SBP Research Bulletin
Volume 5, No. 1, May, 2009

Monetary Targeting in Pakistan: A Skeptical Note

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The objective of this study is to evaluate monetary targeting strategy in Pakistan by testing the Quantity Theory of Money and the income velocity of money stated by monetarists and the endogenous money hypothesis postulated by the post Keynesians. Our tests on the Pakistani data covering about thirty years reveal that the quantity theory is an inadequate explanation of inflation, income velocity of money is unstable and money is endogenous. These results suggest rethinking on monetary targeting strategy in Pakistan.

JEL Codes: E12, E5
Key Words: monetary targeting, income velocity of money, endogeniety of money

1. Introduction

Pakistan adopted monetary targeting strategy during the heydays of 'monetarism' when it was central to the conduct of monetary policy. Even in the mid 1990s, when the world around it was showing an obvious decline in the role of money in macro models, Pakistan continued with the very policy. The accepted wisdom in Pakistan *is* and *was* overwhelmed by monetarists' doctrines. Much of the empirical literature on inflation determinants in Pakistan also supports this dominance.

Few exploratory facts from Pakistan economy, however, suggest rethinking on the monetary doctrines and by corollary the monetary targeting strategy. This includes: transformation of Pakistan into a modern credit-based economy due to the reforms of 1980s and 1990s; the fact that monetary aggregate targets and their actual realization since mid 1970s leaves much to be desired; simple correlation analysis that suggest a rather weak relationship between inflation and various monetary aggregates; and the income velocity of money that shows an unstable pattern from 1975 to 2006.

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* The authors are analyst and senior joint director, at State Bank of Pakistan. They are thankful to Riaz Riazuddin, Hamza Malik and Adnan Bukhari for their helpful comments. Any errors or omissions in this paper are the responsibility of the authors.

These facts and the world wide decline in monetarists' paradigm motivated us to evaluate the optimality of monetary targeting in Pakistan. We did this by testing three hypotheses on Pakistani data. The first one relates to the testing of one-on-one money-inflation relationship in the long run, as predicted by the quantity theory of money (QTM). The second, was the test of the 'stable' assumption of the income velocity of money. The third relates to the identification of the endogenous money hypothesis; that is, money is a demand-driven phenomenon. Our findings support the absence of QTM and the presence of endogenous money hypothesis; and our tests reveal that the income velocity of money is not stable. All these results suggest rethinking on the monetary targeting policy in Pakistan.

We articulate our suggestion as follows. Section 2 reviews world-wide rise and demise of monetary targeting along with the endogenous money hypothesis. Section 3 gives some exploratory facts from the Pakistan economy. Section 4 outlines the methodology for testing the QTM, the stable income velocity of money assumption and the presence of endogenous money hypothesis. Section 5 discusses results, followed by concluding remarks in section 6.

2. The Rise and Demise of Monetary Targeting

The roots of the monetary targeting monetary policy regime lie in the famous QTM, best described in Lucas' (1996, p. 665) words, "(T]he central predictions of the quantity theory are that, in the long run, money growth should be neutral in its effects on the growth rate of production and should affect the inflation rate on a one-for-one basis." The strategy, however, came into existence as a result of the influential writings in 1950s and 1960s of the "monetarism" school of thought. Led by Milton Friedman, it argued for a restatement of QTM as a steady, low growth rate of money supply rule over the long run for the eventual subjugation of inflation.

In fact, monetarism challenged the influential monetary policy 'activism' of the 1950s and 1960s that sought an optimal point on the downward sloping Phillip's curve to stabilize either inflation or unemployment. Monetarists' 'counter-revolution' argued for the short run presence and long run absence of Phillip's curve; thereby, not only puncturing the 'activists' theories but also bringing them on the top of the mainstream economics. Their popularity peaked in the 1970s and early 1980s and since then motivated a considerable amount of empirical research on money growth and inflation.[1] Furthermore, monetarists' hypothesis also influenced the leading central banks of the world, i.e., Bundesbank, Federal

[1] See, De Grauwe and Polan (2005, p. 242) for a brief review of these studies.

Reserve Bank, Bank of Canada, Bank of England, among others, to adopt monetary targeting as their nominal anchor.

By late 1990s, however, virtually no major central bank in the world was a monetary targeter.[2] Two main reasons are forwarded for the demise of this strategy. First, the constant stream of financial deregulations and innovations of the 1970s, 1980s and 1990s kept destabilizing the demand for money. In other words, velocity of money, supposed to be fixed for the smooth functioning of monetary targeting regime, turned out to be highly variable. Second, the money growth and inflation relationship did not turn out to as predicted by the aforementioned monetary hypothesis and empirical studies on QTM.[3] Some argued it was a lack of proper commitment on the part of the central banks in implementing the monetary targeting strategy. For example, Mishkin (2000) argues that the strategy's failure in some industrial countries was due to their central banks' indulgence in 'game playing': targeting of multiple monetary aggregates, inconsistent target announcements, overshooting of targets without reversing and lack of effective communication. This, he notes, greatly undermined the credibility of this strategy and eventually led to its failure.

Apart from unstable velocity of money and absence of significant money-inflation correlation, literature on country experiences of monetary targeting policy reveals other dimensions of the demise of this strategy as well; including the aforementioned game playing hypothesis.[4] We nonetheless assume that the most compelling reasons for abandoning this strategy have remained the lack of

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[2] Exception to this was Germany and Switzerland; who by early 2000s were inflation targeters (Germany was in euro zone by 2000; the European Central bank does not regard its monetary stability objective as an inflation target]. Indeed, there has been a spectacular decline in the role of money in monetary policy around the world; as King (2003, p. 63) observes, "The decline and fall of money in policy formulation is confirmed by a fall in the number of references to money in the speeches of central bank governors. So much so that over the past two years, Governor Sir Edward George has made one reference to money in 29 speeches, Chairman Greenspan one in 17, Governor Hayami one in 11 and Wim Duisenberg three in 30."

[3] Quoting several studies, this is well described on three grounds by Moroney (2002, pp. 398-399): "[1] income velocity of (and thus the demand for) monetary aggregates is so unstable that money growth is an unreliable explanation [2] if money, the price level and output are not cointegrated, then there is no stable long-run relationship among them [3] there is a class of policy rules with a unique solution that shows that the price level is independent of monetary policy but dependent strictly on fiscal policy. This 'fiscal theory of price level determination' *breaks any link between money growth and inflation*."

[4] See, Argy et al. (1989) for a review of international experiences of monetary targeting strategy; see, Gomme (1998) for a concise review on the experience of Bank of Canada; and see, Friedman (1988) for lessons from the U.S. economy. See, for a detailed scrutiny of monetarism, Desai (1981).

significant relationship between money and inflation and the instability in the velocity of money.

