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Effectiveness of Monetary Policy in Controlling Inflation in Pakistan in the Presence of Positive and Negative Oil Price Changes

Habib-Ur-Rehman
Ex MPhil student
Quaid-i-Azam University, Islamabad
pirhabib099@gmail.com

Eatzaz Ahmed
Professor
Iqra University, Islamabad
eatzaz@iqraisb.edu.pk

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Abstract: *This study evaluates the effectiveness of monetary policy in controlling inflation in Pakistan. Using quarterly data from 1980 to 2022, the study finds that the policy rate is either an ineffective or counterproductive instrument, while the monetary base serves as an effective tool for controlling inflation. Significant evidence is found against the view that monetary policy is ineffective in controlling inflation in the presence of inflationary cost-push shocks. The study also finds that the effectiveness of monetary policy is asymmetric in combating inflation during inflationary and anti-inflationary oil price shocks. Despite these observations, the study recommends a cautious approach based on additional research involving diverse tools and experimentation with a gradual mixing of instruments.*

Keywords: Monetary policy, effectiveness, Pakistan.

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1. Introduction

The objectives of monetary policy have evolved over the past several decades. Since central banks have had to strive to strike a balance between often conflicting goals, they have learned from advancements in economic theory and their own experiences that their ability to control inflation and maintain financial stability is compromised by unsustainable efforts to influence real economic variables like output. (Taylor, 1993, 1999 and Mishkin, 2007). The targets of monetary policy have also transitioned from monetary aggregates to interest rates (see Taylor, 1993, 1999; Mishkin, 2007; Orphanides, 2007; and Bernanke, 2017).

A number of studies, including Nakata and Schmidt (2019) and Carvalho et al. (2021), indicate that monetary policy becomes more effective when agents' expectations regarding inflation align with the goals set by the central bank, which occurs only when the former believe in the competence of the latter. Akbari and Rankaduwa (2006) suggest that inflationary expectations are influenced by economic instability and uncertainty. Thus, the effectiveness of monetary policy is often constrained by external factors beyond the control of central banks, such as changes in global commodity prices.

While there is general consensus on the effectiveness of monetary policy in controlling demand-pull inflation, views are mixed regarding cost-push inflation. Some famous studies, such as Tobin (1972) and Gordon (1975), warn that overly aggressive monetary tightening in response to cost-push inflation may reduce output with little effect on the inflation rate, a position later supported by Blinder (1997). However, Woodford (2003) and Blanchard and Galí (2007) argue that monetary policy can still help anchor inflation expectations, thus limiting the second-round inflationary effects of supply shocks. Using an elaborate equilibrium model, Baeriswyl and Cornand (2010) show that the effectiveness of monetary policy in addressing cost-push inflation depends on its disclosure regime. In the presence of policy uncertainty, the central bank may find it optimal to accommodate the output gap at the expense of inflation. However, as the degree of transparency increases, the effectiveness of the policy in

combating inflation also increases, and the optimal policy becomes more aligned with fighting inflation.

The monetary policy framework in Pakistan is governed by the State Bank of Pakistan (hereafter SBP) Act of 1956, which initially focused on price stability and economic growth through aggregate monetary targeting. However, over the past three decades, this targeting regime transitioned to a mixed approach and eventually settled on interest rate targeting in 2009 (Hanif, 2014). Through a series of amendments to the Act in 1994, 1997, 2012, 2015, and 2022, the Bank gained operational autonomy in its policies, regulations, directives, and prescriptions. The 2012 amendment, which banned federal government borrowing from the Bank, left a loophole that was addressed by the unconditional ban in the 2022 amendment (See SBP-Amendment-Act-2012 and SBP Act 2022). The SBP now provides quarterly reports to the federal parliament and regularly issues the Monetary Policy Statement (MPS) to announce its monetary policy. It is important to note that the SBP has been proactive and consistent in pursuing its monetary policy.[1][2]

Regarding the effectiveness of monetary policy in Pakistan, the evidence is mixed. Masood and Ahmad (1980) observe that monetary policy has been somewhat influential on price levels. Chaudhry et al. (2015) demonstrate that both the interest rate and money supply serve as important instruments for controlling inflation. Nizamani et al. (2016) and Mukhtar and Younas (2019) also find that the interest rate is an effective tool for controlling inflation in the short run. Conversely, Qayyum (2008) notes that the monetary authority missed its inflation targets due to its failure to control the money supply. Choudhri et al. (2015) suggest that monetary policy has insignificant impacts on inflation, possibly due to frictions in the credit and exchange markets. However, further analysis of the data indicates that this explanation is insufficient. The study attributes the ineffectiveness of the policy to biases in the estimation of monetary shocks, caused by arbitrary recursive identification restrictions in the estimated VAR model used to retrieve the parameters of the structural VAR model. Munir (2018) also finds that monetary policy in Pakistan is

[1] For more detail on the monetary policy framework of Pakistan and its historical evolution, see Shah et al. (2018).

[2] A recent study by Samiullah and Ahmad (2025) observes that during the past 125 quarters monetary policy has remained consistent with the high-inflation situation for 74% of times and with the low-inflation situation for 62% of times compared to 42% and 52% consistency rates of fiscal policy with the high and low GDP growth situations respectively.

unable to control inflation because credit to the private sector suffers as a result of tight monetary policy.

The weak performance of monetary policy is often attributed to deficiencies in transmission channels. For instance, Khan and Khan (2012) suggest that bank loans and deposits have not played a significant role in the monetary transmission mechanism. Other studies, including Hussain (2009), Safia (2012), Shah et al. (2021), and Abdullah et al. (2021), also highlight the ineffectiveness of most transmission channels. Baig (2011) even finds all channels to be ineffective. Nasir et al. (2021) indicate that monetary transmission mechanisms have been weak due to low banking penetration and rigidities in the financial sector.

In its review reports for 2019 and 2023, the SBP underscores its efforts to enhance the transmission mechanisms through financial deepening and regulatory improvements. Hussain et al. (2022) observe that the effectiveness of monetary policy has improved over time due to advancements in policy formulation, implementation, and communication. The study claims that the transmission will strengthen as the economy fully adopts a free-floating exchange rate regime, avoids monetary financing of budget deficits, and implements flexible inflation targeting.

