

The Applicability of Quantity Theory of Money in Case of Pakistan: A Time Series Analysis

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Abstract

This paper aims at a dynamic investigation of the validity of Quantity Theory of Money, which states that growth in price level is proportionately due to growth in money supply, in case of Pakistan. Annual Data on all the policy variables are taken for the period from 1961 to 2010. Stationarity Analysis is done through unit-root testing, to see that whether the variables are stationary at levels or not. As all the variables included in the study are found to be stationary at levels, Ordinary Least Squares Methodology is used which reveals that Inflation, being statistically significant, is positively dependent upon the growth in money stock, although not proportionately. Moreover, Engle Granger pair wise causality test is applied to see the direction of this causal relationship between money stock growth and the rate of inflation. Results reveal that there exists long-run positive relationship, between these two variables, operating from growth in money stock to the rate of inflation.

Keywords:- Inflation, Money Supply, Gross Domestic Product.

1. Introduction

Inflation, being the most debated issue in the world economies, owing to its serious repercussions on the resource distribution and growth patterns, has gained enormous attention of the researchers worldwide. The policy-makers, being highly sensitive to the damages caused to the economy, by inflation, are designing policies which aim at controlling it, all over the world. Cecchetti (2000), while in his article on the objectives behind designing the parameters of monetary policy states that the economy observes lower growth levels at the hands of even modest inflationary pressures. Over the past years, Policy-Makers have tried to assess the dynamics of relationship between money supply, income growth and general price level because of their crucial role in designing as well as modelling the pattern of growth and macro-economic situation in the economy. According to the monetarists' point of view, money supply holds one to one transformation with the inflationary pressures in the holds, while taking other factors like velocity of money to be constant. However, this theory is strongly supported by the empirical findings in the long run, but the short-run findings contradict the monetarists' point of view.

The monetarists claim that, as monetary authority control and designs the money supply, therefore, if increase in money supply doesn't affect output levels, it would surely feed inflationary pressures in the economy proportionally. The monetarist's point of view primarily relies on the Quantity Theory of Money (QTM), which states that excess of money supply over the real productivity capacity of the economy in the long run determines long-run variations occurring in the general price level. Keeping in view of the fiscal perspective of price level determination, QTM fully describes the path followed by the prices in the economy only in case money supply and government debt burdens remains quite unresponsive towards financing public expenditures. The price level can remain independent of the fiscal stance in this case. But how can it be remain impartial to the variation occurring in the government debt as the debt servicing costs do affect the levels of real money balances via affecting future money creation perspectives.

The monetarists have two clear and distinct policy instruments such as the Quantity Theory of Money and the other one is to control on the natural rate of unemployment. Monetarist's point of view is based on the research that as the supply of money increases, this will lead to increase in price level which has its poor impact on the growth rate level in economy for short run but it has dynamic and compelling rise in inflation rate for long run terms. But by keeping all other factors, remain to be in constant state, the supply of money can be controlled by monetary authorities which causes a proportionality change in inflation rate. If money supply is not properly controlled by the representative authorities it will result, output level more tope than the natural output level in short run while in long run it will cause a rise in cost of commodities and a certain rise in inflation. It is

commonly observed that economists divert their macroeconomic policy instead of achieving full employment level and keep their policies to chase a constant and absolute monetary growth rate level.

With respect to policy implementation in Pakistan to control inflation, a tight monetary policy has contributed to keep low inflation level. In Pakistan, rate of inflation started to accelerate late in year (2003). But real crises of inflation in Pakistan started in the year (1998/1999). But later it gradually reduced to below than 5% and remained at stable level up to the year (2005). According to the Schimmelpfening (2006) concluding remarks that excess supply of money over long time is the main cause and becomes one of the most important factor in the economic field for inflationary rise while on the hand, at the same time they also argue that some other industrial problems may also have a definite share in the influence of inflation. Therefore, according to in M. Ali Kemal point of view that inflationary trend in Pakistan is only due to excess supply of money. However it is a well known fact and a lot of research has been done by the economist on the topic of inflation and on its concerns etc. Inflation has serious impacts on the growth of an economy as well as on the distribution of income.

