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Assessing the Role of Money versus Interest Rate in Pakistan

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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 behaviours 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-emphasised.

JEL Classification: E31, E52
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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 at the same time 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 rates because the latter suffers from the problem of equilibrium indeterminacy. Similarly Bhattacharya and Singh (2007) found that money maximises welfare in the presence of real shocks.[2] Gordon (1979) on the other hand concluded in favour of the superiority of the interest rate over monetary instrument for Canada. Similarly Atkeson, *et al.* (2007) found that interest rates have a natural advantage over money instrument.

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[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 instruments are better.

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)]. 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 of the SBP from an increased focus on money towards the use of interest rate as an instrument of monetary policy has been effective; and should the former be completely de-emphasised *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 over time 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 base economy models under money growth rule perform well as compared to the cashless economy models with Taylor type rule.

In contrast to the aforecited 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 the 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. Therefore, it may be advisable for the SBP not to completely de-emphasise 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 organise the structure of the remainder of our paper as follows. Section 2 lays down methodological framework for generation of indicators of persistent changes in

[3]Woglom (1979) and Benaive and Richard (1983) are among others who have worked on similar lines.

variables of interest. Section 3 discusses testing and estimation strategy, specifies the model, highlights data. Section 4 brings forth the results and discussion while Section 5 examines the soundness of the generated indicators for analysis and robustness of the results. At the end 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 (see next section). This is important because only a small fraction of variations in monetary policy instruments may tend to relate to a small 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) 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 is the 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 the 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 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 $\dot{m2}_t$) over time into its long-term growth path $\dot{m2}l_t$ and the fluctuations around it $\dot{m2}f_t$, such that:

$$\dot{m2}_t = \dot{m2}l_t + \dot{m2}f_t \qquad \text{for } t = 1, \ldots\ldots, T.$$

In the second step, the HP filter is applied to $\dot{m2}f_t$ to obtain its long-term trend path, which corresponds to persistent variations, denoted by $\dot{m2}fl_t$ such that:

$$m\dot{2}f_{\mathrm{t}} = m\dot{2}fl_{\mathrm{t}} + m\dot{2}ff_{\mathrm{t}} \quad \text{for } t = 1, \dots \dots . . T,$$
$$\Rightarrow m\dot{2}fl_{\mathrm{t}} = m\dot{2}f_{\mathrm{t}} - m\dot{2}ff_{\mathrm{t}} \quad \text{for } t = 1, \dots \dots . . T.$$

Where $m\dot{2}fl_{\mathrm{t}}$ 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:

$$i_{\mathrm{t}} = il_{\mathrm{t}} + if_{\mathrm{t}} \quad \text{for } t = 1, \dots \dots . . T.$$

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:

$$if_{\mathrm{t}} = ifl_{\mathrm{t}} + iff_{\mathrm{t}} \quad \text{for } t = 1, \dots \dots . . T.$$
$$\Rightarrow ifl_{\mathrm{t}} = if_{\mathrm{t}} - iff_{\mathrm{t}} \quad \text{for } t = 1, \dots \dots . . T.$$

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:

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

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:

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

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 ($\dot{y}_{\mathrm{t}}$) is decomposed into its long-term growth path $\dot{y}l_{\mathrm{t}}$ and the fluctuations around it i.e. $\dot{y}f_{\mathrm{t}}$ such that:

$$\dot{y}_{\mathrm{t}} = \dot{y}l_{\mathrm{t}} + \dot{y}f_{\mathrm{t}} \quad \text{for } t = 1, \dots \dots . . T.$$

Secondly, the HP filter is applied to $\dot{y}f_{\mathrm{t}}$ to obtain its long-term path as:

$$\dot{y}f_{\mathrm{t}} = \dot{y}fl_{\mathrm{t}} + \dot{y}ff_{\mathrm{t}} \quad \text{for } t = 1, \dots \dots . . T.$$
$$\Rightarrow \dot{y}fl_{\mathrm{t}} = \dot{y}f_{\mathrm{t}} - \dot{y}ff_{\mathrm{t}} \quad \text{for } t = 1, \dots \dots . . T.$$

Where, $\dot{y}fl_{\mathrm{t}}$ 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 models. Since, Pesaran and Pesaran (1997) and Pesaran and Shin (1999) reported that 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 for I(0) or 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) or 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:

$$\Delta\pi fl_t = \emptyset_0 + \sum_{i=1}^{p} \emptyset_i \Delta\pi fl_{t-i} + \sum_{j=0}^{q1} \emptyset_j \Delta m\dot{2}fl_{t-j} + \sum_{k=0}^{q2} \emptyset_k \Delta ifl_{t-k} + \sum_{m=0}^{q3} \emptyset_m \Delta\dot{y}fl_{t-m} + \gamma_0 \pi fl_{t-1} + \gamma_1 m\dot{2}fl_{t-1} + \gamma_2 ifl_{t-1} + \gamma_3 \dot{y}fl_{t-1} + \epsilon_t \quad \ldots \quad (1)$$

