The Long–Run Relationship Between Money Supply, Real GDP, and Price Level: Empirical Evidence From Sudan

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Abstract
The long-run relationships between three macroeconomic variables (real Gross Domestic Product (GDP), money supply (MS) and price level (CPI)) have been examined for the Sudan economy using annual data over the period 1960 to 2005. To explore the short-run direction of causality between GDP, MS and CPI, Granger Causality test has been applied and in order to investigate the existence of long-run relationship, co-integration analysis has been employed. The direction of causation between real GDP and prices was found to be uni-directional from real GDP to CPI without any feedback. Regarding the causal relationship between money and prices, the analyses suggests that the causation runs from money supply to prices, but price level does not causes money supply. Finally, there is no causality between real GDP and money supply in the case of Sudan during the period 1960 – 2005. Further, the co-integration analysis established that the real GDP, money supply and CPI were found to be co-integrated suggesting a existence of long-run relationship.

Keywords: Sudan economy, real GDP, money supply, consumer price index, cointegration, Granger causality.

Introduction

Over the last few years, modelling the relationships between income, money supply and price level have been one of the main controversial issues of interest for economists, researchers, and policy makers. This is simply because a clear understanding of the relationship between these macroeconomic variables is of crucial importance, particularly to the policymakers in ensuring that effective macro-economic stabilization policies can be designed and implemented effectively. Although economic theory suggests the mechanisms through which these variables could influence each other, the issue has been a subject of considerable debate. Over the years, a number of approaches have been developed which allow us to more fully explore the causality lies behind the connection between these variables.
This relationship has been extensively investigated in both, theoretical and empirical literature by researchers for both developed and developing countries over different sample periods and provided the conflicting evidences on this issue, see for example: Ramachandra (1986), Miller (1991), Friedman and Kuttner (1992), Stock and Watson (1993) Boucher and Flynn (1997), Jamie Emerson (2005), Herwartz and Reimers (2006) Majid (2007) Saatcioglu and Korap (2008).

To the best of our knowledge, there has been little empirical analysis for the long–run relationship between three important macroeconomic variables, namely real Gross Domestic Product (GDP), money supply (MS), and the Price level (CPI), in the context of the Sudan economy. This paper seeks to redress this gap by examining the short–run direction of causality between these three variables. Moreover, Granger Causality test and Co-integration analysis will be applied in order to explore the existence of long-run relationship over the period 1960 - 2005.

The remaining of this paper is organized as follows: Following this introduction, Section 2 provides salient features of the Sudan economy during the study period. Section 3 presents the theoretical framework for income, money and prices. In the fourth section the hypotheses of the Study are described, and the fifth section provides the data and methodology. The results of the estimation are discussed in section 6, and finally, section 7 concludes the paper.

Salient Features of the Sudan Economy during the Study Period

To facilitate analysis and provide an initial glimpse into the forces underlying the relationship between the three macroeconomic variables alluded to above, the sample period was decomposed into two subperiods, namely: 1960 – 1989 and 1990 – 2005.

First Subperiod 1960 – 1989

The earlier part of the first subperiod almost coincides with the Ten Year Plan of 1960/61 to 1969/70 – which was suspended in 1964 following a civilian popular revolution – and the Five Year Developmental Plan of 1970/71 – 1974/75.

During this period extending from 1960 to 1975, the dominant macroeconomic policy and development strategy was outward orientation. Two investment promotion Acts were issued which followed the abnegation of the nationalization program of the military regime of 1969.

The five year plan aimed at achieving an increase in GDP by 7.6 percent per annum. The plan had fallen short of achieving its targets, the overall rate of growth recorded during the plan period was only 4 per cent. The plan was supplemented with a five year interim program of action in 1972. This plan of action was directed towards the transportation and communication sectors. This was dictated by the then-nature of direct private foreign investment.

During the early 70's agriculture used to be the dominant sector of the economy. Consequential upon that, the shift from agriculture to transport and communication sectors in association with neglect of the power sector led to structural imbalances in the Sudan economy.

The five year plan was suspended after two years of its inception. A Six – Year Plan was formulated for the period 1977/78 – 1982/83 to replace the suspended five year plan. This plan was aimed at achieving growth rate of 7.5 per cent per annum. It was proposed to be financed by domestic and foreign sources.