The empirical literature on Pakistan primarily analyzes the role of monetary policy in controlling inflation generally. Evidence regarding the effectiveness of this policy in managing inflation associated with supply shocks is mostly indirect and implied. For instance, Mangla and Hyder (2017) find that monetary policy remains effective in controlling inflation in the context of oil price shocks. However, the study uses the real T-bill rate as an indicator of monetary policy, which may not accurately reflect the actual policy instrument, the policy rate. Rehman (2014) and Zeshan et al. (2019) note that in the presence of positive oil price shocks, contractionary monetary policy can be counterproductive.

The evidence from other countries is also not encouraging. Rehman (2014) shows that contractionary monetary policy is counterproductive for India and Sri Lanka, though it is productive for Bangladesh. The study concludes that rising oil prices strengthen the supply side effect of monetary tightening. Analyzing interest rates, inflation, GDP, and exchange rate data, Hamzah et al. (2018) indicate that since inflation in Malaysia is driven by external factors, it is the most exogenous variable, whereas interest rates are the most endogenous variables. Therefore, the monetary authority cannot effectively control inflation and should instead

focus on the supply side. Chen and Semmler (2024) show that monetary policy in Australia is not very effective during episodes of wage-driven cost-push inflation.

It may be noted that in practice it is difficult to separate the components of inflation driven by supply and demand factors from the observed data. Commenting on the stagflation of the 1970s, Friedman (1975) opined that persistent inflation was caused by a misalignment of monetary policy rather than oil prices; a position echoed by Taylor (1999) and the famous quote of Clarida et al. (2000): "it is hard to imagine . . . oil shock alone could have generated high inflation . . . in the absence of an accommodating monetary policy." The presence of second-round effects through inflationary expectations (as noted in Woodford, 2003, and Blanchard and Galí, 2007) creates further doubts regarding the identification of supply-driven or demand-driven inflation.

The above observations notwithstanding, this study aims to analyze and compare the effectiveness of monetary policy in Pakistan in response to inflationary and anti-inflationary oil price shocks. Although supply shocks also encompass changes in other raw material prices, wage rates, and supply-chain channels, oil price variations are considered the predominant shocks for Pakistan for two reasons. First, oil is the largest import category, accounting for about 23% of imports during 2022-23 (Pakistan Economic Survey), making Pakistan's trade balance particularly sensitive to oil price fluctuations that affect the price level through various channels. Second, the culture of wage negotiations by labor unions has not yet developed in Pakistan. Therefore, it is reasonable to focus exclusively on oil price shocks for the country. The practice of relying on a single variable when analyzing supply shocks or even cost-push inflation is not uncommon. For instance, Chen and Semmler (2024) use the wage price index as the driver of cost-push inflation in Australia.

Inflation in the presence of positive or inflationary oil price shocks can be attributed to a cost-push factor, while inflation despite the presence of negative or anti-inflationary oil price shocks can likely be attributed to demand-pull factors. Thus, comparing the effectiveness of monetary policy in the two situations leads to the research question of whether the policy is as effective in dealing with inflation associated with cost-push oil price shocks as it is in dealing with inflation primarily linked to demand-pull factors. Regardless of whether inflation results from a shortage of aggregate supply or an excess of aggregate demand, tight monetary policy is, by design, intended to curtail aggregate demand. Therefore, not all

economists agree on the merit of unconditional monetary tightening to combat inflation. This question must be addressed directly, as proposed in this study.

A novel feature of the study is considering non-linearity in the response of inflation to monetary policy variables through partial-sum decomposition of data based on the direction of changes in a conditioning variable, specifically the oil price. This contrasts with the typical decomposition of a variable based on its own direction of changes, as proposed by Shin et al. (2013), who introduce the non-linear co-integration model in the literature, and followed by others such as Qureshi and Javed (2024) and Ullah et al. (2021).

The two instruments of monetary policy considered for this analysis are the policy rate (reverse repo rate) periodically announced by the State Bank of Pakistan and the quantity of base money, or M0. Since the supply-side and demand-side factors causing inflation differ, and monetary policy is designed to operate only through the demand side, the effectiveness of monetary policy in controlling the two types of inflation is expected to be different. If this expectation is observed to be valid, it would be necessary to incorporate asymmetry into monetary policy.

The study includes the oil price itself, the nominal exchange rate, and real GDP as control variables, and employs a Non-Linear Autoregressive Distributed Lags (NARDL) model using quarterly data from Q1 1980 to Q4 2022. Section 2 explains the methodology. Section 3 presents the results and discussion, while Section 4 concludes the study.

2. Methodology

Tightening monetary policy by increasing the central bank's policy rate is generally viewed as a counter-inflationary strategy. However, its practical effectiveness in controlling inflation rates is questionable. This is particularly true during stagflation when inflation stems from rising production costs and consequently a shortage of aggregate supply, rather than from expansion in aggregate demand. The primary argument against the effectiveness of tight monetary policy focuses on the role of interest rates in the cost of production. To understand this argument, let us examine how changes in interest rates influence the goods market.

The role of the interest rate in the goods market, noted in famous studies like Gordon (1975), Woodford (2003), and Blanchard and Galí

(2007), and explained in simple terms by Rehman (2014), arises from both demand-side and supply-side channels. On the demand side, an increase in the interest rate raises the cost of borrowing, which in turn reduces components of aggregate demand, particularly aggregate investment and aggregate consumption. The resulting decrease in aggregate demand lowers the price level. On the supply side, an increase in the interest rate raises the marginal cost of production by increasing the user cost of physical capital and the rental cost of operational capital. This, in turn, reduces aggregate supply and consequently raises the overall price level. Therefore, an increase in the interest rate has a counter-inflationary effect through aggregate demand and an inflationary effect through aggregate supply, the latter often referred to as stagflation.

Several factors influence which of the two effects will be stronger. First, the relative strength of these effects depends on whether monetary policy is examined from a short-run or long-run perspective. The tight monetary policy aimed at combating inflation has an immediate contractionary effect on aggregate demand, while its contractionary impact on aggregate supply may be delayed due to the adjustment costs involved in adjusting the capital stock, as explained in Scarth (2009). Therefore, in the short run, monetary policy is expected to be effective in fighting inflation, whereas in the long run, it is likely to be ineffective or even counterproductive.