… and the Endogenous Money Hypothesis

Relatively distinct in their arguments, post Keynesian economists, led by Nicholos Kaldor and Basil Moore (Kaldor, 1982, 1985 and Moore, 1988), also criticize the monetarism and by corollary the monetary targeting strategy. This school of thought rejects the basic assumption of monetarists' that money is an exogenous phenomenon; that is, policy determined. They argue that in a modern 'credit-money-economy' a central bank is bound to accommodate the private sector credit demand not as a matter of 'political choice' but as a matter of 'structural necessity' (Cottrell, 1994). Furthermore, as a guarantor of the financial system any attempt by a central bank to control the supply of money would actually undermine its credibility as a lender-of-last-resort (Kaldor, 1985).

Changes in the real economy, for example wages, employment and inventory, determine the demand for bank loans that in turn determine the supply of money. In particular, the money supply completely depends on the loans demanded; since loans make deposits and the deposits generate the monetary aggregate(s), the loans demanded cause the money supply. A central bank can only exert influence on money indirectly through interest rate. In fact, Kaldor and Moore argue for a perfectly elastic horizontal money supply curve; to the extent that money supply is a function of money demand only.[5]

These dynamics lead the post Keynesians to challenge one of the most fundamental monetarists' contentions that reduction in money growth actually reduces inflation. They instead argue that reduction in money growth is actually a side effect of achieving disinflation through invoking recession. For instance, monetarists argue that the famous disinflationary episodes of the late 1970s and early 1980s were due to the *reduction* in money growth *leading* to lower inflation. Post Keynesians argue that this causation is wrong. Because, strict monetary policy essentially implies rising interest rates that dampen aggregate demand through depressing investments (and exports) therefore invoking recession. As recession deepens and unemployment rises, growth in the money wages slow down; with deceleration in wage cost, inflation abates. In effect, growth in the

[5] This is sometimes termed as 'too' horizontal a view. Therefore, the post Keynesian literature has further refined the endogeneity of money hypothesis in three different, yet intertwined views; 'accomodationists', 'structuralists' and 'liquidity preference' (Palley, 1996, 1994, Howells, 1995 and Pollin, 1991). All the three varieties fundamentally endorse the endogeneity hypothesis; they, however, differ in their fine interpretations.

demand for credit slows down that actually slows the money supply. Therefore, the deceleration in money supply is a side effect of recession and unemployment. Hence, monetarists' contention is a false rationalization (Cottrell, 1994).

3. Some Exploratory Facts from Pakistan

Despite the aforementioned world-wide decline in monetary targeting strategy, the central bank, the State Bank of Pakistan's (SBP), core mode of monetary policy conduct remained the very strategy. In particular, the strategy has remained in vogue as follows: 'selective credit/credit ceilings' from the second quarter of fiscal year 1973 to August 1992; 'credit to deposit ratio' from September 1992 to September 1995; and 'M2' target from September 1995 to date. Prior to 1990s SBP conducted its monetary policy with direct control instruments; bank-wise credit ceilings were used as active instrument of monetary control. This system was established after the adoption of "credit planning" through the National Credit Consultative Council (NCCC) set up under SBP in 1972.

The credit policy adopted under NCCCs Annual Credit Plan had a specific objective to support the public and some priority sectors. For this purpose, a number of credit schemes such as Locally Manufactured Machinery, Export Refinance Scheme, Commodity Operation Scheme, were launched at subsidized rates. As public sector was enjoying virtually unlimited access to credit at subsidized rates, the magnitude of the flow of credit to the private sector, which was subject to selective credit, was set in residual to the global credit target. Furthermore, as the government relied heavily on bank borrowing for budgetary financing, the resulting debt structure in absence of a developed secondary market and administratively set yield structure, promoted financial repression. Besides, the higher operational cost provided banks little incentive to increase their deposit or lending base thus promoting financial disintermediation.

However, as of late 1980s, in particular from 1989 onwards, Pakistan embarked upon a reforms program aimed at instilling competition in the markets to achieve efficient allocation of financial resources. Therefore, financial markets were liberalized, measures were taken to strengthen institutions, banking laws went through changes, domestic debt management was improved and foreign exchange and capital markets were reformed and liberalized. In 1991, as a major landmark development, the government of Pakistan for the first time auctioned short term (6-month) Market Treasury Bills (MTBs) and long term (3, 5 and 10 years) Federal Investment Bonds (FIBs). SBP (2002) gives a comprehensive review on the liberalization policies undertaken from late 1980s onwards.

These developments changed the character of Pakistan's economy, especially that of the financial sector. There were now more banks and other financial intermediaries, more innovations and therefore more financial products. In fact, there was a remarkable increase in financial intermediation. The currency to deposit ratio declined from 51.4 percent in 1990 to 34.3 percent in 2000 (SBP (2002); and the same ratio for 2007 further reduced to 26.1 percent. Indeed, the ingredients of a credit-based economy started to become apparent in the 1990s, continuing well into the 2000s.

On the other hand, SBP's performance in terms of actually realizing the monetary targets over 1975-2006 has remained subdued. A 'performance-analysis' of monetary targeting in Pakistan is summarized in Table 1. As presented, along with CPI Inflation both Credit and M2 have hardly met these targets. Allowing a ±1 percentage point margin of error in the whole sample, (1975-2006), the credit growth overshot its target 21 times and undershot 7 times. With this margin of error criterion, the credit growth reached its target only 4 times in 1981, 1982, 1996 and 1997.

Similarly, M2 growth targets were undershot 5 times and were overshot 23 times in the sample. Its performance, allowing the aforementioned margin of error, is similar to that of the credit one; that is, 4 times only. If we focus only on the sample from 1995-2006 during which operational monetary target was M2, it was only in 1997, 1998 and 2000 when M2's growth realization deviated from its target value by a difference of -0.2, 0.3 and -0.1 percentage point. As a whole, it overshot by 7 times and undershot by 2 times.

Performance on CPI Inflation is mixed. In fact, nothing consistent, such as increase in CPI Inflation to be consistent with a proportional increase in M2, comes out (Table 1). In the available sample (1991-2006) of CPI inflation target, the realization of inflation rates overshot the target values 8 times and undershot 4 times. Like credit and M2 growth, inflation hit the target range 4 times in the available sample, with best results in the years 2001 and 2006 when targets deviated by -0.1 percentage point. Based on this, therefore it is difficult to establish any consistent pattern between CPI Inflation and the monetary aggregates.

