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ABDUL QAYYUM

This paper attempts to investigate the linkage between the excess money supply growth and inflation in Pakistan and to test the validity of the monetarist stance that inflation is a monetary phenomenon. The results from the correlation analysis indicate that there is a positive association between money growth and inflation. The money supply growth at first-round affects real GDP growth and at the second round it affects inflation in Pakistan. The important finding from the analysis is that the excess money supply growth has been an important contributor to the rise in inflation in Pakistan during the study period, thus supporting the monetarist proposition that inflation in Pakistan is a monetary phenomenon. This may be due to the loose monetary policy adopted by the State Bank of Pakistan to show the high priority of the growth objective. The important policy implication is that inflation in Pakistan can be cured by a sufficiently tight monetary policy. The formulation of monetary policy must consider development in the real and financial sector and treat these sectors as constraints on the policy.

JEL classification: E31, C22, C32

Keywords: Money Supply, Inflation, Growth, Quantity Theory, Monetary Policy, Pakistan

1. INTRODUCTION

Inflation adversely affects the overall growth, the financial sector development and the vulnerable poor segment of the population. There is clear consensus that even moderate levels of inflation damage real growth [Cecchetti (2000)]. Inflation decreases the real income and also induces uncertainty. Considering such adverse impacts of inflation on the economy, there is a consensus among the worlds' leading central banks that the price stability is the prime objective of monetary policy [King (1999); Blejer, *et al.* (2000)] and the central banks are committed to the low inflation [Goodfriend (2000)]. Hence the central banks have adopted inflation as the main focus of monetary policy, targeting inflation explicitly or implicitly as and when required.

Maintaining the price stability is the responsibility of a central banks and it is accountable for achieving it. It is argued that sufficiently tight monetary policy maintained for sufficiently long time could halt even the most deeply rooted inflation [Friedman (1963)]. The price stability is obtained when economic agents such as households and business stop to take inflation at the time of decision-making. In the words of Blinder, prices are stable when ordinary people in their ordinary course of business stop talking about inflation.

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There are a number of theories including the demand-pull, the cost-push inflation, and the quantity theory of money explaining the causes of inflation. The possible sources of inflation include rising costs such as wages, profits, imported inflation—exchange rate, commodity prices, external shocks, exhaustion of natural resources and taxes. Quantity theory assumes that the changes in income arise due to the changes in prices and output is always at its permanent level. Therefore, the price level is determined by the money supply via the operation of real balance effect [Allsopp and Vines (2000)]. Recent inflation has generated a heated debate among the policy maker about the sources of inflation in Pakistan.

The State Bank of Pakistan (the Central Bank) has the explicit mandate to ensure price stability and promote growth. In order to contain inflation within the targeted level set by the Government, the SBP used money supply as an instrument/intermediate target. The statistics reveal that money supply growth exceeded its target levels for four consecutive years (2002-2005) due to easy monetary policy stance to support the growth process. However, the expansionary monetary policy resulted in rapid inflation reaching double digit in 2005. Since inflation is a tax on money holdings. Inflation tax for the year 2005 is estimated at Rs 61928 million or 0.98 percent of GDP. Before 2005 monetary policy was biased towards supporting growth because inflation was at low level. With the rising inflation from 2005 monetary policy stance has tilted towards the containing of inflation [State Bank of Pakistan (2006)].

Causes of inflation in Pakistan has been investigated by a number of researchers have attempted overtime [Bilquees (1988); Khan and Qasim (1996); Hussain (2006); Khan and Schimmelpfennig (2006)]. These studies show that while monetarists argument that monetary factors play dominant role in the long run inflation is valid [Khan and Schimmelpfennig (2006); Bilquees (1988)] in the short run other factor such as food prices also effect inflation [Khan and Schimmelpfennig (2006); Bilquees (1988); Khan and Qasim (1996)].

This paper attempts to investigate the linkage between the money growth and inflation in Pakistan to test the validity of monetarist's stance that inflation is a monetary phenomenon. The results of this exercise would be important for policy-makers to contain inflation within limits. In the next section we introduce the quantity theory of inflation to explain the linkage between money supply growth, inflation and growth and introduce the methodology for estimation. Section 3 of the paper reports the results of estimation and the final section concludes the paper.