The second factor determining the relative strengths of demand and supply side effects of the monetary policy rate is the proportion of aggregate demand that is affected by interest rates. While discussing the composition of aggregate demand, Bernanke and Gertler (1995) remark that "Fixed business investment eventually declines in response to a monetary tightening, but its fall lags behind those of housing and consumer durables." In developing countries, especially Pakistan, the home mortgage market is negligible, and credit financing for other consumer durables like vehicles and home appliances has limited coverage. Thus, the demand-side effect of monetary policy is expected to be small; therefore, tight monetary policy is expected to be either unproductive or counterproductive in controlling inflation.

The third factor in the context mentioned earlier is the state of expectations, as explained in various studies, including Nakata and Schmidt (2019), Carvalho et al. (2021), and Akbari and Rankaduwa (2006). During demand-pull inflation, economic agents, including consumers, investors, and exporters, have optimistic expectations; therefore, their

price elasticities of demand are relatively low, which enables firms to shift the burden of incremental costs to consumers. As a result, the supply-side effect of the increase in cost may dominate the demand-side effect, making tight monetary policy ineffective or even counterproductive in controlling inflation. On the other hand, in the case of cost-push inflation, pessimistic expectations make buyers sensitive to prices; therefore, there is a greater chance that tight monetary policy will be effective in controlling inflation.

The above theoretical considerations require a model of inflation that not only provides short-run and long-run effects of monetary policy on inflation but also allows for asymmetry in the inflation rate's response to changes in monetary policy variables during periods of inflation, which are accompanied by both positive and negative changes in oil prices.

A comparative analysis of the effectiveness of monetary policy in addressing these two episodes of inflation would be beneficial for understanding how monetary policy may be formulated in Pakistan. If we examine the historical data, we see that the three major inflationary shocks in Pakistan occurred during the periods from 1972 to 1975, 2008 to 2011, and 2022 to 2023, when the inflation rate surpassed the 20% mark. All these periods of high inflation coincided with significant increases in world oil prices. For instance, during the 17 quarters from Q1 2007 to Q4 2011, the Brent oil price per dollar rose by 102%, while the CPI increased by 77%. More recently, in the past 12 quarters from Q3 2020 to Q3 2022, oil prices and the CPI jumped by 142% and 149%, respectively.

The policy/reverse repo rate is regarded as the primary instrument of monetary policy, while the monetary base serves as the secondary instrument. As noted in footnote 3, the SBP implemented a mixed policy before switching to an interest rate targeting regime in 2009. Moreover, even when the monetary base was not a specific target of the stated policy, it was adjusted to allow the government to manage its budget deficit. Malik (2024) points out that the SBP has continued to provide funds to the government indirectly by supplying liquidity to scheduled banks, enabling them to lend to the government. Over the past 42 years, the correlation coefficient between fiscal deficit and year-to-year changes in the monetary base is 0.95. This correlation is significant, particularly since the monetary base is largely detrended when converted to year-to-year changes. Lastly, incorporating the monetary base into the model would also account for the inflationary pressures stemming from the government's fiscal deficit.

The model follows the standard practice of including additional (control) variables that are expected to influence inflation. These variables, some of which originate from both the demand and supply sides, include the nominal exchange rate, real GDP, and world oil price. The theoretical rationale for incorporating these variables is clearly articulated in the literature.[3]

The following notations are used for the model.

ΔLP_t = Inflation rate or the growth rate of price level represented by CPI

ΔR_t = Change in interest rate (reverse repo rate)

ΔR_t^P = Change in interest rate associated with positive change in oil price

ΔR_t^N = Change in interest rate associated with negative change in oil price

ΔLM_t = Growth rate of monetary base

ΔLM_t^P = Growth rate of money base associated with positive change in oil price

ΔLM_t^N = Growth rate of money base associated with negative change in oil price

ΔLER_t = Growth rate of exchange rate, rupees per US dollar

ΔLY_t = Growth rate of real GDP

ΔLOP_t = Growth rate of oil price

ΔLOP_t^P = Growth rate of oil price when oil price is increasing

ΔLOP_t^N = Growth rate of oil price when oil price is decreasing

Using general notation X, the above variables in the first difference form are constructed as follows.

$$\Delta X_t = X_t - X_{t-1}$$

$$\begin{aligned} \Delta X_t^P &= X_t - X_{t-1} \quad if\ OP_t > OP_{t-1} \\ &= 0 \qquad\qquad if OP_t \leq OP_{t-1} \end{aligned}$$

[3] See, for example, Abdullah et al. (2021), Chaudhry (2015), Choudhri et al. (2015), Hussain (2009). Hussain et al (2022) and Mangla and Hyder (2017).

$$\Delta X_t^N = X_t - X_{t-1} \quad if\ OP_t < OP_{t-1}$$
$$= 0 \quad if OP_t \geq OP_{t-1}$$

Once the variables in conditional first difference form are constructed, the level variables are obtained by integration as follows.

$$X_t = \sum_{t=1}^{n} \Delta X_t,\ X_t^P = \sum_{t=1}^{n} \Delta X_t^P, \qquad X_t^N = \sum_{t=1}^{n} \Delta X_t^N$$

where

$$X_t = X_0 + X_t^P + X_t^N$$

Econometrics literature offers various modeling options to examine relationships, such as analyzing the effectiveness of monetary policy in controlling inflation (see Enders, 2012; Lütkepohl, 2013; and Pesaran and Shin, 1999; Pesaran, et al., 2000, 2001). A popular approach involves estimating a VAR or VECM model, retrieving structural parameters to identify structural shocks in monetary policy variables, and estimating the impulse responses of the inflation rate to these estimated structural shocks. The main advantages of this approach are: a) it enables the estimation of monetary policy reactions to unanticipated inflationary shocks rather than the actual inflation, which is partially anticipated; and b) it is a system of equations representing multivariate relationships among the variables of interest. The drawbacks include: a) the imposition of arbitrary restrictions on contemporaneous relationships that lack a sound empirical foundation; and b) a lack of short-run contemporaneous relationships between the model's variables, except for those imposed by the arbitrary identification restrictions.