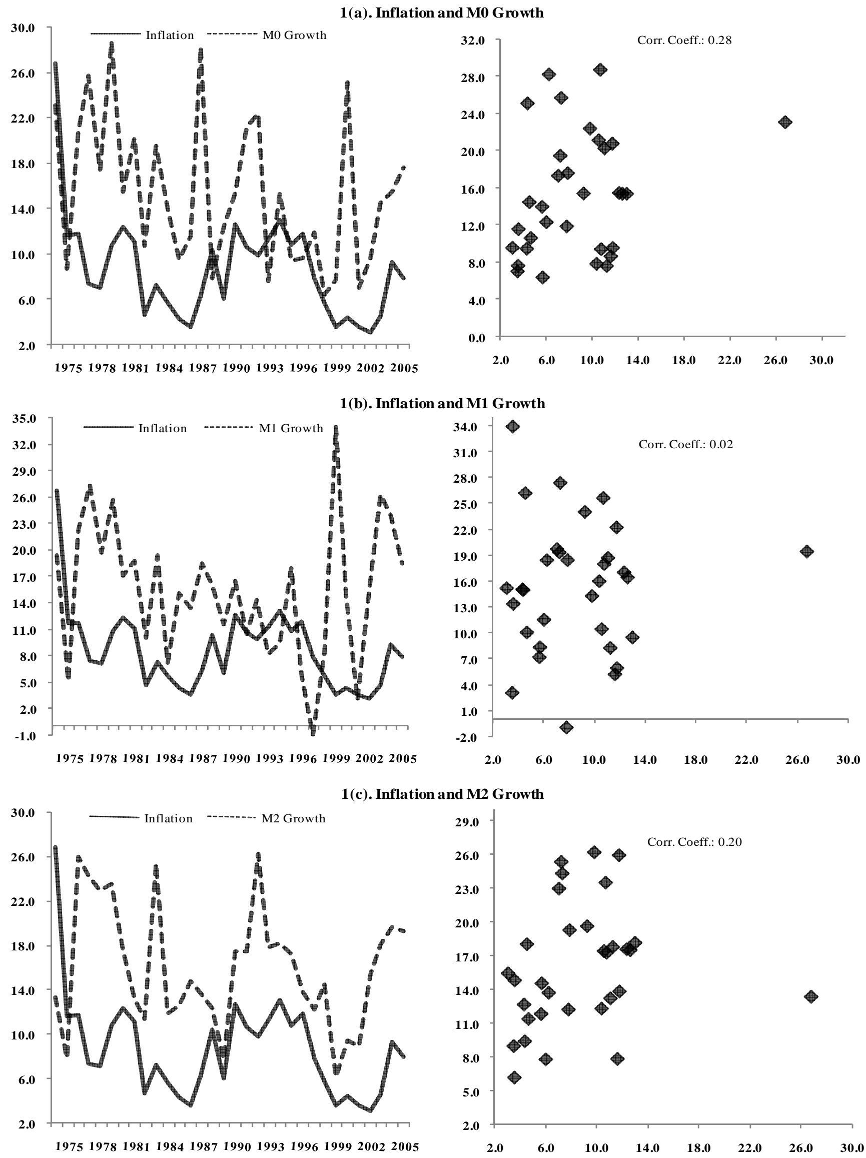
Table 1. Growth in Monetary Aggregates and CPI Inflation: Target and Actual

Fiscal Year	**Credit** (percent)			**M2** (percent)			**CPI Inflation** (percent)		
	Target	**Actual**	**Difference**	**Target**	**Actual**	**Difference**	**Target**	**Actual**	**Difference**
1975	8.9	4.1	-4.8	11.2	6.0	-5.2		26.8	
1976	3.7	5.2	1.5	11.3	20.3	9.1		11.6	
1977	2.4	5.4	3.0	13.6	19.7	6.1		11.8	
1978	5.0	6.1	1.1	10.6	19.3	8.8		7.3	
1979	9.4	11.1	1.7	12.0	20.3	8.3		7.1	
1980	13.3	10.2	-3.1	13.7	15.7	2.0		10.7	
1981	11.3	10.7	-0.5	10.3	12.0	1.7		12.4	
1982	15.6	15.0	-0.6	13.8	10.4	-3.4		11.1	
1983	14.5	17.5	3.0	13.9	23.4	9.5		4.7	
1984	13.8	20.6	6.8	12.3	11.1	-1.2		7.3	
1985	13.2	14.7	1.5	10.4	11.9	1.5		5.7	
1986	12.9	18.3	5.4	9.4	14.1	4.7		4.4	
1987	9.3	16.7	7.4	11.3	13.1	1.8		3.6	
1988	9.5	15.5	6.0	11.7	11.8	0.1		6.3	
1989	7.7	10.4	2.7	11.2	7.5	-3.7		10.4	
1990	10.1	12.7	2.6	10.3	16.9	6.6		6.1	
1991	8.9	12.5	3.6	9.7	16.9	7.2	7.0	12.6	5.6
1992	9.3	13.8	4.5	11.1	25.6	14.5	8.5	10.6	2.1
1993	8.7	23.2	14.5	9.2	17.4	8.2	8.0	9.8	1.8
1994	11.5	13.8	2.3	13.1	17.9	4.7	8.0	11.3	3.3
1995	11.6	18.1	6.5	10.7	17.0	6.3	7.0	13.0	6.0
1996	14.6	14.1	-0.5	12.0	13.7	1.6	9.5	10.8	1.3
1997	12.9	13.8	0.9	12.2	12.1	-0.2	8.5	11.8	3.3
1998	16.1	15.0	-1.1	14.1	14.4	0.3	9.0	7.8	-1.2
1999	18.0	14.5	-3.6	13.5	6.1	-7.4	8.0	5.7	-2.3
2000	17.9	2.8	-15.2	9.4	9.3	-0.1	6.0	3.6	-2.4
2001	12.1	8.2	-3.9	10.4	8.9	-1.5	4.5	4.4	-0.1
2002	13.3	7.2	-6.1	9.5	15.3	5.8	5.0	3.5	-1.5
2003	12.0	21.2	9.2	10.7	17.9	7.2	4.0	3.1	-0.9
2004	8.9	34.0	25.1	11.0	19.5	8.5	3.9	4.6	0.7
2005	15.6	33.4	17.8	11.2	19.2	8.0	5.0	9.3	4.3
2006	19.3	23.5	4.2	12.8	14.8	2.0	8.0	7.9	-0.1

Source: *State Bank of Pakistan* and *Janjua (2004).*

Note: Prior to 1991 there were no explicit targets for inflation rate; the emphasis has remained on the qualitative aspect of moderate prices as opposed to a quantitative inflation target. However, as a *means* credit and monetary growth have been used to achieve the *ends* of moderate price level

