

Testing the Relationship between Money Supply and Gross Domestic Product in Egypt

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Abstract

This paper uses the Cointegration, Error Correction Model, and Granger Causality techniques to determine the relationship between the real money supply and real GDP in Egypt, and the direction of the causality between the two variables in both short and long run. The study covers the period from 1991 to 2010. ADF test showed the two series are integrated of order one $I(1)$. The Cointegration test indicated the existence of a long run equilibrium between real GDP and real money supply based on Engle-Granger two steps test. The Error term and F-test from VECM beside the Granger causality test indicated unidirectional causality running from real GDP to real money supply in the short run as well as in the long run. This result consistent with the Keynesian theory, the (RBC) theory and various empirical studies in different countries. We conclude that real money supply had neutral effect on the real GDP growth in Egypt during the study period.

1. Introduction

The relationship between money supply and output has been receiving increasing attention than any other subject matter in the field of monetary economics in recent years, because of the importance of economic growth among the macroeconomic objectives of nations in both developed and developing.

There were debates between Keynesian and monetarists about the relationship direction between money supply and output. Monetarists argued that the changes in the amount of money led to unexpected changes in nominal income because of the stability of money, where Friedman assumed that it was the most stable function. While the Keynesian assumed that the role of money supply is very limited because of the liquidity trap and the investment elasticity of interest was low, so the positive changes in income led to raising money demand for transactions and raising the amount of money, and this means, the direction of causality came from income to money and not the opposite.

Money supply and GDP had variance changes in Egypt during the study period, due to adapting the Egyptian government the Economic Reform and Structural Adjustment Program (ERSAP) in response to the declined in the Egyptian economy during 1986-90 period (that was coupled with Massive fiscal and current account deficits, high inflation rates, negative interest rates, accumulated external debt and high open unemployment). The Egyptian government initiated the ERSAP, that had many goals such as: stabilization of the economy in order to restore macroeconomic balance and reduce inflation; structural adjustment to stimulate medium and long term growth; and modification of social policies to minimize transitory effects of economic reform on the poor and vulnerable groups. (African Development Bank Group, 2000:1). As a result, it was necessary to reform the Egyptian monetary policy, through reforming the money, capital, and foreign exchange markets, and reactivate the financial markets to play its role in allocating resources. It was difficult to use the direct guidance tools to achieve the monetary policy objectives, therefore the monetary reform program turned to indirect instruments, and it was needed to develop a central tool to linkage between the fiscal policy and the monetary policy, and to guide the market forces in activating the role of the money market. This tool was the treasury Bills (T.B) that used for conducting monetary policy and activating its role. These procedures reflected on the growth rate of real money supply (M1) during the study period, where M1 raised from negative value (-14.1%) in 1991 to 5.5% in 2000 and to 6% in 2010. On the other hand, there were variance changes in real GDP growth rate during the study period as a result of internal and external events, where real GDP growth rate raised from 1.9% in 1991 to 3.6 in 2000, and to 5.5% in 2010. (CBE annual reports different issues). The changes in real GDP and money supply in the study period could indicate that there is a causality relationship between real GDP and money supply.

The study aims at testing the relationship between the real money supply (M1) and the output expressed in real GDP in Egypt during (1991-2010), this could help to identify which variable affects the other, and explaining the changes that occur in the future in both output and money supply. Also it could contribute to know the effectiveness of monetary policy that was implemented in Egypt during the study period.

The remainder of the paper is organized as follow. In the next section, reviewing the related literatures. Section (3), shows the methodology used to test the relationship between output and money. Section (4) is an overview of real GDP and real money supply growth in Egypt during the study period. Section (5) presents the empirical results. Section (6) is the concluding remarks.

2. Literature Review

2.1 Review of Economic Thought

The debates about the relationship between money and economic activity started since the mercantilists' era, where the mercantilists addressed the relationship between money and economic activity through the Quantity Theory of Money that linking between the changes is the amount of money and the general prices level.

Tomas Mun (1630) is considered the first writers who pointed out that the increasing in the amount of the precious metal would lead to an increase in domestic prices relative to prices of other countries. Other economists such as: John Locke (1691), David Hume (1752), David Ricardo (1880), and John Stuart Mill (1848) reformulated the relationship between money and prices in what is known the traditional amount of money, which confirmed that the prices and money in circulation were changing at the same rate. The presence of this relationship in the traditional literature emphasized on the neutrality of money, that means the changed in money would not affect the real economic variables in the economy, but it would lead to relative changes in the price level, this would happen only if no money holding. (Mill, 1848).

Despite of Locke (1691) and Hume (1752) thought the Quantity Theory of Money was correct in its simple formula, some of mercantilists believed that the domestic trade depended on the amount of money, and it was necessary to raise it in order to raise the employment of labor (*John Law, 1705*). In addition, they thought that the increasing in money supply reduced the cost of borrowing which increased sales and profits without increasing prices. This idea was completely conflicted with the Quantity Theory of Money. Cotillion (1755) pointed out the increasing of precious metals would led to raise individuals' income who worked in this sector, and so raised the spending on the consumption goods, and this would lead to raising food prices and farmers' profits, while reduced real wages, which in turn led to rising nominal wages that led to rising the spending and then prices. From above it is cleared that the mercantilists award of the possible impact of the money on the economic activity and its distributional effects.

