EFFECTIVENESS OF EXPECTATION CHANNEL OF MONETARY POLICY TRANSMISSION: EVIDENCE FROM PAKISTAN

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CERTIFICATE

This is to certify that this thesis entitled: **"Effectiveness of Expectation Channel of Monetary Policy Transmission: Evidence from Pakistan".** submitted by **Ms. Tasmina Perveen** is accepted in its present form by the School of Economics, Pakistan Institute of Development Economics (PIDE), Islamabad as satisfying the requirements for partial fulfillment of the degree in Master of Philosophy in Economics and Finance.

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Author's Declaration

I, **Tasmina Perveen** hereby state that my MPhil thesis titled **Effectiveness of Expectation Channel of Monetary Policy Transmission: Evidence from Pakistan** is my own work and has not been submitted previously by me for taking any degree from Pakistan Institute of Development Economics or anywhere else in the country/world.

At any time, if my statement is found to be incorrect even after my Graduation, the university has the right to withdraw my MPhil degree.

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Dedication

First, I would like to thank ALLAH ALMIGHTY, the most gracious and the most merciful, for making me able to complete this task. Without HIS blessings, completion of this task would not have been possible.

I would like to express my gratitude to my thesis Supervisor Dr. Saud Ahmad Khan. Throughout this research, he helped me and encouraged me to do my best work. Without his guidance and insightful comments, I would never be able to achieve this milestone in my academic life. His patience was exceptional throughout this phase.

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Abstract

Global Financial Crises (GFC) 2007-08 highlighted the importance of incorporating expectations while making economic decisions. The expectations channel of monetary policy transmission mechanism emerged as an important channel than the other channels after the advent of GFC. This study examined the effectiveness of expectations channel of monetary policy transmission mechanism in the case of Pakistan. The monthly data used in this study have been selected from 2012M01 to 2021M12. The empirical analysis applied in this study used six variables Structural Vector Autoregressive (SVAR) model to lessen the gap between inflation and inflation expectations, then to figure out how macroeconomic indicators feed into the formation of expectations and then to estimate the influence of expectations shocks over the macroeconomic aggregates. This study involves a survey of professional forecasters as well. The results of Impulse Response Functions (IRFs) are supported by the Forecast Error of Variance Decomposition (FEVD) analysis. The influence of household inflation expectations over the core inflation is explained relatively better than the influence of SBP projections. The responses of monetary policy shocks are more influential than the demand and supply side shocks in the formation of expectations. However, the variations in the macroeconomic aggregates are explained significantly better through SBP projections than inflation expectations of households. Findings backed by empirical analysis further confirm that expectations channel works better via discount rate than via SBP projections in case of Pakistan.

Key Words: *Global Financial Crises, Expectations Channel, Households Inflation Expectations, Survey of Professional Forecasters, State Bank of Pakistan (SBP) Projections, Structural Vector Autoregressive (SVAR) Model.*

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LIST OF ABBREVIATIONS

AIC	Akaike Information Criterion
DSGE	Dynamic Stochastic General Equilibrium
EEC	Expected Economic Conditions
ECB	European Central Bank
FED	Federal Reserve
FEVD	Forecasting Error of Variance Decomposition
FG	Forward Guidance
FPAS	Forecasting and Policy Analysis System
GFC	Global Financial Crises
IRF	Impulse Response Functions
MPD	Monetary Policy Department
NKPC	New Keynesians Philips Curve
NARDL	Non-Linear Autoregressive Distributive Lags
PBS	Pakistan Bureau of Statistics
QE	Quantitative Easing
REH	Rational Expectations Hypothesis
SVAR	Structural Vector Auto Regressive
SBP	State Bank of Pakistan
SFP	Survey of Professional Forecasters
UMP	Unconventional Monetary Policy
VAR	Vector Auto Regressive

CHAPTER 1

INTRODUCTION

1.1 Background:

"It would be foolish, in forming our expectations, to attach greater weight to matters which are uncertain."

John Maynard Keynes

The quote above sheds light on the importance of forming expectations in economic decision-making. While economists historically placed little emphasis on expectations and instead focused solely on the static state, it has become evident over time that accounting for expectations is crucial to ensuring accurate economic forecasting (Working, 1949). Mankiw (1990) argues that rational expectations must be taken into consideration when altering macroeconomic policy trajectory due to their immense significance. The revolutionary hypothesis surrounding rational expectations known as Rational Expectation Hypothesis (REH) proposes that an agent's mental effort involves not only forecasting their own future but also predicting how others will forecast the future as well (Guesnerie 1992). By recognizing this intricate web of expectations formation, a more thorough understanding of economics can be achieved.

A country's central bank has the crucial task of developing a comprehensive and dynamic set of principles and guidelines, known as monetary policy. This arduous process is undertaken to achieve its ultimate goal i.e., ensuring stability within the national economy. Amongst all other objectives that drive monetary policy formulation, preserving price stability remains at the forefront for any nation striving towards economic prosperity. Furthermore, attaining full

employment levels, fostering domestic financial equilibrium while simultaneously facilitating seamless international transactions are also imperative aspects incorporated into this multifaceted framework. Henceforth, changes implemented under such policies usually depend on both internal and external influences which work collaboratively to meet predetermined goals (Loayza & Schmidt 2002).

In order to achieve its policy objectives, the central bank often resorts to altering either their short-term interest rate or monetary aggregates through various instruments. These measures operate in distinct ways and impact the economy differently via transmission mechanisms. Among them, there are five channels of monetary policy transmission mechanism identified. In Pakistan's context, Agha et al., (2005) have investigated the credit (balance sheet) channel, asset price channel, exchange rate channel and interest rate channel using an extended VAR model. However, little research has been conducted on the expectations channel which remains a relatively unexplored area across both developed and developing economies alike.

In the aftermath of the devastating Global Financial Crisis (GFC) that shook the world in 2007–2008, a paradigm shift occurred in how monetary policy was perceived and executed. With interest rates hitting rock bottom owing to unconventional monetary policies, there emerged an unprecedented focus on the expectations channel as a crucial component of transmitting monetary policy. Before this crisis had struck, other channels were considered more pivotal for analyzing how effectively money flows through various sectors of an economy with respect to implementing sound monetary policies. However, post-GFC era witnessed significant attention being paid towards understanding and leveraging expectations concerning future economic growth trajectories while making decisions about financial regulations and interventions needed at critical junctures to keep economies stable yet growing.

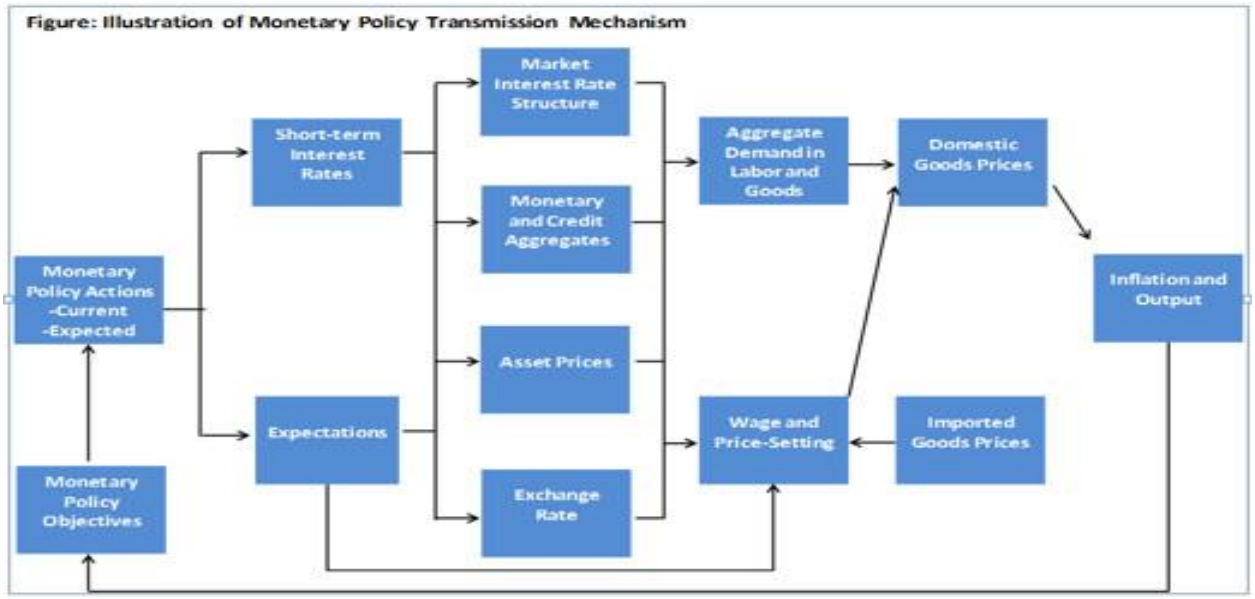

Figure 1.1: Illustration of monetary policy transmission mechanism; Source: SBP, 2023

Upon observing figure 1.1 from a more comprehensive standpoint, it is evident that the primary objective of monetary policy is to sustain economic output and curb inflation through recent or forthcoming measures. By leveraging multiple channels such as the market interest rate channel, balance sheet channel, asset price channel and exchange rate channel, short-term interest rates are employed to impact domestic inflation and aggregate demand (Mukhtar & Younas, 2019), (Mishkin, 1995; Agha et al., 2005).

The process of wages and price setting is a complex one that requires careful consideration of various factors, including the expectations channel. According to Goyal and Parab (2021), different methods can be employed to approach this aspect of economic decision-making. However, it is clear that market expectations regarding future core inflation play a crucial role in shaping how individuals and organizations set prices and wages. Moreover, monetary policy has a significant impact on these expectations as well as on overall economic behavior. As Sousa and Yetman (2016) noted that central bank communications are particularly critical in this regard since they influence the credibility of such institutions among stakeholders. Ultimately, understanding the intricate interplay between monetary policy decisions, market

expectations about inflation rates, wage-setting practices, and pricing strategies is essential for creating sustainable economic growth and stability over time.

