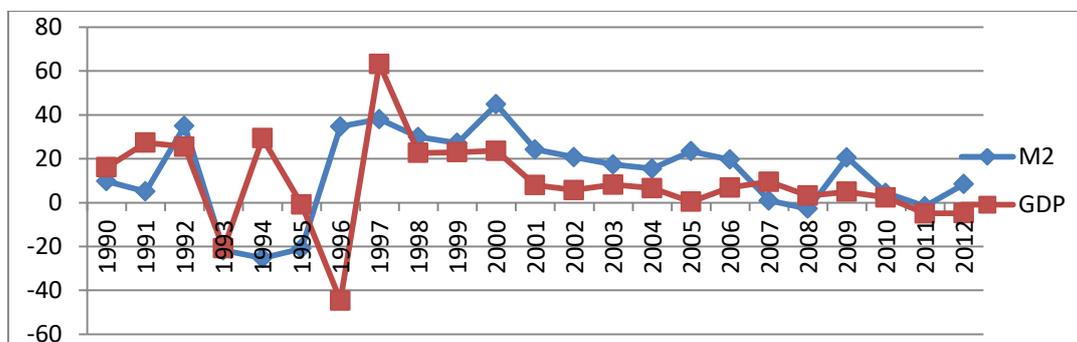


Figure 1: Growth rate in Real GDP and Money supply (M2)

**METHODOLOGY**

State of the art econometric tools of analysis are employed:

- Unit root test.
- Cointegration analysis.
- Granger Causality test.

The unit root test is used to detect the stationarity of the two macroeconomic variables under study. The test is undertaken for two reasons. First, avoid the spurious regression problem. Second, a basic assumption underlying the application of causality test is that the time series in question should be stationary. Hence, in order to detect the stationarity of the two variables, we employ the ADF test with intercept and trend .Dickey and Fuller [17]. Individual economic time series may not be stationary, but there may be cases of linear combination among them. This means that nonstationary economic time series may produce stationary relationships if they are cointegrated. This is a reason why we subjected the two macroeconomic variables series individually to unit root analysis. If both time series are integrated of the same order, I(d) for d=0,1,2,..., then the two series are said to be cointegrated and the regression on the same levels of the two variables is meaningful, in addition to the possibility to proceed with the estimation of the following cointegration regression:

$$LGDPg_t = \alpha + \beta M_t + \varepsilon_t \tag{1}$$

$$LM_t = \alpha + \beta LGDPg_t + \mu_t \tag{2}$$

Where *LGDPg<sub>t</sub>*: economic growth rate, *LM<sub>t</sub>*: money supply growth rate at time t, and  $\varepsilon_t$  and  $\mu_t$  are random error terms (residuals). Residuals  $\varepsilon_t$  and  $\mu_t$  measure the extent to which *LGDPg<sub>t</sub>* and *LM<sub>t</sub>* are out of equilibrium.

If the residuals of the two variables do not contain unit roots, the econometric relationship among the variables could be cointegrating. The Johansen [18] cointegration test is used for analyzing the long run relationship between the two variables in Sudan. The Granger causality test is also used to determine the direction of Granger causality. If the money supply helps to forecast its economic growth, then we can say that money supply Granger causes the economic growth. Furthermore, if economic growth also Granger causes money supply, this means that there is bilateral

causality between money supply and economic growth. However, if both variables do not cause each other, it means that these two variables are statistically independent. On the other hand, if money supply causes the economic growth but the economic growth does not cause money supply, then a unidirectional causality from money supply to economic growth exists. If there is no cointegration among the variables, the VAR procedure will be used. However, if a unique cointegrating vector for the variables used in the cointegration analysis, the Granger causality procedure based on VECM is used. This procedure is particularly favorable compared to the standard VAR as it permits temporary causality to emerge from the sum of the lagged coefficients of the explanatory differenced variables and the coefficient of the error correction term (ECT). Besides indicating the direction of causality among variables, the VECM framework could also distinguish between short run and long run causality. The significance of the F-test and Wald  $\chi^2$  test helps to indicate any short run causality between the independent variable and dependent variable. The long run causality is indicated through the error correction term where a significant t-statistic shows the existence of long run causality running from the independent variable to the dependent variable.

