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Assessing the Role of Money versus Interest Rate in Pakistan

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Assessing the Role of Money versus Interest Rate in Pakistan

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Abstract

We empirically examine the role of monetary aggregate(s) vis-à-vis short term interest rate as monetary policy instruments, and the impact of State Bank of Pakistan's transformation towards the latter on their relative effectiveness in terms of inflation in Pakistan. Using indicators of 'persistent changes' in the underlying behaviors of variables of interest, we found that broad money consistently explains inflation in (i) monetary, (ii) transitory and (iii) interest rate regimes. Though its role has receded whilst moving from the transition to the interest rate regime, the interest rate instrument seems to be positively related to inflation, a phenomenon commonly known as price puzzle. In light of these findings, we recommend that the role of money should not be completely de-emphasized while moving towards flexible inflation targeting regime as planned.

Keywords: Monetary policy instruments, price puzzle, ARDL, Pakistan

JEL Classification: E31, E52

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Non-technical Summary

Pakistan's monetary policy framework has evolved over time. Like other countries, the focus is tilting towards price stability, which unequivocally is deemed essential for the achievement of a sustainable economic growth. Along with the tilt in preference, as is evident from State Bank of Pakistan's Strategic Plan (for 2016-2020) to adopt flexible inflation targeting by 2020, several encouraging developments at institutional level have occurred. One of interesting developments is the shift in focus from quantity of money as an instrument of monetary policy to interest rate. Whether this shift of the SBP focus from monetary aggregates towards the use of interest rate as an instrument of monetary policy has been effective (to tame inflation); and should the former be completely deemphasized vis-à-vis the latter are the major policy relevant questions, which this research has endeavored to empirically explore, in a closed economy setting. The main findings of this research are as follows:

1. Broad money significantly and consistently explains inflation throughout monetary, transition and interest rate regimes.
2. With the increased focus on interest rate, the role of monetary aggregates has receded. Yet controlling money supply still has the capacity to effectively counter inflation.
3. Interest rate, on the other hand, has seemingly positive relationship with inflation, a phenomenon commonly known as 'price puzzle' in the literature. There is a need to explore it further. When taken in isolation, the positive magnitude of the interest rate has receded while moving from transition regime to the interest rate regime.

In light of above findings the role of monetary aggregates should not be completely deemphasized in the wake of the intended flexible inflation targeting framework.

1. Introduction

Although the debate about the choice of an appropriate monetary policy instrument is well known, it is far from being settled. The main instruments over which the contention has remained are the price—interest rate—and quantity of money.[1] While there is a consensus that both cannot be used simultaneously to influence the target variables (Turnosky, 1975), studies concluded differently on their relative effectiveness as monetary policy instruments. For example, Sargeant and Wallace (1975) argued that reserve money is a better instrument as compared to the interest rate because the latter suffers from the problem of equilibrium indeterminacy. Similarly, Bhattacharya and Singh (2007) found that money maximizes welfare in the presence of real shocks.[2] Gordon (1979) on the other hand concluded in favor of the superiority of the interest rate over monetary instrument for Canada. Similarly Atkeson et al. (2007) found that interest rate has a natural advantage over quantity of money as monetary policy instrument.

Research has also indicated that a combination policy (a certain mix between interest rates and money), as given in Poole (1970) instead may be a better option. He chalked out a theoretical framework for a combination policy; however his static unified framework only allows answering the underlying question of the relative effectiveness of monetary policy instruments in terms of output; rather than the inflation, taming which is the prime objective of most of the central banks today.[3]

Monetary policy practices at the State Bank of Pakistan (SBP), the country's central bank have varied over time (see Hanif, 2014 for details). Historically money played an important role as a monetary policy instrument. The focus nevertheless has now shifted towards interest rate and currently an interest rate corridor system is in place effective from August, 2009 (Hussain, 2009; Khan, 2010 and Hanif, 2014). Whether this transition from focus on quantity of money towards the use of interest rate as an instrument of monetary policy has been effective; and should the former be completely deemphasized vis-à-vis the latter are crucial questions yet to find research-based answers. It is also important to ascertain if the transformation of Pakistan's monetary policy's focus from targeting monetary aggregates towards the active use of short term interest rate has any bearing on their relative effectiveness in terms of inflation in the country.