Fisher's (1911) exchange equation ($MV=PT$) was considered the famous classical mathematical formulas. It expressed the relationship between the amount of money and the general price level, where (M) is the amount of money, (V) is the money velocity, (P) is the general price level, and (T) is the volume of transactions. He assumed that output would be fixed at full employment, velocity of the money would be fixed too, and thus the equation showed only the relationship between the amount of money and the general price level, especially in the long run.

The neo-classical economists(Cambridge school), pointed out, the money supply affected both prices and output in the short run, but in the long the money supply only affected the general price level and not output.

They reformulated the exchange equation to new equation called the equation of Cambridge. Which stated the amount of nominal money demand and then money supply (at money market equilibrium) are proportional linked directly to the nominal per capita income or output, this equation had the following formula: $(M_s = M_d = KY)$. Where (M_d) is money demand, (M_s) Money supply, (K) is the liquidity preferences, and (Y) is nominal income. (Pigou, 1917)

Keynes (1936) rejected the Quantity Theory of Money in the short run because their assumptions (Y was fixed at full employment and V was fixed) did not apply in a real world of uncertainty and with high level of unemployment. Keynes argued that changing in money supply were not the only responsible for changing in the general price level, but there was another variable affected the price level which is the employment of production factors. In the case of absence of full employment, the increasing in money supply would lead to increasing total spending, and then increased the total output. When the economy reached to full employment, the increasing in money supply only led to higher prices. Thus, the money supply was non-neutral when the economy operated at less than the full employment level, where there was indirect effect of money supply on economic activity, through the influence of money supply on interest rates, and then investment and output.

On the other hand Monetarists (1963) stressed on the importance of the money supply in determining nominal GDP and the price level. (Mohamed, 2005: 10). Where they adopted the Quantity Theory of Money, and they thought the changing in the amount of money led to expected changes in nominal income, where the money supply directly affected the economic activity and then output in short run. Because monetarists believed that markets were stable and worked well, they argued that the economy was near or quickly approaching full employment, and so in the long-run, the economy would be at full employment output (Y_f), and so the Quantity Theory of Money in the long-run would show M and P are the only variables in this equation, which means changing money supply will only impact the price level and cause inflation. In addition the growth rate of a money supply will equal the growth rate price level (or inflation) in the long-run. This conclusion explained Friedman's famous quote "*Inflation is always and everywhere a monetary phenomenon.*" (Friedman, 1969).

The monetarist's points of view were different with the post-Keynesian's points of view for the effectiveness of money supply on the economic activity, and then output under the Rational Expectation Hypothesis, where: (Al-Mahdi, 2000: 120-126)

Post-Keynesians argued that increasing the money supply affected both output and the general prices level, and there was different impact depending on individual's rational and irrational expectations. In the case of an anticipated increase in money supply, and under rational

expectations, people expected the possibility of a rise in the general prices level, and also led to increasing money supply that reduced interest rates, thereby increased investment and output. But the expectations of higher prices, led to high wages rate, but at low rate (because of relative sticky wage rates), and led to a reduction in total supply and then the low level of economic activity which would be less than the increasing in economic activity arising from the lower interest rate. The ultimate effect was increasing the level of economic activity. If the monetary policy was unexpected, it had the biggest impact on economic activity, where there were no expectations of rising prices, and therefore would not be a change in aggregate supply.

- The monetarists supposed a complete flexibility of both wages and prices, and hence there was no effect of money supply on the economic activity, this could be happen in the case of expected monetary policy, where the expected increasing in the money supply, led to increasing the general price level in the future, while the aggregate demand increased at the moment, and increased the level of economic activity. It also led to workers' claim to raise their nominal wages (in order to maintain their real wages without reduction); and so production costs would increase; this could affect the economic activity to return to its previous situation, this means that the expected monetary policy had no impact on the economic activity(neutrality of money).

In the case of unexpected monetary policy, it could be effective in influencing the economic activity. For example, implementing unexpected expansionary monetary policy led to an increase in the aggregate demand, and in the absence of unexpected higher prices, nominal wages remained without change, as well as the aggregate supply, it followed that (because of the rising aggregate demand) an expansion in the level of economic activity combined with raising in the general price level, and thus monetary policy would be effective (non-neutrality of money).

From the above we conclude that the impact of monetary policy on real output and employment under the hypothesis of rational expectations depended largely on the degree of expectations and the institutional structure, if sufficient information was available to the public about how the monetary policy was working, and if the institutions adjusted their positions in light of the applied policy, the money supply would have no impact on both of real output and employment. But the monetary authorities could affect the output in the short run by adapting a way that making predictions were not accurate enough.

Minsky (1977) argued that money is an endogenous variable, where the paper money supply determined by the banking system that based on the lending which depended on the volume of economic activity, the

increased in the amount of money led to increased the investment and then increased the amount of money again.