Where in case of Pakistan study, the era of mid (1970) was considered as the worst inflationary period of Pakistan, where as annual inflation growth level was up to more than 15% annually. The economy level of country was not stable due to the unprecedented nature of increase in prices and moreover the nature of the country was in great trouble due to the nationalization process. By keeping this situation in control by adopting moderate accommodating policy, rising in supply side of money through proper flexible monetary policy also resulted as inflationary fuel in era of 1970 (Jones and Khilji 1988). The economy was going under great fluctuations due to devastating floods in Pakistan and on the other hand trend in devaluation in local currency as compared to international currency. Both local and international markets were showing that before making their optimum decisions people were considering an absolute expected inflation in this era. But from 1980 to early 1990 the rate of inflation remained below the significant level up to 7.4% with respect to its South Asian neighboring countries.

1.2. Objectives of the Study

The main objective of the study is to investigate the dynamic relationship among growth in money supply, GDP growth, velocity of money and prices so as to determine that inflation in Pakistan is a monetary phenomenon or not.

2. Literature Review

The strength as well direction of relationship between inflation and money supply is investigated to empirically testify the validity of Quantity theory of money in a number of developed as well as developing countries.

Sakib-Bin-Amin (2011) tested applicability of the QTM in case of Bangladesh using time series data on the policy variables from 1976 to 2006. Unit root testing is conducted to have stationary analysis of the variables included in the model through Augmented Dickey Fuller Test as well as Phillip-Perren test. To check the long-run causality among the policy variables, Johanson Co-integration test is applied. Results from this test indicates presence of three co-integrating vectors showing long-run relationship between the money supply and price level, hence justifying Quantity Theory of Money in case of Bangladesh. While to check direction of the relationship among the concerning variables, Granger Causality test is applied which reveals of Uni-directional Relationship between money supply and the prices.

Grauwe and Polan (2005) state that in the long-run, relationship between money growth and inflation is not a surprising phenomenon. They tested the causality between money supply and inflation using time series data of 30 years from 1969 to 1999 on the largest sample of 160 countries. Empirical findings revealed a strong positive relationship, although not proportional as it was described by the QTM, between money supply and the inflation.

Ghazali, Amin, Muhammad and Samsu (2008) undertook a study to test validity of Quantity Theory of Money in Malaysia taking monthly data on all the variables included in the model from 1974:1 to 2006:3. While applying Johanson co-integration econometric test and yoda-yamamoto causality test, empirical findings found that there exists a long –run and unidirectional relationship between money supply and general price hike in the Malaysian economy.

Khan and Schimmelpfennig (2006) tested the applicability of QTM in case of Pakistan taking monthly data from January 1998 to June 2005 using monetary variables as well as wheat prices and found that inflation is a monetary matter, having no link with the food price growth (wheat support price) in the long run, although food support prices happen to be a determinant of inflation in the short-run as well.

M.N.A. Shams (2012) undertook a study to analyze the causality and direction of relationship among income, money and prices, taking yearly data on all the policy variables from 1972-73 to 2009-10 for the Bangladesian economy. Co-integration analysis of the model clearly indicates about the presence of long-run causal relationship among the variables included in the model. Empirical results also verify about presence of uni-directional relationship operating from money supply to prices.

Mohammed Al-Jarrah (1998), undertook a study to investigate about the relationship among broad money, income and inflation for the Saudi Arabia along with to find the direction of causality between money supply and inflation while using Quarterly data on all the concerning variables from 1965:ii to 1993:iv. Co-integration analysis indicates existence of long-run relationship among all the variables. Moreover, Granger analysis is resorted to in order to locate the direction of causality among these variables. Results revealed out of the presence of bi-directional relationship operating from prices to money as well as from money to prices.

Lee and Li (1983) while investigating the relationship between money and inflation in Singapore found that there existed a uni-directional relationship between growth in money supply and level of prices.