The period 1978 – 81 was characterized by economic instability which was caused by macroeconomic shocks originated from the balance of payments deficit and fiscal expansion. To rectify the situation, the government resorted to the nominal devaluation of the currency. Due to
the soaring of petroleum prices during this period, a surplus of foreign exchange was created for oil purchasing countries. This facilitated at the time, advancement of loans to less developed countries to finance projects and to support balance of payments deficit.

The Six Year Plan faced an amalgam of difficulties. This plan envisaged significant domestic source financing but this envisionment was not materialized. Due to scant public saving, the government resorted to borrowing from the banking sector to finance fiscal deficit.

The three years 1983/84 – 1985/86 witnessed the implementation of the public investment program. The government adopted stringent three financing period in which maximum possible resources directed to the rehabilitation of the productive capacity of the economy and for improving infrastructure. However, the GDP did not seem to pick up as required. A number of factors contributed to the slowdown in the growth rate of GDP:

- Due to the predominance of the agriculture sector contributing almost 35 – 40 per cent at the time, the structure of the economy remained stagnant.
- Flow of foreign capital to the public sector was extremely mismanaged resulting in conspicuous failure of projects causing huge debt problems.
- By the end of the year 1989, the total amount of external debt amounted to 13.9 billion dollar, before that specifically in the year 1984, the IMF stopped its assistance to the Sudan.
- The external balance was much deteriorated affecting three important variables: saving, investment and production.
- Due to natural hazards e.g. low rainfall and desertification, in addition internal migration from rural to urban areas, GDP declined during the period 1983 – 1985.
- Productive capacity of the economy was extremely affected by lack of spare parts, power cuts and non availability of basic imported inputs caused by severe shortage of foreign currency.
- The order of priorities of the Western foreign investment was shifted towards Eastern European Countries after the demise of the former Soviet Union which created an economic vacuum.
- Due to the failure of the Adis Ababa Accord, the civil war was rewaged in 1983, diverting resources from production to national defense.

Thus, due to the prolonged period of economic slowdown and weaknesses during the first sub period - which was reflected in balance of payments disequilibrium combined with unfavourable terms of trade, weak public investment program and low rate of growth for GDP-Sudan has adopted structural adjustment program with the help of the IMF, World Bank and some bilateral sources. However, these efforts to undertake policy reform during the period precipitated minimal positive effects. Excessive government intervention and control was led to negative real GDP growth, overvalued official exchange rate which led in turn to resources misallocation, deterioration of foreign trade and dwindling of exchange reserves and accumulation of enormous external debt as alluded to above.

Fiscal performance was hindered and eventually arrested by narrow and inelastic revenue base, price inflexibility and poor expenditure management and control. Enormous fiscal deficit emerging from substantial government expenditure compelled the government to resort to domestic bank financing. This act led to rapid monetary expansion which in turn ignited prices to soar up.
Second Subperiod 1990 – 2005

During this last subperiod the Sudan economy has experienced a series of internal and external imbalances. To correct the imbalances, various economic measures were undertaken by the central bank which led to impressive performance towards the latter years of the period, namely 1997 – 2005. These measures aimed at stabilizing monetary system to make it more efficient in achieving the desired economic targets. Major among these measures adopted by the central are the following:

- Introduction of instruments that served well in managing aggregate demand and strengthened supply response later. Those instruments include the following:
  - the legal reserve ratio
  - the liquidity ratio
  - reforming the Murabaha and Musharaka margins
  - reforming the Murabaha and Musharaka margins
  - introduction of central bank Musharaka certificate
  - commercial banks financing ceilings

- To better manage the banking sector liquidity, the central bank reduced in 1997 the legal required reserve ratio to 26 per cent instead of 30 per cent. This measure enhanced efficiency in regulating the financing practices of commercial banks.

- The central bank instructed commercial banks to keep at least 10 per cent of the total deposits in local currency to meet customers requirements.

- The central bank adopted Murabaha margins instrument to influence the demand for banking credit in one hand and to reduce the increase in aggregate demand on the other hand.

- 95 per cent of the banking sector credit was allocated to priority economic sectors.

- The year 1998 witnessed the introduction of the central bank Musharaka certificate to enhance liquidity management.

- Unification of the foreign exchange system in October 1998 and the replacement of official exchange rate by a moving average of the market ratio. By the year 2003, the central bank adopted formally a managed – float exchange rate regime.

Further, to discipline the government operations, fiscal reforms programs were introduced during the period 1996 – 2000. These reforms were purported to give force to the government revenue by implementing a wide tax reform and nationalizing public expenditure to achieve the optimal resource allocation. The fiscal reform was made possibly by enacting the following:

- Introduction of the value added tax in 1999 which was applied on all domestic sales, services and imports.