To the best of our knowledge, this is an unexplored research area. In a related attempt, Ali and Ahmad (2014) explored the relative performance of inflation, and price level targeting regimes under alternative monetary policy instruments, and found money as a better performer relative to interest rate for Pakistan. Their analysis, however, is based on calibrating their model while using parameters from Din and Khan (2011), which used annual data from 1972–2009. Neither their focus was nor could their study (by construct) observe the evolution of the relative role of money and interest rate—especially in the context of SBP's transition from the former to the latter—which was completed by 2009. It therefore did not take into account the full-fledged interest rate regime. Most recently Ahmad et al. (2016) theoretically evaluated the role of money in propagating business cycle fluctuations in Pakistan and found that cash based economy models under money growth rule perform well as compared to the cashless economy models with Taylor type rule.

[1]Atkeson et al. (2007) accounts for exchange rate as one of the instruments in addition to interest rates and money.
[2]It may be noted that they also found that in the presence of nominal and relatively small shocks instead of money, interest rate instrument is better.
[3]Woglom (1979) and Benaive and Richard (1983) are among others who have worked on similar lines.

In contrast to the approaches used in above cited literature, we use; i) the framework used by Hayat et al. (2016) to extract indicators of persistent changes in the variables of interest to be able to closely observe the most relevant underlying relationships and, ii) apply ARDL approach for estimation of such relationships.

The results indicate that money remains a consistent performer vis-à-vis interest rate but its role has been receding with an increased focus of SBP on interest rate as a monetary policy instrument. Nevertheless, there is an evidence of a positive relationship between interest rate and inflation, which is indicative of the possibility of a price puzzle. It needs more research. It may be advisable for the SBP not to completely de-emphasize the use of money as an instrument of monetary policy (vis-à-vis interest rate) as it has been significantly effective in taming inflation in the country.

We organize our paper as follows. Section 2 lays down methodological framework for generation of indicators of persistent changes in variables of interest. Section 3 discusses testing and estimation strategy, specifies the model, and highlights data. Section 4 brings forth the results and discussion while Section 5 examines the soundness of the generated indicators for analysis and a sort of robustness of the results found in this study. Section 6 concludes the paper.

2. Methodological Framework

In order to examine the relative importance of money versus interest rate as monetary policy tools as well as their evolution over time, following Hayat et al (2016), we first generate indicators representing persistent variations in variables of interest, and then use them to estimate their long-term relationships through ARDL approach. Generating indicators of persistent variation is important because only a fraction of variations in monetary policy instruments may tend to relate to a fraction of variations in target variables (such as inflation and/or real economic growth) given that the central bank may not necessarily exercise full control over the variations in monetary policy variables especially broad money. This postulation, as a starting point is consistent with Bullard (1999); Uhlig (2005) and Hayat et al. (2016). We derive indicators of persistent variations from a) growth in broad money, b) market interest rate, c) inflation, and d) real GDP growth rate in two steps as follows.

In the first step the Hodrick and Prescott (1997) filter—henceforth HP filter—is applied to decompose the observed series (X_t), which we call base variable in this study, into its permanent (long term) path (Xl_t) and the transitory fluctuations (Xf_t). The Xf_t are obtained by subtracting the long-term path from the observed time series X_t such that $Xf_t = X_t - Xl_t$. In the second step, we apply HP filter to Xf_t to extract its permanent part (Xfl_t), which we consider as an indicator of persistent variations in X_t. One may ask about the justification of use of the HP filter. First, our choice of this filter is driven by the fact that HP filter allows the trend to vary over time and hence the magnitudes of deviations, which may better represent policy responses (variations) in the underlying policy as well as goal variables (Hayat, et al. 2016). Second, double HP filter outperforms other detrending and smoothing methods in turning point signal stability i.e. identifying turning points quickly (Nilsson and Gyomai, 2011), which are reflective of structural changes and hence regimes. This feature is important because our purpose is to observe the evolution of money and interest rate instruments across different regimes: (i) monetary, (ii) transitory and (iii) interest rate regimes.