Ali Kemal (2006) in his extensive study, aiming to check to validity of QTM in case of Pakistan supported the monetarist views that money supply holds a significant relationship with the inflationary pressures in the economy. He used Quarterly data from 1975:1 to 2003:4 on all the policy variables. Using Johanson Co-integration technique, his findings show that although in the short-run, money supply and inflation relationship is not somewhat spontaneous, however, in the long-run, an expansion in the money affects general price level positively which verifies that inflation is a monetary phenomenon in Pakistan in the long run.

Abdul Qayyum (2006) also attempted in his study on money, inflation and growth to check validity of inflation being a monetary phenomenon in Pakistan. Using Correlation matrix technique in order to check that whether long-run relationship exists or not between money growth and inflationary pressures in Pakistan. Empirical findings revealed that price level is strongly as well as positively affected by the money supply thereby supporting monetarist's point of view in the context of Pakistan's economy. The author further stresses upon the State Bank of Pakistan to pursue strict monetary policy so that high inflationary pressures may be checked and bring down to a normal level.

Taslim (1982), in his study on the Bangladesian Economy revealed that although agricultural food prices do contribute to the inflationary pressures, but growth in money stock remained the major factor behind severity of the price-hike.

Karfakis (2002;2004) and ozmen (2003), while checking the applicability of QTM on the Greece economy stated that the contradictory findings revealed that the theory stating that a change in money supply is followed by a proportional change in price level is not supported here.

S. K. A. Wasti et. al (2009) undertook an extensive study to investigate long-run relationship among broad money, prices, fiscal policy and economic growth in Pakistan with the help of time series data ranging from 1977 to 2007. Johanson Co-integration technique to investigate long-run relationship among these variables is used which states about presence of four co-integrating vectors. Hence long-run causal relationship among all these variables is established. Granger Causality test to check the direction of this long-run relationship which states that there do exists a bi-directional relationship operating from money supply to prices and from prices to money in case of Pakistan.

Fazal Husain & Kalbe Abbas (2006) undertook a study to re-examine the causal association between money supply and national income as well as between money supply and inflation in case of Pakistan with the help of yearly data on all these policy variables from 1949-50 to 1998-99. The authors have employed Granger Causality and ECM technique in their study to decide that whether a long-run relationship exists among these variables or not; and in case of presence of such relationship, what is the direction of such causal relationship. The empirical analysis clearly indicates that there do exist a long-run relationship among these variables and in respect of validity of Quantity Theory of Money, the study reveals about existence of bidirectional causal relationship between money supply and prices.

Mohsen M. and Maysam M. (2010), undertook an extensive research to examine the causal association among money supply, income and prices in Iran while taking a longer data set on all these variables from 1960-2008. The Gregory-Hansen (1996) co-integration approach is resorted to in order to detect presence of long-run relationship among these variables. The empirical findings support existence of long-run relationship among these variables. On the other hand, Granger Causality test is applied to assess the direction of such relationship between these policy variables. The results conclude that in the long run, there exists a compelling unidirectional relationship operating from GDP and inflation to the money supply. However, there do exist a quite weak unidirectional relationship flowing from money supply to the general price level over the short run.

Gaurang Rami (2010), while investigating the causal relationship between money supply, real GDP and prices in India while applying Granger-Causality Approach. Annual data has been taken on these policy variables from 1951 to 2005. Vector Auto-regressive approach is resorted to select appropriate lag length criteria. The study actually aims at whether the Monetarists or Keynesian's view is supported or not in case of the Indian economy. Empirical findings support the Monetarist's view as it is described in QTM strongly.

Nachane and Nadkarni (1985) undertook the first extensive study on detecting causality among money-output-inflation taking time series quarterly data on the variables included in the model for the period 1960 to 1981. Empirical results confirmed presence of unilateral relationship running from growth of money supply to the prices.

Sims Budina et al (2002) analyzed the validity of Quantity Theory of Money in case of Romania with the help of time series data ranging from 1992 to 2000, through investigating the casual relationship among money stock, output and prices and found empirically that price-hike was largely due to growth in money stock in the economy.