The successful transmission of monetary policy hinges on the expectations channel, which can have far-reaching effects. As inflation expectations rise, real prices inevitably follow suit. The Standard New Keynesian Phillips Curve (NKPC) supports this notion by highlighting how expected inflation may impact current core inflation levels. To achieve its objectives, it is vital for the central bank to anchor public expectations accurately. By doing so, monetary policymakers stand a greater chance of meeting their desired outcomes effectively. A study conducted by Bao et al., in 2012 found that market movements often converge towards underlying price trends following unexpected shocks to public expectations. The research also reveals that negative expectation shocks lead markets towards rational equilibrium but not vice versa, underscoring the importance of carefully managing and regulating market expectations when making crucial decisions affecting economic policies and regulations at large. Similarly, Hussain and Hayat (2016) investigated that incorporating inflation expectations can improve the inflation forecast which is imperative for the effective conduct of monetary policy in case of Pakistan.

According to NKPC[1], Where actual inflation is considered as the function of inflation expectations of one period ahead and current output gap with random white noise error term. It can be observed through the timeline (from January 2012 to December 2021) in the case of Pakistan where the inflation expectations of the Pakistani households and core inflation goes in the same way for some of the periods of sample data. Gap is wider in some of the periods of sample timeline i.e., especially in the start of the sample period and onward from 2015 to 2019. Whereas gap is relatively minimum in recent periods of the sample data. There is a need of policy implications to minimize the gap between inflation and inflation expectations

[1] $\pi_t = \beta\, \pi_{t+1}^{e} + \delta x_t + \mu_t$

which is the first objective of present study. This phenomenon is explained in the following figure.

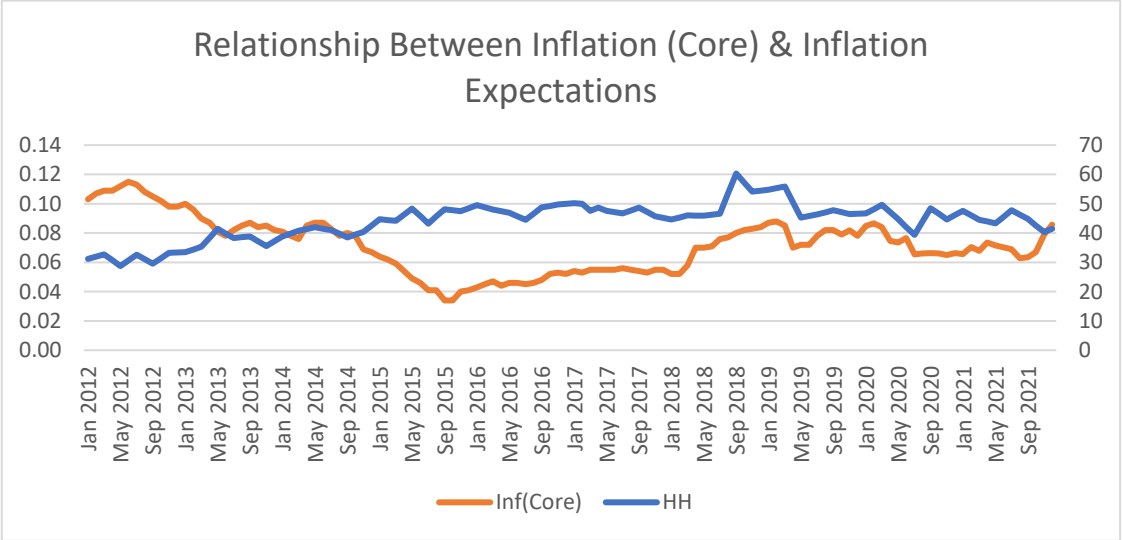

Figure 1.2: The relationship of Core Inflation and Household inflation expectations; (Author's estimates)

The core inflation and inflation expectations of Pakistani households are shown in Figure 1.2. Both are not increasing in the same direction, demonstrating that core inflation does not rise in tandem with rising household expectations and having gaps in some of the periods.

When we delve into the intricacies of this topic, it becomes evident that there exists a plethora of studies that unequivocally showcase its immense significance. Despite the widespread nature of research in this field, one aspect remains elusive i.e., the expectations channel within monetary policy's transmission mechanism. To effectively tackle core inflation concerns in both conventional and unconventional monetary policy settings, it is imperative to anchor this channel soundly (Ciccarelli et al., 2017). Put succinctly, there lies an extensive terrain yet to be explored when it comes to understanding and harnessing the full potential of this crucial component within monetary policymaking.

1.2 Research Problem:

Broadly speaking, as mentioned earlier, that expectations channel is one of the five channels of monetary policy transmission mechanism. The expectations channel refers to the expectations of the public and different stakeholders like investors regarding future inflation and interest rates (Goyal and Parab 2021). As long-term interest rate mainly depends upon the market expectations about the short-term interest rate which adjusts accordingly and impact the long run interest rate and aggregate demand. Research problem of this study is to identify the effectiveness of expectations channel of monetary policy transmission in case of Pakistan.

1.3 Research Questions:

Normally, output and inflation are influenced by monetary policy through interest rate, credit, exchange rate and asset prices channels (Mishkin, 1995). There are lots of studies (Mukhtar and Younas, 2019; Agha et al., 2005) available related to these channels in case of Pakistan. Mukhtar and Younas (2019) explored the bank lending and asset price channel of monetary policy mechanism for Pakistan. But there is no such study available to explore the effectiveness of expectations channel of monetary policy transmission for Pakistan. Present study can fill this research gap. Following research questions have been inquired:

1. Do expectations shocks (households inflation expectations and SBP projections) impact the macroeconomic aggregates?
2. Which tool (either via SBP projections or via policy rate) of expectations channel of monetary policy transmission mechanism is more effective in case of Pakistan?
3. How can the core inflation be handled with the help of handling inflation expectations?

1.4 Objectives of the Research:

Present study can fill the gap of such transmission channel in case of Pakistan as we can have a similar study in case of India by Goyal and Parab (2021). The objectives of this study are:

1. To analyze the fixed point between inflation and inflation expectations to shorten the gap between the two.
2. To evaluate the impact of shocks of macroeconomic indicators on the inflation expectations.
3. To examine the impact of SBP projections and household inflation expectations over the shocks of macroeconomic aggregates.

1.5 Organization of the Study

This chapter is ended here by incorporating the organization of the dissertation. Next chapter will shed light upon the literature about the subject matter. Literature both on theory and methodology has been critically reviewed. Chapter 3 is about the methodology of this study which is supported by both theory and literature. The next chapter, which is chapter 4 is about the empirical analysis containing quantitative data analysis by using SVAR estimations and diagnostics. Chapter 5 is about the qualitative portion of the study which includes the survey of professional forecasters. Chapter 6 is about the significance of research/contribution to the literature. Last but not the least, Chapter 7 concludes the study. Whereas appendix involves the bibliography, supporting tables, graphs, and questionnaire.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction:

How monetary transmission channels influence an economy has been widely discussed during the last couple of decades (Bernanke & Gertler, 1995; Angeloni et al., 2003; Koop et al., 2009; Beck et al., 2014; Wang et al., 2022; Spulbar & Birau, 2023). Several researchers have written theoretical and empirical papers in this regard (Ehrmann & Fratzscher, 2004; Takáts & Vela, 2014; Angeloni et al., 2003). We divided this current section into two sub-sections. In the first part, we review the theoretical literature on the monetary policy transmission channels and their possible impacts on the domestic economy. While the second part belongs to the empirical literature on monetary policy transmission channels with special emphasis on the expectations channel, as it is the center of gravity of this study.

2.1.1 Literature related to Theory:

A monetary policy transmission channel is a mechanism through which the monetary authority decisions influence the price level in particular and the economy in general (Takáts & Vela, 2014; Wang et al., 2022; Angeloni et al., 2003; Spulbar & Birau, 2023). The idea is that interest rates or money supply changes by central banks can affect the behavior of financial institutions, businesses, and households which, in turn, can impact overall economic activity and inflation (Rehman et al., 2023). The transmission process of any country is characterized by uncertain and long-time lags (Clark, 1981; Dong et al., 2023). Therefore, the accurate impact of monetary authority decisions on the price level and economy is challenging to predict. According to the Reserve Bank of Australia, the transmission of monetary policy can be summarized in two stages: 1) monetary policy changes affect interest

rates in the economy, and 2) interest rate changes affect economic activity and inflation. The following figure highlights these two stages and some important transmission channels through which monetary policy affects the economy.