For all the four (base) variables—broad money growth, interest rate, inflation and real GDP growth rate—we therefore apply the two step procedure to obtain our desired indicators of persistent variations as follows.

2.1 Indicator of Persistent Variations in Broad Money Growth

In the first step the HP filter is applied to decompose the observed series of growth in M2 (denoted by $\dot{m}2_t$) over time into its long-term growth path $\dot{m}2l_t$ and the fluctuations around it $\dot{m}2f_t$, such that:

$$\dot{m}2_t = \dot{m}2l_t + \dot{m}2f_t \qquad \text{for } t = 1, \ldots\ldots, T.$$

In the second step, the HP filter is applied to $\dot{m}2f_t$ to obtain its long-term trend path, which corresponds to persistent variations, denoted by $\dot{m}2fl_t$ such that:

$$\dot{m}2f_t = \dot{m}2fl_t + \dot{m}2ff_t \qquad \text{for } t = 1, \ldots\ldots T,$$

$$\Longrightarrow \dot{m}2fl_t = \dot{m}2f_t - \dot{m}2ff_t \qquad \text{for } t = 1, \ldots\ldots T.$$

Where $\dot{m}2fl_t$ is the desired series representing persistent variations in broad money growth.

2.2 Indicator of Persistent Variations in Interest Rate

Similarly, the HP filter is applied to decompose the interest rate (i_t) over time into its long-term path and the fluctuations around it. In the first step:

$$i_t = il_t + if_t \quad \text{for } t = 1, \ldots\ldots T.$$

In the second the HP filter is applied again to if_t to obtain its long-term path of our interest ifl_t as follows:

$$if_t = ifl_t + iff_t \quad \text{for } t = 1, \ldots\ldots T.$$

$$\Longrightarrow ifl_t = if_t - iff_t \quad \text{for } t = 1, \ldots\ldots T.$$

2.3 Indicator of Persistent Variations in Inflation

The two-step strategy of application of HP filter is also employed to generate indicators of inflation, and real GDP growth as follows:

$$\pi_t = \pi l_t + \pi f_t \quad \text{for } t = 1, \ldots\ldots T,$$

where π_t is inflation rate in time t. The πl_t is its long-term path in time t and πf_t represents the fluctuations around πl_t over time. In the first step, the HP filter is applied to π_t to obtain πl_t and πf_t. In the second step, the HP filter is applied to πf_t to obtain its long-term path such that:

$$\pi f_t = \pi fl_t + \pi ff_t \quad \text{for } t = 1, \ldots\ldots T.$$

$$\Longrightarrow \pi fl_t = \pi f_t - \pi ff_t \quad \text{for } t = 1, \ldots\ldots T.$$

Where, πfl_t is the desired inflation indicator.

2.4 Indicator of Persistent Variations in Real GDP Growth Rate

Likewise, the strategy of the application of the two-step HP filter is used to obtain the real GDP growth indicator. Firstly, the time series of the growth in real GDP ($\dot{y}_t$) is decomposed into its long-term growth path $\dot{y}l_t$ and the fluctuations around it i.e. $\dot{y}f_t$ such that:

$\dot{y}_t = \dot{yl}_t + \dot{yf}_t \quad$ for t = 1, … … . . T.

Secondly, the HP filter is applied to $\dot{yf}_t$ to obtain its long-term path as:

$\dot{yf}_t = \dot{yfl}_t + \dot{yff}_t \quad$ for t = 1, … … . . T.

$\Longrightarrow \dot{yfl}_t = \dot{yf}_t - \dot{yff}_t \quad$ for t = 1, … … . . T.

Where, $\dot{yfl}_t$ is the desired real growth indicator.

3. Estimation Approach, Model Specification and Data

We use auto regressive distributed lag (ARDL) bounds testing and estimation approach to cointegration proposed by Pesaran and Shin (1999) and Pesaran et al. (2001) to obtain long-run parameter estimates. The estimators of the ARDL are super-consistent for long-run coefficients and it performs particularly well in small samples without losing long-run information. The ARDL approach allows the selection of optimal dynamic model. Since, Pesaran and Pesaran (1997) and Pesaran and Shin (1999) reported that Schwartz Bayesian Criterion (SBC) is a consistent model selection criterion in small samples and that it selects a relatively more parsimonious model (Enders, 1995), we use SBC. The ARDL works even in the presence of endogenous regressors irrespective of the order of integration (1 or 0) of explanatory variables (Pesaran and Pesaran, 1997; Pesaran and Shin 1999).