Moore (1988) and Wary (1990) believed that the central bank in the modern economy did not control the amount of money and that money supply adjusted with the demand for credit. When firms borrowed from private banks, it led to lower banks' additional reserves and pushed private banks to Central Bank, which would increase the money supply to counter a surge in demand for credit to avoid the collapse of the banking system, and therefore the function of banks in the modern economy was to finance the business sector, and this demand was determined by money supply and not the monetary authorities. The increasing in investment expenditure (real capital or financial assets) required a response of funding institutions to increase the demand for credit, this led to an increase in money supply, which offset by a similar increase in money supply without affecting the interest rate, and this happened only if the central bank did not respond to the increase in demand. This means that the central bank controlled the rate of interest but it did not control the amount of money, where the money supply by the central bank depended on the anticipated profit rates by private institutions, therefore, both the demand and supply of money depended on anticipated profit rates for the private sector. In this model money supply was endogenous variable, and so the monetary policy affect the real variables.(non-neutrality of money).

It is clear from the above; there are differences views about the direction of the relationship between money supply and output.

2.2 Review of Empirical Studies

Friedman M. and Schwartz A. (1963) and Friedman, M. and Meiselman, D. (1963) studies were the first applied statistical studies. 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 argued that the sharp contraction that occurred during the Great Depression (1929-1933) was result of the high decline in money supply during the same period. While Friedman and Meiselman focused on the monetarist-Keynesian debates about the effectiveness of monetary and fiscal policies. They tasted the Keynesian assumption about the stability relation between income and consumption, and the monetarists' assumption about the stability of the money demand, they concluded that the monetarists' model that link between spending and amount of money showed a better description to determine the total spending, and it was stronger than the Keynesian model.

In the of Brunner and Meltzer (1976) study, they argued that funding the increasing in government spending by raising the money supply would increase the total expenditure; and thereby increased the nominal income that led initially to increase the real income and eventually to increase prices.

Sims (1972) study was the first study 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 helped in the interpretation of output and not the opposite, which means that there was a causality direction from the amount of money to GDP, this result consistent with Friedman and the monetarists point of view.

Williams and Gowl (1976) applied the Sims' model on the UK and they concluded that the direction of causality came from the output to the amount of money (as opposed to the findings of the Sims) and this was consistent with the Keynesian approach.

Friedman, B. And Kutuner(1992, 1993) study for the period (1960-1990) of USA, argued that the relationship between the amount of money and output became less stronger with increasing time period, on the other hand, they found that the explanatory power of the interest rate had stronger impact than the amount of money in the interpretation of changes in output.

Rader B.,(2010) tried to find out, whether the quantitative theory of money holds in the Czech Republic, and whether there was a strong empirical relationship between money supply and output. He found out there was indeed strong and mutual relationship between these two variables. However, the results did not clearly confirm or reject the validity of the Quantitative Theory of Money. Scatter gram analysis showed clear and positive relationship between money supply and output, no matter how much lagged the money supply variable. But Impulse-Response analysis showed negative reaction of real output to random shock in money supply.

Daniela Z., and Mihail C.,(2010) tried to study the relationship between money supply and GDP, in order to construct a function which would explicit this connection for Romania, depending on the data of money supply (M3) and of GDP over ten years through the ADF, They obtained that both series are non-stationary, and when they applied the Engle-Granger cointegration method, they concluded that there was a cointegration between two series.

For developing countries' studies, Abbas (1991) tested the causal relationship between money and output in some Asian countries, and he found that there was mutual relationship between money and income in Pakistan, Malaysia and Thailand. While the study of Kalumia and Yourogou

(1997) found strong causal relationship directed from money to income in five countries in West Africa, which means non-neutrality of money.

Tan and Baharumshah (1999) study tried to test the causal relationship between money, output and prices in Malaysia; they found that money is non-neutral in the short run, which means there is unidirectional relationship from money to output and not the opposite.

While in the study of Hussein and Abbas (2000) tested the causal relationship between money, income and prices in Pakistan, they found unidirectional relationship from income to money and not the opposite, which indicated that the real factors, and not nominal played effective role in the growth of national income in Pakistan.

Vector and Stephen (2000) explored whether a significant long-run relationship existed between money and nominal GDP and between money and the price level in the Venezuelan economy. They applied time-series econometric techniques to annual data for the Venezuelan economy for 1950 to 1996. An important feature of their analysis was using unit roots test and cointegration with structural breaks. Certain characteristics of the Venezuelan experience suggested that structural breaks might be important. Since the economy depended heavily on oil revenue, oil price shocks have had important influences on most macroeconomic variables. Also since the economy possessed large foreign debt, the world debt crisis that exploded in 1982 had pervasive effects on the Venezuelan economy. Radical changes in economic policy and political instability might have also significantly affected the movement of the macroeconomy. They found that long-run relationship existed between narrow money (M1) and nominal GDP, the GDP deflator, and the CPI when one made allowances for one or two structural breaks.

Abdul Raziq and others (2003) tried to test the effect of real GDP, government spending, the 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 helped in explaining the changes in money supply and not the opposite.

Hussein (2005) studied the causal relationship between money growth, inflation, currency devaluation and economic growth in Indonesia during the period 1954-2002. The empirical results suggested that there existed a short-run bi-directional causality between money supply growth and inflation and between currency devaluation and inflation. For the complete sample period, the causality running from inflation to narrow money supply growth was stronger than that from narrow money supply growth to inflation.