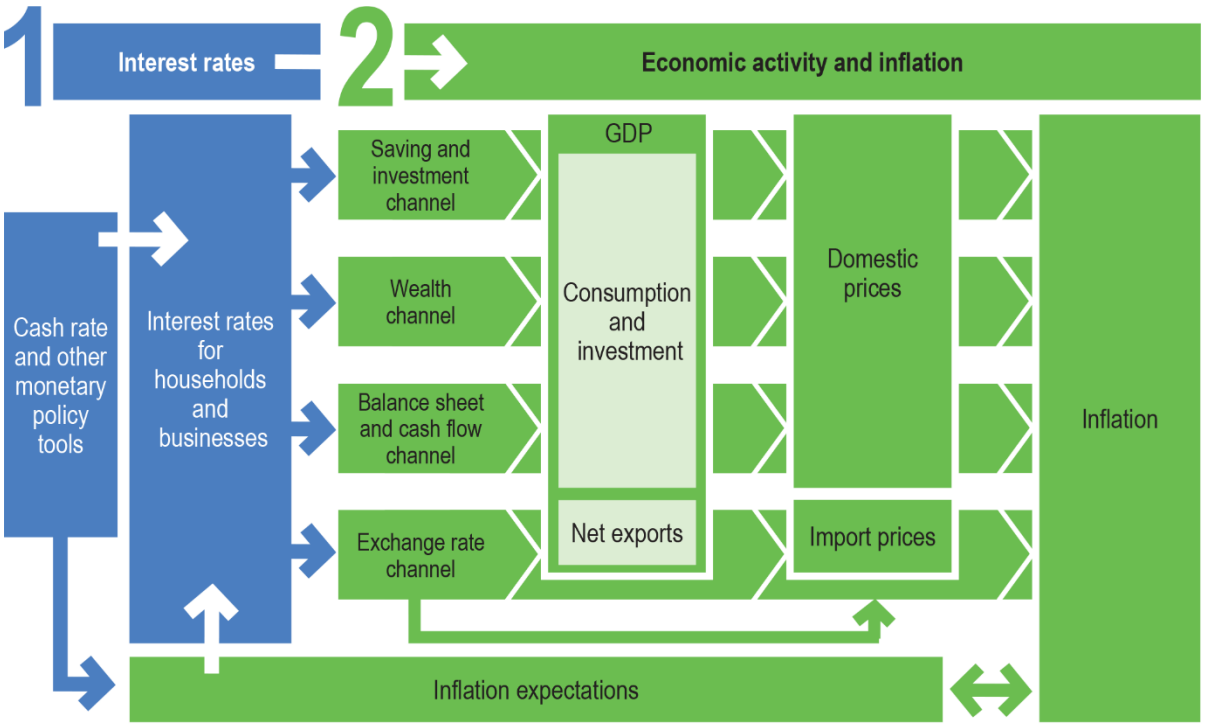

Figure 2.1: Transmission Mechanism of Monetary Policy; Source: Reserve Bank of Australia, 2023

As outlined in the figure 2.1 (similar to figure 1.2), there are several transmission channels through which the monetary policy influences the economy (Koop et al., 2009; Takáts & Vela, 2014; Beck et al., 2014; Wang et al., 2022). Most reported in the literature include investment and consumption decision channel, exchange rate channel, asset prices channel, credit channel, and expectations channel (Auclert, 2019). The commonly known monetary policy transmission channel is the interest rate to investment and consumption decision channel which is also known as the intertemporal substitution channel. An increase in the real interest rate by the central bank affects the investment and saving decisions of firms and households (Archibald & Hunter, 2001). For instance, a rise in interest rate makes the loan less attractive to finance investment and consumption. Likewise, a fall in interest rate reduces

the incentives attached to saving and encourages households to buy more as they face lower costs of borrowing (Sunday, 2012). Ultimately, this lower cost increases the demand for assets like housing and cars in the economy (Mojon, 2000; Hülsewig et al., 2009; Mohanty, 2012; Auclert, 2019).

Another important monetary transmission channel that has a strong impact on the economy is the exchange rate channel of an open economy (Leitemo et al., 2002; Zams & Cooray, 2007; Ali et al., 2017). An increase in interest rate appreciates the domestic currency that reduces the price of goods traded in local currency. However, this process discourages exports and stimulates imports, which invigorates the trade deficit. Similarly, the wealth channel also plays a vital role in the monetary policy process, for instance, an increase in interest rate hinders corporate profits and reduces stock prices (Albacete & Lindner, 2017). This financial value reduction of the corporation and household wealth discourages investment and consumption plans. Furthermore, the monetary policy of a central bank also functions through the credit channel (Iacoviello & Minetti, 2008). An increase in policy rate increases the bank lending rate which leads to a reduction in the credit supply and/or its charm to firms and households. Again, this discourages the investment and consumption levels of the economy. Mishkin (1995) provides a comprehensive discussion of the monetary transmission channels. As per that study, the balance sheet channel happens in case of asymmetric information i.e., one party has incomplete information than the others. It infers that when a firm has a lower net worth then lending to these businesses may be affected by asymmetric problems like adverse selection and moral hazard problems. In other words, contractionary monetary policy increases interest rate and decreases the cash flow. The lending level decreases due to adverse selection and moral hazard which leads to a reduction in investment and GDP in the economy (Morgan, 1993; Florio, 2004; Ciccarelli et al., 2015).

Last but not least, the expectations channel, which is also the core of this research, is another distinguished channel of the monetary policy process (Minella & Souza-Sobrinho, 2013; Sharma, 2022; Goyal & Parab, 2023). This channel refers to how expectations related to policy actions shape existing economic behaviors (Kryvtsov & Petersen, 2019). It is based on the idea that future expectations can influence the behavior of businesses, households, and financial institutions today, even if no actual policy changes have yet occurred. For instance, if the central bank indicates that it plans to increase the rate of interest in the future, businesses and households may expect that borrowing charges will upsurge and may begin to decrease their investment and spending today, even before the rate of interest hike takes effect (Goyal & Parab, 2023). In other words, any decision of the central bank may influence the expectations of economic agents about the performance of the economy. For example, an increase in interest rate by SBP to control inflation gives a signal of contained economic activities not only in the present but also in the future. A credible central bank strongly anchors expectations of price stability (Minella & Souza-Sobrinho, 2013).

2.1.2 Monetary Policy Transmission Channels in Pakistan:

As mentioned earlier, there are several kinds of monetary policy transmission channels reported in the literature including saving and investment channel, credit channel, exchange rate channel, expectations channel, wealth channel, and balance sheet channels. From the perspective of Pakistan, there are several papers published which examine the monetary policy transmission mechanisms from various perspectives. Some important studies from that thread of literature are reviewed in this sub-section.

A latest study from the perspective of Pakistan is conducted by Ghauri et al. (2022) in which they analyze the different channels of monetary policy transmission mechanism. The objective of the study is to examine the impact of risk, credit, and interest rate channels on the monetary policy of the country. Also, using data from 1995 to 2020, the study provides

the short-run and long-run analysis of bank capital, foreign debt, and monetary policy transmission mechanisms. ARDL modeling report that the risk channel does not follow the co-integration benchmark in the case of Pakistan. The interest rate and credit channel have statistically significant and negative impacts on the dependent variable of the study. Likewise, Agha et al (2005) use the SVAR technique to examine the monetary transmission channels in Pakistan. The outcomes show that monetary tightening leads first to a decrease in domestic demand, mostly investment demand financed by bank lending, which leads to a regular decline in price pressures that ultimately lessens the general price level with a significant lag. Moreover, in addition to the conventional interest rate channel, the findings point to a transmission mechanism in which commercial banks play a significant part.

Alam & Waheed (2006) examines the monetary transmission mechanism in Pakistan through a novel perspective called “sectoral-level analysis”. The objective of this quarterly data analysis is to analyze whether monetary policy shocks have different sectoral analyses. Another distinctive feature of the study is the incorporation of monetary and financial reforms' impact on the monetary transmission mechanism. VAR modeling analysis for seven different sectors reported the real effects of monetary policy. Sectoral analysis revealed that the impact of monetary shocks varies with the sector. For instance, insurance and finance, retail and wholesale trade, and manufacturing sectors seem to decline in reaction to the interest rate shocks. On the other hand, study observe the insensitivities of construction, mining and quarrying, agriculture, and ownership of dwellings to interest rate changes.

Javid & Munir (2010) study the price puzzle and monetary transmission mechanism in Pakistan. Using the VAR modeling technique of econometrics, they analyze the impact of monetary policy shock on the general price level and other major macro variables like money supply, exchange rate, and output. Quarterly data covering the period of 1992 to 2010 report that monetary policy shock that is contractionary in nature has a positive impact on the output

and prices increase over some horizon following the tightening of monetary policy but continuously falls after the initial rise.

Rafique et al. (2021) examine the balance sheet channel of monetary transmission in which secondary data from 217 PSX-listed manufacturing firms is collected. The panel data analysis i.e., fixed effect model and random effect model results find a positive association between investment and cash flow during the periods of tight monetary policy. The influence on cash flows is visibly more noticeable than that of the quantitative impact of an upsurge in capital cost, which gives rise to a balance sheet channel. Similarly, Shabbir (2012) also examines the balance sheet channel of monetary policy in Pakistan for non-financial listed firms of PSX. The panel data analysis finds strong evidence of the presence of a net worth channel. Also, a tight monetary policy degrades the net worth of both large and small medium firms, with small-medium firms getting more hit on revenues, short-term borrowing, and cash flows.

Furthermore, Rashid & Shah (2019) study the monetary transmission channel from another perspective in which they analyze the role of bank size and liquidity position in transmission mechanisms. Also, the study revolves around the role of conventional and Islamic banks in transmitting the effects of monetary tightening in the country. Findings indicate that both conventional and Islamic banks significantly cut their financing during the period of tight monetary policy. It verifies the existence of credit channel in 11 Islamic and 17 commercial banks. The outcome also reveals that the tight monetary policy affected Islamic banks less than their conventional peers. Another study conducted by the same authors (Shah & Rashid, 2019) examines the credit supply channel of monetary policy and provides a comparative analysis of Malaysia and Pakistan. It through empirical observation examines the credit supply channel of monetary policy and investigates the differential effect of monetary policy on the credit supply of Islamic banks in Malaysia versus Pakistan. The two-step System GMM approach concludes the presence of credit supply channel in the baseline models for

both economies and the differential influence of monetary policy through Islamic banks in Malaysia versus Pakistan in the expanded models.