Operationally, the ARDL is a two-stage procedure. The first stage is to test for the existence of cointegration by computing the F-statistic. Since the asymptotic distribution of this F-statistic is non-standard, Pesaran et al. (2001) tabulated two sets of appropriate critical values both for I(0) and I(1), for different numbers of regressors (k) with and without intercept and trend. If the computed F-statistic falls outside the band for respective critical values of I(0) and I(1), cointegration exists. If it falls within that band then the result of the inference is inconclusive. In the second stage, long-run coefficients are obtained, provided the cointegration is established in the first stage. In general form, the error correction version of our ARDL model may be given as:

$$\Delta\pi fl_t = \emptyset_0 + \sum_{i=1}^{p} \emptyset_i \Delta\pi fl_{t-i} + \sum_{j=0}^{q1} \emptyset_j \Delta \dot{m2}fl_{t-j} + \sum_{k=0}^{q2} \emptyset_k \Delta ifl_{t-k} + \sum_{m=0}^{q3} \emptyset_m \Delta \dot{y}fl_{t-m} +$$

$$\gamma_0 \pi fl_{t-1} + \gamma_1 \dot{m2}fl_{t-1} + \gamma_2 ifl_{t-1} + \gamma_3 \dot{y}fl_{t-1} + \epsilon_t. \qquad (1)$$

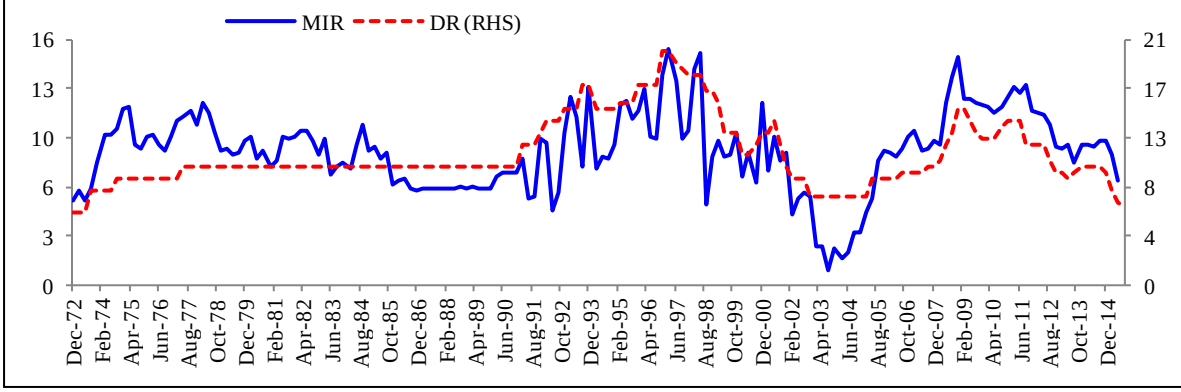
Where πfl, $\dot{m2}$fl, ifl, and $\dot{y}$fl are inflation, broad money growth, interest rate and real GDP growth rate indicators, respectively. The Δ denotes the first difference operator and ϵ is the error term.

We use quarterly data series from Q1-1974 to Q2-2015. We also analyzed the regime wise subsamples: monetary (1974-1995), transitory (1995-2009) and interest rate regimes (2009-2015)[4]. The main variables are expressed in terms of a year on year (YoY) change in CPI, real GDP and broad money—which allows us to control possible seasonality—while the call money rate (as a proxy of policy rate) is in levels. Data for broad money growth and call money rate is taken from the SBP. Since the policy rate remained constant from 1977 to 1990 and also for a short span in early 2000s

[4] More specifically the respective data spans are as follows: Q1-1974 to Q1-1995, Q1-1995 to Q1-2009, and Q1-2009 to Q2-2015.