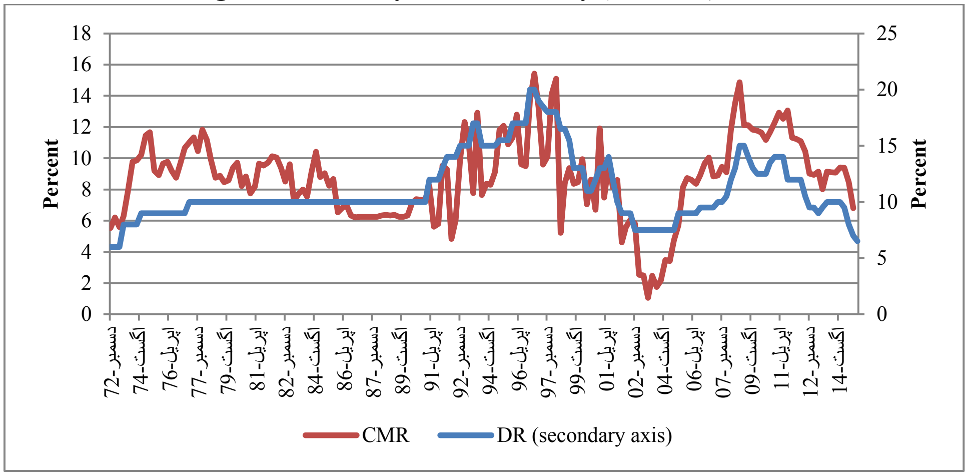
Where πfl, $m\dot{2}fl$, ifl, and $\dot{y}fl$ are inflation, broad money growth, interest rate and real GDP growth indicators, respectively. The Δ denotes the first difference operator and ϵ is the error term.

We use quarterly data series from Q1-1974 to Q2-2015. The main variables are expressed in terms of a year on year (YoY) change in CPI inflation, real GDP and broad money—which allows us to control of 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 SBP. Since, the policy rate remained constant from 1977 to 1990 (Figure 1), as an alternative, we therefore used call money rate. The call money rate closely mimics the behaviour of the policy rate.[4] The correlation coefficient between policy rate and call money rate is 0.95.

Inflation data is obtained from the national statistical agency, the Pakistan Bureau of Statistics (PBS). National income accounts are complied 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 qurterised the data only until 2012, we extended their data set up to 2015 while using the proportions therein, 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.

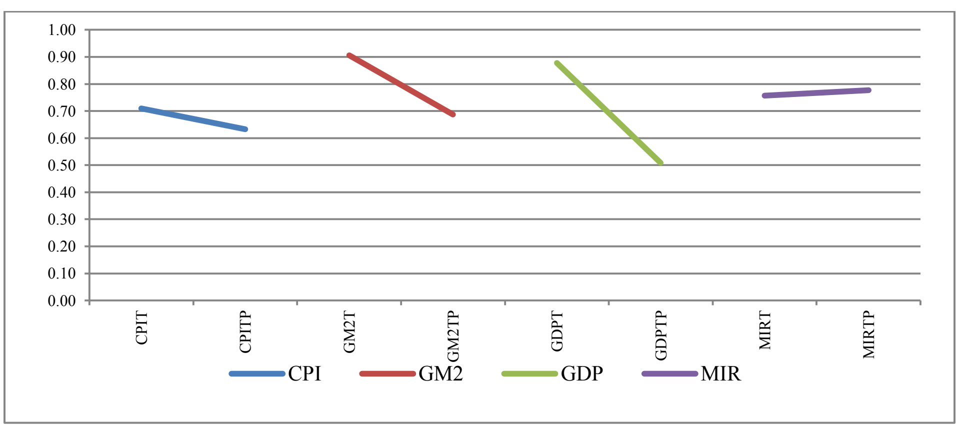
[4]We use nominal interest rate as the SBP uses nominal rather than real interest rate in its policy messages, and it is the nominal rate that is used/quoted by the banking system in its transactions.

Fig. 1. Call Money Rate and Policy (Discount) Rate



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 led us lose 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 goal variables as all the shocks may not be treated to be representing informed policy actions or responses [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).