Another influential contribution to the monetary policy transmission mechanism in Pakistan is made by Mukhtar & Younas (2019) in which they analyze the bank lending and asset price channels. Applying the SVAR modeling approach to monthly data covering the period of 2000 to 2016 reveals that the monetary aggregates targeting agenda is still effective in influencing the general prices and output level. Results further report that the traditional interest rate channel looks ineffective in the monetary transmission mechanism process of Pakistan. In other words, the conventional Taylor-type rule is not observed to be applicable in transferring monetary policy shocks on the price level. The findings of this study are supported by the impulse response function and generalized forecast error variance decomposition.

Due to the lack of long-term inflationary expectations data, there have not been many empirical studies available in the literature that measure the expectations channel in developing economies like Pakistan, India, and Bangladesh. However, there is a strand of empirical literature available that postulates that the expectation channel of monetary policy can interact with other transmission channels, such as credit and interest rate channels. For instance, if businesses and households expect that interest rates will increase in the future, they may lower down their borrowing today, which can strengthen the impacts of the interest rate channel. Additionally, some researchers indicate that the expectations channel can also work via interaction with financial markets because the asset prices are directly associated with the expectations of future monetary policy actions which in turn can influence the behavior of financial institutions and investors. In other words, it can create spillover effects across asset classes and different markets. Kryvtsov & Petersen (2019) also highlighted that the effectiveness of monetary policy depends, to a large extent, on the expectations of market

players about future actions. The next section provides a plethora of empirical literature on the role of expectations channel in an economy.

2.2 Literature related to Methodology:

Normally, the effectiveness of monetary policy has been examined by researchers and policymakers through various transmission channels including exchange rate, asset price, balance sheet, credit, and interest rate channels (Angeloni et al., 2003; Ehrmann & Fratzscher, 2004; Koop et al., 2009; Takáts & Vela, 2014; Beck et al., 2014; Wang et al., 2022; Angeloni et al., 2023). But some recent historical crises like the Asian Financial Crisis of 1997, the Global Financial Crisis of 2007-08, and the COVID-19 crisis transformed the way of thinking about the effectiveness of monetary policy. These crisis episodes have rejuvenated the role of expectations in the monetary policy transmission process. That is why the expectation channel of monetary policy has become the key area of research in the last couple of years. Several scholars like Woodford (2003) and Ang et al. (2011) put special emphasis on the significance of expectations management in the monetary policy process. According to neo-classical synthesis, there are five commonly accepted principles of macroeconomics, one of which is that future expectations play a vital role in the monetary policy mechanism (Taylor, 1998; Guler, 2016).

In the economics profession, both for empirical and theoretical purposes, it is traditional to assume that the expectations are rational (Kantor, 1979; Au et al., 2003; Gertchev, 2007; Sargent, 2013; Cerulli-Harms et al., 2019; Mokanov, 2022). It is argued that the benefit of this hypothesis lies in its relative neutrality with respect to the structure of the model whose findings would then be free from arbitrary assumptions for the expectations formation mechanism. Coibion & Gorodnichenko (2015) highlighted a question about the process of formation of expectations, and how developing the perfect empirical model for these expectations remains an unsolved mystery. Another seminal contribution in this regard is

made by Shaw (2019) who concluded that the quarterly "Inflation Expectations Survey Data of Households (IEHS)" do not form results based on the rational expectations principle. As far as monetary policy is concerned, the effective use of expectations in the policy process depends on the reliability of the central bank and the transparency of its communication with financial markets, households, and businesses.

A number of theoretical and empirical studies are available in the literature which presents stylized facts on the operation of expectations channel of monetary policy. Mohanty & Turner (2008) and other researchers pointed out some key factors on which the effectiveness of the expectation channel depends. First, central bank credibility plays an essential role in this regard: a lower degree of credibility leads to lower anticipated impacts of monetary policy and vice versa. Second, the extent of the predictability of central bank actions is also documented as an important factor. Researchers suggest that the level of this factor can be improved by increasing the public communication of policy and the level of transparency. Moreover, a degree of commitment by the central bank is also recognized as a key factor operation of the expectations channel. A number of researchers (Eggertsson and Woodford, 2003; Mohanty & Turner, 2008) mentioned that the role of the expectations channel can be enhanced by the higher degree of commitment of the central bank while changing its policy instruments. For instance, in order to remove deflation from the economy, the Bank of Japan considered this commitment factor while introducing a quantitative easing policy in the early 2000s. The bank announced that, until the inflation rate sustained at a positive level, it would maintain its zero-interest rate policy. This policy aimed to manage the public expectations related to the inflation rate (Spiegel, 2006; Girardin & Moussa, 2011).

Gaiotti & Nicoletti-Altimari (1996) pointed out that forward guidance can be a very useful mean for influencing expectations and expanding the effectiveness of the monetary policy. A number of researchers have found that a well-articulated and perfectly communicated

forward guidance can lead to stronger economic growth, higher inflation expectations, and lower long-term interest rates. Also, credibility plays an important role in the effectiveness of forward guidance. For instance, if businesses and households do not believe that the central bank will follow through on its direction, it will have a minor effect on their behavior. Thus, a central bank needs to stay consistent in its policy actions and build a reputation for credibility. Additionally, a thread of literature reported that the effectiveness of the expectations channel of monetary policy may vary across the different kinds of monetary policy instruments. For instance, some researchers suggest that the expectations channel may be less strong for conventional interest rate policy than for unconventional policies, such as quantitative easing.

The structural vector autoregressive (SVAR) has been a widely used econometrical technique in literature to examine the effectiveness of different monetary policy channels. From the perspective of the expectations channel, an influential study is conducted by Goyal & Parab (2021) in which they examined the effectiveness of the expectations channel of monetary policy transmission in India by using survey-based expectations of households and professional forecasters in the SVAR technique. The objective of this study was to examine how expectations shocks feed into the dynamics of macroeconomics and influence core inflation. Results revealed that the Survey of Professional Forecasters expectations shocks has a significant impact on food and headline inflation. Also, supply shocks, RBI projection shocks, and petrol price shocks affect household inflation expectations. Core inflation affects expectations in the long run while food inflation has a short-run influence.

Another important contribution to the expectation channel of monetary policy is made by Sharma (2022) in which he used monthly data on actual future CPI as a proxy for inflation expectations. After employing Structural Factor Augmented VAR (SFAVAR) technique, results revealed that more than 80 percent of long-run inflation expectations are self-

explanatory. An instant fall in expectation is observed when the contractionary monetary policy of increasing the interest rate is employed by the central bank. Moreover, this study concluded that inflationary expectations in developing countries rise swiftly but are rigid in falling. Likewise, Minella & Souza-Sobrinho (2013) conducted a semi-structural model analysis for the Brazilian economy and reported that the interest rate channel has significant importance in affecting the output level of the economy while the expectations channel, in turn, is the most relevant in the response of inflation.

Gumata et al. (2013) used the quarterly data for the South African economy over the period of 2001 to 2013 with the objective of analyzing the effectiveness of different monetary policy transmission channels. A large Bayesian VAR model is used because it helps to handle several transmission channels simultaneously. Findings indicated that all channels are effective, but the importance and size of their effectiveness vary. The interest rate channel is documented as the most important monetary policy transmission channel followed by the exchange rate channel, expectations channel, and credit channel. However, the asset channel is identified as the weakest channel of monetary policy in South Africa. Dabla-Norris & Floerkemeier (2006) also employed the VAR model for the Armenian economy on a similar subject. The authors mentioned that the action of monetary policy have impacts on the economy by influencing the expectations and confidence of economic agents. Also, parallel to Mayes (2004) and Kontulainen et al. (2004), the expectations channel can play a key role in improving the transmission mechanism of monetary policy by shortening the reaction lags.

A very similar kind of study is conducted by Sidaoui & Ramos-Francia (2008) in which they examined the monetary transmission mechanism for the Mexican economy with special emphasis on expectations and credit channels. Using VAR analysis and a small-scale macroeconomic model, the authors reported that the expectations channel helps the monetary policy authority and reduces the inflation pressures with reduced output costs. Additionally,

without the consideration of the expectations channel, it seems impossible for the credit channel and interest rate channel to fully explain the response of inflation to changes in the stance of monetary policy. As well, Rossini & Vega (2008) conducted a study in which they survey the empirical papers related to monetary policy transmission channels over the period of 1996 to 2006 for Peru. The paper concluded that the expectations channel has strengthened during the survey period. Furthermore, Guinigundo (2008) study used inflationary data from 1992 to 2005 for the Philippine economy. The ARMA model of econometrics is used to evaluate the monetary transmission channels. Results revealed that, in the inflation targeting process, the expectations channel plays a more important role in monetary policy transmission. In the conduct of monetary policy, the improved transparency connected with inflation targeting has amplified policymakers' perception of the significance of measuring public inflation expectations. Moreover, the results revealed that, during the inflation targeting period, the expectations channel has strengthened in the Philippines.

Ciccarelli et al. (2017) suggest that anchoring long-term inflation expectations are crucial for assessing the effectiveness of unconventional monetary policy. Their study, which uses the SVAR model, finds that long-term inflation expectations deteriorated during the great recession. However, the conduct of unconventional monetary policy helped regain control over inflation while also managing the recession risk. This study implies that expectations play a critical role in the effectiveness of monetary policy. Furthermore, Mehra and Herrington (2008) used the SVAR model to analyze the responses of projected inflation to various macroeconomic variables. They found that expected inflation works in an intuitive way in response to most of the shocks. In particular, expected inflation increases with a surprise increase in actual inflation. However, it may decrease with a slight increase in unemployment. This finding supports the notion that expectations are important in determining the effectiveness of monetary policy.