2. METHODOLOGY

We use quantity theory of money to formulate the theory of determination inflation (prices). The quantity theory of money states that there is a relationship between money supply (M), velocity of money (V), prices (P) and real income (Y) and can be written as an identity

$$MV = PY \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (1)$$

The money supply determined outside the system that is it is exogenous, income velocity of money is independent of the other variables in the identity¹, Y is real income. Under these assumptions the equation of exchange can be written as the theory of price determination. The Equation 1 can be written into price equation as

$$P = MV/Y \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (2)$$

Taking log of the equation, we can get

$$\text{Log } P = \text{log } M + \text{log } V - \text{log } Y \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (3)$$

By differentiation of Equation 3 we can get the equation for inflation such as

$$\frac{1}{P} \frac{dP}{dt} = \frac{1}{M} \frac{dM}{dt} + \frac{1}{V} \frac{dV}{dt} - \frac{1}{Y} \frac{dY}{dt} \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (4)$$

or

$$g_p = g_m + g_v - g_y$$

The equation shows that growth in prices (i.e., the rate of inflation) is determined by the growth in money supply, growth in velocity, and growth in real income. In a simple version of quantity theory, it is assumed that the real income grows at the long-run rate and the velocity of money remains constant. Under this assumption inflation is determined by the change in money supply. Friedman and Schwartz (1982) however, writes that this is an extreme proposition that the velocity is constant and must be rejected. The velocity and income grow slowly and this behaviour is independent of the behaviour of money supply or prices [Laidler (1997)]. Furthermore, the empirical evidence from Pakistan shows that the income velocity of money is not constant and the real income growth deviates from potential level of real income growth [Qayyum and Bilquees (2005) and Figure 1]. Quantity theory identifies that the money supply is the key factor that effects the changes in price level [Laidler (1997)]. By adding error term to capture effect of other variables we modify equation 4 to arrive at our model to analyse inflation in Pakistan as:

$$g_p = \beta_0 + \beta_m g_m + \beta_v g_v + \beta_y g_y + u \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (5)$$

This equation elaborates the relationship between the price level and the factors that determine it. Those factors include the money supply, real income, other factors that affect the demand for money. These other factors that are included in the velocity factor may be called as proportionality factors. If real income and other determinant of money demand are constant then this equation implies the direct relationship between growth in money supply and rate of inflation.

The demand for money is determined by the real income. The real income changes over time. The main determinants of real income growth are labour, capital and technological change. These deterministic factors of growth are unrelated to the demand

¹There is a debate between the economists about the nature of the velocity. Neo-Keynsian economists such as Kaldor and Khan state that velocity is entirely a bogus concept which simply relates the relationship between the money supply and the volume of money payments. The concept of the velocity as ‘Will-ó-the-wisp’ is strongly rejected by the monetarists such as Friedman and Schwartz (1982).

for money. Therefore it can be concluded that the real income growth is independent of quantity of money supply and the price level. It implies that there is proportional relationship between the price level and the nominal quantity of money relative to real income [Dwyer and Hafer (1999)].

Theory states that the velocity can be determined by the financial structure, monetisation of the economy, fiscal deficit, shifts in expenditures etc [Bordo and Jonung (1990) and Gordon (1985)]. The relationship between the inflation and the growth in velocity has important policy implication. If growth in the velocity is relatively unimportant then it indicates that inflation and growth in nominal quantity of money supply relative to real income are proportional. Otherwise there is no significant relationship between the inflation and the growth in nominal quantity of supply relative to real income [Dwyer and Hafer (1999)]. Therefore, relative importance of money supply and money demand in determining the rate of inflation can be explored by the estimation of the above Equation (i.e., 6).

In order to analyse the time series properties of data (i.e., unit root hypothesis) we used Augmented Dickey Fuller (ADF) test. Model is estimated by using Autoregressive Distributed Lagged (ARDL) approach introduced by Pesaran and Shin (1995), Pesaran and Pesaran (1997) and Pesaran, *et al.* (2001). The final form of the model is achieved by using general to specific methodology. During the application of the methodology we used a battery of diagnostic tests.

For this analysis we use time series data from 1960 to 2005. The data on real GDP growth is taken from the Federal Bureau of Statistics (FBS) and velocity of money is calculated by using data from the SBP. The data on the nominal GDP is adjusted according to new wider based coverage of items and calculation of GDP initiated from the year 2000-01 by the FBS.