Figure 1. Inflation and Monetary Aggregates Growth, 1975-2006



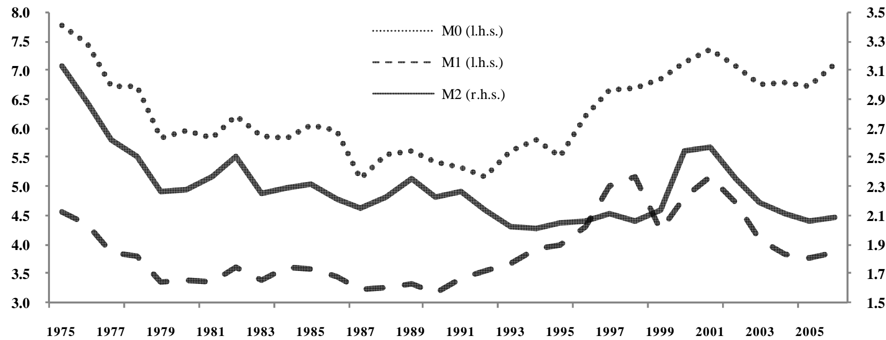
Source: *State Bank of Pakistan*
Note: All the monetary aggregates are with one lag

There could be two reasons behind this rather subdued performance, the first being the lack of significant relationship between inflation and monetary aggregates in Pakistan. Figure 1, covering a period of more than 30 years (1975-2006), summarizes this relationship through correlations. In particular, Figures 1(a), 1(b) and 1(c) present the correlations between CPI inflation and growth rates of M0, M1 and M2. Assuming that the growth rate of money is determined by the inflation rate, which also implies the exogeneity of money, all the monetary aggregates are taken with one lag. The correlation coefficient between Inflation and M0 is 0.28, between inflation and M1 is 0.02 and between inflation and M2 is 0.20. Even by removing the outlier in the sample (CPI inflation of 26.8 percent in 1975), the correlation coefficients in the case of M0 and M1 are reduced to 0.18 and -0.07. But, for M2 it improves to 0.38, which we assume is still not very convincing.

The other reason can be the velocity of money, variability of which implies instability in money demand. Figure 2 shows the income velocity of money defined for M0, M1 and M2 from 1975 to 2006. As shown, all the three velocities trend downwards and start rising from early 1990s. The rise in M2 velocity is comparatively less pronounced than M0 and M1; it nonetheless is at a higher value in 2006 than its bottom value in 1994. In particular, two simple points emerge from this figure: variability in velocities is *noteworthy* and the velocities *reverse* their downward trend from early 1990s onwards, coinciding with the financial liberalization policies.

To make further sense of Figure 2, we analyze the ‘constant’ velocity assumption of the monetarists and track the trend behavior of velocity within the Bordo-Jonung’s U-shaped hypothesis. Bordo-Jonung’s U-shaped hypothesis is based on the stylized long run, with data spanning from 1870s to 1980s, trend behavior of velocity of money of several developed economies (Jounung, 1978, Bordo and Jonung, 1990 and 2003). The hypothesis argues that historically the trend behavior of velocity has remained influenced by two different regimes, with each regime characterized by different stage of development. The first regime is characterized by a shift from barter system to the cash and demand deposit ones, in which increased monetization takes place thus resulting in the secular fall in the income velocity of money. The second regime is a result of financial liberalization and technological progress that redefines the role of money through the introduction of a wide range of financial products and means of transferring funds. As a result, the income velocity of money either stabilizes or even follows a secular increase. That is how income velocity of money tracks a U-shaped pattern. Therefore, as one might guess, this pattern would cause instability in the demand for money.

Figure 2. Income Velocity of Money, 1975-2006



The data span that we have for Pakistan is rather short for the application of Bordo-Jonung's framework of analysis; especially with the fact that a barter system is not a possibility for a 1970s or a 1980s Pakistan. Looking at Figure 2, we nonetheless find one important point conforming to Bordo-Jonung's U-shaped hypothesis. It is the rise in all the three varieties of velocity from early 1990s. While for M2 and M1 velocities we cannot claim a secular increase, they are nonetheless on the rise since early 1990s. As mentioned before, this time period is identified with the implementation of the financial liberalization programs in Pakistan. Therefore, based on the U-shaped velocity hypothesis analysis, we can argue that income velocity of money demand might not be a 'constant' phenomenon in Pakistan.

4. Testing Monetarists' Doctrines

The aforementioned exploratory facts and the world wide decline in monetarism paradigm motivate us to evaluate the optimality of monetary targeting strategy in Pakistan. We do this by testing for the presence of three hypotheses on Pakistani data. The first one, as predicted by the QTM, relates to the testing of one-on-one money-inflation relationship in the long run. The second test focuses on the 'constant' assumption of the income velocity of money. The third, as postulated by the post Keynesians, relates to the identification of the endogenous money hypothesis. In what follows, therefore, we present the methodologies to test the QTM, 'constant' assumption of income velocity money and the endogenous money hypothesis.

Testing the QTM

In the empirical literature on Pakistan, the evidence on money as a determinant of inflation is considerable. Table 2 summarizes some of the recent empirical research on inflation and money relationship in Pakistan. With the exception of Chaudhry and Choudhary (2006) and Akbari and Rankaduwa (2006), who find M2 in their estimates of inflation as insignificant and inelastic, all of other studies find money as a significant determinant of inflation. Furthermore, five out of eight studies attempt to 'model' inflation in Pakistan and do not address the one-on-one money-inflation relationship in particular.

While Abbas and Hussain (2006) investigate the cointegrating relationship between GNP deflator and M2, Qayyum (2006) and Kemal (2006) are the only studies that attempt to model the QTM. The former estimates a behavioral equation, whereas the latter relies on the cointegration and error correction approach. Their findings conform to the one-on-one relationship between money and inflation. These studies use an approximation for the 'quarterly' GDP growth rate series. As the use of an approximation to the quarterly GDP series for Pakistan has yet to establish itself, we view these results with caution.

We attempt to model QTM in this study, as opposed to modeling inflation and particularly look for one-on-one relationship between money and inflation. Therefore, following DeGrauwe and Polan's (2005) representation, we begin by the roots of the QTM that lie in the famous identity:

$$MV = PY \tag{1}$$

The relationship simply dictates that for a given velocity of money (V) and given quantity of output (Y), controlling for some monetary aggregate (M) would yield the desired level of price (P). More specifically, the aforementioned identity is transformed into a theory by first moving to growth rates and then solving the P:

$$m + v = y + p \tag{2}$$

and

$$p = m - y + v \tag{3}$$

In Equations (2) and (3), lower case denotes growth. In Equation (3), the growth rate of price (p) – that is, inflation – is expressed as a function of growth rates of money (m), output (y) and velocity (v).