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1 “Murabaha” is a term of Islamic Fiqh and it refers to a particular kind of sale having nothing to do with financing in its original sense. If a seller agrees with his purchaser to provide him a specific commodity on a certain profit added to his cost, it is called a Murabaha transaction. The basic ingredient of Murabaha is that the seller discloses the actual cost he has incurred in acquiring the commodity, and then adds some profit thereon. This profit may be in lump sum or may be based on a percentage.

2 “Musharaka” is a word of Arabic origin which literally means sharing. In the context of business and trade it means a joint enterprise in which all the partners share the profit or loss of the joint venture. It is an ideal alternative for the interest-based financing with far reaching effects on both production and distribution Usmani (1998).

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Introduction of Government *Musharaka* Certificate as a fiscal instrument to mobilize resources to finance the federal budget with no inflationary pressures

To round off our discussion of the salient features of the second sub period. Table 1, which is self-explanatory, exhibits the most important economic indicators of the latter years of the sub period that pertains to the three macroeconomic variables under study.

<table>
<thead>
<tr>
<th>Table 1: Selected economic and monetary indicators of Sudan (2001-2005)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicators</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Real GDP %</td>
</tr>
<tr>
<td>Non-oil GDP %</td>
</tr>
<tr>
<td>Average inflation</td>
</tr>
<tr>
<td>Broad money growth</td>
</tr>
<tr>
<td>Velocity(average)</td>
</tr>
<tr>
<td>Foreign reserves</td>
</tr>
</tbody>
</table>

Source: Compiled by authors based on data from the Central Bank of Sudan annual reports.

**Theoretical Framework for Income, Money and Prices**

Income, money and prices are important macro variables which play crucial role in an economy. A clear understanding, or at least insight, on the relationship between these macroeconomic variables is of significant importance, particularly to policymakers in ensuring that effective macro-economic stabilization policies can be designed and implemented.

There has been a long debate in economics regarding the role of money in the determination of income and prices. The Monetarists claim that money plays an active role and leads to changes in income and prices. In other words, changes in income and prices in an economy are mainly caused by the changes in money stocks. Hence, the direction of causation runs from money to income and prices without any feedback, i.e., unidirectional causation.

The Keynesians, on the other hand, argue that money does not play an active role in changing income and prices. In fact changes in income cause changes in money stocks via demand for money implying that the direction of causation runs from income to money without any feedback. Similarly, changes in prices are mainly caused by structural factors.

Although there is disagreement among economists on the roles of income, money, and prices as well as their interrelationship, these variables are considered important and large amount of literature in economics deals with these macroeconomic variables.

In particular, the causal relationships between money and income and between money and prices have been an active area of investigation in economics particularly after the provocative paper by Sims (1972). Based on Granger causality, Sims developed a test of causality and applied it to the United States data to examine the causal relationship between money and income. He found the evidence of unidirectional causality from money to income as claimed by the Monetarists. Lee and Li (1983) examined causality among money, income, and prices in Singapore and found bidirectional causality between income and money and unidirectional from money to prices. Joshi and Joshi (1985) found bidirectional causality between money and income in Indian economy. Khan and Siddiqui (1990) found unidirectional causality from money to money and bidirectional between money and prices in Pakistan. Abbas (1991) performed causality test between money and income for Asian countries and found bidirectional causality in Pakistan, Malaysia and Thailand. Herwartz and Reimers (2006) in a panel based paper also try to analyse
the dynamic relationships between money, real output and prices for an unbalanced panel of 110 economies and find that particularly for high inflation countries homogeneity between prices and money cannot be rejected.

In the context of the extensions of the Quantity Theory of Money (QTM). It is claimed that QTM relationship requires that there exist proportional relationships between the growth rates of money supply and price level and that money must be (super) neutral which is resulted from stationary velocity of money and unaffected real output level in the long-run following the permanent changes in the growth rate of money supply. In a more elaborate way, real output and velocity changes must be orthogonal to the growth rate of the money stock considered (Grauwe and Polan, 2005). Among many other papers, Fisher and Seater (1993), King and Watson (1997) and Bullard (1999) examine some theoretical underpinnings of the QTM relationship. Serletis and Krause (1996) and Serletis and Koustas (1998) using a low frequency data from ten developed countries over one hundred year give in general support for the long-run neutrality proposition. Karfakis (2002; 2004) and Ozmen (2003) examine the validity of the QTM relationship for the case of Greece and find contradictory results especially for the exogeneity/endogeneity characteristic of the money considered.