3. EMPIRICAL FINDINGS

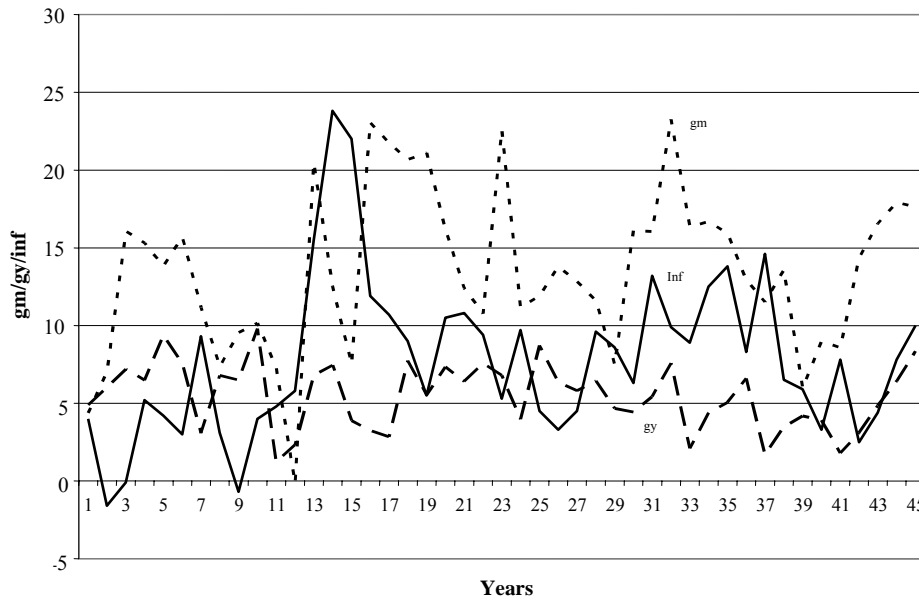
Trends in inflation, money growth and the real GDP growth during 1960–2005 are presented in the Figure 1. Average rate of inflation, money growth, real GDP growth and velocity of money during the study period are 8.1 percent, 13.9 percent, 5.5 percent and 2.9, respectively (Table 1). As can be seen from the Table 1, the change in money supply dominated the change in nominal income due to decline in the velocity.

Table 1

Trends in Inflation, GDP Growth, Money Growth, and Velocity

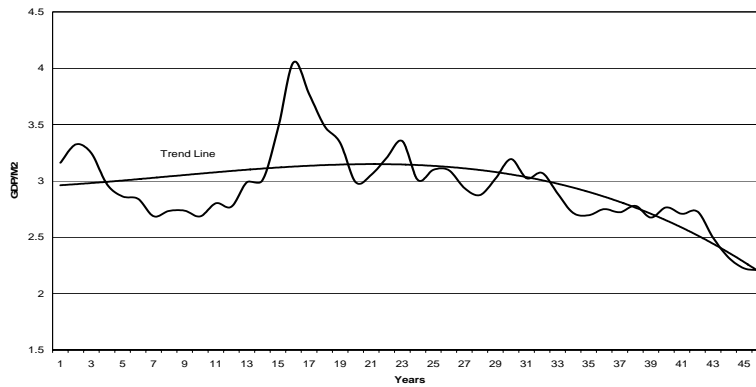
	Money Growth	Inflation	Real GDP Growth	Nominal GDP Growth	Velocity	Velocity Growth
1960–69	11.143	3.4	5.875	9.50	2.901	-1.97
1970–79	14.437	11.3	5.082	15.63	3.318	0.72
1980–89	13.069	7.62	6.404	13.73	3.084	0.67
1990–99	14.836	9.99	4.493	13.39	2.809	-1.44
2000–05	13.997	5.97	4.737	13.35	2.448	-3.76
1960–05	13.868	8.11	5.469	13.12	2.946	-0.79

Fig. 1. Inflation, Money Growth and Real Income Growth in Pakistan (1996–2005)



As can be seen from Figure 2, the velocity of money in Pakistan shows inverse U shaped trend.² The velocity of money, however, shows a decreasing trend in Pakistan over the period 1973 to 2005, implying that it is not constant over the period of study. Moreover, the regression of velocity has significant time trend with coefficients -0.013 with a standard error of 0.0035 also rules out the constant velocity proposition. The fluctuations in the velocity can be explained by the changing structure of the financial sector in Pakistan and due to the extensive reforms undertaken in this sector during last two decades. The process of monetisation—the spread of the money economy and the expansion of commercial banking—is responsible for the downward trend in the velocity [Bordo and Jonung (1990)].