From the perspective of the inflation targeting system, an influential contribution is made by Guler (2016) in which the author examines the effectiveness of the expectations channel of monetary transmission for Turkey. The simple VAR model of econometrics is used to analyze this effectiveness and concluded that the central bank of the country cannot affect inflation expectations via both the policy interest rate and inflation targets. Furthermore, inflationary expectations are significantly affected by actualized exchange rates and inflation rates. Also, there is another thread of literature that examines the expectations channel of the monetary transmission mechanism from the perspective of financial journalists. Tambini (2010), Reid and Siklos (2020), and Reid et al. (2020) highlighted that the media articles that deal with monetary policy matters play an important role in the formation of inflation expectations. The role of the media cannot be considered as a neutral channel in the formation of expectations about monetary policy decisions. The media play a vital role in modeling expectations around the announcements of monetary policy. Financial journalists have the ability and writing skills to affect the public attitude and perceptions towards the economy and the policies executed by the central bank of the country.

2.3 Summary of Literature Review and Literature Gap:

Expectations have significant importance in an economy as they influence the behavior and decision-making process of economic agents. It is crucial for central bank policymakers to manage and monitor these expectations to make sure that inflation remains stable and under control. In this chapter, we review comprehensive literature on the subject of monetary policy transmission mechanisms with special emphasis on the expectations channel of monetary policy. Due to the lack of long-term inflationary expectations data, there have not been many empirical studies available in the literature that measure the expectations channel. To the best of our knowledge, there is no serious attempt on the expectations channel of monetary policy

that has yet been made from the perspective of Pakistan. The study in hand is an attempt to fill this research gap by using the latest economic data and modern econometrical tools.

CHAPTER 3

RESEARCH METHODOLOGY

3.1. Research Strategy:

The effectiveness of the expectations channel of monetary policy transmission can be examined in the case of Pakistan by using inflation expectations of households (in the shape of Expected Economic Conditions) and central bank communications (in the shape of SBP projections about inflation) in a SVAR. SVAR model provides a complete structure of an atheoretical vector auto regressive model. SVAR is initially used by Leduc et al., (2002) for examining the responses of monetary policy to the expectations shocks based upon the Livingston Survey (biannual survey for the economy of US) for post and pre 1979 war era in US.

Then a similar study is also conducted by the same authors Leduc et al., in 2007 after that such approach is named as Leduc, Sill and Stark (LSS) Approach. Mehra and Herrington (2008) followed the same approach to examine the shocks impacting the expectations of the households of the United States. Goyal & Parab (2021) also analyzed the effects of the shocks upon the macroeconomic indicators and movement in the macroeconomic indicators in response of these shocks in India.

Recently from 2000 to onward, monetary trends had a lot of similarities over the time for different subjects (countries) especially in industrialized economies. SVAR models are widely used to analyze the transmission mechanism of monetary policy and business cycle fluctuations now a days. There are a lot of studies available which support this argument. Gottschalk (2001) argued that SVAR models are useful to study the dynamics of the model. This study involves the use of SVAR models and then imposition of the restrictions along with analysis supported by impulse response functions and forecast error of variance

decomposition. The author summarized that this model is best for the study of the monetary policy transmission mechanism.

Gerlach and Smets (1995) further compared the effects of monetary policy upon the prices and output for G-7 countries where they argued that SVAR is an appealing method to study the transmission mechanism of monetary policy. Sousa and Zaghini (2007) conducted a study in which they constructed global monetary aggregates i.e., the main monetary aggregates of the G-5 countries and confirmed influence of those aggregates over inflation and global output. With the use of a Structural Vector Autoregressive Model, authors concluded that after the aggregate monetary policy shock, the output (global) declined significantly, and inflation persists over time.

As per theoretical justifications, SVAR is reduced-form Vector Autoregressive (VAR) model in which a vector of variables say X and Y depend upon each other as well as lagged X and Y. Since VAR model can be obtained as a solution/reduced form of the SVAR model, so we may have come across to the problem of identification. Along with the problem of identification, there is a chance of multicollinearity. The problem of multicollinearity is so severe that it is taken for granted. (Enders, 2015)

The excess of structural parameters than those of reduced form parameters is called the problem of identification. The problem of identification can be sorted by putting restrictions in which we can put some of the coefficient of the contemporaneous effects, some long run effects, and some of the covariances terms equal to zero to get rid of extra structural parameters. Identification refers to the comprehension of past differences in information, which enables these disparities to be employed for anticipating the results of a future course of action (Sims, 2009).

As far as the model is concerned, we can write SVAR model in the following way for the p[th] lag.

$$\beta_0 Z_t = c^* + \beta_1 Z_{t-1} + \beta_2 Z_{t-2} \ldots\ldots + \beta_p Z_{t-p} + \mu_t \qquad (3.1)$$

In above equation, β_0 is a matrix of a structure applied to reduced form vector auto regressive model while μ_t is the disturbance term and these disturbances are mutually and serially uncorrelated. This study employs the parametric restriction method, which is a widely used technique for achieving identification and interpretability of the parameters in SVAR models (Mukhtar & Younas, 2019). To ensure that the model's structural parameters are both identified and accurately interpreted, theoretical restrictions must be imposed as guidelines. Two categories of restrictions can be incorporated into a SVAR model to achieve proper identification: short-run restrictions aimed at capturing immediate dynamics or long-term restrictions focused on sustained changes over time.

Through these restrictions based on rigorous economic theory, researchers construct a framework whereby they study structural shocks via parameter adjustments. Thus, by implementing precise constraints grounded in well-established concepts from economics research, scholars gain greater depth and precision when analyzing structural relationships between variables distinguished by complex interdependencies essential to many macroeconomic issues today.

Here, we want to test the impact of expectations shocks on the macroeconomic indicators. We have estimated six variables structural vector auto regressive models with restrictions applied on the lower triangular of recursive matrix. In our model, we impose $\frac{N(N-1)}{2}$ restrictions on the β_0 just for identification. As our model consists of 6 variables, 15

restrictions needed to be imposed. Restrictions greater than $\frac{N(N-1)}{2}$ may make the model as over identified.

3.2 Research Design:

Our research design is based upon the expectations channel through which the expectations can influence the macroeconomic aggregates. According to Goyal and Parab (2021), the expectations channel can be described in the following way.

(a) Via Policy Rate:

$$r_t \downarrow \rightarrow \pi^e_{t,\ldots.t+s} \uparrow \rightarrow \pi_t\,, i^e_{t,\ldots.t+s}\,, W^e_{t,\ldots..t+s} \uparrow \rightarrow \pi^e_{t+1} \qquad (3.1.1)$$

(b) Via Central Bank Projections:

$$\pi^{e,SBP}_{t,\ldots t+s} \rightarrow \{\pi^e_{t,\ldots.t+s}\} \uparrow \rightarrow \pi_t\,, i^e_{t,\ldots.t+s}\,, W^e_{t,\ldots..t+s} \uparrow \rightarrow \pi^e_{t+1} \qquad (3.1.2)$$

r_t Stands for SBP Discount Rate, $\pi^e_{t,\ldots.t+s}$ means current inflation expectations over the time $t, \ldots. t+s$, $, i^e_{t,\ldots.t+s}$ refers to perceptions about interest rate variations over the time $t, \ldots. t+s$, $, W^e_{t,\ldots.t+s}$ means the expectations regarding the nominal wages over the time $t, \ldots. t+s$, whereas π^e_{t+1} stands for expected inflation in one time period ahead from t, π_t is the actual current inflation while $\pi^{e,SBP}_{t,\ldots t+s}$ refers to SBP's inflation projections.

Inflation perceptions are directly impacted by policy rates. Such perceptions affect the nominal interest rate variations, wage management and expected future inflation, which in turn, can impact the macroeconomic aggregates. The same channel can work through the SBP projections about future inflation expectations.

Following the Goyal and Parab (2021), the data vector used for the analysis here comprises of $\left[lnPET_t, \pi_t^{e,HH}, SBP_t^{FC}, R_t, y_t^g and\, \pi_t\right]$. Expectations are taken as exogenic of contemporaneous macroeconomics aggregates. Our identification matrix is over identified as given by the following equation 3.2.

$$\mu_t = \beta_0 e_t \tag{3.2}$$

Which we can expand in the following way.

$$\begin{pmatrix} u^{lnPET} \\ u^{\pi^{e,HH}} \\ u^{SBP^{FC}} \\ u^{R} \\ u^{y^g} \\ u^{\pi} \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ b1 & 1 & 0 & 0 & 0 & 0 \\ b2 & 0 & 1 & 0 & 0 & 0 \\ b3 & b6 & b9 & 1 & 0 & 0 \\ b4 & b7 & b10 & b12 & 1 & 0 \\ b5 & b8 & b11 & b13 & b14 & 1 \end{pmatrix} \begin{pmatrix} e^{lnPET} \\ e^{\pi^{e,HH}} \\ e^{SBP^{FC}} \\ e^{R} \\ e^{y^g} \\ e^{\pi} \end{pmatrix} \tag{3.3}$$

Here in above SVAR structure, $u^{lnPET}, u^{\pi^{e,HH}}, u^{SBP^{FC}}, u^R, u^{y^g} and\, u^{\pi}$ are structural shocks for natural log of petrol prices, inflation expectations of households, State Bank of Pakistan projections, discount rate, output gap and core inflation respectively. Whereas residuals for reduced form equations are as e^{lnPET}, $e^{\pi^{e,HH}}$, $e^{SBP^{FC}}$, e^R, e^{y^g} and e^{π} for the same variables respectively. They explained the unexpected movement in each of the variables. The ordering of the variables is done based on level of endogeneity and information available at a specific point of time.