A second approach is to rely on a single-equation ARDL analysis, which offers the benefit of a) providing estimates of both short-run contemporaneous relationships and the long-run relationship, and b) the ability to estimate co-integration relationships even when some of the regressors are stationary at level. The drawback is that the monetary policy response can only be estimated in relation to observed inflation rather than inflationary shocks.

Since each approach has advantages over the other, the choice between the two depends on the priority given to their relative benefits. Because monetary policy does not always arrive as a surprise, we find it worthwhile to assess its overall effectiveness, regardless of its anticipated and unanticipated components. We also emphasize understanding the

short-run contemporaneous relationship, alongside the long-run one. For these reasons, the ARDL approach is preferred over the VAR/VECM approach.

To allow for asymmetry in the relationship a non-linear version of ARDL (NARDL) model is considered. The specific model is given by:

$$\begin{aligned} DLP_t = {} & \lambda_0 + \lambda_1 LP_{t-1} + \lambda_2^P\, R_{t-1}^P + \lambda_2^N\, R_{t-1}^N + \lambda_3^P\, LM_{t-1}^P + \lambda_3^N\, LM_{t-1}^N \\ & + \lambda_4\, LER_t + \lambda_5\, LY_{t-1} \\ & + \lambda_6^P\, LPOP_{t-1}^P + \lambda_6^N\, LOP_{t-1}^N + \sum_{i=1}^{k_1} \alpha_i\, \Delta LP_{t-1} + \sum_{i=0}^{k_2^P} \beta_i^P\, \Delta R_{t-i}^P \\ & + \sum_{i=0}^{k_2^N} \beta_i^N\, \Delta R_{t-i}^N \\ & + \sum_{i=0}^{k_3^P} \gamma_i^P\, \Delta LM_{t-i}^P + \sum_{i=0}^{k_3^N} \gamma_i^N\, \Delta LM_{t-i}^N + \sum_{i=0}^{k_4^P} \delta_i^P\, \Delta LER_{t-i}^P \\ & + \sum_{i=0}^{k_4^N} \delta_i^N \Delta LER_{t-i}^N + \sum_{i=0}^{k_5^P} \theta_i^P\, \Delta LY_{t-i}^P \\ & + \sum_{i=0}^{k_5^N} \theta_i^N\, \Delta LY_{t-i}^N + \sum_{i=0}^{k_6^P} \pi_i^P\, \Delta LOP_{t-i}^P + \sum_{i=0}^{k_6^N} \pi_i^N\, \Delta LOP_{t-i}^N + \varepsilon_t \end{aligned} \qquad (1)$$

The terms involving variables in level form represent a long-run relationship, from which error-correction component of the model can also be extracted as follows:

$$\begin{aligned} & \lambda_1[LP_{t-1} - \pi_0 - \pi_2^P\, R_{t-1}^P - \pi_2^N\, R_{t-1}^N - \pi_3^P\, LM_{t-1}^P - \pi_3^N\, LM_{t-1}^N \\ & -\pi_4\, LER_t - \pi_5\, LY_{t-1} - \pi_6^P\, LPOP_{t-1}^P - \pi_6^N\, LOP_{t-1}^N] = \lambda_1 \varepsilon_{t-1} \end{aligned}$$

where $\pi_j = \lambda_j/\lambda_1$ and $\pi_j^s = \lambda_j^s/\lambda_1$ for s = P, N.

The remaining terms in the equation denote short-run relationships. Among these, the terms with a lag of zero indicate short-run contemporaneous relationships, while the terms that involve the first or higher lags signify lead-lag relationships.

At this point, it is important to note that the long-run relationship exists between the variables, most of which are expected to be first-order integrated and exhibit long-run variation. Conversely, the short-run

relationship pertains to the first differences of the variables, which are assumed to be stationary. In this context, it means that in the long run, our focus is on the price level rather than the inflation rate, and we explore the effectiveness of monetary policy in controlling the price level. In contrast, for the short run, we focus on the inflation rate itself and examine the effectiveness of monetary policy in managing the inflation rate. The role of other (control) variables is interpretable in the same manner. Additionally, we note that the error-correction mechanism refers to the correction/ adjustment process involving the inflation rate when the price level deviates from its equilibrium path.

3. Data, Results and Discussion

The study relies on quarterly data for the period 1980-2022. Table 1, which is self-explanatory, summarizes the descriptions and sources of data. Most of the data series are directly available from the sources shown in the table. A few missing values of quarterly GDP are filled by temporally disaggregating annual GDP across the four quarters using the quarterly GDP shares in the adjacent years. The policy rate in Pakistan is announced every two months, which was previously announced at irregular intervals. The quarterly value of the policy rate for each quarter is obtained by taking the weighted average of daily data in that quarter, where the weights represent the number of days in the quarter for which each particular value of the policy rate remains valid. Data on oil prices are reported on a monthly basis, which are averaged over quarters to obtain the quarterly series.

Table 1: Variables, Units and Sources

Variables	Description	Unit	Sources
P	Consumer Price index	Index based on 1980 Q1 base price	State Bank of Pakistan
R	SBP Reverse Repo Rate (Policy Rate)	Percentage rate per annum	State Bank of Pakistan
M	Reserve Money	Billion rupees	State Bank of Pakistan
ER	Exchange rate	Rupees per US dollar	State Bank of Pakistan
Y	Real Gross domestic product	Billion rupees in 1980 Q1 constant prices	State Bank of Pakistan
OP	Crude oil, Brent	US dollars per barrel	Energy Information Administration (EIA)

Quarterly data on price levels and inflation rates are subject to seasonal variation, which can be addressed by calculating year-to-year changes in price levels. However, oil price changes, which depend on different factors including global economic activity and worldwide events like wars, the Covid pandemic, and global recessions, are independent of the seasonal variations dictated by Pakistan's economic calendar. Moreover, using year-to-year changes in oil prices for analysis, as one would for price levels, would obscure significant information regarding price variations. For a fruitful analysis of monetary policy in addressing inflation amidst both positive and negative oil price changes, changes in all variables are computed on a quarter-to-quarter basis without any effort to eliminate seasonality from the data.