What follows from this transformation is one important proposition that in the long run, there is a proportional relation between inflation and growth rate of money: a permanent increase in money growth would lead to an equal increase in inflation. This proposition is tested using a simple OLS estimation on Pakistani data. Specifically, the study estimates the following equation:

$$p_t = \alpha_0 + \alpha_1 m_t - \alpha_2 y_t + \mu_t \quad (4)$$

Where, p_t, m_t and y_t are the rates of inflation, money growth and output growth respectively; and error term, μ_t, is assumed as velocity. Our assumption of velocity as a random variable is justified on the basis of 'non-constant' income

Table 2. Some Recent Studies on the Money-Inflation Relationship in Pakistan

Study	Sample	Variables	Findings
Qayyum (2006)	1960-2005 (quarterly)	Dependent: *CPI inflation*. Independent: money, *GDP growth, income velocity of money*	Money is significant
Chaudhry and Choudhary (2006)	1972-2004	Dependent: *GDP deflator*. Independent: *M2, real GDP, import price*	M2 is insignificant
Akbari and Rankaduwa (2006)	1982-2004	Dependent: *CPI, WPI*. Independent: *exchange rate, foreign price, M2, large scale manufacturing index*	M2 is inelastic
Khan and Schimmelpfennig (2006)	1998-2005 (monthly)	Dependent: *CPI inflation*. Independent: *M2, interest rate, private sector credit, large scale manufacturing index, nominal effective exchange rate, wheat support price*	M2 is significant
Kemal (2006)	1975-2003	*CPI inflation, M2, GDP*	All variables are cointegrated
Abbas and Husain (2006)	1960-2004	*GDP deflator, GNP, M2*	Long run relationship between GDP deflator and M2
Bokil and Schimmelpfennig (2005)	1975-2004 (annual & quarterly)	Dependent: *CPI inflation*. Independent: *M2, GDP, large scale manufacturing index*	M2 is significant
Khan and Schimmelpfennig (2005)	1998-2005 (annual & monthly)	Dependent: *CPI inflation*. Independent: *M2, interest rate, private sector credit, GDP, large scale manufacturing index, wheat support price*	M2 is significant

velocity of money discussion in the preceding section. Hence, the QTM in its one-on-one prediction would hold if the estimate of α_1 in Equation (4) equals 1. Or, any estimate of α_1 (very) close to 1, would validate the QTM theory.

Testing the 'Stable' Velocity Assumption

To understand the underlying concept of 'stable' velocity of money, we follow Friedman (1956; p. 16), "The quantity theorist accepts the empirical hypothesis that the demand for money is highly stable … This hypothesis needs to be hedged … (that] the quantity theorist need not and generally does not, mean that the real quantity of money demanded per unit of output, or the velocity of circulation of money, is to be regarded as *numerically constant* over time …" (emphasis added]. Therefore, for our analysis we assume that income velocity of money is stable if it is 'mean reverting' over a period of time.

To test this assumption, we follow the guidelines offered to us by one of the most fundamental concepts of time series econometrics: the properties of a stationary stochastic process. Loosely speaking, a stationary stochastic process does not depend on time; if a time series is stationary it will fluctuate around a constant level. Formally, "a series is said to be stationary if its mean and variance are constant over time and the value of covariance between two time periods depends only on the distance or lag between the two periods and not on the actual time at which the covariance is computed." (Gujarati, 1995, p.713)

Sometimes, even a visual inspection of a time series may indicate its stationarity status, especially when it follows a secular upward (or downward) trend. This however might not be the case if the series does not exhibit any trend; this is especially the case if the sample size is small (as in Figure 2 here). In any case, standard Augmented Dickey-Fuller (ADF) test can be applied to determine the stationarity status of a time series.

Therefore, assuming Y_t to be a time series, the ADF test amounts to running the following regression:

$$\Delta Y_t = \beta_0 + \beta_1 t + \rho Y_{t-1} + \sum_{i=1}^{k} \phi_i \Delta Y_{t-i} + \varepsilon_t \qquad t = 1,2,3,... \tag{5}$$

Equation (5) is self explanatory except for t which is a time or trend variable and (for example) ΔY_{t-1} would equal $(Y_{t-1} - Y_{t-2})$. After running the regression, the

t-statistics of the coefficient ρ is compared with the Mackinnon's critical values. If they exceed the critical values then the null of non-stationarity is rejected. The estimation of Equation (5) is done, in the first place, in levels when the dependant variable is not differenced. If the null is not rejected in levels then the dependant variable is differenced once. If, still the null hypothesis is not rejected then the dependant variable is differenced twice.

Note that if stationarity is confirmed through the estimation of Equation (5) in levels then we conclude that the series is stationary or an integrated process of order zero, I (0). In other words, the series is a mean reverting process, or as we would call it here as a 'stable' series. In other cases, if the series is either an integrated process of order one or two, I (1) or I (2), then we conclude that it is not a mean reverting process or as we would call it here as an 'unstable' series.

Testing the Endogenous Money Hypothesis

Empirical investigations stemming from the predictions of Post Keynesian school of thought models are nearly non-existent in Pakistan. In fact, there is only one study, Ahmad and Ahmed (2006), which investigates the endogenous money hypothesis. Using Granger Causality tests on Pakistani data, the study finds the hypothesis valid in the short run and argues for weak evidence in the long run. Highlighting some of the shortcomings of standard Granger Causality test, our test of the endogenous money hypothesis would make use of a relatively improved methodology of Auto Regressive Distributed Lag (ARDL) procedure popularized by Pesaran and Pesaran (1997) and Pesaran and Shin (1999).

There are several advantages of applying this approach.[6] The main being the fact that it can be applied on a time series data irrespective of whether the variables are I(0) or I(1) (Pesaran and Pesaran, 1997). Second, it takes sufficient numbers of lags to capture the data generating process in a general-to-specific modeling framework (Laurenceson and Chai, 2003). Third, a dynamic Error Correction

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[6] The empirical literature investigating the endogenous money hypothesis has generally applied the standard Granger Causality test (Shanmugam et al. (2003) and Vera (2001)]. Conceptually, this test examines the dynamic linkage between the two time series only when the series are stationary. Furthermore, the test detects the current changes in one variable due to the past changes of another variable, but sometimes fails to detect the causality due to the current changes. Therefore, a cointegrating model that can capture long run as well as short run causality is a better choice. For this, various methods have been prescribed including Engle and Granger (1987), Johansen (1988) and (1991) and Johansen and Juselius (1990). The performance of these models, however, is restricted when the sample size is small or when the order of the cointegrating variables is not the same.

Model (ECM) can be derived from ARDL through a simple linear transformation (Banerjee *et al., 1*993). The ECM integrates the short-run dynamics with the long-run equilibrium without losing long-run information.