Fig. 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, Diagnostic 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 imposition of optimal lag lengths. We started with 10 quarters as the maximum lag length in case of full sample and kept reducing unless we could pick a cointegrating model with no issues of serial correlation, heteroscedasticity, and estimated coefficients' stability. This allowed for up to two and half years, 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, 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 $H_0\colon \gamma_1 = \gamma_2 = \gamma_3 = 0$ against the alternative $H_1\colon \gamma_1 \neq 0,\ \gamma_2 \neq 0,\ \gamma_3 \neq 0$. The *F*–statistics computed for the joint significance of γ_1, γ_2 and γ_3 for the full (1974–2015) and sub-samples (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 percent 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 we used works well even in the presence of endogenous regressors irrespective of the order of integration [I(1) or I(0)] of explanatory variables [Pesaran and Pesaran (1997); Pesaran and Shin (1999)]. Alternative methodologies to minimise 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 that 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—Regime-wise Results

Since our objective is to assess if the 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).[6] Furthermore, as a cross check, we used Bai Perron's (1998) test for identification of multiple breakpoints and found supporting evidence that breaks occurred in 1995 and 2009 (Appendix 1). Further supporting evidence of these breaks can also be had from the cointegration graph for our full sample model (see the first panel of Appendix 2).

The results indicates that a clear picture cannot be seen 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 2, 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.

Supply side effects of real growth seem rather visible, which tend to reduce inflation. This result is consistent with Hayat, *et al.* (2016) which founded 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 2, 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 2, 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), Kemal (2006), Khan and Schimmelpfennig (2006), Serfraz and Anwar (2009) and Hayat, *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 2, 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.[7]

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

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

Table 2

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	0.16	1.06	0.61
	[0.12]	[0.67]	[0.00]***	[0.00]***
$\dot{m2}fl$	0.08	0.95	1.26	0.60
	[0.57]	[0.02]**	[0.00]***	[0.00]***
$\dot{y}fl$	–0.81	–5.93	–1.37	–1.70
	[0.09]*	[0.04]**	[0.00]***	[0.00]***
a	0.01	0.14	0.05	–0.07
	[0.38]	[0.01]	[0.05]	[0.00]
$ECT(-1)$	–0.003	–0.004	–0.02	–0.35
	[0.00]***	[0.00]***	[0.00]***	[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	2.10	2.03	2.18
R^2	0.99	0.99	0.99	0.99

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

The price puzzle issue is nontrivial as it renders the interest rate instrument ineffective [vis-à-vis the broad money instrument in conducting monetary policy], which is the main policy tool currently used by the SBP. We therefore suggest that money should not be de-emphasised.

5. SOUNDNESS OF INDICATORS AND ROBUSTNESS CHECK

To check whether our generated double filtered indicators has allowed us to obtain intuitively consistent approximations of the underlying phenomena; we did the estimations both using the base data and cycle series. The results obtained using base data (Table 3)—although not as intuitive as the results obtained from our double filtered indicators—by and large provide support to our mainstream results as compared to the results obtained using cycle series (Table 4).

All the mainstream models obtained using double filtered indicators not only fits the data well but also approximate cointegrating relationships as compared to the models that instead uses the variables in base and cycle form. The results obtained using cycle series are highly inconsistent, largely depicts 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 2).

Table 3

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)
$\dot{i}_t$	0.62 [0.01]**	0.33 [0.34]	1.53 [0.00]***	1.41 [0.00]***
$\dot{m2}_t$	0.44 [0.01]**	0.26 [0.12]	0.20 [0.51]	0.24 [0.46]
$\dot{y}_t$	0.01 [0.98]	–1.07 [0.02]**	1.79 [0.15]	–0.39 [0.54]
a	–3.71 [0.25]	8.04 [0.08]	–16.49 [0.02]	–7.14 [0.23]
$ECT(-1)$	–0.22 [0.00]***	–0.29 [0.00]***	–0. 29 [0.11]	–0.67 [0.05]*
ARDL	(7,0,7,1)	(8,0,3,3)	(7,5,8,5)	(2,0,0,0)
COIN	1%	2.5%	Nil	Nil
DW	1.99	2.01	1.98	2.26
R^2	0.90	0.86	0.98	0.83

This table reports the long-run coefficients and the *P*-values. The latter are reported in 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 percent, 5 percent and 10 percent level, respectively.

Table 4

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)
$\dot{if}_t$	–0.31 [0.22]	0.09 [0.82]	0.33 [0.32]	–0.68 [0.49]
$\dot{m2f}_t$	–0.15 [0.18]	–0.20 [0.18]	0.23 [0.35]	–0.29 [0.46]
$\dot{yf}_t$	–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	1%	Nil	Nil	Nil
DW	1.98	1.95	1.70	2.30
R^2	0.84	0.80	0.88	0.67

This table reports the long-run coefficients and the *P*-values. The latter are reported in 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 percent, 5 percent and 10 percent level, respectively.