It is worth emphasizing that the empirical issue of money, price and output relationships is of crucial importance to the Sudan given the current economic environment. That is, if empirical analysis reveals strong association between output, money supply and prices, then price stability can be taken as the most important candidate for monetary policy objectives. Thus, in a developing economy like the Sudan, one of the important tasks of the central bank in forming its monetary policy is to understand the causal relationship between money and income and to understand the dynamics of future movements of some relevant aspects of the real economy.

Hypotheses of the Study

The major objective of this paper is to test specific relationships among the three macroeconomic variables under study, namely: real GDP, money supply and price. Thus the paper sets the hypotheses in a form of two questions:

(i) Is it the money supply that causes price movements or is it the price movements that cause money supply for the Sudan economy?

(ii) Is it GDP that causes the money supply or is it the money supply that causes GDP for the Sudan economy?

The corresponding equations for the two hypotheses respectively are:

\[ MS_t = \sum_{i=1}^{n} \alpha_i CPI_{t-i} + \sum_{j=1}^{n} \beta_j MS_{t-j} + \mu_{1t} \]  

\[ CPI_t = \sum_{i=1}^{n} \gamma_i CPI_{t-i} + \sum_{j=1}^{n} \delta_j MS_{t-j} + \mu_{2t} \]  

Equations (1) and (2) pertain to the first hypothesis (i). The following two equations (3) and (4) pertain to the second hypothesis (ii):

\[ GDP_t = \sum_{i=1}^{n} a_i MS_{t-i} + \sum_{j=1}^{n} b_j GDP_{t-j} + \mu_{3t} \]  

\[ MS_t = \sum_{i=1}^{n} c_i GDP_{t-i} + \sum_{j=1}^{n} d_j MS_{t-j} + \mu_{4t} \]
The first hypothesis, in particular, will enable us to discern whether, as generally believed in the Sudan, that the monetary expansion associated with the government borrowing from the banking system is the key factor contributing to prices movement. Despite the fact that the opposite argument—specifically that prices movement could cause money supply changes—has not been intensively explored for the Sudan economy as it seems irrelevant given the prevailing nature of the Sudan economy, still we shall try to shed some light on this relationship. For the second hypothesis Granger test will be used to find out the nature of causality between GDP and MS for the Sudan economy.

It is worth emphasizing that since the relationship between the three variables is taken pairwise, here we are dealing with bilateral causality. This will not be extended to multivariate causality through the technique of vector autoregression (VAR) since our objective is quite specific.

The questions posed above, which constitute the hypotheses to be tested, are critically important to the policy makers and answers or at least insights useful in analyzing the questions will be provided by the present study.

Data

The main type of data that will be used for the study is time series data, which is limited to the period (1960 to 2005). The main source of data is the Central Bank of Sudan (CBoS) annual reports. The macroeconomic data under examination consists of real Gross Domestic Product (GDP), money supply and price level. The measure of money supply used is the broad one, which consists of currency held by non-bank public and demand deposit held at the monetary sector (Narrow money; M1), and time deposits held at commercial banks. As far as prices are concerned, Consumer Price Index (CPI) is used to represent the movements in prices.

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 three macroeconomic variables under study. The test is undertaken for two cogent reasons. First, to avoid the problem of spurious regression. Second, a basic assumption underlying the application of causality test is that the time series in question should be stationary. Hence, in order to implement this test the Augmented Dickey–Fuller (1981) test is applied to detect the stationarity of the three variables.

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 another reason why we subjected the three macroeconomic variables series individually to unit root analysis. If the residuals of the three variables do not contain unit roots, the econometric relationship among the variables could be co-integrating. To determine the existence of a long-run relationship between real GDP, money supply and prices a cointegration test is carried out. In the present study the Engle and Granger (1987) two step procedures for modelling the relationship between cointegrated variables has been employed.
To test the two hypotheses outlined in section 4, Granger Causality test is employed. The steps involved in implementing the Granger Causality test are already outlined in textbooks, see for example Pearl (2000) and Hoover (2001). However, in our case, the numbers of lagged terms introduced in the causality test are determined by the Schwartz Information Criterion. Determination of the number of lags, to our mind, is an important empirical question since the direction of causality may depend to some extent on the number of lagged terms involved.