Fig. 2. Income Velocity of Money (1960 to 2005)



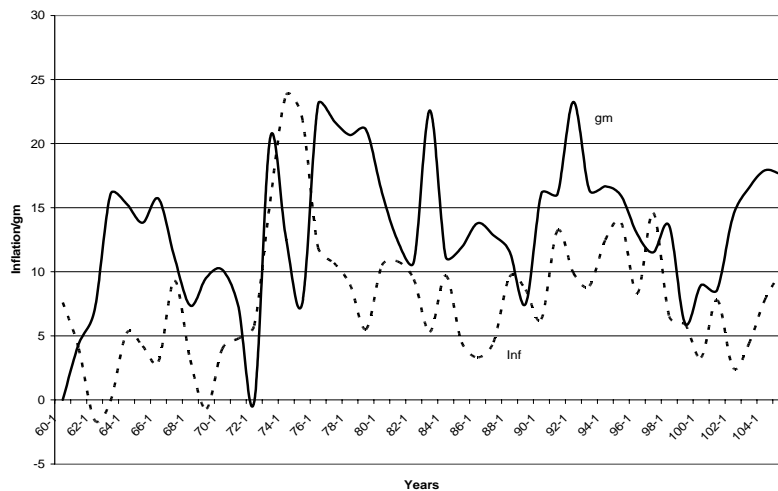
²The trend line is estimated by using the HP filtre [Hodrick and Prescott (1997)].

Prior to undertaking formal analysis we first investigated the stationarity of the data series. Results from the ADF unit root test revealed that all variables considered in the analysis are stationary at the 5 percent level of significant. The estimated value of ADF t -test for g_p , g_y , g_m and g_v is -3.164 , -5.372 , -4.838 , and -5.512 , respectively.

Secondly, we calculated the correlation between the money growth, real GDP growth, Inflation and change in velocity. As can be seen from the Table 2, there is a strong and positive correlation between the rate of inflation and its own two lags, the rate of inflation and one year lag of money growth, and the rate of inflation and growth in velocity. It implies that money growth this year affects rate of inflation in the next year. This association is supported by the evidence shown in Figure 3, representing the money growth and inflation. Further the growth in money supply has positive correlation with current real GDP growth but it is not statistically significant. There is also insignificant correlation between lag of money growth and real GDP growth.

Table 2
Correlation Matrix

	g_p	$g_p(-1)$	$g_p(-2)$	g_y
g_p	1.0000			
$g_p(-1)$	0.61942*	1.0000		
$g_p(-2)$	0.34176*	0.62309*	1.0000	
g_m	0.12238	0.19938	0.31723*	0.22609
$g_m(-1)$	0.30158*	0.16613	0.21791	0.06892
$g_m(-2)$	0.063304	0.34907*	0.19012	0.20193
g_y	-0.12669	-0.15110	-0.32085*	
$g_y(-1)$	-0.025486	-0.14843	-0.15788	
$g_y(-2)$	-0.10557	-0.018584	-0.14372	
g_v	0.59650*	0.21358	-0.11780	
$g_v(-1)$	0.20185	0.58398*	0.21657	
$g_v(-2)$	0.16099	0.15443	0.55871*	



Finally, the model is estimated using the ARDL approach and the general-to-specific methodology. The estimation started by the general model with the lag structure of 3. By using general to specific methodology the model is tested down to the specific model of inflation for Pakistan. For this purpose we used AIC criterion, t -test and F -tests. The results of the preferred model are presented in the Table 3.

Table 3
Specific Model of Inflation

	Coeff	t -value	t -prob	Split 1	Split 2	Reliable	Partial R2
$g_p(-1)$	0.10752	2.981	0.0051	0.0039	0.0201	1.0000	0.1309
g_y	-0.88172	-11.425	0.0000	0.0000	0.0000	1.0000	0.6552
$g_y(-1)$	-0.10760	-1.958	0.0578	0.0393	0.0125	1.0000	0.0722
g_m	0.97938	22.639	0.0000	0.0000	0.0000	1.0000	0.8975
G_v	1.05987	26.347	0.0000	0.0000	0.0000	1.0000	0.8961
RSS	34.70825	sigma		0.96854	R ²	0.96498	
Radj ²	0.96119	LogLik		4.00454	AIC	0.04740	
HQ	0.12323	SC		0.25427	T	42	
p	5	FpNull		0.00000	FpGUM	0.69047	
Chow(85:1)	0.6231	Chow(101:1)		0.1362	AR 1-4	0.6767	
ARCH 1-4	0.7963	Hetero test		5.3369			

The model clears all the misspecification tests: the residual is normally distributed and homoscedastic; and it is also free from the problem of serial correlation and Autoregressive Conditional Heteroscedasticity (ARCH). The results reveal that the estimated parameters of the model maintains constancy over the period of study i.e., they are fully reliable. Furthermore, as can be seen from the table, the money supply growth contributes 90 percent to the explanatory power. It implies that the money supply is the key factor that affected the inflation in Pakistan.