Khan and Siddiqui (1990) made an extensive research to determine the direction of relationship between money and income as well as between money and prices in the context of Pakistan, using Engle Granger pair wise causality approach. The results established bi-directional relationship between money stock and inflation, as well as uni-directional relationship operating from income to money stock growth.

Hamad S. AL-Bazai (1999), made an extensive study involving dynamic analysis of money supply in Saudi Arabia with the help of quarterly data on all the variables included in the model from 1971:1 to 1995:4, while applying vector autoregressive approach. Unit root analysis is made to check the stationarity condition. Empirical results revealed uni-directional relationship running from money supply to the price level. These also suggest for a policy-mix to be adopted by the Saudi monetary authorities to get the desired growth levels without letting prices to go up.

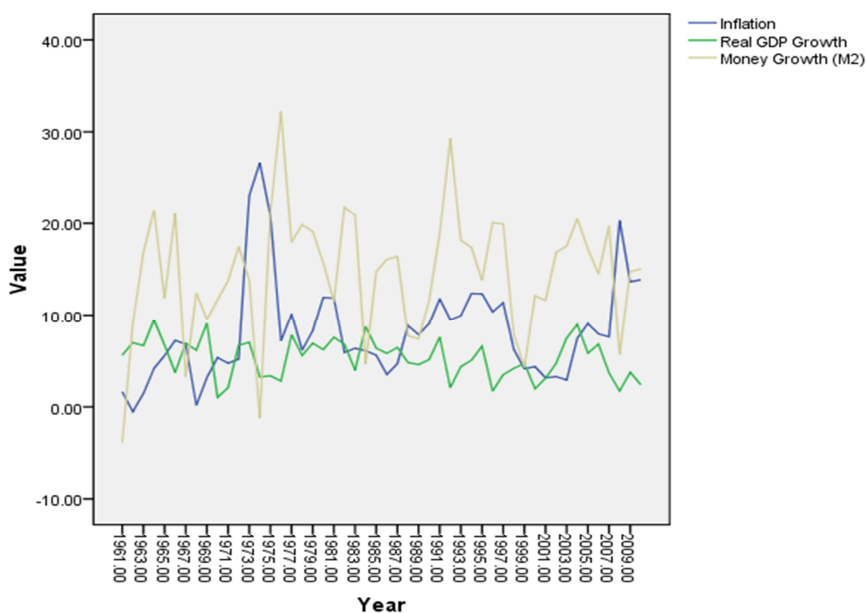
T.M. Al-Fawwazl and K.M. Al-Sawai'e (2012) in order to analyze the relationship among various macroeconomic variables including money supply, output and inflation in the context of Jordan economy, while taking annual data series on all these variables from 1976 to 2009 . The results found long-run positive causal relationship, although not too strong (0.21) between the money stock and price level in the economy.

3. Money Growth and Inflationary Pressures

As we know that the model of Quantity Theory of Money, which is regarded as the basis of the theory which states that Inflation is a monetary matter can be defined such that,

$$MV=PY$$

Whereas, M=Money Supply, V= Velocity of Circulation of Money, P=Price Level, Y=National Output.



The focal point of the theory states that variations occurring in the money stock lead to proportionate variations in the price level in an economy. Polan and Grauwe (2005), while discovering short run as well as long run dynamics of the applicability of QTM states that there exists one to one relationship between growth in money stock and price hike. The analysis also lays before us the characteristic of neutrality of money supply in the long-run, however, in the short-run; the neutrality feature of money supply is not maintained as the growth in money supply is followed by a growth in the level of national income.

The above figure brings before us an idea as to how all the rate of inflation, Real GDP growth and M2 growth are associated with each other. The figure demonstrates that the variables are quite significantly correlated to each other.

4. Data and Estimation Methodology

4.1. Data:

In order to investigate about the validity of Quantity Theory of Money in case of Pakistan, time series annual data on all the concerned variables, whether they be monetary or real ones ranging from 1961-2010 is used.

Table below shows the definitions of the variables on which model is constructed, along with the sources from which data on these variables are taken.