Here in the timeline, data is taken on a monthly basis. Petrol prices are taken to be the most exogenous with no contemporaneous effect upon the other macroeconomic indicators. Whereas the second equation has contemporaneous impact upon the household expectations and lagged impact upon the remaining variables. Likewise, the SBP projections can not have a contemporaneous impact upon the discount rate because it can only be influenced by its own shock in the same period. Restrictions greater than $\frac{N(N-1)}{2}$ made our model over-

identified as we put the coefficient of the contemporaneous impact of the $u^{SBP^{FC}}$ over the $e^{\pi^{e,HH}}$ is equals to zero because both are the surveys which have been made independently. The monetary policy committee considers all the available information for setting up the policy rate. So, the policy rate is contemporaneously affected by petrol prices, inflation expectations of households and SBP projections. The last two variables which includes output gap and core inflations are taken as most endogenous because both are influenced by the rest of the variables with a great extent.

The ordering of the variables is important to incorporate because it can have a crucial impact upon the impulse response functions of the shocks. Furthermore, contemporaneous effects have the strongest impact, and it could be only wiped out with the time being.

3.3 Methods of Data Collection

The data collection is being made through secondary sources for the sample period. The time for our analysis is from January 2012 to December 2021 for secondary data analysis. Secondary sources consist of the State Bank of Pakistan (SBP), International Financial Statistics (IFS) and Pakistan Bureau of Statistics (PBS), where data of all the required variables was available. Monthly data of most of the variables was available at the given sources which is taken for analysis. Complete construction of the variables is available in the next section.

3.4 Description of the Variables:

Following are the variables that have been used for our analysis:

Core Inflation: Core Inflation is referred as a measure change in the cost of goods and services excluding food and energy sectors. Monthly data of Core Inflation is taken from monthly statistical bulletins of the SBP.

SBP Projections: SBP Projections is linked with monetary policy decision-making process in which research staff from Monetary Policy Department (MPD) formulate the model-based projections by using a version of forecasting measures. SBP does not publish monthly data of the projections about inflation. However, annual reports of the early sample period contain the data of SBP projections, and in recent years, quarterly reports are also available which contain the data of SBP projections. Data is taken from annual and quarterly reports of SBP, and monthly time series has been made by using EViews 12 by changing the frequency of data by using linear interpolation method.

Output Gap: The output gap is widely used as the input of the monetary policy reaction function to set the relevant instrument of the policy. It is an indicator used to assess the economic condition. The output gap is the unobserved but estimated concept. The difference between potential output and the actual level of output is termed as the output gap. The amount of goods and services that an economy can produce at maximum is the potential output and it is deemed that a healthy economy is the one where actual and potential output grow together. Output gaps can be positive or negative but none of them is desirable. When the actual output is more than the potential output it is tagged as a positive output gap whereas a negative output gap is the one where the actual output is less than the potential output. To minimize the output gap, the central bank adjusts the nominal interest rate.

In the literature, different approaches have been proposed to estimate the output gap. These approaches can be categorized as structural approach, statistical approach, and mixed approach. In the structural approach potential output is estimated by using the economic theory, the most commonly used structural approaches are structural vector autoregressive and the production function while the statistical approach is based upon statistical procedures to estimate potential output. Some of the most prominent statistical approaches include the

linear trend method, quadratic trend method, Hodrick-Prescott (HP) filter by (Hodrick & Prescott, 1997), the BN filter, and the Baxter and King filter, and the Band-pass (BP) filter.

The quadratic trend method is one of the above-mentioned approaches which is used to estimate potential output. The benefit of using this approach is that Seasonal variations may be filtered through dummy variables (Satti & Malik, 2017). More precisely the following equation is used.

$$y_t = \alpha_0 + \alpha_1 t + \alpha_2 t^2 + \beta_2 D_2 + \beta_3 D_3 + \cdots + \beta_{12} D_{12} + \varepsilon_t \qquad (3.4)$$

Where t represents time and D_2 to D_{12} are the dummy variables to adjust seasonality. The application results of the filter are given in the figure below.

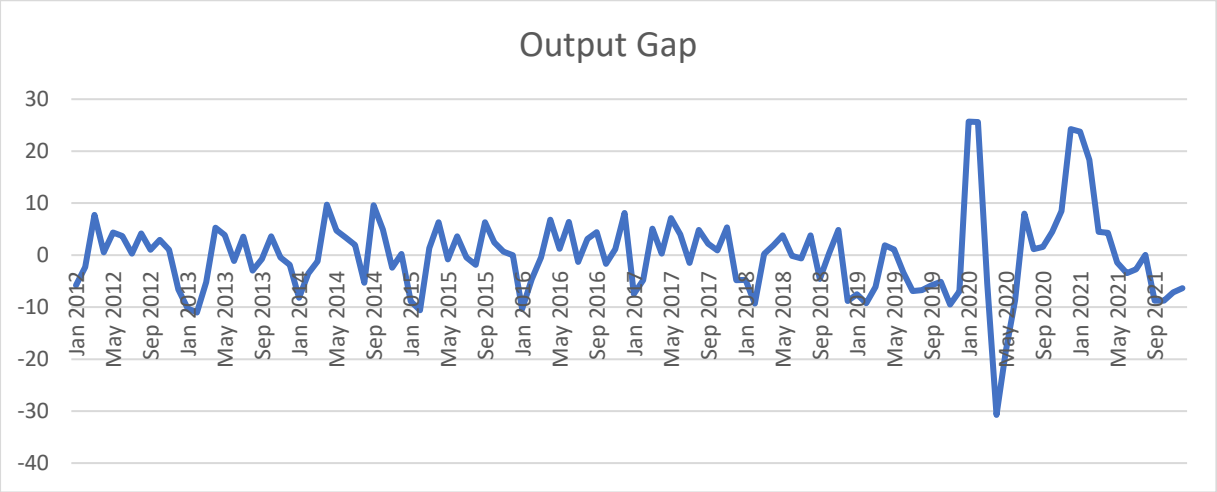

Figure 3.1: Output Gap estimated through Quadratic Trend; (Author's estimates)

The figures above show that seasonality is well adjusted by using the quadratic trend method for our sample data. Moreover, the output gap which is estimated is more consistent with the historical evaluation of business cycles in the economy of Pakistan. This finding is consistent with (Satti & Malik ,2017). So, output gap is estimated through the quadratic trend method. As far as the analysis of present study is concerned, the monthly data of industrial production is used as a proxy of GDP which is obtained from the International Financial Statistics (IFS) for the sample timeline from 2012M01 to 2021M12. As monthly data of GDP is not available

and Industrial Production Index is one of the commonly used macroeconomics indicators for assessing the cyclical position of the economy in the absence of GDP Data (Carvalho & Rua, 2017).

Discount Rate: The Discount Rate is a tool used by the State Bank of Pakistan to provide banks with a three-day repo facility when they have no other lending options. It serves as an official instrument for assessing monetary policy in Pakistan since its monthly fluctuations reflect changes in the country's overall economic strategy. The data of discount rate is obtained from SBP.

Petrol Prices (Super): Petrol prices are the prices of petrol which are taken in Pakistani Rupee and data is taken from the monthly bulletins publish by the Pakistan Bureau of Statistics. A natural log of the data of the petrol prices is used for analysis. As fuel prices are not the component of the core inflation but it can influence the inflation expectations of the households which can impact the core inflation. That is the intuition of inclusion of petrol prices in our model.

Inflation Expectations of the Households: Inflation expectations of households is defined as the expected rise in the price level which is ascribed by the households (here in our case, Pakistani households). Data of the concerned variable is taken from consumer confidence survey of SBP Pakistan. The data series which was taken for the sample period is named as Expected Economic Conditions (EEC). Bi-monthly data is taken from SBP, and it is converted into monthly time series by taking averages.

3.5 Analysis and Discussion:

The expectations channel holds significant importance in the transmission mechanism of monetary policy. It encompasses the influence that future decisions regarding monetary policy have on various economic agents such as consumers, businesses, and financial

markets. This dynamic relationship between expectations and behavior has a direct impact on the effectiveness of monetary policy in achieving its objectives.

By considering how individuals and entities anticipate changes in policy rates or other key aspects of monetary policy, policymakers gain insights into how these expectations shape their decision-making processes. For instance, if stakeholders expect an imminent increase in policy rates by central banks to curb inflationary pressures, they may adjust their spending habits or investment strategies accordingly. Consequently, these behavioral shifts can either reinforce or dampen the desired effects of implemented policies.

Similarly, expectations about monetary policy can influence exchange rates. If the central bank is expected to tighten the monetary policy, such as raising interest rates, it can attract capital inflows, leading to an appreciation of the domestic currency. On the other hand, expectations of loose monetary policy can lead to capital outflows and depreciation of the domestic currency. Changes in the exchange rates can have an impact on various economic indicators like export competitiveness, import costs and inflation.

Likewise, the expectations about future policy rates can influence asset prices such as stock prices, bond prices and real estate prices. Lower expected policy rates can lead to an increase in asset prices, as investors anticipate higher returns on their investments. On the other hand, higher expected policy rates can cause a decrease in asset prices as investors anticipate lower returns. Changes in assets prices not only impact the wealth and financial stability of individuals and businesses, but they can also have broader implications for the overall economy.

In short, the expectations channel operates through the interaction of central bank communications, policy rate expectations, consumption and investment decisions, asset

prices, exchange rates and inflation expectations. Understanding and managing these expectations is vital for the central bank to ensure the effective transmission of monetary policy and to achieve their macroeconomic objectives.

Our study is going to provide genuine evidence regarding the effectiveness of the expectations channel of monetary policy transmission mechanism in the case of Pakistan with the help of survey-based data of inflation expectations of household in the shape of Expected Economic Conditions (EEC) and professional forecast with a special focus on central bank announcements in the shape of a variable named as SBP Projections from monetary policy statements.