We solved the estimated model to get the long run equation for inflation as shown by the Equation 6 (t -ratios are in the parentheses)

$$g_p = -1.09591 * g_y + 1.09289 * g_m + 1.17935 * g_v \quad \dots \quad \dots \quad \dots \quad (6)$$

(-12.5)
(30.1)
(28.3)

The results indicates that in the long run there is a one to one relationship between the rate of inflation and growth in money supply, growth in real income and growth in velocity of money. The result of one to one relationship between the growth rate of money supply and the rate of inflation is consistent with the other studies such as McCandless and Weber (1995), Rolnick and Weber (1994) and Lucas (1980), among others.

Further, the results also confirm the monetarist's proposition that money supply is the main factor that contributes towards the inflation in Pakistan. Other factors that contribute the inflation in Pakistan are money demand captured by the real GDP growth and the financial sector reforms indicated by the velocity growth.

The real income changes over time. The factors that determine the real income are largely unrelated to the demand for money. The major factors that effect the growth of real income over time are the resources available to produce goods and services and technological change. It is argued that the real income is independent of quantity of money and the price level. As a result changes in real income do not affect the price level but there is proportional relationship between the price level and the nominal quantity of money relative to real income [Dwyer and Hafer (1999)]. We tested this hypothesis that inflation and money growth relative to real income are proportional. The results presented in the following equation indicate that there is one to one relationship between the inflation and money growth relative to real income in Pakistan.

$$g_p = 1.077970 (g_m - g_y) + 1.12153 g_v \quad \dots \quad \dots \quad \dots \quad \dots \quad (7)$$

(57.75) (36.43)

The institutional change in the financial sector, captured by the velocity variable, is a continuous process. Financial sector development is due to purely technological factors (independent of the money supply process) and a reaction by individuals and financial institutions to the monetary framework. Both factors are not fully predictable. Thus adopting a constant money growth rule without taking into account fundamental changes in the trend in the velocity due to the institutional change may lead to departures from the long run price level stability [Bordo and Jonung (1990) and Laidler (1997)].

Moreover, if the output and velocity grows at stable rate of resources growth and institutional evolution then the theory states that the inflation is driven by the excess growth of money supply over the output growth minus velocity growth, that is [$g_m - (g_y - g_v)$]. This proposition is tested and the results are presented in the following

$$g_p = 1.082661 [g_m - (g_y - g_v)]$$

(57.7887)

The result reveals that there is proportional relationship between the excess money supply over the output growth and the velocity growth. Average money supply growth adjusted fro output growth and velocity growth during 2000-2005 was 13 percent. It ranges from 6 percent in 2000 to over 19 percent during 2002 and 2003. It implies that excess money supply main cause of inflation in Pakistan.

4. CONCLUSION

The study tested the monetarists proposition that money supply has been the main determinant of inflation in Pakistan. For this purpose, we estimated the relationship between the rate of inflation, money growth, growth in real income, and growth in velocity in Pakistan in the 1960–2005 period.

The results from the correlation analysis indicate that there is strong relationship between the money growth and inflation. The correlation coefficient between the money growth and current real GDP growth is 0.226 and it is 0.069 with previous year's money growth and current year's real GDP growth. However it is statistically insignificant. The results lead us to say that money growth at first round effect real GDP growth and at second round the money growth effects inflation in Pakistan.

The important conclusion that emerged from the analysis is that the money supply growth has been an important contributor to the rise in inflation in Pakistan during the study period. This is to conclude that inflation in Pakistan is a monetary phenomenon. This may be due loose monetary policy adopted by the State Bank of Pakistan to boast the high priority of the growth objective. It is argued that the policies to boast output growth through money supply only have short run effect on real output but generate inflation. Indeed the recent act of tightening the monetary policy by the State Bank of Pakistan, supports the monetarist argument that the inflation in Pakistan is a monetary phenomenon.

The important policy implication is that inflation in Pakistan can be cured by sufficiently tight monetary policy. The formulation of monetary policy must consider development in the real and financial sector and treat them as constraints on the policy [Gordon (1985)].

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