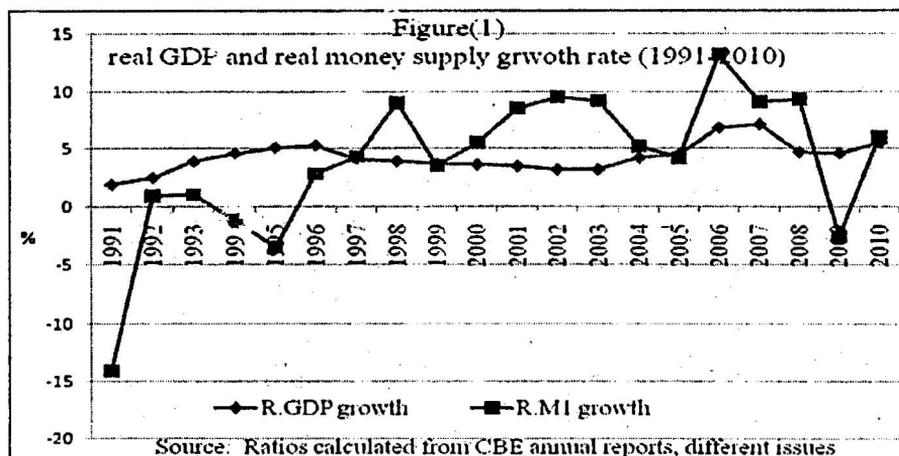
Obaid (2007) tested the causality relationship between money supply (M3) and real GDP in Egypt during the period (1970-2006), by using Granger test. He concluded that there were no causality between the nominal money supply and nominal GDP during the study period, while when he used the real money supply and real GDP, he found that there were mutual causality relationship between real money supply and real GDP in Egypt (non-neutral money), and thus the monetary policy was 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

Finally, Ogunmuyiwa and Francis (2010) investigated 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.

It is clear from the results of previous studies, the relationship between money supply and output or income (expressed in different measures) are 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.

3. GDP and Money Supply in Egypt: an Overview

The aim of this section is to review the developments that had occurred in both of the GDP and money supply in Egypt during the study period that had witnessed many changes at local and global levels. At the local level, the implementation the (ERSAP) since mid-1991, which needed to reform the monetary policy and adjusted its operational, medium, and final goals, in order to achieve the macroeconomic objectives. At the global level, the economic crisis that had happened in Southeast Asia in the mid-1997, the events of September 11, 2001 and finally the global financial crisis that began in 2008. Figure (1) shows the growth rates of both real GDP and real money supply during the period (1991-2010).



3.1 Money Supply Growth

The growth of the real money supply was instable during the study period, because of the instability of CPI. In the beginning of the period There was a decline in money growth rate (M1), where it was -14.1% in 1991 and it went up to 2.8% in 1996, the declining in money growth rate during (1991-1996) was a result of implementation the first phase of the economic reform program that included stabilization phase, which aimed at controlling the increase in money supply in order to control the rate of inflation as the main objective of monetary policy. The money growth rate began to rise to 4.3% in 1997 and continued to rise for up to 9.5% in 2002; this might be due to using the CBE expansionary tools such as reducing the reserve ratio to 14% of the total deposits in local currency. In 2003 there was a new low of the CBE, the banking system and currency, Also the decree on liberalizing the Egyptian Pound exchange rate. The new law stated, "Price stability is the main objective of monetary policy, which is ahead of other goals. Accordingly, CBE is committed – in the medium term – to achieve low rates of inflation that contribute to building trust and therefore create the right environment to stimulate investment and economic growth", (Official Newspaper, 2003); this led to raise the growth rate of real money supply to highest value in 2006 for up to 13.2%. But due to the global financial crisis the growth rate of money supply in 2009 was negative value -2.6%, but it increased to 6% in 2010.(CBE, annual reports, different issues).

3.2 GDP growth

The growth rates of real GDP had clear variations during the study period, where the real GDP growth rate increased from 1.9% in 1991 to 5.3% in 1996(the year witnessed the end of the stage of economic stabilization), but in the following year, the Egyptian economy was affected by economic crisis

that took place in Southeast Asia in mid-1997, this led to increasing the monetary outflows from Egypt in terms of foreign currencies during 1998 and 1999, also there was a decline in the volume of Foreign investments, and there was increasing in imports from Southeast Asia countries that had currency devaluation due to crises, (Egyptian imports from these countries increased from \$15.7 billion in 1997 to \$16.9 billion in 1998). This was reflected in the trade balance (which had a deficit of \$11.8 billion in 1997 compared with \$10.2 billion in 1997). In the end of 1997, the Egyptian tourism market exposure to Luxor incident terrorist, which had significant decline in tourism income for a long period of time, this affected the tourism sector and hotels, as well as economic activities associated with them, and in the same year there was a global decline in oil export prices. The results of all these events declined the economic growth to 3.9% in 1998 and to 3.6% in 2000. Due to September 11-2001 events the economic growth continued to decline to 3.2% in 2002 and 2003 (Abu -Alyun, 2003: 23-24) The growth rate started to raise in the following years, where it reached 7.1% in 2007, this happen due to increasing of investments in economic sectors, the growth of petroleum and non-petroleum exports, and reducing taxes on incomes and corporate profits. In 2008 the Egyptian economy was influenced by global financial crisis and its negative effects in 2008, where the growth rate dropped up to 4.7% due to lower tourism and the Suez Canal revenues, as well as declining the real growth rate of the aggregate investment that recorded negative level. In 2010 there was a raise in output growth up to 5.5%. (CBE, annual reports different issues).