The ARDL approach is described in two steps. In the first step, bound testing is conducted to detect the *presence* of cointegrating relationship, irrespective of the stationarity status of the variables, using the model:

$$\Delta y_t = \gamma_0 + \sum_{i=1}^{p} \gamma_{1i} \Delta y_{t-i} + \sum_{i=1}^{p} \gamma_{2i} \Delta x_{t-i} + \gamma_3 y_{t-1} + \gamma_4 \; x_{t-1} + \zeta_t \qquad (6)$$

In the first part of Equation (6), γ_1 and γ_2 represent the short run dynamics of the model. The null hypothesis is of the non-existence of the long run relationship; that is, $\gamma_3 = \gamma_4 = 0$. The estimated F-stat from Equation (6) has non standard distribution; therefore, Pesaran and Pesaran (1997) have tabulated the upper and lower bound of critical values. An estimated F-stat above the upper bound assumes the variables to be I (1) stationary and below the lower bound indicates that the relationship is non-stationary.

The second step consists of estimating long run and short run relationship. At first, the long run relationship is estimated using the following cointegrating equation:

$$y_t = \delta_0 + \delta_1 x_t + e_t \qquad (7)$$

Where, y_t and x_t are two different time series; e_t is a vector of stochastic error terms; and δ_0 and δ_1 are the parameters. When there is a long run relationship, there exists an error correction representation. Then, therefore, an error correction model is estimated:

$$\Delta y_t = \lambda_0 + \sum_{i=1}^{r} \lambda_{1yi} \Delta y_{t-i} + \sum_{i=0}^{s} \lambda_{2xi} \Delta x_{t-i} + \lambda_3 \zeta_{t-1} + \upsilon_t \qquad (8)$$

ζ_{t-1}, is the error correction term obtained from the residual of Equation (7). The error correction model result indicates the speed of adjustment back to the long run equilibrium after a short run shock. ζ_{t-1}, in Equation (8) provides a useful alternative to the Granger causality test. The test is based on *past changes* in one

Table 3. QTM Estimate based on Equation (4) (Dependant Variable: p_t)

	Coefficient	t-stat	Probability	Adj. R^2	DW-stat	F-stat
Intercept	5.643	2.263	0.031			
y_t	-0.854	2.067	0.048	0.226	1.126	5.526 (Prob.: 0.009)
m_{t-2}	0.469	3.248	0.003			

variable explaining *current change* in the other. If, however, variables share a common trend then *current* adjustments in y towards its long-run equilibrium

value are partly the result of *current* changes in x. Such causality can be detected if the error correction term in Equation (8) is statistically significant.[7] Therefore, if the relevant variables are cointegrated, then causality must exist in at least one direction which is not always detectable if the results are only based on the standard Granger causality procedure.

5. The Results

Based on the methodologies outlined in the preceding section, we now present the results on the QTM theory, stability of the income velocity of money and the presence of the endogenous money hypothesis.

The QTM Estimates

We estimated equation (4) using a sample of more than 30 years from 1975 to 2006. We assumed that a sample of this size is sufficient to fulfill the 'long-run' condition of QTM to hold. The data is from SBP on M2 (m_t), real GDP (y_t) and CPI inflation (p_t), converted into growth rates. As mentioned earlier, we did not use any independent estimates of velocity and assumed it to be in the error term. This assumption is reasonable, as reflected in the results of the test in the next section.

We estimated equation (4) using ordinary least squares method. To run the regression in the original specification of the QTM, we used nominal GDP growth

[7] In particular, if lagged values of x in a model with dependent variable y are jointly significant then null hypothesis (x does not Granger-causes y) is rejected and *vice versa*. Furthermore, if the relevant variables are cointegrated and the error correction term is significant then causality must exist at least in one direction; that is, current changes in y are caused by the current changes in x .

Table 4. ADF Test Results on the Income Velocities of Money based on Equation (5)

Y_t	Absolute t-statistics of ρ		Remarks
	Level	First Difference	
M0	1.57	4.24	I (1)*
M1	2.09	5.00	I (1)*
M2	2.90	5.09	I (1)*

* 95 percent absolute critical value for ADF statistics: 2.96

rates; however, no meaningful relationship was detected. Therefore, we estimate equation (4) with p_t as dependent variable and m_t and y_t growth rates as independent variables and report the results in Table 4.

As evident, the estimate might not be reflecting very robust statistics of Adj. R^2, DW-stat and F-stat, but the residual tests suggests no serial correlation. Therefore, it is technically an acceptable specification. Plot of estimated and actual p_t, not shown here; indicate that the estimated values track the actual ones rather well. Furthermore, the individual contribution of the explanatory variables is statistically significant and consistent with the a priori signs.

GDP growth rate enters the estimate with correct sign and is statistically significant. Similarly, M2 growth, the variable of our prime concern, is positive and statistically significant. Its coefficient, 0.469, however is far below than 1 and therefore does not conform to the QTM prediction of one-on-one relationship with CPI inflation. Moreover, the Wald tests for the null hypothesis that $\alpha_1 = 1$ is rejected at 5 percent level of significance. This further negates the presence of QTM in the above estimate.

Note however that a very low Adj. R^2 of only 0.226 suggests that not only QTM is an inadequate explanation; there could potentially be more determinants of inflation in Pakistan other than M2 and GDP growth. This also highlights the need to model inflation in Pakistan. Apart from the fact that M2 growth only marginally explains inflation in Pakistan, its significance with two lags, that is 24 months, is also debatable. In fact, it defies the conventional wisdom of monetary policy, variations in monetary aggregates, affecting prices with 6 to 12 months lag in developing countries. Nonetheless, we report this result as it is the best fit among the other estimates with M0 and M1 and with level and one lag specifications.

Stability of the Income Velocity of Money

To implement the ADF test methodology, we run the regression as in Equation (5) on all the three velocities of M0, M1 and M2. The data we used was from SBP covering a time period from 1975 to 2006. The results are presented in Table 5. The given results are obtained considering the deterministic trend; that is, estimation of equation (5) with intercept term. Even after considering the stochastic trend, estimation of equation (5) with trend variable as well, the results in Table 5 remain unchanged.

The test clearly reveals that all three velocities are integrated processes of order one, I (1); that is, the income velocities of money in Pakistan are non-stationary process. This implies that the income velocities of M0, M1 and M2 are not mean reverting processes. Therefore, we conclude that income velocity of money in Pakistan is an 'unstable' phenomenon.

Recall Friedman's explanation from Section 4.2. on the meaning of stable velocity of money. He further elaborates that increase in velocity during unusual episodes of hyperinflations is still consistent with stable velocity assumption. This argument, however, might not hold in the present day Pakistan as it has never experienced hyperinflation. Indeed, the source of this instability stems from the liberalization policies that Pakistan implemented in late 1980s and 1990s.