Empirical Results

Table 2 displays the correlation between real GDP, Money, and CPI. This correlation matrix measures the two-way relation between the mentioned variables. It indicates high correlation between variables pairwise. The highest correlation emerges between Real GDP and CPI, the magnitude of the correlation is almost (0.93).

Table 2: Correlation Matrix between Real GDP, MS and CPI 1960-2005

<table>
<thead>
<tr>
<th>Variables</th>
<th>Real GDP</th>
<th>MS</th>
<th>CPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real GDP</td>
<td>1</td>
<td>0.84862</td>
<td>0.9270</td>
</tr>
<tr>
<td>MS</td>
<td></td>
<td>1</td>
<td>0.9080</td>
</tr>
<tr>
<td>CPI</td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

Source: Compiled by the authors.

Tests for Stationarity (Unit Root Tests)

The tests for unit roots are closely related to the investigation of stationarity in a time series. As alluded to above, unit root tests like Augmented Dickey-Fuller (ADF) are employed to detect the stationarity of the three variables. The test is applied to both the original and to the first differences. Further, both the models with and without trend are attempted. The truncation lag parameters are determined following the Schwarz procedure. The results are reported in Table 3.

Table 3: Unit Root Tests (ADF) for the selected variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>$ADF_{t_c}$</th>
<th>$ADF_{t_f}$</th>
<th>$ADF_{t_c}$</th>
<th>$ADF_{t_f}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real GDP</td>
<td>4.786464*(0)</td>
<td>1.845699(0)</td>
<td>-</td>
<td>6.062003*(0)</td>
</tr>
<tr>
<td>MS</td>
<td>4.349154*(4)</td>
<td>4.455225*(4)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CPI</td>
<td>5.508351*(0)</td>
<td>0.304858(2)</td>
<td>-</td>
<td>-3.064653(0)</td>
</tr>
</tbody>
</table>

Notes:
- $t_c$ and $t_f$ are the test statistics for the ADF tests with allowance for only constant and constant & trend terms in the unit root tests, respectively.
- * denotes the rejection of the unit root null hypothesis for the 1 per cent significance.
- The numbers in parentheses are the lags used for the ADF test, which are augmented up to a maximum of 4 lags. The choice of optimum lag for the ADF test was decided on the basis of minimizing the Schwarz information criterion.

Source: Compiled by the authors.

The unit root test results given in Table 3 indicates that the unit root null hypothesis are rejected for all the variables in their levels when including only constant in the model, but when
including trend and intercept in the test equation, the ADF results show that the unit root hypothesis can be rejected only for MS, differencing real GDP and CPI series provide stationarity of these variables. (GDP and CPI are trend-stationary).

Cointegration results

The Johansen procedure was used to test for the existence of a long-run relationship between real GDP, MS and CPI, i.e. a co-integrating relationship. Table 4 and Table 5 provide the results of the cointegration tests.

Table 4: Cointegrating Analysis

<table>
<thead>
<tr>
<th>Hypothesized No. of CE(s)</th>
<th>1 Percent Critical Value</th>
<th>5 Percent Critical Value</th>
<th>Likelihood Ratio</th>
<th>Eigenvalue</th>
</tr>
</thead>
<tbody>
<tr>
<td>None *</td>
<td>35.65</td>
<td>29.68</td>
<td>57.27833</td>
<td>0.666396</td>
</tr>
<tr>
<td>At most 1</td>
<td>20.04</td>
<td>15.41</td>
<td>8.975038</td>
<td>0.132386</td>
</tr>
<tr>
<td>At most 2</td>
<td>6.65</td>
<td>3.76</td>
<td>2.726657</td>
<td>0.060088</td>
</tr>
</tbody>
</table>

(*) denotes rejection of the hypothesis at (1%) significance level

Likelihood ratio test indicates 1 cointegrating equation(s) at 5 percent significance level

Source: Compiled by authors.

The likelihood ratio test indicates one cointegrating equation at 5 percent significance level. The results of the long-run relationship are presented in Table 5.

Table 5: Normalized Cointegration Coefficient: 1 Cointegrating Equation

<table>
<thead>
<tr>
<th>REALGDP</th>
<th>MS</th>
<th>CPI</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.000000</td>
<td>0.333220</td>
<td>-2.297790</td>
<td>-136276.6</td>
</tr>
<tr>
<td></td>
<td>(2.34773)</td>
<td>(16.0741)</td>
<td></td>
</tr>
</tbody>
</table>

Log likelihood: -1395.282

Source: Compiled by authors.