Table 01: Description of Variables

Sr.No.	Variable Name	Description	Source
1.	Gpt	Rate of Inflation	Eco. Survey of Pakistan
2.	Gyt	GDP growth rate	Eco. Survey of Pakistan
3.	Gmt	Growth in Money Supply	SBP, Annual Reports Different Issues.
4.	Gvt	Growth in Velocity of money	SBP, Annual Reports Different Issues.

Next, we move towards including in this studies the expected signs of the variables included in the model, as the economic theory presents before us their possible impact on the dependent variable.

Table No. 02

Variable	Impact on the Dependent Variable
Gm	Positive
Gy	Negative
Gv	Positive

4.2. Methodological Framework

As already discussed, the monetarist's Quantity Theory of Money is always resorted to, whenever question of determination of price level occurs, which states that;

$$MV = PY \text{----- Eq. (1)}$$

Taking logarithm on both sides, we get,

$$\text{Log}(MV) = \text{Log}(PY)$$

$$\text{Log}M + \text{Log}V = \text{Log}P + \text{Log}Y$$

It implies that;

$$\text{Log}P = \text{Log}M + \text{Log}V - \text{Log}Y \text{----- Eq. (2)}$$

Taking differentiation w.r.to time "t" on both the sides, we get

$$\frac{1}{P} \frac{dP}{dt} = \frac{1}{M} \frac{dM}{dt} + \frac{1}{V} \frac{dV}{dt} - \frac{1}{Y} \frac{dY}{dt} \text{----- Eq. (3)}$$

$$\text{Let } G_p = \frac{dP}{dt}, \quad G_m = \frac{dM}{dt}, \quad G_y = \frac{dY}{dt}, \quad G_v = \frac{dV}{dt}$$

Then eq. (3), can be written as

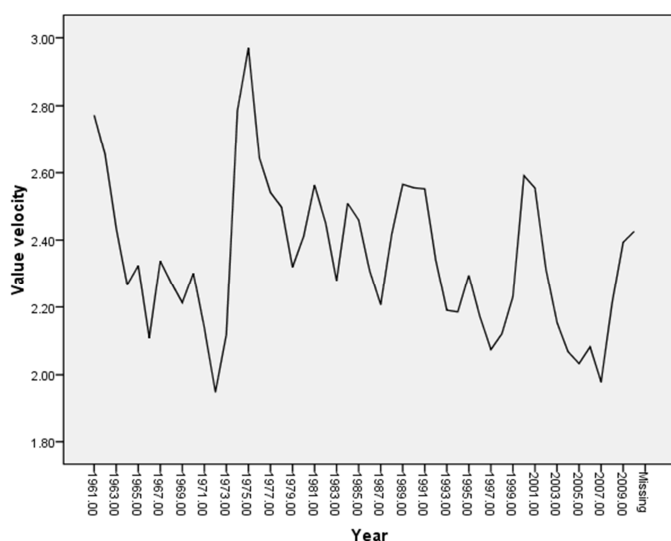
$$G_p = G_m + G_v - G_y \text{----- Eq.(4)}$$

Here, it is evident that the growth in price level is dependent upon growth in money supply, pattern of change in the velocity of circulation over time and growth behavior of the national income. Monetarists claim that over the longer periods of time, velocity of circulation and growth in income remains constant. Therefore trends in price level solely depend upon the changes in the money supply. Economists, even the monetarists, do agree on the point that it is hard to accept that velocity remains constant in the long run. Qayyum and Bilquees (2006) revealed out of the empirical findings that velocity of money and growth in output remained to be non-constant in the long run in Pakistan, whereas, laidler (1997) finds out that although it is hard to believe in the stagnancy of velocity and income growth in the long run, money supply remains to be major determinant of the inflationary pressures.

Finally, we arrive at the model, such that;

$$G_p = G_m + G_v - G_y + \epsilon$$

Here Inflation rate (Gp) is dependent variable, whereas growth in money stock (Gm), growth in the velocity of money (Gv) and GDP growth rate(Gy) are independent variables.