The positive and negative changes in oil prices, on which the study specifically focuses, are illustrated in Figure 1. The figure indicates that the 171 observations are nearly evenly divided, with 90 positive and 81 negative changes. It is also clear that, in absolute terms, the positive changes average 18.6%, which is larger than the negative changes, averaging -13.9%. Additionally, the positive changes feature more noticeable outliers, highlighting the severity of adverse shocks for Pakistan and other oil-importing countries.

Figure 1: Quarter to Quarter Percentage Changes in Oil Price

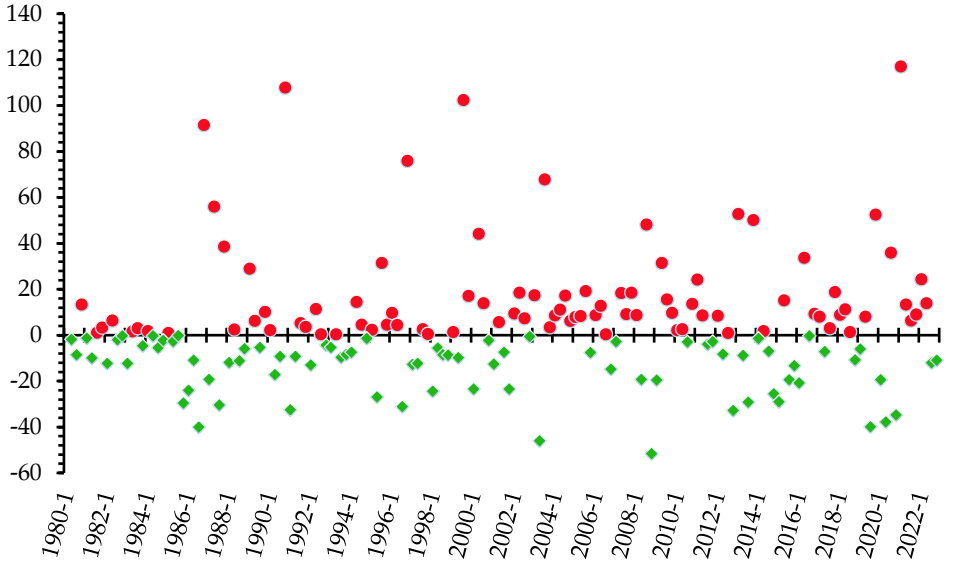
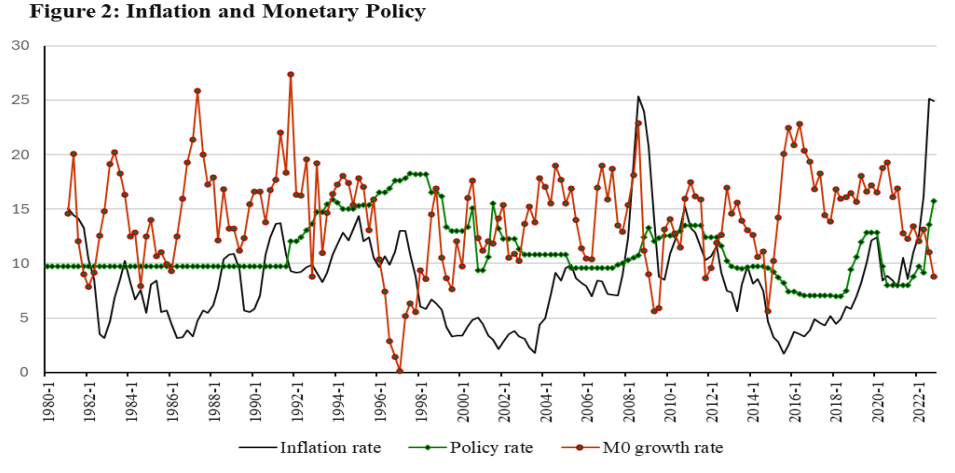


Figure 2 illustrates the trends in the inflation rate, policy rate, and growth rate of the monetary base over the past 42 years. Although this display does not assist in analyzing the effectiveness of monetary policy, there are several interesting observations worth noting. First, the policy rate remained constant for a long period, approximately 12 years, from 1980-1 to 1991-3. This clearly indicates that during this time, the SBP either refrained from market intervention in general or, more likely, did not utilize the policy rate as an instrument. Another observation is that apart from this period, the policy rate and money growth rate exhibit a moderate but statistically significant inverse relationship, with the simple correlation coefficient estimated at -0.43. This signifies that the two variables are neither closely related nor entirely independent of one another. Finally, the inflation rate demonstrates a positive relationship with the policy rate and a mild negative relationship with the money growth rate.

Figure 2: Inflation and Monetary Policy



The descriptive relationship between the inflation rate and the monetary policy variables during periods of both rising and falling oil prices is examined using alternative lag structures. Figure 3 displays scatter plots featuring the lagged values of monetary variables from two quarters on the horizontal axis and the current inflation rate on the vertical axis. The left and right panels represent periods of increasing and decreasing oil prices, respectively. The figure reveals asymmetry in these relationships. Specifically, the policy rate appears to be more closely correlated with the inflation rate during periods of declining oil prices, while the relationship between the money growth rate and inflation is slightly stronger during periods of rising oil prices. Additionally, it can be inferred from the figure

that the policy rate is not effective in controlling inflation, whereas the monetary base demonstrates some level of effectiveness.

Figure 3: Scatter Plots Featuring the Lagged Values of Monetary Variables

Figure 3(a): Inflation rate and policy rate whn oil price increases (Inflation rate is on vertical axis)

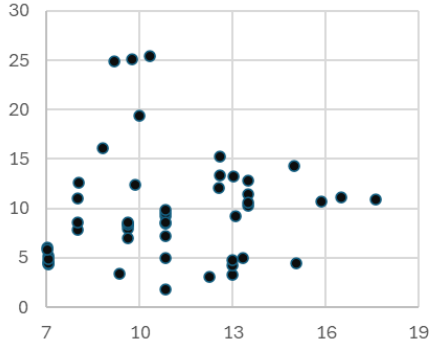


Figure 3(b): Inflation rate and policy rate whn oil price decreases (Inflation rate is on vertical axis)