The long-run equilibrium relationship among the tested variables is based on the following cointegrating vector:

\[ [1.00 , 0.333220, -2.297790, -136276.6] \]

These values represent the coefficient for real GDP (normalized to one), MS, and CPI. Hence, the long-run equilibrium relationship can be expressed as:

Real GDP = -0.333220MS + 2.297790CPI + 136276.6
Granger Causality Results

After we looked for the long-run relationship of the variables, we now test for the direction of causation between money and prices for the Sudan economy during the period 1960-2005. As pointed out earlier, the present study has adopted the Granger Causality test to examine the pairwise relation between variables. The results are provided in Table 6.

Table 6: Pairwise Granger Causality Tests: Sample 1960-2005

<table>
<thead>
<tr>
<th>The Null Hypothesis</th>
<th>Obs.</th>
<th>F-Statistics</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS does not Granger Cause REALGDP</td>
<td>45</td>
<td>1.09391</td>
<td>0.30159</td>
</tr>
<tr>
<td>REALGDP does not Granger Cause MS</td>
<td>45</td>
<td>2.03313</td>
<td>0.16129</td>
</tr>
<tr>
<td>CPI does not Granger Cause REALGDP</td>
<td>45</td>
<td>2.63849</td>
<td>0.11178</td>
</tr>
<tr>
<td>REALGDP does not Granger Cause CPI</td>
<td>45</td>
<td>8.91861</td>
<td>0.00470</td>
</tr>
<tr>
<td>CPI does not Granger Cause MS</td>
<td>45</td>
<td>2.56862</td>
<td>0.11650</td>
</tr>
<tr>
<td>MS does not Granger Cause CPI</td>
<td>45</td>
<td>16.5524</td>
<td>0.00020</td>
</tr>
</tbody>
</table>

Source: Compiled by authors.

The Granger Causality test results from Table 6 revealed a uni-directional causation between money and prices in the Sudan. The direction of causation between money supply and prices runs from money supply to price. On the other hand, there is no reverse causation from price movements to money supply. To explain this result, besides the federal government borrowing from the banking system which contributed to inflation in the Sudan, it also seems that financial markets of all kinds are not well developed and their influence in the economy as a whole is not strongly felt. Moreover, the majority of the Sudan people do not have adequate knowledge and much confidence in these financial markets. Hence, it seems that the main alternative to holding money is spending on goods and services. As a consequence, it is most likely that the supply of money is the most important factor that determines the spending on goods and services and therefore causes the movement in prices. However, beside money supply we believe that some structural elements play a significant role in generation of inflation as well e.g. export instability, agricultural bottleneck and foreign exchange scarcity. The test also provides evidence of a uni-directional causation from real GDP to price suggesting that real income Granger causes price level during 1950 to 2005. On the other hand, there is no reverse causation noted from prices to national income. Finally, no much amount of causation was found between real GDP and money supply.

Concluding Remarks

A brief description is given to the Sudan economy during the study period 1960 – 2005. The salient features relevant to the three macroeconomic variables are presented. Unit root test is carried out to avoid spurious regression and to enable for undertaking Granger Causality test since the assumption of stationarity is essential, as well as cointegration analysis. The results from correlation analysis indicate that there is strong correlation between the three variables pairwise.

The Granger causality test reveals a uniform directional causation between the supply of money and prices movement. The causation runs from money supply to prices. This we regard as a piece of empirical evidence supporting the monetarist claim, to the extent that monetary
expansion is not promptly followed by a response from the production sector of the economy, the supply of money will have a direct effect on prices.

The Sudan economy, like many other developing economies, is a dual economy in the sense that traditional sector coexist with a modern sector. However, the traditional sector is the most dominant since almost 80 per cent of the populations live in this sector. Consequential upon that the increase in money supply does not seem to affect the output of the traditional sector which constitutes a large share in the GDP. This is due to the fact that the economic activity of this sector is exclusively determined by exogenous forces. This might be one reason why no much amount of causation was found between money supply and real GDP at least in the short run.

Further, the co-integration analysis has established that the real GDP, money supply and price level were found to be co-integrated suggesting a existence of long-run relationship between these macroeconomic variables.

In spite of the fact that a complete model of the inflationary process needs to be formulated, still we believe that the results of first hypothesis which established a unidirectional causation between money supply and prices movements, constitutes a satisfactory framework for the discussion of anti-inflationary policies in the Sudan.

References