**DATA AND EMPIRICAL RESULTS**

**Data**

Data of growth of the GDP, Quantity of money (M2) and inflation rate (CPI) has been taken from Central Bank of Sudan, National accounts statistics (various issues). All the data are measured in real terms (2000=100).

**Empirical results**

**Unit Root Test**

Table (2) shows the results of the ADF unit root tests for levels and first differences of GDP and M2 series. The t-values on the level obtained from ADF test are clearly less than the critical values and therefore GDP and M2 are non-stationary time series at their levels. In addition table (2) shows that the same test applied to the first differences of the two series. The results show that the two variables are stationary at their first differences, and so the two variables are integrated of order one I(1)

**Table 2: ADF Unit root tests for level and first differences\***

Variables	Level		First difference	
	Intercept	Intercept & Trends	Intercept	Intercept & Trends
GDP	-2.49	-2.88	-3.12	-3.06
M2	-1.64	-2.54	-5.62	-4.31

Source: Researcher's estimation using SPSS

\* ADF critical values at level are: -4.071 at 1%, -3.464 at 5% and -3.158 at 10%. While ADF critical values at first differences are: -2.727 at 1%, -1.964 at 5% and -1.627 at 10%

**Cointegration Test**

Having established that two variables are integrated of same order, we proceed to test for presence of cointegration between the two variables. We employ Johansen cointegration test. It may be noted here that we are interested to check for the presence of cointegrating relationship between the variables, however, number of cointegrating vectors is not of our interest. Table (3) presents the results of the null hypothesis that there is no cointegration against the alternative that there exists cointegration. Starting with the null hypothesis that cointegration does not exist among the two variables; the trace statistic value is shown to be greater than the critical values at both 5% and 1% levels. Hence, we reject the null hypothesis of no cointegration in favor of existence of cointegration for all the series at both 5% and 1% levels. However, the maximum Eigen statistic value indicates that 2

cointegration equation at 5% level of significance, while it shows no cointegration at 1% level. Thus, both the trace and maximum Eigen value test statistics indicate that there is a long run equilibrium relationship between money supply and economic growth in Sudan.

Hence, we can analyze the long run cointegration equation of GDP with their independent variable of money supply with VECM. The equation can be written as follow where the numbers in ( ) are t-statistics.

$$LGDP = 2.12 + 0.47 LM \quad (3)$$

(1.74) (2.84)\*

Form the above equation; we argue that money supply is significantly positive related to the economic growth in Sudan during the study period.

**Table 3: Johansen Panel cointegration (Trace and Maximum Eigen Value Test)**

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	5% critical value	1% critical value
None	0.667396	19.65	15.197	10.310
At most one	0.132376	12.26	3.962	6.936

Hypothesized No. of CE(s)	Eigen value	Max-Eigen Statistic	5% critical value	1% critical value
None	0.667396	15.45	14.036	17.936
At most one	0.132376	11.19	3.962	6.936

Source: Researcher's estimation using SPSS.

**Granger Casualty Test**

The existence of cointegrating relationship between money supply and economic growth for Sudan suggests that there must be long run Granger causality in at least one direction. The Granger causality test based on VECM is applied to variables after first differencing, with the purpose of testing whether the money supply causes the economic growth or vice versa. The results are presented in Table (4)

From Table (4), the result is different for the short-run and long-run. First, in the short-run, there is a unidirectional causality exists from the economic growth to the money supply. This means that the economic growth Granger causes money supply. This result indicates that the economic growth could stimulate money supply in the short run. Second, in the long run there is no causality relation between real GDP and real money supply in Sudan during the study period.

**Table 4: Result of Granger causality tests**

Null hypothesis	F-statistic	Short-run Results	ECT(-1) t-statistic	Long-run Results
- LM does not cause LGDP	LM: 0.8160	LM $\leftarrow$ LGDP	LM: 0.072	LM $\leftarrow$ LGDP
- LGDP does not cause LM	LGDP: 3.9144**		LGDP: -0.536	LGDP $\rightarrow$ LM

Source: Researcher's estimation using SPSS

\*\*\*, \*\* and \* indicates significance at 1%, 5% and 10% respectively.