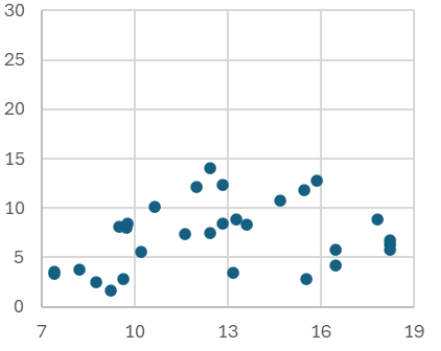


Figure 3(c): Inflation rate and money growth rate whn oil price increases (Inflation rate is on vertical axis)

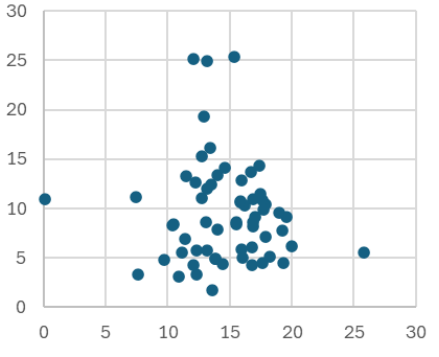
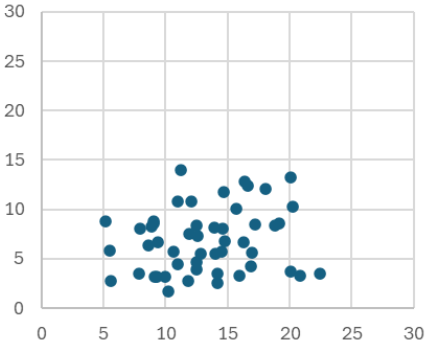


Figure 3(d): Inflation rate and money growth rate whn oil price decreases (Inflation rate is on vertical axis)



In the econometric analysis, testing for unit roots is the first step in estimating the ARDL model. According to Pesaran et al. (2008), an ARDL analysis is valid regardless of whether all the regressors are stationary, all are first-order integrated, or if there is a mixture. The only requirement is that the variables pass the co-integration test. However, the unit root test is still necessary to select the correct critical value of the F-statistic in the Bounds test. Table 2 indicates that all the variables are non-stationary and first-order integrated.

Table 2: Results of Unit Root Test

Variable	Test at Level		Test at First difference		Order of Integration
	Test Statistic	Probability	Test Statistic	Probability	
LP_t	0.937902	0.9958	-4.26974	0.0007	One
R_t	-1.99706	0.288	-11.6047	0	One
R_t^P	-1.46632	0.5484	-12.4751	0	One
R_t^N	-1.74931	0.4047	-12.3965	0	One
LM_t	0.146614	0.9683	-5.60143	0	One
LM_t^P	1.022774	0.9967	-15.5366	0	One
LM_t^N	-1.30799	0.6255	-13.8217	0	One
LER_t	-0.3143	0.919	-9.29648	0	One
LY_t	-2.08188	0.2523	-4.84884	0.0001	One
LOP_t	-1.23867	0.6572	-18.2417	0	One
LOP_t^P	1.230882	0.9983	-14.6759	0	One
LOP_t^N	0.438486	0.984	-13.5057	0	One

Source: Authors' calculations.

Next, a Wald test for symmetry is applied to determine whether the effects of the two components of a variable corresponding to positive and negative changes in oil price have the same or different impacts on price levels. The results of the test, shown in Table 3, indicate that the effect of interest rates is not symmetric, while the effect of crude oil prices is symmetric. Regarding the monetary base, the null hypothesis of symmetry cannot be rejected at the 10% level of significance. However, the null hypothesis simultaneously restricts all parameters related to the considered variables, and the test is applied to the model in its raw form, not directly on its co-integrating and error correction forms (equation 1). Therefore, it is possible that if the null hypothesis is accepted with a narrow margin, as occurs in the case of the monetary base, asymmetry may emerge in one of the short-run and long-run relationships. To avoid Type-II error in this regard, we allow for the possible presence of asymmetry in the effect of the monetary base. If asymmetry is present, it will be evident.

Table 3: Results of Wald Test on Symmetry

Variables	F-Statistics	Probability
R_t	11.218	0.0472
LM_t	8.790	0.1178
LOP_t	3.021	0.6968

Source: Authors' calculations.

For lag selection, the practice is to estimate the ARDL model with a sufficiently large number of lags and then trim the model using some performance criteria. With quarterly data, we consider a lag of eight quarters to be sufficient and apply the Schwartz Bayesian Criterion (SBC) for lag selection. The finally selected lags are 3, 1, 0, 0, 1, 3, 2, and 0, respectively.

Since monetary policy is specifically designed to control inflation, it is possible that the interest rate and/or monetary base responds to the current inflation rate and, thus, suffers from an endogeneity problem. However, since the SBP primarily responds to past inflation rates and the target inflation rate for current and future periods, the endogeneity issue is unlikely to arise. Furthermore, while proposing the ARDL framework, Pesaran and Shin (1999) formally address the endogeneity problem and conclude that correcting for endogeneity amounts to generalizing the model to higher lags; therefore, if sufficient lags are included in the model to ensure that no serial correlation remains in the errors, endogeneity would be managed. In our case, as Table 5 shows, the null hypothesis of zero serial correlation up to four lags is accepted. Nevertheless, we also apply a block exogeneity test by estimating a VAR model in which all variables in the model except for oil price are treated as endogenous variables. The VAR model is estimated with five lags (selected by various performance criteria such as Akaike, SBC, and HQC). The results in Table 4 indicate that all the monetary policy variables are exogenous, and therefore, we can apply the ARDL-based co-integration approach to analyze the effectiveness of monetary policy in controlling inflation.

Table 4: Test of Block Exogeneity (Excluded Variable is ΔLP_t)

Endogenous Variable	Chi-square Statistic	Probability
ΔR_t^P	7.853287	0.4479
ΔR_t^N	12.46552	0.1316
ΔLM_t^P	6.583457	0.5822
ΔLM_t^N	5.311220	0.7239

Source: Authors' calculations.

The bounds test is applied to test the existence of co-integration among the variables involved in the model. The F-statistic value is 15.44, which is much greater than the upper bound critical value of 3.90 at 1% level of significance, which confirms the presence of a co-integration among the variables.