The research questions of the study which include to determine the influence of the expectations shocks upon the macroeconomic indicators can be answered by measuring the response of inflation expectations of household and SBP projections over the shocks of all other macroeconomic indicators through impulse response functions which are further supported by forecast error of variance decomposition. Furthermore, present study also confirms that which tool (either via policy rate or via SBP projections) of monetary policy transmission is more effective in case of Pakistan. All the research questions can be answered through the analysis presented in the next chapter. Likewise, the fulfillment of the research objectives can also be done through the same analysis.

CHAPTER 4

ESTIMATIONS AND INTERPRETATIONS

4.1 Stationary Condition:

Following the approach of Mehra and Herrington (2008) and Goyal and Parab (2021), we estimated VAR model and then SVAR. Finally, to gain a more comprehensive understanding of the expectations channel of transmission mechanism of monetary policy, an exhaustive analysis has been conducted using impulse response functions and forecast error of variance decomposition.

To start with the analysis, we checked the stationarity of all the variables. The Augmented Dickey Fuller and Phillips–Perron tests are applied to both levels and the first differences of each series. The ADF test evaluates the hypothesis that the data series has an integration order of one versus having zero integration as an alternative. In addition, it assumes that the time series follows ARMA structure, which necessitates careful selection of appropriate lag length and considers as a critical issue with practical implications of using ADF test. An inadequate lag length would bias the results by leaving behind some residuals serially correlated while excessive lag lengths would impact the testing power negatively.

Whereas PP test differs from ADF in their parameterization for addressing heteroscedasticity and serial correlation within the residuals. Unlike ADF, which utilizes a parametric approach to establish the ARMA structure, PP does not factor in any considerations of serial correlation. The main advantage of PP over ADF is its greater resilience as it avoids imposing determinations regarding lag length. Nonetheless, if both tests indicate comparable results, then they possess identical theoretical acceptance and statistical significance. The intuition

behind the selection of ADF test is that most of the macroeconomic time series follows the ARMA structure followed by parametric approach.

Table 4.1: Unit Root Analysis

	Level (p-values)			**First Difference (p-values)**		
	None	**Intercept**	**Trend and Intercept**	**None**	**Intercept**	**Trend and Intercept**
Log (Petrol Prices)	0.8457	0.6421	0.8288	0.0000	0.0000	0.0000
HH Inflation Expectations	0.8263	0.1108	0.7532	0.0000	0.0000	0.0000
SBP Projections	0.3742	0.2744	0.5845	0.0000	0.0003	0.0014
Discount Rate	0.5389	0.0975	0.3166	0.0002	0.0042	0.0143
Out Put Gap	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Core Inflation	0.3413	0.2708	0.8016	0.0000	0.0000	0.0000

Source: Author's Own Estimations

The data used in analyzing the effectiveness of expectations channel of monetary policy transmission mechanism in Pakistan was tested for stationarity using the ADF test and PP Test. Both tests yield similar results indicating that all variables, except output gap, were non-stationary at levels with p-values greater than 0.05. The table above reports the results from various tests conducted by considering intercept, intercept and trend, and without both

intercept and trend to prove null hypothesis being integrated of order one. Discount rate is stationary at first difference which shows real shocks in the data. Yasir (2015) confirmed that the historical data of discount rate for Pakistan is non-stationary in nature. Furthermore, while checking for stationarity, not only the condition for constant mean is to be confirmed but also the conditions of constant variance and covariance are to be confirmed as well. Constant mean can make the time series of discount rate stationary at level, but the conditions of constant variance and covariance may make the time series stationary at first difference.

Merely the output gap exhibits stationarity at level, whereas for the first differences of the remaining variables, P-values are less than 0.05 indicating rejection of the null hypothesis that it is integrated with order one. This signifies that after taking the first differences, the data becomes stationary which makes it suitable to estimate structural VAR models based on such transformed series. Results are given in table 4.1.

4.2 Lag Selection:

The optimal lag selection of the structural vector autoregressive model is an important and essential stage of estimations. There are different criterions of lag selection which are summarized in the following table 4.2.

Table 4.2: Lag Selection through Criterion

Lags	LogL	LR	FPE	AIC	SC	HQ
1	1077.096	NA	2.88e-16	-18.75849	-17.87972*	-18.40200
2	1144.879	120.9098	1.63e-16*	-19.33115*	-17.57362	-18.61817*
3	1180.112	59.03989	1.67e-16	-19.31734	-16.68104	-18.24787
4	1203.716	37.00067	2.14e-16	-19.09399	-15.57892	-17.66803
5	1241.314	56.33197*	2.13e-16	-19.14079	-14.74696	-17.35835
6	1258.983	22.52516	3.21e-16	-18.79248	-13.51988	-16.65354
7	1283.430	30.39401	4.34e-16	-18.58432	-12.43296	-16.08890
8	1312.991	33.55553	5.54e-16	-18.46830	-11.43817	-15.61639

Source: Author's Own Estimations

After carefully analyzing various criteria such as Akaike Information Criteria, Hannon Quin Information Criteria and Final Prediction Error among others, the optimal lag length was found to be two. However, upon considering Likelihood Ratio, it became apparent that a

longer lag length of 5 would better to capture the complex dynamics of the system under present study. While selecting an appropriate number of lags is crucial for accurate results, too many can also result in issues like with degree of freedom. Therefore, a parsimonious approach was taken in which only a small set of variables were kept while maintaining a moderate but suitable lag length at 5. Similar approach was used by the Disyatat and Vongsinsirikul (2003) for studying the monetary policy and its transmission mechanism for Thailand. Agha at al., (2005) followed the similar approach for selection of the lags while exploring the different transmission mechanisms of monetary policy of Pakistan. Moreover, during analysis certain challenges arose regarding autocorrelation specifically at lag 2. Thus, by increasing the number of lags to five we were able to overcome this problem by providing depth to our findings.

The test for absence of the autocorrelation at the selected lag i.e., lag 5 is conducted and no autocorrelation is being found (See Appendix B). LM test has been conducted to test the absence or presence of the serial correlation at the selected lags which is followed by the Edgeworth expansion corrected likelihood ratio statistics having null hypothesis of 'no serial correlation at lag h' (which is 5 in our case). P-value at lag 5 is insignificant i.e., 0.4740 which implies the acceptance of the null hypothesis which states that no serial correlation found at the selected lag. LM test statistics are being provided in the Appendix B.

4.3 VAR Analysis:

Before going into the SVAR analysis, we estimated the VAR equation for the data set (See Appendix C). The intuition behind referring to the VAR model is to get reference for the interpretation of the variance decomposition. After that we estimated a six variables structural vector autoregressive model with identifying restrictions applied by using a lower triangular matrix. As stated earlier, recursive restrictions are being imposed upon the variables based on either absence or presence of the contemporaneous effect of variables upon each other. The

lag selection is done by the lag selection criterion which is given in the previous section. The values of t-statistics are significant for the majority of the variables at selected lags. Appendix C can illustrate the VAR results which we are skipping to mention in this section because the impulse response functions (IRFs) and forecast error of variance decomposition (FEVD) can give us the same interpretation which is done in the section 4.5 of this chapter.

4.4 SVAR Analysis:

The SVAR model (equation 3.3) mentioned in the previous chapter is estimated through using the E-views 12 based on seasonally adjusted monthly data available from January 2012 to December 2021. Initially, to start the SVAR analysis, we applied the VAR model over the data (see Appendix C). The vector form of equation 3.3 can be re-written in the following way for the purpose of analysis.

$$\begin{pmatrix} u^{lnPET} \\ u^{\pi^{e,HH}} \\ u^{SBP^{FC}} \\ u^{R} \\ u^{y^{g}} \\ u^{\pi} \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ b1 & 1 & 0 & 0 & 0 & 0 \\ b2 & 0 & 1 & 0 & 0 & 0 \\ b3 & b6 & b9 & 1 & 0 & 0 \\ b4 & b7 & b10 & b12 & 1 & 0 \\ b5 & b8 & b11 & b13 & b14 & 1 \end{pmatrix} \begin{pmatrix} e^{lnPET} \\ e^{\pi^{e,HH}} \\ e^{SBP^{FC}} \\ e^{R} \\ e^{y^{g}} \\ e^{\pi} \end{pmatrix} \qquad (4.1)$$

In above matrices, u^{lnPET}, $u^{\pi^{e,HH}}$, $u^{SBP^{FC}}$, u^{R}, $u^{y^{g}}$ and u^{π} are structural disturbances whereas e^{lnPET}, $e^{\pi^{e,HH}}$, $e^{SBP^{FC}}$, e^{R}, $e^{y^{g}}$ and e^{π} are residuals of reduced form equations respectively. To identify the required restrictions of the model, two techniques can be employed which are recursive VAR and SVAR. While both methods use a matrix (A) to capture these constraints and there is a notable difference between them. In recursive VAR, Cholesky decomposition assumes that the A matrix is diagonal i.e., mostly in its lower portion. Conversely, with SVAR method, we have more flexibility as it allows for different structure assumptions for the model through applied restrictions illustrated by vector form of equation 4.1. Unlike in recursive VAR where covariance matrix of structural disturbances

should form a diagonal arrangement, in SVAR model, the identifying restrictions as given in equation 4.1 however should be lower triangular which confirms the orthogonality of the structural shocks.