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 favour of our main findings.[8] Since we also found evidence of structural break in 1982–83 (Appendix 1), we controlled for it through dummy variable and re-estimated our models (a) and (b) in Table 2 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.[9]

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 distinct 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 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 equalised 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 effective unless this puzzle is explored and addressed. Since broad money is still effective, its role should not completely be de-emphasised.

APPENDIX 1

Appendix 1

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 percent. A trimming level of 15 percent was used and the maximum breaks allowed were 5. The critical values are that of Bai and Perron (2003).

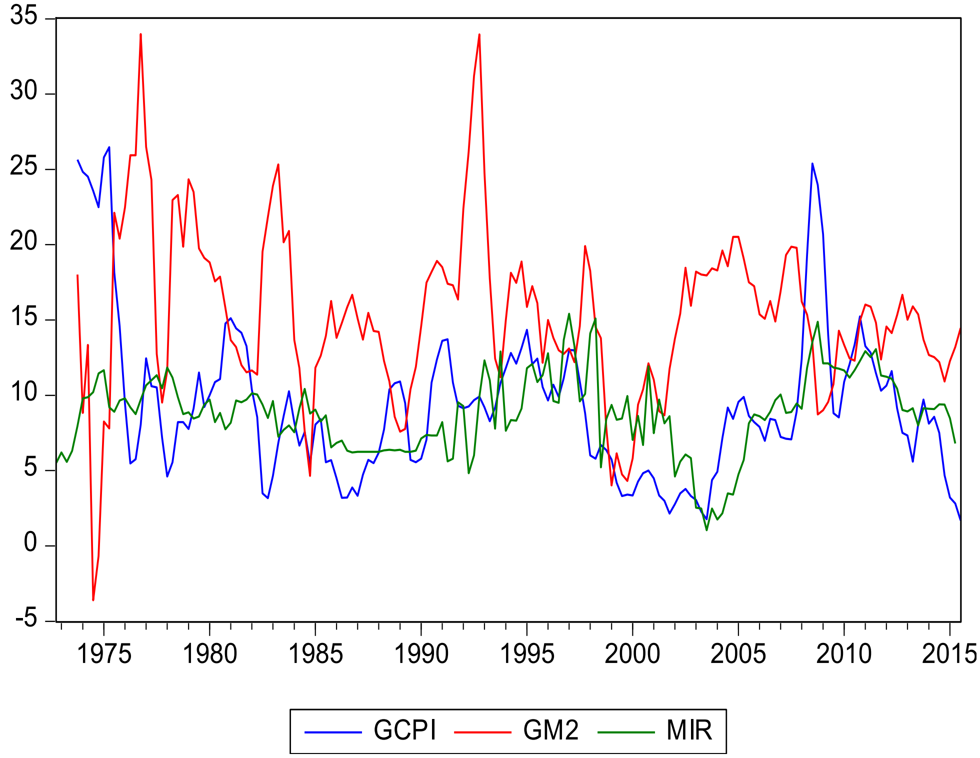
[8] For brevity purposes, these results however are not reported and may be obtained from the corresponding author if needed.

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

Appendix 2

Supplementary Material

Graph of Base Variables (GCPI is Inflation, GM2 is Growth in Broad Money, and MIR is Market Interest Rate)



Descriptive Statistics of the Base Variables

	GCPI	GM2	MIR
Mean	9.361266	15.30568	8.844052
Median	8.606444	15.00142	8.936667
Maximum	26.48080	33.99265	15.42333
Minimum	1.780676	–3.617128	1.050000
Std. Dev.	5.121828	5.568757	2.607813
Skewness	1.391459	0.245834	–0.292618
Kurtosis	5.340424	4.615676	3.544695
Jarque-Bera	92.00458	19.84619	4.447716
Probability	0.000000	0.000049	0.108191
Sum	1563.331	2556.049	1476.957
Sum Sq. Dev.	4354.698	5147.834	1128.914
Observations	167	167	167

Unit Root Tests of Base Variables

Table

Stationarity Properties of the Variables

	ADF		*PP*	
Variables	Level	First difference	Level	First difference
GCPI	[0.01]**		[0.01]**	
GM2	[0.00]***		[0.00]***	
MIR	[0.06]*	[0.00]***	[0.00]***	

This table reports the *P*-values of the Augmented Dicky–Fuller (*ADF*) and the Phillips–Perron (*PP*) tests in brackets. ***, ** and * indicate that the series are stationary at the 1 percent, 5 percent and 10 percent level of significance, respectively.

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