4. Methodology

The causality test relationship between the quantity of money supply and GDP requires three steps.

- First, the time series would be analyzed to determine the order of integration.
- Second, the investigation of the long run relationship between the quantity of money and GDP in Egypt.
- And finally, the existence of cointegration between the two time series indicates the existence of a causality relationship at least in one direction in short run as well as the long run (Granger, 1988).

Most of time series are non-stationary where the series' mean, variance and/or covariance depend on time. Thus the conventional regression techniques produce spurious regression, (Granger and Newbold, 1974). One of the most widely used tests is the Augmented Dickey-Fuller unit root test (ADF). (Dickey and Fuller, 1986, 1981, 1979).

The next step is to test for possibility long run relationship between the two series after establishing the stationary of the variables included in the model. Cointegration is a test of the existence of long run equilibrium of non-

stationary series. (Granger, 1987) (Granger and Newbold, 1974). There are different methods to test for cointegration (Al-Najar, 1993). Among them is Engel-Granger two steps test which carried out the same steps as ADF test. Another test developed by Johansen(1988, 1991), Johansen and Juselius (1990) using the maximum like hood procedure. This method is preferable than Engle-Granger procedure, especially when model includes more than two variables (Gonzalo, 1994).

Vector Error Correction Model (VECM) will be utilized to estimate the speed of adjustment to the deviation in the long run equilibrium and to assess the direction of causality in both short and long run.

We can test the causality between the two variables in both short and long run by estimating the following two equation using (OLS) regression method:

$$\Delta GDP_t = a_0 + \sum a_i \Delta GDP_{t-i} + B_j \sum \Delta MI_{t-j} + g_1 e_{t-1} + v_t \quad (1)$$

$$\Delta M_t = B_0 + \sum B_j \Delta MI_{t-j} + a_i \sum \Delta GDP_{t-i} + g_2 e_{t-1} + \eta_t \quad (2)$$

Where: (GDP) is real Gross Domestic Product, (M1) is Narrow definition of real money supply, (Δ) shows the 1st differences, (t) is time. (e_{t-1}) Error correction term

The short run causality is based on a standard F-test statistics to test jointly the significance of the coefficients of the explanatory variables in their first difference. The long run causality is based on a standard T-test of the lag value error correction term for one period. Negative and statistically significant values of the coefficients of the residuals of one lagged period indicate the existence of long run causality. If both parameters (g_1, g_2) are statistically significant, this means there is a mutual causality relationship (from GDP_t to M_t) and (from M_t to GDP_t), while if (g_2) is only statistically significant, this means there is a causality relation in one direction (from GDP_t to $M1$), and this means that (GDP) leads (M1) to the equilibrium in the long run but not the opposite. (Hussein and Abbas, 2000) , (Abbas, K., 1991).

5. Date and Empirical Results

In order to study the causal relationship between the quantity of money and GDP in Egypt during (1991-2010) we used GDP data at constant prices(2000=100) ,Quantity of money(M1) and inflation rate (CPI) data that obtained from the annual reports of CBE.

5.1 Unite Roots Testing:

Table (1) shows the results of the ADF unit root tests for levels and first differences of GDP and M1 series. The t-values on the level obtained from ADF test are Clearly less than the critical values and therefore we accept the null hypothesis of a unit root for both GDP and M1 series at 5%

significant level. Thus GDP and M1 are non-stationary time series at their levels. In addition table (1) shows that the same test applied to the first differences of the two series. The results show that the calculated t-values are greater than the critical values at 5% significant level, this means rejection the null hypothesis that the series have unit roots in their first differences, which means that the two variables are stationary at their first differences, and so the two variables are integrated of order one I(1)

Table (1) ADF Unit root tests for level and first differences*

Variables	Level		First difference	
	Intercept	Intercept & Trends	Intercept	Intercept & Trends
GDP	1.84	2.56	3.64	3.95
M1	1.61	2.43	4.25	3.61
Critical values at 5%	3.03	3.67	3.03	3.67
Critical values at 10%	2.65	3.28	2.65	3.28

*Number of lags is determined according to Akaike Information Criterion(AIC) (Akaike, 1974)

5.2 Cointegration Test

Having established the stationary of the two times series under consideration, the next step is to test for cointegration. Although the individual time series tends to deviate from equilibrium in the short run, they may have long run equilibrium. Table(2) shows the results of Engle and Granger two steps test for cointegration for the following two equation using (OLS) method :

$$\text{Log GDP}_t = \alpha + \beta \text{Log M1} + \varepsilon_t \quad (3)$$

$$\text{Log M1} = \alpha + \beta \text{Log GDP}_t + \mu_t \quad (4)$$

The results represent the outcome of regression of the two equations and the ADF test which applied on the residuals obtained from the two regressions. The results imply that the residuals are free of unit roots which means that residuals are stationary and cointegrated of degree zero I(0), this means there exists cointegration between GDP and M1, and so there is an equilibrium relation between the two variables in the long run. And thus