Table 5: Estimation Results of ALRD Model

Variable	Long-Run Coefficient	Short-Run Coefficient
Intercept	1.1778	0.0946
	(0.56)	(0.56)
Reverse repo rate during periods of oil price increase (R_t^P)	0.0025	-0.0036
	(0.20)	(-1.65)
Reverse repo rate during periods of oil price decrease (R_t^N)	0.0393	0.0032
	(5.27**)	(5.76**)
Monetary base during periods of oil price increase (LM_t^P)	0.6326	0.0508
	(3.07**)	(2.84**)
Monetary base during periods of oil price decrease (LM_t^N)	0.5651	-0.0146
	(2.92**)	(-0.52)
Exchange rate (LER_t)	0.1898	0.0687
	(1.17)	(2.24*)
Real GDP (LY_t)	-0.2594	-0.1942
	(-0.93)	(-4.62**)
Crude oil Price (LOP_t)	0.1839	0.0148
	(4.28**)	(4.28**)
One quarter lagged consume price index (LP_{t-1})		0.2578
		(3.80**)
Two quarters lagged consumer price index (LP_{t-2})		-0.2084
		(-3.18**)
One quarter lagged exchange rate (LER_{t-1})		0.0449
		(1.34)
Two quarters lagged exchange rate (LER_{t-2})		-0.0764
		(-2.41*)
One quarter lagged real GDP (LY_{t-1})		-0.092
		(-2.06*)
ERROR Correction Coefficient		-0.0803
		(-12.1**)
Bounds Test (F statistic)	15.44♦*	
R^2	0.999	
Serial Correlation LM Tests (Chi-Square Statistic)		
Lag 1	0.12	
	(0.73)	
Lags 1-4	0.86	
	(0.83)	

Source: Authors' calculations.

Notes:

*: The t-statistics (in brackets) are significant at 5% level of significance.

**: The t-statistics are significant at 1% level of significance.

♦: The F value exceeds the upper bound critical value at 1% level of significance.

After this confirmation, we present the results of the estimated ARDL model in Table 5. The tests for serial correlation indicate an absence

of autocorrelation in the residuals and, therefore, confirm the selected lag structure. The value of R^2 is expectedly very high due to the time-series data and the inclusion of numerous explanatory variables in the model.

The estimated error-correction coefficient is negative and highly significant, yet its absolute value is relatively small. Thus, the error-correction process is slow but smooth, as it does not involve oscillations or changes of direction in the deviations from the long-run relationship during this process. Only eight percent of the error committed in the current quarter is corrected in the next quarter. This indicates the presence of sticky expectations among economic agents regarding the price level, thereby limiting the effectiveness of monetary policy. The estimated coefficient suggests that it would take about two years to reduce an inflationary shock to half its magnitude. This may, after all, be an acceptable inference, given that major shocks caused by external factors are often followed by reverse aftershocks (the so-called technical correction). In this context, the commitment of the SBP to its monetary policy is crucial, as it is the persistent pursuit of the policy that would make it effective in breaking the inflationary cycle in the long run. While analyzing the inflation targeting approach to monetary policy, Bernanke and Mishkin (1997) highlight the importance of monetary policy discipline alongside transparency and communication in making the policy workable.

In examining the main results concerning the effectiveness of monetary policy in controlling inflation, we find that during periods of rising oil prices, a tight monetary policy, characterized by an increase in the policy rate, is only weakly effective in managing the inflation rate (short-run effect), both in terms of the sign and significance of its impact, and is ineffective in influencing the price level (long-run effect). Conversely, when oil prices are falling, raising the policy rate seems counterproductive for controlling either the price level or the inflation rate. The relevant estimated coefficients yield a perverse (positive) sign and are highly significant. A plausible explanation for this outcome lies in expectations. When oil prices are on a downward trajectory, a significant source of cost-push inflation is absent, so any increase in inflation can mainly be attributed to demand-pull pressures. In these circumstances, economic agents maintain a positive outlook, allowing firms to pass additional costs on to consumers and investors. Consequently, the negative supply-side effect of a tight monetary policy on inflation outweighs the intended positive demand-side effect.

When it comes to the second tool of monetary policy, namely the monetary base, the results are encouraging. Here, tight monetary policy appears to be effective in controlling price levels (in the long run) as well as the inflation rate (in the short run) during periods of rising oil prices. According to the parameter estimate, a 10% decrease in the monetary base results in a 6.33% decrease in the consumer price index in the long run. The short-run effect, although statistically significant, is much smaller. For example, a 100 percentage-point cut in the growth rate of money results in only a 5.1% decrease in the inflation rate. While this may seem like a weak response, it is important to note that this is only the impact period effect, which is magnified when the lag effects operating through inflation inertia are considered. Furthermore, the long-run effect of tight monetary policy directly estimated in the model is substantial enough to justify the costs associated with implementing tight monetary policy.

The contractionary monetary policy through the monetary base appears to be effective in controlling the price level in the long run during periods of declining oil prices, but it seems ineffective in managing the inflation rate in the short run. The long-run effect of tight monetary policy on the price level during times of decreasing oil prices is slightly less than its effect during periods of rising oil prices. In the short run, the policy of reducing the growth rate of the monetary base is ineffective in controlling inflation amidst negative changes in oil prices.

Various factors contribute to the ineffectiveness of the policy rate as a tool for controlling inflation in Pakistan. First, as noted in various studies reviewed in this paper, the policy remains ineffective due to the presence of price rigidities, market frictions, and weaknesses in the transmission channels, particularly the credit channel and low banking penetration.[4]

Second, although the SBP does not formally lend money to the government, it continues to facilitate the government in borrowing from commercial banks (Malik, 2024). When interest rates rise, the government continues to mop up liquidity from the economy, and credit to the private sector becomes the "adverse victim" of tight monetary policy (Munir, 2018). Shah et al. (2021) also point out that the interest rate shock in a tight monetary policy is not fully transmitted to the economy because it effectively fails to control credit to the private sector. The study even recommends that the SBP should also target the required reserve ratio

[4] See, Abdullah et al. (2021), Baig (2011), Choudhri et al. (2015), Hussain (2009), Khan and Khan (2012), Nasir et al. (2021) and Safia (2012).

alongside the policy rate to achieve the right amount of credit in the economy.