4.3. Constancy of the velocity of money:

The above figure clearly shows that velocity of money is not constant over the length of time period from 1960-2010, being not consistent with what is emphasized upon in the Quantity Theory of Money. The result of non-constancy of velocity of money is also corroborated by the findings of Mr. Abdul Qayyum (2006).

4.4. Stationary Analysis:

The stationary analysis is done to see that whether the series are stationary on levels or at 1st or 2nd difference. It is important to check the stationary condition, because to apply OLS without putting the series under stationary test may lead to suffer from Spurious Regression. The traditional ADF test is widely used to determine that whether the series are stationary on levels or on their 1st, 2nd difference.

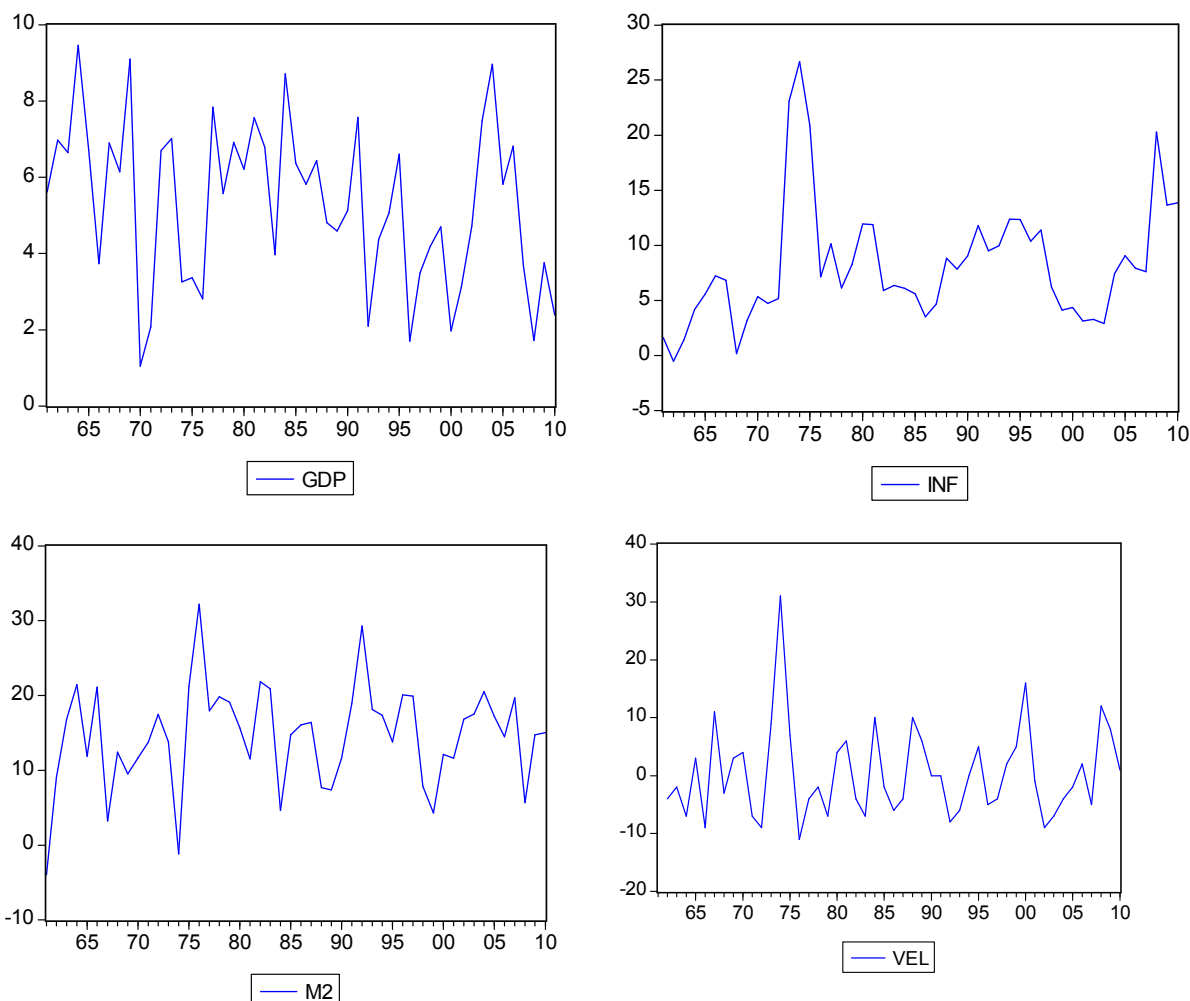
Variables	At levels			At Difference		
	No trend	With trend	Result	No trend	With trend	Result
Inflation(%)	-3.17**	-3.18*	Stationary	-----	-----	-----
Real GDP(%)	-5.37***	-5.76***	Stationary	-----	-----	-----
Money Supply(%)	-6.33***	-6.22***	Stationary	-----	-----	-----
Velocity of Money(%)	-6.15***	-6.08***	Stationary	-----	-----	-----