(Figure 1), we use call money rate as an alternative. The call money rate closely mimics the behavior of the policy rate. The correlation coefficient between policy rate and call money rate is 0.95.

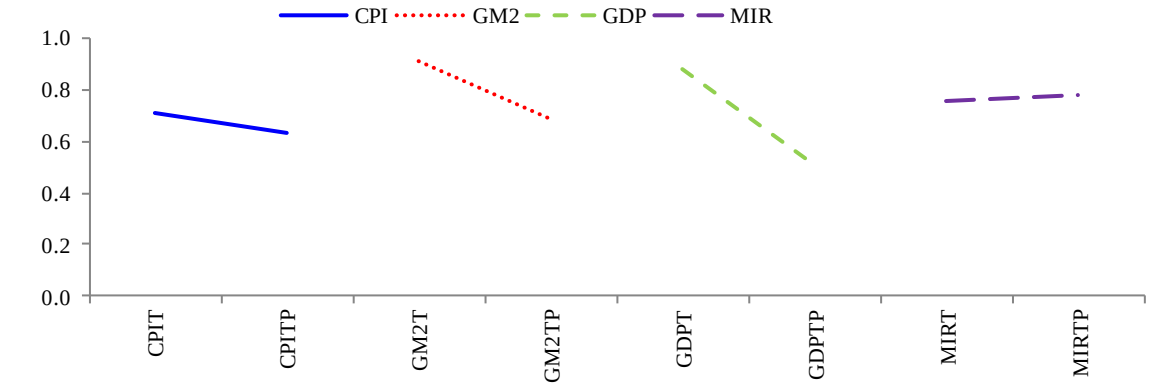
Figure 1: Call Money Rate (MIR) and Discount Rate (DR)



Inflation data is obtained from the country's national statistical agency, the Pakistan Bureau of Statistics (PBS). National income accounts are compiled by the PBS only on annual basis; we therefore use the quarterly GDP data for Pakistan for the fiscal years 1973–2012 estimated by Hanif et al. (2013). Since they quarterized the data only until 2012, we extended their data set up to 2015 while using the proportions therein for 2012, on the basis of the latest available annual data from the PBS for the period 2013–2015. It may be noted that for the entire series to be consistent, we transformed their series from 1974 to 2012 on the new base year i.e. 2005–2006.

In order to be confident whether our generated 'indicators' represent the behaviors in the respective base variables, and to make sure that it might not have led to a considerable loss of information, we checked their correlations with their respective base variables and cycle series. Figure 2 shows that by and large, double filtering has not resulted in loss of significant information as exhibited by correlation coefficients with respective base and cycle variables, especially in case of inflation and interest rate indicators. Instead it seems that rather the noise part has been purged, which may not necessarily be representing policy induced actions and responses in variables (see Hayat et al. 2016).[5] For example, the correlation between the base variable CPI inflation and its cycle series (CPIT) is 0.71 and that of CPI inflation and our generated indicator is 0.63 (see Figure 2).

Figure 2: Correlation of the Base Variable with Respective Cycle Series and Generated Indicators



[5]A true test to this effect nevertheless would be for the indicators to yield intuitive results as against the base and cycle series (see Section 4 and 5).

4. Results

4.1 Model Selection, Diagnostics, and Cointegration Tests

Given the lack of theoretical guidance as to what should be the appropriate maximum lag length in a particular situation, we relied on a general-to-specific approach for selection of optimal lag lengths. We started with 10 quarters as the maximum lag length in case of full sample and used the SBC model selection criterion and selected a model with no issues like those pertaining to serial correlation, heteroskedasticity, and estimated coefficients' stability. This allowed lags for up to two and half years. It is a reasonable transmission time for the effects of monetary policy instruments at least in the case of Pakistan (considering past research in this area like Khan, 2008). In case of subsamples as well, any maximum allowable lag length (lower than 10) was tried during the selection process. We used the SBC model selection criterion as it selects the most parsimonious model.