Table (3) Estimates for VECM

Regression Equation Variables	ΔGDP	$\Delta M1$
Constant	0.63 (1.45)	0.46 (1.12)
g_1	-0.73(2.23)*	
g_2		-0.35 (1.57)
ΔGDP_{t-1}	0.12 (1.96)*	1.08 (2.43)*
ΔGDP_{t-2}	0.1 (1.23)	1.69 (1.75)
$\Delta M1_{t-1}$	0.06 (0.83)	0.4 (2.14)*
$\Delta M1_{t-2}$	0.2 (0.14)	0.13 (0.61)
F-stat	1.23	6.12
Prob. (f-stat)	0.456	0.006

*significant at 5%. values in brackets are t-ratio

In addition from table (3) we could determine the causality in short run between the variables using F-test for the explanatory variables in VECM. The results shows the F-stat is very high (6.12) in M1 regression equation compared with the value F-stat in GDP equation (1.23), this indicates the existence of short run causality from GDP to M1 and not the opposite.

5.4 Granger Causality Test

The Granger causality test helps in determining the direction of causality between the two variables included in the model. Since the two series are integrated of order one $I(1)$, the Granger causality is applied using the first differences of two variables involved in equations (1) and (2), and excluding the error correction term (e_{t-1}) from the two equations. Table (4) shows the Granger causality, where the null hypothesis of GDP equation is (ΔGDP does not Granger cause ΔM), and the null hypothesis of M1 equation is (ΔM does not Granger cause ΔGDP). As shown in table (4) the first null hypothesis is rejected which means that GDP growth Granger causes M1, however, the second null hypothesis is accepted implying the M1

does not Granger cause GDP. The results confirm the existence of unidirectional causality from real GDP to real money supply that obtained from VECM results.

Table (4) Pairwise Granger Causality Test

Null hypothesis	F-Stat	Probability
Δ GDP does not Granger cause Δ M	6.63	0.015
Δ M does not Granger cause Δ GDP	0.453	0.611

*Number of lags=2

From the above results, we conclude that all tests show a long run equilibrium relationship between the two series during the period (1991-2010), and there is unidirectional causality from real GDP to real money supply in the short run as well as the long run. This result consistent with both the Keynesian theory and the Real Business Cycle Theory (RBC), by Kydland and Prescott (1982) that emphasized on the effect of GDP on Money supply. They attributed the changes in output growth led to changes in money growth; due to two reasons: The First, the developments in the real sectors of the economy affected the individuals financial decisions, and this affects the quantity of money demand, and because of the financial system reacted to changes in the money demand, the changes in output growth created changing in the growth of money supply, this means output caused money and not the opposite. The second reason came from the assumption that individuals have the information that could not be quantified for economic activity, for example, the expected rise in output led to rise in both of the demand for money and credit; and so policy-makers would allow to increase the money supply to counter the increasing in money demand; and therefore the interest rate would not change. (Jonsson, 2006:561).

So we can say, the changes in the money supply did not help in explaining the changes in output, while the changes in output helped to explain the changes in the amount of money in both short and long run; and thus the Egyptian monetary policy had no significant effect on the GDP growth rate in Egypt during the study period. This could be due to the following:

- During the period (1991-1996) which represented the stabilization program, that aimed at controlling the money supply in order to controlling the inflation as a main goal of the monetary policy, but during this period GDP raised from 1.9% in 1991 to 5.3% in 1996.
- Since the conclusion of the stabilization program in 1996, the CBE was concerned with achieving multiple objectives simultaneously, which were in many instances conflicting. These objectives included attaining

high economic growth while maintaining low inflation and preserving a stable exchange rate.

- Between 1996 and 2006 CBE applied various quantitative and price instruments at different points in time to achieve its multiple objectives leading to a lack of consistency in monetary management. These instruments included reserve requirements, government securities, repo and reverse repo operations and the CBE discount rate. Until June 2005, banks' excess reserves were the CBE's operational target, which were very volatile. Moreover, linking the policy decisions to macroeconomic outcomes has been complicated by the dominance of state-owned banks in the banking sector, which created rigidities in the interest rate structure. In addition, the existence of large non-performing loans (NPLs) led to disconnecting between price measures and macroeconomic outcomes.
- A close examination of the various interest rates during 1996 and 2006 revealed that there was no single interest rate that best reflected the monetary policy stance. The movements in these interest rates appeared to be secular, with no evident cyclical pattern, suggesting that the interest rate channel did not materially contribute to economic fluctuations in Egypt. Moreover, the coefficient of variation in the nominal policy interest rates (Treasury bill rate and discount rate) was quite low ranging between 0.1 and 0.3 throughout the period. This was reflected in the nominal retail rates as well, which also demonstrated low variability ranging between 0.04 and 0.1. In addition, Granger causality tests suggested a weak interest rate transmission channel for Egypt during this period. This result is not surprising given that the CBE's operational target at the time was banks' excess reserves, which were very volatile. In other words, quantitative measures undertaken by the CBE were considered more effective in steering aggregate demand.(Al-Mashat, 2008: 5)
- In addition, the period witnessed investing large part of money supply in real estate, which led to a surplus in the real estate wealth supply. Another part of liquidity was used to import large quantities of products from Asian counties that devaluated its currency during the Asian financial crisis, this led to (in addition to other factors mentioned previously) a liquidity crisis in the Egyptian economy during that period.