(The values showing *, ** and *** reveal that the series are stationary on 10%, 5% and 1% respectively based on the MacKinnon critical values)

As all the series are stationary at levels, therefore, we apply OLS to check the long-run relationship between the dependent and the independent variables. However, had any variable included in the model be non-stationary at level, then it was not possible for us to apply Ordinary Least Squares Method for investigating long-run relationship among these variables.

The figures below clearly shows that all the variables that are included in the model are stationary at levels.

Graphs of the Stationary Analysis at Levels



5. Analysis of the Empirical Findings

As the model corresponds to the multiple regression analysis, therefore, we apply the traditional method of Ordinary Least Squares to get the desired findings. This method has been resorted to in our study as all the variables included in the model are stationary at levels, so there is not any risk of getting results out of such regression analysis, being affected from the "Spurious regression".

Table No. 4 Ordinary Least Squares

Variable	Co-efficient	Std. Error	t-statistics	Prob.
Constant	0.85484	2.7889	0.31	0.76
R.GDP(%)	-0.25862	0.2667	-0.97	0.34
M2(%)	0.57446	0.1358	4.23	0.0001
Velocity(%)	0.7323	0.1097	6.68	0.0000
R-square= 0.5374		F-statistics=17.422		
Adj. R-square=0.5065		Prob.(F-stat)=0.00000		
Durbin-Watson= 1.483		Log likelihood=-133.97		

The above table reveals that the model is over all a good-fit model, as it is crystal clear from the significant value of F-test. Both the money stock and velocity of circulation of money have positive as well as statistically significant impact on the inflationary pressures, while the GDP growth's effect on the rate of inflation is negative as well as statistically insignificant, duly supported by the economic theory.

However, the monetarist's contention that there exists a one-to-one relationship between growth in money stock and rate of inflation in the economy doesn't seem to be verified here, as the co-efficient of money stock is less than one.

Therefore, our estimated model happens to such as:
 $G_p = 0.85484 + 0.57446G_m + 0.7323G_v - 0.2586G_y + \mu_t$

5.1 Causality Analysis of the Quantity Theory of Money:

Engle Granger Pair wise causality test is resorted to find out the direction of the relationship between money and prices. No doubt, our model includes other variables too, but as our economic analysis is confined only to find out that whether inflation is a monetary phenomenon in Pakistan or not, therefore, we would restrict ourselves to analyze results of the Engle Granger Causality test which are concerning to the money stock growth and the prices.

While taking Lag order to be 1(one), Engle Granger Test reveals out that Inflation is a monetary phenomenon as the Null hypothesis of the test, stating growth in money supply doesn't affect inflationary pressures is rejected at 10 per cent level of significance. Hence the long run relationship, operating from money supply to inflation is clearly established.