For the model in equation (1), the null hypotheses of non-existence of a long-run relationship is given by $H_0: \gamma_1 = \gamma_2 = \gamma_3 = 0$ against the alternative $H_1: \gamma_1 \neq 0,\ \gamma_2 \neq 0,\ \gamma_3 \neq 0$. The F–statistics computed for the joint significance of γ_1, γ_2 and γ_3 for the full (1974–2015) and subsamples (1974–1995, 1995–2009 and 2009–2015) are 10.99, 17.51, 9.35 and 162.67, respectively. All these computed statistics exceed the corresponding critical value bands of Pesaran et al. (2001) for unrestricted intercept and no trend at 1% level, leading us to reject the null of non-existence of a long-run relationship. This implies that the decision to proceed with computing long-run coefficients is conclusive and there is no need to know the cointegration rank (Pesaran and Pesaran, 1997). The long-run parameter estimates are obtained subsequently.

Although we are mindful of the possibility of endogeneity, we have confidence in our estimates as the ARDL methodology works well even in the presence of endogenous regressors and irrespective of the order of integration [I(1) or I(0)] of explanatory variables (Pesaran and Pesaran, 1997; Pesaran and Shin 1999)[6]. Alternative methodologies to minimize the extent of possible endogeneity are 2SLS and GMM, which however require identification of 'instrumental variables'. Generally, it is hard to find 'instrumental variables' for the variables in the equation to be estimated. In such cases, suggestion in the empirical literature is the use of lagged variables. In this study, the way we have developed each indicator, it in itself is like an instrument for the underlying variable. And that the use of the lagged values of these indicators in ARDL modeling reduces the chances of endogeneity in our estimation.

4.2 Money versus Interest Rate Effectiveness—Regime-Wise Results

Since our objective is to assess if SBP should exert an increased emphasis on interest rate compared to the broad money and whether the transformation in the focus of Pakistan's monetary policy from the latter to the former has had any bearing on their relative effectiveness in terms of inflation, we conduct analysis of sub-periods that correspond to i) monetary targeting regime (1974–1995), ii) transition period from monetary targeting to interest rates as monetary policy instruments (1995–2009), and iii) an interest rate regime (2009–2015).[7] As a cross check, we used Bai Perron's (1998, 2003) test for identification of multiple breakpoints and found supporting evidence that breaks occurred in 1995 and 2009 (Appendix).

[6] We applied ADF test and found that none of the variables used in this study for ARDL model estimation is integrated of order higher than 1.

[7] See Hanif (2014) for a discussion on key developments in these phases.

The results do not reveal a clear picture when the estimations are carried out for the full sample from 1974 to 2015 as neither money nor interest rate has a significant role in explaining inflation in Pakistan (Table 1, column (a)). This may be due to the fact that during the entire sample period, SBP's monetary policy preferences in terms of use of instruments have varied, which has obscured the results for the overall sample. This, however, is not the case when we subsequently observe the results for the specific regimes.

Table 1: Long-Run Estimates

Variables	Full Sample 1974-2015 (a)	Monetary Regime 1974-1995 (b)	Transition Period 1995-2009 (c)	Interest Rate Regime 2009-2015 (d)
ifl	0.39 [0.12]	0.16 [0.67]	1.06 [0.00]***	0.61 [0.00]***
$m\dot{2}fl$	0.08 [0.57]	0.95 [0.02]**	1.26 [0.00]***	0.6 [0.00]***
$y\dot{f}l$	-0.81 [0.09]*	-5.93 [0.04]**	-1.37 [0.00]***	-1.7 [0.00]***
a	0.01 [0.38]	0.14 [0.01]	0.05 [0.05]	-0.07 [0.00]
$ECT(-1)$	-0.003 [0.00]***	-0.004 [0.00]***	-0.02 [0.00]***	-0.35 [0.00]***
ARDL	(8,3,6,4)	(8,1,5,8)	(5,2,5,0)	(2,0,2,2)
COIN	1%	1%	1%	1%
DW	1.86	2.1	2.03	2.18
R2	0.99	0.99	0.99	0.99

This table reports the long-run coefficients and the P-values. The latter are reported in square brackets. ARDL shows the order of the lags of the selected models whereas COIN stands for cointegration. ***, ** and * indicate significance at 1%, 5% and 10% level, respectively.