-Starting from June 2006, CBE moved from a quantitative operational target (excess reserves) to a price target (overnight inter-bank rate), and launching a Corridor system, but it couldn't achieve the objectives of the monetary policy, where the Egyptian pound lost its real value against the other foreign currencies; this led to the inflation rate became double although the decreasing in the monetary expansion. Moreover, the net international reserves declined by 26.7% in the same

period as a result of CBE interference in the foreign exchange market as a seller of the foreign exchange.

Finally, the reasons behind ineffective Egyptian monetary policies were the policy-makers who developed the short or medium run objectives of the monetary policy depending on subjective points of view or to achieve a particular interest to those in the power in Egypt, and so these objectives in many instances conflicting. In addition there was no independence of CBE in making its decisions, despite of a law of 2003, the CBE decisions were determined from outside and not from inside the CBE; this led to the inability of the CBE to design an independent monetary policy that influenced the macroeconomic variables as it happened in developed countries; and thus the money supply could not affect the real economic variables and minimized the fluctuations in the Egyptian economy during the study period.

6. Conclusion and Remarks

The study aimed at determining the causality relationship between real money supply and real GDP in Egypt. ADF test results showed the two series were non-stationary at their levels, but they were stationary at their first differences, this means the time series of GDP and M1 were integrated of order one $I(1)$. Engle and Granger two steps and the ADF test showed that the residuals were free of unit roots which means that residuals were stationary and cointegrated of degree zero $I(0)$, this means there were cointegration between GDP and M1, and so there was an equilibrium relationship between the two variables in the long run; and thus there was causality relationship at least in one direction between the two variables. The Granger causality test showed that there was unidirectional causality from real GDP growth to real money supply growth in the short run as well as the long run. We conclude that the changes in money supply did not help to explain the changes in GDP in Egypt during the study period, while the changes in GDP clearly explained the changes in money supply. the study recommends the following:

-Monetary authorities Could achieve the economic growth goal by providing cash balances without leading to inflation, this could be happen if CBE controls the demand for money and directing the money supply to meet the needs of the demand for cash balances, This will be done under the complete independence of the authority of the Central Bank in making decision far away for government intervention.

-Studying of the structure of interest rates in the future due to the call to raise interest rates on the dollar after reducing it several times after the events of September 11-2001, and taking into account the impact of restructuring the interest rate on investment levels and the requirements of the development process and also the short run financial flows and exchange rates.

-Coordination between the CBE as a responsible and independent institution for implementation the objectives of monetary policy and the other government agencies that responsible for formulating and implementing fiscal policy, trade policy and exchange rate policy within the framework of general stat of economic policy, and the agreement on economic objectives such as growth rate, and inflation rate and determining the time range for implementation and find a way to ensure the effectiveness in application and follow-up the procedures of implementation.

References

- Abbas, K.(1991),"Causality Test Between Money and Income: A Case Study of Selected Developing Asian Countries (1960- 1988)", *The Pakistan Development Review*.(30).
- Abdul Raziq, B. and Others (2003),"Money Supply in Qatar: An Empirical Investigation", *Journal of Economic and Administrative Sciences*, Vol.(18), No. (2), June
- Abo Al-Ayoun,(2003),"Monetary Policy Development in Egypt and the Future Prospective", *Egyptian Center for Economic Studies (ECES)*. Working Paper, No.(78). February.
- African Development Bank Group,(2000),"Egypt and Economic Reform and Structural Adjustment Program (ERSAP)", *Performance Evaluation Report (PPER)*, May,15.
- Akaike, H.,(1974),"A New Look at Statistical Model Identification", *IEEE Transactions on Automatic Control*, No.(19).
- Al-Mahdi, Adel,(2000),"Economic Development and Economic Resources Analysis", Center of Publishing and distribution of University books, Helwan University.
- Al-Mashat, Rania,(2008),"Monetary Policy in Egypt: A Retrospective and Preparedness for Inflation Targeting", *Egyptian Center for Economic Studies (ECES)*. Working Paper, No.(134), June.
- Al-Najar, H.,(1993),"Estimation of Disequilibrium in the Labor Market with Cointegration and Error Correction", Ph.D. thesis, University of Colorado, Boulder.
- Cantillon, R.,(1755)"*Essai sr la nature du commerce en general.*" Ed. H. Higgs, Macmillan, London, ; reprinted in 1964, Augustus M. Kelly, New York.
- Central Bank of Egypt, *Annual Reports*, Different issues
- Charemza, E. And Deadman, D.,(1997),"*New Directions in Econometric Practice*", 2nd edition. Edward Elgar. Cheltenham, UK.
- Daniela Z., and Mihail I.,(2010),"Linking Money Supply With Gross Domestic Product In Romania", *Annales Universitatis Apulensis Series Oeconomica*, 12(1)
- Dickey, D. and Fuller, W.,(1979),"Distribution of the Estimators for