Table No. 5 Results of the Engle Granger Test

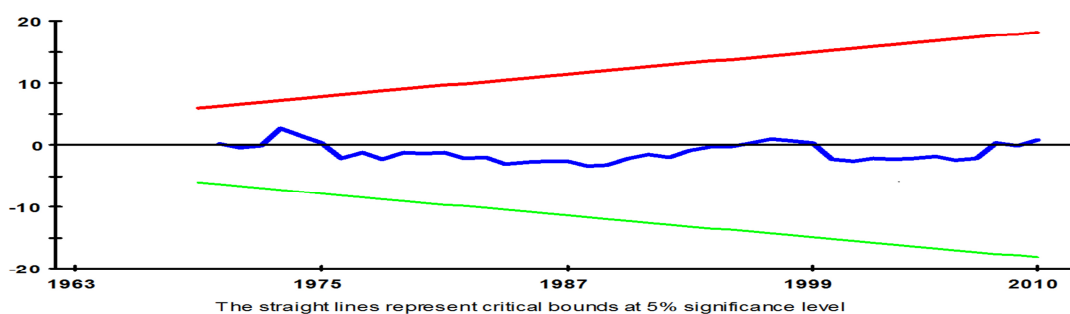
Pairwise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Probability
M2 does not Granger Cause P	49	3.25064	0.07795
P does not Granger Cause M2		1.00813	0.32060
GDP does not Granger Cause P	49	0.33291	0.56676
P does not Granger Cause GDP		7.03671	0.01092
CIR does not Granger Cause P	48	4.55071	0.03839
P does not Granger Cause Vel		3.08939	0.08561
GDP does not Granger Cause M2	49	0.36812	0.54701
M2 does not Granger Cause GDP		1.41746	0.23993
Vel does not Granger Cause M2	48	1.90255	0.17461
M2 does not Granger Cause Vel		0.42945	0.51559
Vel does not Granger Cause GDP	48	10.2896	0.00247
GDP does not Granger Cause Vel		0.15971	0.69132

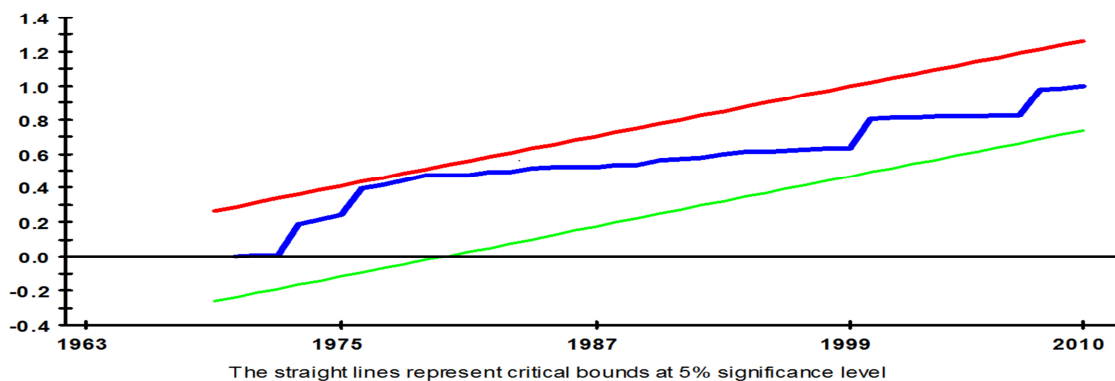
5.2. Stability Analysis

CUSUM and CUSUMSQ tests have been applied to see that whether the model is stable or not.

Plot of Cumulative Sum of Recursive Residuals



Plot of Cumulative Sum of Squares of Recursive Residuals



Both the figures show that our model satisfies all the conditions necessary to be fulfilled in order to get stability of the model.

6. Summary and Conclusions

As the results revealed that the quantity theory of money is valid to the extent that inflation is a monetary phenomenon and the causality relationship operates from money growth to the prices, although the original QTM theory that growth in money stock is followed by a proportionate growth in rate of inflation in the economy is not proved, therefore, it should be emphasized upon the State Bank of Pakistan to adopt an inflation targeting policy to check the inflation rate to quite a normal level. To increase money supply in order to accelerate growth proportions in the economy through adopting soft monetary policy may let the economy to achieve the desired growth levels at the cost of damaging inflationary pressures.

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