The Endogenous Money Results

To implement the methodology as outlined in Section 4.3., the log linear variables we use are LCPS and LM0 and LM2 over the period 1973-2006. Our objective is to check the causality between LCPS and LM0 and LM2; that is, LCPS $\Rightarrow$ LM0 and LCPS $\Rightarrow$ LM2. To differentiate the market structure that existed before 1991, prior to the landmark auctions of MTBs and PIBs, we introduced a dummy variable (DUM) assuming a value of 1 from 1991 to 2006, 0 otherwise.

The results in Table 6 are based on bound test as given in equation (6). All the specifications include an intercept, a linear trend and a dummy variable. As obvious, the F-Stat for specifications (i) and (iii) crosses the upper limits of the bound; implying that there is a cointegrating relationship between "LM0 and LCPS" and "LM2 and LCPS". In other words, in the long run LCPS causes LM0 and it is not the LM0 that causes the LCPS, as envisaged by the monetarists. Similarly, it is LCPS that determines the LM2; therefore, credit determines the deposits that lead to the creation of money supply process. Having confirmed the presence of cointegrating relationship and establishing the direction of causality,

we now further strengthen our result by calculating the long run coefficients and checking the significance of the error term in the ECM specification.

The results of the estimates based on Equations (7) and (8) are reported in Table 7. The results are based on AIC criterion of lag selection procedure. A significant DUM in both cases shows that the market liberalization and the creation of secondary market have further strengthened the impact of credit on the monetary aggregates.

The coefficients for LCPS and the error term in both specifications, with LM0 and LM2 as dependent variables, are significant, thus validating the causality and long run relationship between "LCPS and LM0" and "LCPS and LM2". The first result, with LM0 as dependent variable, shows that 1 percent increase in the LCPS results in 0.28 percent increase in LM0. Long run cointegration relationship from LCPS to LM0 and the significant error term leads us to the conclusion that in the long run LCPS determines the LM0.

The second result, with LM2 as dependent variable, shows that 1 percent increase in LCPS causes LM2 to rise by 0.17 percent. Furthermore the lag term of the LCPS is found jointly significant, forcing the rejection of the null hypothesis that the LCPS does not cause LM2. The significant error term in the presence of the cointegrating relation between LCPS and LM2 at the same time also confirms that the causality exists from credit to money supply. Both the test results support the endogenous money hypothesis in Pakistan.

Table 5. Cointegration Results based on Equation (6)

Specification	Dependent Variable	Independent Variable	F-Stat†	Intercept	Trend	DUM2	Order of Cointegration
(i)	LM0	LCPS	13.53	Yes	Yes	Yes	I(1)*
(ii)	LCPS	LM0	4.42	Yes	Yes	Yes	-
(iii)	LM2	LCPS	6.36	Yes	Yes	Yes	I(1)**
(iv)	LCPS	LM2	2.87	Yes	Yes	Yes	-

* 1 % level of significance; † 99 % critical values: lower: 6.52 – upper: 7.58
**5% level of significance; ; † 95 % critical values: lower: 4.90 – upper: 5.87

Table 6. Results based on Equations (7) and (8)

Dependent Variable	Order of Lags (AIC)	LCPS	Intercept	DUM	Trend	Error Term	Joint Significance (ChiSq)
M0	1,0	0.28*	0.22*	0.06*	0.044*	-0.72*	-
M2	3,1	0.17**	0.36*	0.10*	0.032*	-0.50*	10.41*

* 1 % level of significance; **5% Level of Significance

6. Concluding Remarks

This study finds that the QTM does not hold in its one-on-one money-inflation relationship, that income velocity of money is unstable and that the money is endogenous. But, does this imply that 'money' is irrelevant? Paul Volcker once observed, "(T]here is a kind of commonsense view that inflation is too much money chasing too few goods. You could oversimplify it and say that inflation is just a monetary phenomenon. There are decades, hundreds of years, of economic thinking relating the money supply to inflation and people to some extent have that in their bones."[8] Therefore, it would take some deal of audacity on our part as well to negate a theory that has remained rather dominant.[9] Nonetheless, two multi-country investigations of the QTM do support our findings.

In one of various tests of the QTM, Moroney (2002) separates countries into 'high-money-growth and high-inflation' and 'low-money-growth and low-inflation' categories. The former category is characterized by money growth exceeding real GDP growth by at least 15 percent and for the latter category exceeding by less than 6 percent. He finds that QTM in its nearly one-on-one prediction is strongly supported in the former category and does not carry the same support in the latter category. Similarly, De Grauwe and Polan (2005) confirm this result by separating countries into four categories characterized by annual average money (M1 and M2) growth rates of less than 15, 20, 30 and 100 percents. The QTM holds in its one-to-one prediction in the last two categories and the coefficients for less than 20 percent category are 0.79 and 0.88 for M1 and M2. For the first category, however, the coefficients are rather low at 0.22 (M1) and 0.25 (M2). Furthermore, low inflation countries in these studies are typically OECD countries where average inflation has remained at single-digit level in the last thirty years.

In Pakistan average annual inflation and money growth (M2 growth) remained 8.7 percent and 16 percent during 1975-2006. M2 growth to real GDP growth over the same time has remained at 3.5 percent. Therefore, if we take aforementioned studies' line of argument Pakistan can be categorized into 'low-money-growth and

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[8] As quoted in Barnett and Samuelson (2007, p. 178).

[9] Many, such as the Governor of Bank of England Mervyn King, still believe that ignoring money might turn out to be costly and that sooner or later it would make a comeback in standard models. Quoting Hilaire Belloc he concludes an interesting article on the role of money in the economy as, "I'm tired of Love: I'm still more tired of Rhyme/But Money gives me pleasure all the time." (King, 2003, p.86).

low-inflation' countries. This brings our result of the absence of QTM in Pakistan in line with the international evidence.

Furthermore, our finding of the income velocity of money as unstable is a widely accepted phenomenon in quite a few countries of the world. Similarly, our confirmation of the presence of endogenous money in Pakistan is also in line with the established Post Keynesian hypothesis. These results point to the fact that we might need to rethink on monetary targeting monetary policy strategy in Pakistan.

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Comments

Omer and Saqib's skeptical note goes a long way in reminding both academics and practitioners in monetary policy (central bankers) the complexities and uncertainties in formulating and implementing monetary policy. While the objective of the paper is stated to be an evaluation of monetary targeting strategy in Pakistan, there is hardly any systematic or direct evaluation of this regime. Instead, the authors focus on testing the applicability of QTM, instability of income velocity and endogeneity of money in Pakistan. After rejecting the former and accepting latter two hypotheses, they indirectly conclude rethinking monetary strategy in Pakistan.