- Autoregressive Time Series With a Unit Root", *Journal of the American Statistical Association*,(74).
- Engle, R. F. and Granger, C. W.,(1987)" Cointegration and Error Correction: Representation , Estimation and Testing", *Econometrica*, Vol. (55),No.(2)
- Fisher, I.,(1911),"*The Purchasing Power of Money: Its Determination and Relation to Credit, Interest, and Crises*", Macmillan, New York.
- Friedman, M.,(1969),"*The Optimum Quantity of Money*", Macmillan.
- Friedman, M. and Kuttner, K.N.(1992),"Money, income, Prices, and Interest Rates", *The American Economic Review*, (83).
- Friedman, .M and Meiselman, D.,(1963),"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.
- Friedman, .M and Schwartz, A. J.(1963),"*A Monetary History of the United States, 1867-1960*", Princeton University Press.
- Gonzalo, C., (1994),"Five Alternative Methods of Estimating Long-Run Equilibrium Relationship", *Journal of Econometrics*,(60).
- Granger, C. W., (1988),"Some Recent Development in a Concept of Causality", *Journal of Econometrics*,(39).
- Granger, C.W and Newbold, P. (1974),"Spurious Regression in Econometrics", *Journal of Econometrics*, (2).
- Hatem, Samy, (2003),"*Economics of Money and Banking*", 1st edition, Al-Esraa for publishing, Egypt.
- Hossain, Akhtar,(2005),"Granger-Causality Between Inflation, Money Growth, Currency Devaluation and Economic Growth", *International Journal of Applied Econometrics and Quantitative Studies*, Vo.(2-3)
- Hume, D., (1875),"*Essays, Moral, Political, and Literary*", (Ed. T. H. Green and T. H. Gorse). Longmans Green, London.
- Hussain, Al-Asrag,(2005),"A Review of The Monetary Policy Performance in Egypt during (1997-2004)", *North Africa Economics Magazine*, Issue No.(5)
- Hussain, F. and Abbas, K(2000),"Money, Income, Prices, and Causality in Pakistan: A Trivariate Analysis", *The Pakistan Development Review, Research Report No.*(178).
- Johansen, S., (1988),"Statistical Analysis of Cointegration Vectors", *Journal of Economics, Dynamics and Control*,(12).
- (1991),"Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models", *Econometrica*.(59)
- Jonsson, S., and K. Paul(2006),"Accounting for The Relationship Between Money and Interest Rates", *Macroeconomic Dynamics* (10).
- Johansen, S., and Juselius, K.,(1990),"Maximum Likelihood Estimation and Interference on Cointegration with Application to the Demand for

- Money", *Oxford Bulletin of Economics and Statistics*, (52)
- Kalulunia, P. and Yourogou, P. (1997), "Money and Income Causality in Developing Economies; A Case Study of Selected Countries in Sub-Saharan Africa", *Journal of African Economics*, Vol. (6).
- Keynes, J. M., (1923) "*A tract on Monetary Reform*", Macmillan, London
- (1936), "*The General Theory of Employment, Interest and Money*" Harcourt Brace Jovanovich, Inc. New York.
- Kydland, Finn E. and Edward C. Prescott, (1982), "Time to Build and Aggregate Fluctuations", *Econometrica*, (50).
- Law, John (1705), "*Money and Trade Considered, with a Proposal for Supplying the Nation with Money*" New edition. Glasgow.
- Mill, J. S. (1948), "*Principles of Political Economy*", J. W. Parker, London
- Minsky, H.P., (1977), "The Financial Instability Hypothesis: An Interpretation of Keynes and an Alternative to Standard Theory", *Nebraska Journal of Economics and Business*, Winter.
- Mohamed, M., (2005), "Demand Money Function Analysis in Egypt (1970-2004)", *New Horizon for Commercial Studies*, Faculty of Commerce, University of Monofia.
- Moore, B., (1988), "*Horizontalists and Verticalists: The Macroeconomics of Credit Money*", Cambridge University .
- Moursi, Tarek and El-Mossallamy, Mai, (2010), "Monetary Policy Response to Exchange Rate Movements: the Case of Egypt", *Egyptian Center for Economic Studies (ECES)*. Working Paper, No.(158). June.
- Obaid, Gamal, (2007), "Money Supply-Output Causality in Egypt", *Faculty of Commercial and Business Administration Magazine*, Heiwan University.
- Ogunmuyiwa M., and Francis E., (2010), "Money Supply- Economic Growth Nexus in Nigeria", *Olabisi Onabanjo University*, Vol. 22(3)
- Pigou. A.C. (1917), "The Value of Money", *The Quarterly Journal of Economics*, Vol. (32), November,
- Sims, C. (1972), "Money, Income, and Causality", *American Economic Review*, September.
- Wray, L. R. (1990), "*Money and Credit in Capitalist Economies: The Endogenous Money Approach*", Edward Elgar Publishing, Northampton.