The third and foremost reason for the ineffectiveness of the policy rate as a tool of monetary policy is that it focuses more on raising the cost of borrowing and less on controlling the quantity of money. If the growth in the quantity of money is not checked, raising the cost of borrowing will leave too much liquidity that the private sector would be unwilling to absorb, which is not helpful in controlling inflation.

Not all the results mentioned above, particularly those related to asymmetry, are comparable to other studies reviewed in the paper due to significant differences in methodologies. However, where comparison is possible, such as on the effectiveness of policy rates, the results generally align with past literature, including Abdullah et al. (2021), Baig (2011), Choudhri et al. (2015), Hussain (2009), Khan and Khan (2012), Qayyum (2008), Safia (2012), and Shah et al. (2021). Our findings also support the conclusions of Rehman (2014) and Zeshan et al. (2019) that in the presence of positive oil price shocks, contractionary monetary policy is counterproductive.

The short-run effects of other (control) variables are consistent with theoretical expectations, while their long-run effects exhibit mixed patterns. Over the long run exchange rate depreciation is observed to increase the price level, though this relationship is statistically insignificant. In the short run, an acceleration of exchange rate depreciation (an increase in the percentage rate of depreciation) leads to a significant instantaneous rise in the inflation rate.

The relationships between the price level and inflation rate with output and output growth rate are negative, as expected. However, similar to the case of the exchange rate, only the short-run relationship is statistically significant.

The oil price shows a positive direct correlation with inflation in both the long and short runs. Although the short-run instantaneous effect of increases in the rate of oil price inflation (that is, an increase in the growth rate of oil price) is quite small, the long-run effect of oil price increases on the consumer price index is relatively large. For example, a 100% increase in oil prices results in about a 19% increase in the consumer price index, which causes 19% inflation. This result confirms that oil is a key input in the production of goods and services, and changes in the oil

price affect the cost of production across various sectors of the economy, leading to significant long-run effects on the price level.

Finally, the table indicates the presence of inertia in the inflation rate over two quarters. This finding aligns with the slow adjustment (error-correction) process observed in the price level when it deviates from its long-run path. The inflation rate is also seen to respond to the growth rate in exchange rate depreciation with a lag of two quarters, while it reacts to output growth with a lag of one quarter.

4. Concluding Remarks

This study examines the effectiveness of monetary policy in controlling CPI inflation during periods of rising and declining oil prices in Pakistan, using quarterly data from 1981 Q1 to 2022 Q4. Monetary policy is represented by the policy/reverse repo rate and the monetary base. The other control variables included in the analysis are the exchange rate, real GDP, and oil prices.

The first conclusion of this study is that the practice of monetary tightening to control inflation through adjustments in the policy rate, as currently implemented in Pakistan, is largely ineffective, especially when inflation is coupled with negative oil price shocks. In contrast, direct control over the monetary base appears to be much more effective. This conclusion seems to align with the theoretical foundations proposed in Poole (1970), as there are reasons to believe that aggregate demand in Pakistan experiences greater shocks in the goods market compared to those in the money market. Limited banking penetration and financial illiteracy in Pakistan, on one hand, and the presence of monopolistic elements, asymmetric information, and speculation in commodity and real estate markets, on the other hand, suggest that goods markets in Pakistan are subject to significant volatility, which undermines the theoretical arguments in favor of interest rate targeting. Therefore, our result does not support Clarida et al. (1999), a study that serves as the foundation for interest rate targeting policy based on the assumption that economies encounter "Large unobservable shocks to money demand."

The second conclusion is that a tight monetary policy aimed at fighting inflation, despite the presence of a deflationary cost-push (oil price) shock, is either counterproductive (when the instrument is the policy rate) or relatively less effective (when the instrument is the monetary base). The study finds significant evidence against the view that, since monetary

policy is a demand-side policy, it is ineffective in controlling cost-push inflation. On the contrary, monetary policy appears to be an effective tool in controlling inflation in the presence of inflationary cost-push shocks, particularly regarding increases in the price of oil, especially when the policy operates through monetary base targeting. Thus, curtailing aggregate demand through tight monetary policy effectively controls inflation, even though the inflation is caused by supply-side factors. Monetary policy functions like a medicine that has the potential to cure the disease, even when it does not seek to alleviate the cause of the disease.

The third conclusion is that amid uncertainties and sticky expectations, commitment to a stated monetary policy is a prerequisite for its success.

Based on these findings, the study recommends reconsidering the formulation of monetary policy in Pakistan. In particular, the approach of targeting liquidity through direct control of the monetary base appears more effective than the policy of pegging interest rates. It is important to acknowledge that such a transition is not without challenges. The foremost challenge will be identifying the relative magnitudes of goods market and money market shocks through multiple econometric exercises. Friedman's (1982) lecture warns about the potential magnitude of unobserved shocks in money demand that could make monetary aggregate targeting a risky venture. More in-depth research on the efficiency of transmission channels will also be necessary. Perhaps, the SBP would benefit from experimentation, following a calculated gradual mixing of instruments, as also recommended in Ghauri (2022) and Shah et al. (2021).

Another policy implication of the study is that monetary policy should also consider asymmetry in relation to the direction of cost-push shocks. This study finds evidence of asymmetry within a specific framework where both inflation and policy instruments are analyzed without differentiating between their anticipated and unanticipated components. The Monetary Policy Committee of SBP, on the other hand, benefits from the accumulated knowledge acquired through its research department, which examines a variety of models, including VAR and SCGE models. This research could be expanded to investigate asymmetry in the policy reaction functions that provide crucial input for policymaking.

The study is subject to several limitations. First, the conclusions drawn here rely on a specific model that may not necessarily be the optimal

one. The results from a competing VAR model (not presented in the paper) do not confirm the findings of the study. The model considered in this paper analyzes the effectiveness of monetary policy, while the VAR model is suited to analyze the effectiveness of monetary policy shocks. Another limitation of the study is that it does not account for the potential presence of structural breaks in the relationship. In fact, the need for this consideration emerged while interpreting the results more carefully, given the observed history of the data. Finally, the study, which focuses on the analysis of a single cost-push variable, the oil price, could be expanded to include other factors such as exogenous food price shocks and changes in the taxation structure.

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