Omer and Saqib (O&S) henceforth follow De Grauwe and Polan (2005)[*] in testing the Quantity Theory of Money (QTM) in Pakistan. While De Grauwe and Polan test both the proportionality and orthoganality hypotheses of QTM, O&S confine to testing proportionality hypothesis i.e., x% change in money leads to exactly x% change in inflation. Orthoganality hypothesis, also known as the (super) neutrality of money –a permanent increase in the growth rate of money leaves output and velocity unaffected in the long run–is not discussed by O&S. While they succeed in rejecting the proportionality hypothesis, their estimation reveals that x% change in money leads to an almost x/2% change in inflation with a lag of 2 years. Moreover, the coefficient of money was also found to be significant, besides being close to ½ (0.469 to be exact). Here, a simple question arises: Is monetary targeting not appropriate when money supply change leads to a significant (though less than proportionate) change in inflation?

Since the above question is neither posed in the paper nor there is any discussion, why the targets of inflation or money growth were not met in Pakistan, it is difficult to agree with the contention of the authors that monetary targeting is not appropriate in Pakistan. A direct evaluation, had it been done, could have shown the possibility that it was actually the absence of required policy actions dictated by monetary targeting regime; a primary cause of failure in achieving inflation targets in Pakistan, i.e., monetary targeting regime was, perhaps, not really

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[*] De Grauwe, P. and M. Polan (2005). "Is Inflation Always and Everywhere a Monetary Phenomenon." Scandinavian Journal of Economics, 107: 239-259.

followed in spirit. In fact, authors' reported results of money coming out as a significant explanator of inflation could itself be taken as a rationale for adopting monetary targeting in Pakistan!

After brushing aside the proportionality hypothesis of QTM, O&S turn to testing the stability of velocity of money. They test to assess the stationarity of time series of velocities of 30 years (1975-2006) by applying the ADF test. Apparently, there is no technical problem in applying the ADF test on a 30-observation time series. However, inspection of velocity series in Figure 2 of the paper reveals that omitting a few initial observations can alter the result of ADF test. Here, the researchers' judgment becomes important in deciding whether applying ADF test (or any other test) is appropriate in this situation. De Grauwe and Polan test QTM, in a cross-country context with a 30-year time series of 116 countries, it would be difficult to dispute with 'largeness' of their 30-year series. However, within the context of a national study, more caution is needed in applying ADF test even on a 30-year time series.

After rejecting the stability (or stationarity) of velocity time series, O&S turn to assessing the endogeneity of money. Before I comment on their results, it may be appropriate here to give a central banker's simple non-academic perspective on the debate related to exogeneity/endogeneity of money. This debate is largely irrelevant to central bankers, who usually take it for granted that money is indeed endogenous. For money to be a policy variable, it is not necessary that it be set directly. In fact, it can hardly be set directly; its course of change is usually altered indirectly by changing the very short-term (usually overnight) rates in money market. Central bankers also know that they have relatively more control in influencing short-term rates compared to directly influencing reserve money or other monetary aggregates. Also, at the operational level, monetary targeting and inflation targeting regimes become very similar. Differences in triggering the policy changes in short-term rates are crucial. For example, implementation of monetary aggregate targeting would require increase in short-term rates when actual money is exceeding its target and inflation targeting would require the same when forecast inflation is exceeding its target. Of course, there are many other differences as well between different regimes. The main point is that it does not automatically follow from the fact that if money is endogenous, monetary targeting is necessarily inappropriate.

I conclude by saying that Omer & Saqib's paper is an important contribution to monetary policy related literature in Pakistan. They succeed in rejecting the proportionality hypothesis of QTM, but remain silent on (super) neutrality hypothesis. They also claim rejecting the stability in velocity of money (to which I remain skeptical). Finally, they also establish the endogeneity of money in Pakistan–a result hardly surprising to central bankers.

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Comments

The study picks very relevant topic having far reaching implications for the conduct of monetary policy. In case of Pakistan, the literature is scanty on this topic and this is good initiative by authors and must be commended. Monetary targeting approach, which according to the authors the State Bank is pursuing, has been abandoned by most of the central banks. The reason was three-fold: (a) instability of the money demand function; (b) endogeneity of money supply; and (c) instability of velocity of money. This study finds that quantity theory of money, which provides the base for monetary targeting, does not hold in case of Pakistan. Furthermore it also suggests that money is endogenous and velocity is not stable as well. On the basis of these findings authors suggest to consider some alternative to monetary targeting. My few comments on this study are as follows:

1) No justification is given to cover the period 1975-2006. Pre- and post- periods were highly inflationary.
2) OLS is used to estimate Eq(4), the quantity theory of money. Time series properties of the data are not checked. There is possibility of co-integration between these variables which give long run relationship between variables. This could be better option in this case.
3) It is always better to plot data to look at behavior of the variables (for example trend, drift or mean revertibility).
4) While estimating Eq(4), 2nd lag of M2 is used and Wald test shows that coefficient is different from unity. But does this invalidate quantity theory of money. It may be possible that impact of M on inflation appears in episodes. High frequency data may provide better picture.
5) Though the coefficient is significantly different from unity, changes in M2 reasonably influence inflation.
6) Results of diagnostic tests like normality, serial correlation, heteroskedasticity and coefficient stability may be reported.
7) Table 5 presents ADF test on velocities of different aggregates. It is not clear how these velocities are obtained. If these are residuals from equation 4, there is contradiction between earlier statement that residuals is white noise{I(0)} and results presented in table 4 showing that velocities are I(1).
8) Variable LCPS is not defined. Furthermore whether it is only variable that affects M2. There could be misspecification problem.
9) Some detail on bound test should have been provided.

Success or failure of any policy depends on whether pre conditions for that particular policy are fulfilled. For example, monetary targeting contains three basic elements (Frederic S. Mishkin, 2000): (a) how reliable are information conveyed by a monetary aggregate to conduct monetary policy; (b) whether announcement of targets for monetary aggregates is made; and (c) existence of accountability mechanism to avoid large and systematic deviations from the monetary targets. Monetary targeting has been successful policy option in Germany and Switzerland. In other countries, however, it did work well.

Success of inflation targeting requires even more conditions to be fulfilled. These are: (a) setting medium-term numerical inflation targets accessible to general public; (b) commitment to achieve the inflation goal; (c) Many variables beside monetary aggregates are considered for policy decisions; (d) transparent strategy that involves communication with all agents regarding the plans and objectives of policy; and (e) more accountable central bank. Other policy options such as exchange rate targeting or following Taylor type rule have their own limitations especially in an economy like Pakistan. Therefore, further research is needed to answer the questions like which alternative could be best policy option. It is possible that, in current scenario, monetary targeting may be least of the worst alternative. Keeping in mind aforementioned, this study provides a launching pad to deeper investigations in this regard, i.e., to compare different policy options on the basis of loss function and feasibility in context of Pakistan.

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