Supply side effects of real growth seem rather visible, which tend to reduce inflation. This result is consistent with Hayat et al. (2016), which found an inverse relationship between real growth and inflation indicators using annual data from 1961 to 2010. Although the question may remain that whether the real activity indicator used is proxying supply or demand side of the economy. We advocate the former because real growth in GDP is used rather than nominal. Furthermore as is visible from column (b) through (d) in Table 1, the magnitude of the effect of the real growth on inflation decreases, which make sense only when real growth represent an increased supply of goods and services—as the average real growth witnessed in the sample period used in columns (b) (c) and (d) are 5.60, 4.47 and 3.41, respectively.

During monetary targeting regime, the role of money in explaining inflation is both significant and quantitatively large as against interest rate (Table 1, column b). This result is consistent with a range of studies that has found brad money an important determinant of inflation in Pakistan such as Chaudhary and Ahmad (1996), Price and Nasim (1999), Khan and Schimmelpfennig (2006), Serfraz and Anwar (2009), Hayat et al. (2016), and Ahmed et al (2016). A straight forward policy implication for SBP from these results is that money plays a significant role in explaining inflation and therefore it may be used as an effective monetary policy instrument to tame it. It is however interesting to note that interest rate whilst being insignificant during the monetary targeting regime, grew in significance during the transition period to the interest rate regime (Table 1, column (c)).

Under the interest rate regime, both money and interest rate played a significant role in explaining inflation; however the quantitative effect of the latter is more pronounced in this regime as compared to the transition regime. On the other hand, the quantitative effect of broad money receded vis-à-vis the interest rate instrument during the transition period. These results imply that the shift in focus from monetary aggregates towards interest rate as monetary policy instrument has had implications both for the relative importance and significance of the two monetary policy instruments.

When taken in isolation, although the interest rate instrument grew in significance during transition and interest rate regimes, it may not effectively guide the monetary policy as it brings forth an important monetary policy issue for the SBP, commonly known in the literature as 'price puzzle', wherein interest rate and inflation are positively related. Considering price puzzle issue we suggest that money should not be completely deemphasized. The phenomenon of price puzzle is well documented in related literature on Pakistan (for example Khan, 2008) as well as some other countries (see for example Sims, 1992).[8] Although requiring further in-depth research, in case of Pakistan, this phenomenon can possibly be explained by being gradual and sometimes accommodative monetary policy actions. For example, negative real (market) interest rates for most of the period under this study, with few exceptions, especially the period since September, 2011, where the real interest rate remained positive.

5. Soundness of Indicators and Robustness Check

To check whether our generated double filtered indicators has given intuitively consistent approximations of the underlying phenomena; we did the estimations using both the base data and cycle series. The results obtained using base data (Table 2)—although not as intuitive as the results obtained from our double filtered indicators—by and large provide support to our main results as compared to the results obtained using cycle series (Table 3).

Table 2: Long-Run Estimates Using Base Data

Variables	Full Sample 1974-2015 (a)	Monetary Regime 1974-1995 (b)	Transition Period 1995-2009 (c)	Interest Rate Regime 2009-2015 (d)
i_t	0.62	0.33	1.53	1.41
	[0.01]**	[0.34]	[0.00]***	[0.00]***
$\dot{m2}_t$	0.44	0.26	0.2	0.24
	[0.01]**	[0.12]	[0.51]	[0.46]
$\dot{y}_t$	0.01	-1.07	1.79	-0.39
	[0.98]	[0.02]**	[0.15]	[0.54]
a	-3.71	8.04	-16.49	-7.14
	[0.25]	[0.08]	[0.02]	[0.23]
$ECT(-1)$	-0.22	-0.29	-0. 29	-0.67
	[0.00]***	[0.00]***	[0.11]	[0.05]*
ARDL	(7,0,7,1)	(8,0,3,3)	(7,5,8,5)	(2,0,0,0)
COIN	1%	2.50%	Nil	Nil
DW	1.99	2.01	1.98	2.26
R2	0.9	0.86	0.98	0.83

This table reports the long-run coefficients and the P-values. The latter are reported in square brackets. Nil means no cointegration. ARDL shows the order of the lags of the selected models whereas COIN stands for cointegration. ***, ** and * indicate significance at 1%, 5% and 10% level, respectively.