\*Number of lags=2

“ $\leftarrow$ ” indicates the direction of Granger causality

From the above results, we conclude that all tests show a long run equilibrium relationship between the two series in Sudan during the period (1990-2012), while there is no causality between real GDP and real money supply. So we can say, the changes in the money supply do not help in explaining the changes in output, and the changes in output do not help to explain the changes in the amount of money in both short and long

run; and thus the Sudan monetary policy had no significant effect on the GDP growth rate during the study period.

**CONCLUDING REMARKS**

The study aims at investigating the relationship between money supply and economic growth for Sudan economy. Using time series annual data from 1990 to

2012, the cointegration method was applied to discover the nature of two variables. The main finding is that there is a positive long run relationship between the two variables, which leads to test the hypotheses whether the direction of causality runs from money supply to economic growth or the opposite. The Granger causality test shows that there is no causality between real GDP growth to real money supply growth in the long run. Therefore we conclude that the changes in money supply do not help to explain the changes in GDP in Sudan during the study period. Moreover, the changes in GDP obviously do not explain the changes in money supply.

## REFERENCES

1. Friedman M, Schwartz ; A Monetary History of the United States, 1867-1960, Princeton University Press. 1963
2. Friedman M , Meiselman D; The Relative Stability of Monetary Velocity and the Investment Multiplier, Ed. Commission on Money and Credit, in stabilization Policies, Englewood Cliffs, N. J.: Prentice-Hall, 1963
3. Brunner K, Meltzer AH; An aggregative theory for a closed economy', in: J.L.Stein, ed., Monetarism. Amsterdam: North-Holland, 1976; 69-103.
4. Sims C; Money, Income, and Causality, American Economic Review,1972, September, 540-552.
5. David CAE, Gowland DH; Money, Income and Causality: The U.K. Experience. American Economic Review,1967, 66.
6. Friedman M, Kuttner KN; Money, Income, Prices, and Interest Rates, The American Economic Review,1992; 83:472-492.
7. Zapodeanu D, Cociuba M; Linking Money Supply With Gross Domestic Product In Romania. Annales Universitatis Apulensis Series Oeconomica, 2010;12(1):501-507.
8. Abbas K; Causality Test Between Money and Income: A Case Study of Selected Developing Asian Countries (1960- 1988) , The Pakistan Development Review, 1991; 30(4):919-929.
9. Kalulumia P, Yourogou P; Money and Income Causality in Developing Economies; A Case Study of Selected Countries in Sub-Saharan Africa, Journal of African Economics, 1997; 6.
10. Hussain F, Abbas K; Money, Income, Prices, and Causality in Pakistan: A Trivariate Analysis, The Pakistan Development Review,2000;178:1-10.
11. Abdul Raziq B; Money Supply in Qatar: An Empirical Investigation", Journal of Economic and Administrative Sciences,2003;18(2):118-126.
12. Obaid, Gamal ; Money Supply-Output Causality in Egypt, Faculty of Commerce and Business Administration Magazine, Helwan University,2007
13. Ogunmuyiwa M, Francis E; Money Supply-Economic Growth Nexus in Nigeria, Olabisi Onabanjo University, 2010; 22(3)
14. Ahmed Elsheikh , Suliman Zakaria; The long-run relationship Between money supply, real GDP and price level: Empirical evidence Form Sudan, Journal of Business Studies Quarterly,2011; 2( 2):68-79.
15. Central Bank of Sudan, Annual Reports, Different issues.
16. Ali AA, Elbadawi IA; Explaining Sudan economic growth performance, African economic Research Consortium, Kenya, Working Paper No. 9. January 2004.
17. Dickey D, Fuller W; Distribution of the Estimators for Autoregressive Time Series With a Unit Root", Journal of the American Statistical association, 1979; 74(366a):427-431.
18. Johansen S; Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models. Econometrica, 1991; 59(6):1551-1580.