[8] Javid and Munir (2010) also found similar results. Felipe (2009) and Naqvi and Rizvi (2010) are yet other studies that pointed towards this issue while examining the suitability of adoption of inflation targeting for Pakistan.

Table 3: Long-run Estimates Using Cycle Data

Variables	Full Sample 1974-2015 (a)	Monetary Regime 1974-1995 (b)	Transition Period 1995-2009 (c)	Interest Rate Regime 2009-2015 (d)
if_t	-0.31 [0.22]	0.09 [0.82]	0.33 [0.32]	-0.68 [0.49]
$m\dot{2}f_t$	-0.15 [0.18]	-0.20 [0.18]	0.23 [0.35]	-0.29 [0.46]
$y\dot{f}_t$	-0.01 [0.93]	-0.57 [0.08]*	0.22 [0.64]	1.85 [0.18]
a	-0.05 [0.81]	-0.10 [0.83]	0.03 [0.95]	-0.34 [0.52]
$ECT(-1)$	-0.46 [0.00]***	-0.34 [0.00]***	-0. 28 [0.04]**	-0.55 [0.01]**
ARDL	(8,3,6,1)	(5,0,3,0)	(5,0,0,1)	(2,1,0,1)
COIN	0.01	Nil	Nil	Nil
DW	1.98	1.95	1.70	2.30
R2	0.84	0.80	0.88	0.67

This table reports the long-run coefficients and the P-values. The latter are reported in square brackets. Nil means non existence of a cointegrating relationship. ARDL shows the order of the lags of the selected models whereas COIN stands for cointegration. ***, ** and * indicate significance at 1%, 5% and 10% level, respectively.

All the mainstream models obtained using double filtered indicators not only fit the data well but also approximate cointegrating relationships as compared to the models that instead use the variables in base and cycle form. The results obtained using cycle series are highly inconsistent, largely depict incorrect signs and do not pick the breaks, thus failing to track the evolution in the relative role of money versus interest rates. On the contrary the results obtained using the model with generated indicators better identifies the breaks in a cointegrating relationship (see Appendix).

As far as the robustness is concerned, our results are largely robust to alternative specifications for almost all the sample sizes. First we dropped the real growth indicator and estimated the model for all the regimes. Second we ran the regressions for interest rate and broad money indicators both individually and in combination which led us to conclude in favor of our main findings.[9] Since we also found evidence of structural break in 1982–83 (Appendix), we controlled for it through dummy variable and re-estimated our models (a) and (b) in Table 1 just in case the results turn out to be different than without controlling for the structural break. Our inference from the new results obtained however remained unaltered.[10]

6. Conclusion

Pakistan's monetary policy has evolved over time. The evolution of the relative role of money and interest rate is examined across three phases of monetary policy experience in Pakistan i.e. regime of targeting monetary aggregates, period of transition towards interest rate and interest rate regime. A framework has been chalked out that allowed generation of indicators capturing persistent variations

[9]For brevity purposes, these results however are not reported and may be obtained from the corresponding author if needed.

[10] These results are not reported and may be obtained from corresponding author upon request.

in underlying variables. Broad money is found to consistently perform vis-à-vis interest rate throughout the entire spectrum in controlling inflation in the country. Its quantum effect, however, started receding during the transition period and almost equalized the interest rate instrument during the interest rate regime. The role of interest rate is found to be puzzling as it is positively and significantly related to the inflation. The use of the interest rate by SBP therefore may not be as effective as desired unless this puzzle is explored and addressed. Since broad money is still effective, its role should not completely be deemphasized.

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Appendix

Table 1A Bai-Perron Multiple Break Points Test

Breaks	F-Statistic	Critical Value	Break year(s)
1*	41.8	18.26	1982
2*	55.89	14.45	1983, 1991
3*	56.67	12.16	1983, 1991, 2005
4*	61.99	10.56	1983, 1989, 1995, 2006
5*	56.68	8.71	1983,1989,1995,2002, 2008

* Denotes significance level at 1%. A trimming level of 15% was used and the maximum breaks allowed were 5. The critical values are that of Bai and Perron (2003).