If we can open the matrices in the following set of linear equations:

$$u^{lnPET} = e^{lnPET} \quad (4.2)$$

$$u^{\pi^{e,HH}} = b1\, e^{lnPET} + e^{\pi^{e,HH}} \quad (4.3)$$

$$u^{SBP^{FC}} = b2e^{lnPET} + e^{SBP^{FC}} \quad (4.4)$$

$$u^{R} = b3e^{lnPET} + b6\ e^{\pi^{e,HH}} + b9\, e^{SBP^{FC}} + e^{R} \quad (4.5)$$

$$u^{y^g} = b4\ e^{lnPET} + b7\, e^{\pi^{e,HH}} + b10e^{SBP^{FC}} + b12\, e^{R} + e^{y^g} \quad (4.6)$$

$$u^{\pi} = b5e^{lnPET} + b8\, e^{\pi^{e,HH}} + b11\, e^{SBP^{FC}} + b13\, e^{R} + b14e^{y^g} + e^{\pi} \quad (4.7)$$

Table 4.4 shows the values for coefficients of SVAR estimations (see Appendix D for complete results). In table 4.4, higher value of coefficients will yield to higher shocks (may be positive or negative) whereas lower value of coefficients indicates minimal shock. Coefficient of our interest are supported by economics theory. Likelihood Ratio (LR) for over identification of the restrictions is $\chi^2(1) = 0.2652$ having insignificant p-value = 0.6065 which is greater than 0.05 which implies that over identification is valid (See appendix D). In equation 4.3, B1 is positive and significant as it is the impact of the petrol price shock on the formation of inflation expectations of the households. Households expect a rise in inflation as result of the rise in petrol prices. Likewise, in equation 4.7, inflation is inversely related to the shock of output gap. The value of the coefficient (B14) is negative and significant as the p value is less than 0.05.

The variables of our interests to check the efficacy of the expectations channel of monetary policy transmission are discount rate and the SBP forecast. The coefficient of the discount rate with respect to inflation (which is b13) is having negative value i.e., -0.3219 and p-value

is less than 0.05. A decrease in the discount rate will cause the aggregate demand to increase, causing an increase in inflation. Furthermore, the discount rate, which has been set and maintained by the State Bank of Pakistan in a traditional manner, is widely regarded as the primary indicator for guiding market participants about SBP's monetary policy stance. Its purpose was to monitor inflationary pressures effectively.

Table 4.4: SVAR Estimations

Variables	Coefficient	Standard Error	z-statistics	P-Value
B1	7.106991	3.076568	2.310028	0.0209
B2	-0.006230	0.003829	-1.626987	0.1037
B3	-0.031319	0.0006775	-4.622879	0.0000
B4	-15.28597	15.33629	-0.996719	0.3189
B5	0.021496	0.007231	2.972904	0.0029
B6	-0.000268	0.000200	-1.341579	0.1797
B7	-0.079539	0.418518	-0.190049	0.8493
B8	-9.77E-05	0.000196	-0.497053	0.6192
B9	-0.262785	0.160611	-1.636158	0.1018
B10	348.4049	337.5483	-1.032163	0.3020
B11	-0.494840	0.159196	-3.108361	0.0019
B12	-234.6405	194.5667	-1.205965	0.2278
B13	-0.321979	0.091918	-3.502911	0.0005
B14	-0.000123	4.40E-05	-2.806335	0.0050

Source: Author's Own Estimations

Another valid justification of this negative sign of B13 is whenever inflation rose beyond certain limits and approached the breakeven point with respect to the discount rate, changes

in this rate have historically played a crucial role in steering inflation numbers back down towards their desired level (Arif, 2011).

However, the coefficient(B8) of inflation expectations of households with respect to inflation doesn't show any significant impact as p-value is insignificant which implies that the inflation expectations of Pakistani households do not impact the core inflation. Whereas the coefficient of SBP projections with respect to inflation is not as expected, which confirms that the expectations channel of monetary transmission channel work better via discount rate than the via SBP projections.

4.5 Impulse Response Functions and Forecast Error of Variance Decomposition:

The application of a VAR (vector autoregressive) model entails the use of an essential tool, known as the impulse response functions (IRFs). This powerful representation allows us to examine how endogenous variables in a system respond when exposed to shocks associated with errors. To investigate and understand, how different variables can have impact on other variables, in unrestricted VAR models, we utilized IRFs. In conducting the present study in which we focused on capturing the effect of expectations shocks on macro-level aggregates like inflation rates and output performance, we use impulse response functions. To be able to gain better insights of variations into each dependent variable with respect to change in concerning explanatory variables, variance decomposition analysis was used for more relative analyses.

4.5.1 Impulse Response Functions and Variance Decomposition of Petrol Prices Shocks to all other Variables:

Impulse response functions of the one-unit positive standard deviation shock of petrol prices to the shocks in all other variables is given in figure 4.5.1. It gives us the significant responses of petrol prices to all other macroeconomic variables which are given in the VAR

model. Petrol prices significantly responded by their own shock the till 7th period. Initially, its response to its own shock was quite high and positive and then it became zero in the 8th month and afterwards it became negative from onward 9th month.

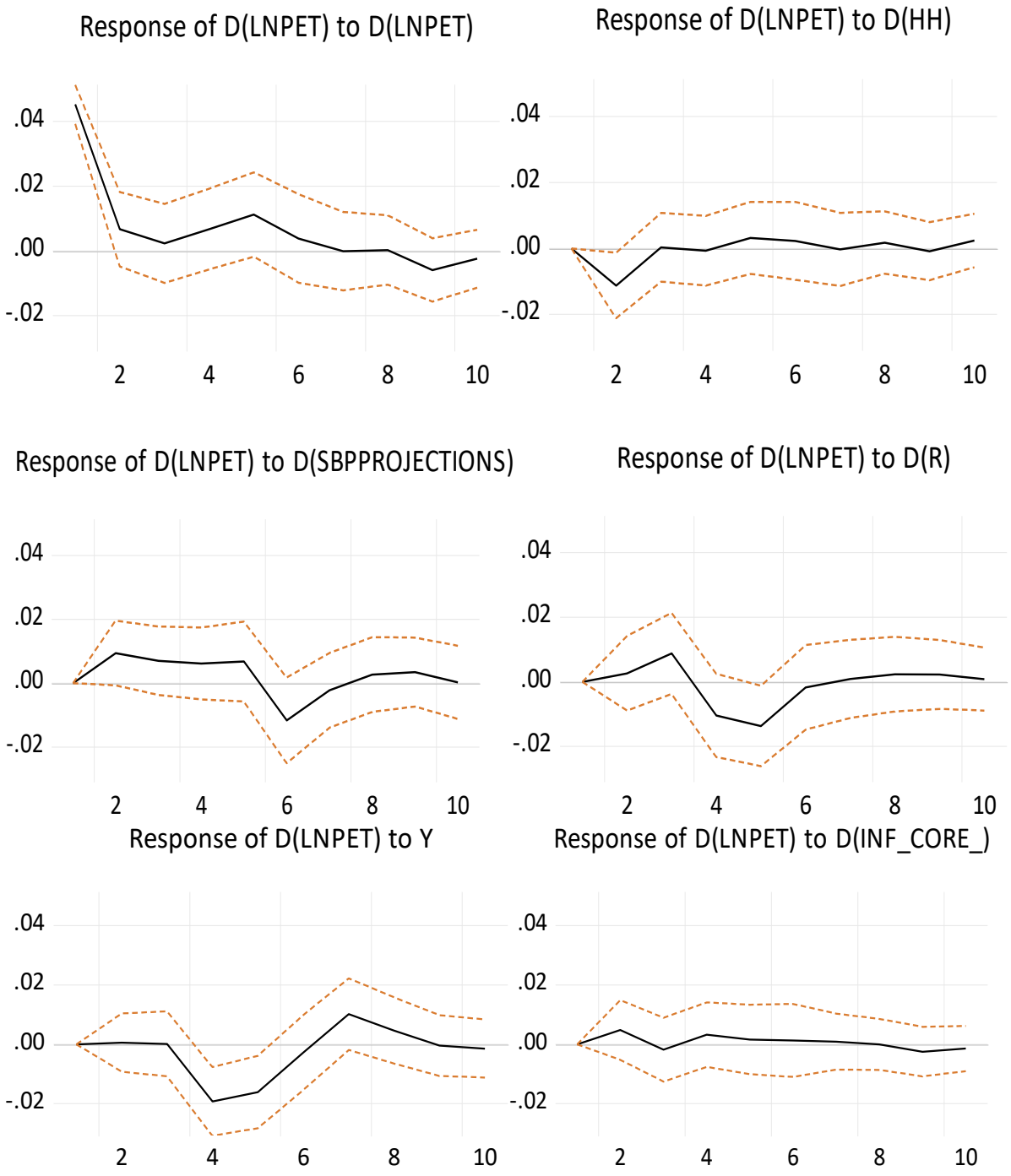

Figure No. 4.5.1: IRFs of Petrol Prices to the shocks all other Variables, *(Author's estimates)*

Its response to household expectations is naïve in the start, standing at below zero but it increases over the time after 3rd month and then it remains persistent over the time horizon. The response of petrol prices to the shocks in monetary policy tools i.e., SBP projection and discount rate shows mixed trends like positive in the start, then becomes negative and from 7th month onwards, it became again positive. The response of petrol prices to the shock of output gap stood at zero till the 3rd month of forecast horizon. Then it remained negative till the 6th month and became positive afterwards. Likewise, the response of petrol price to the shock of core inflation is positive for the first 3 months, after that it became negative for a month. Afterwards, it remained positive till the 10th month and did not show any significant variation throughout the forecast horizon.

As far as Forecasting Error of Variance Decomposition (FEDV) is concerned, it is shown in table 4.5.1 as well where variance decomposition of the petrol price over all other variables is given.

Table No. 4.5.1: FEVD of Petrol Prices over the other Variables

Forecast Horizon	S.E.	D(LNPET)	D(HH)	D(SBPPROJECTIONS)	D(R)	Y	D(INF_CORE)
1	0.045218	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.049423	88.82867	4.776956	4.929020	0.630592	0.114670	0.720094
3	0.051058	85.09840	4.500167	6.848020	2.672931	0.110573	0.769908
4	0.055791	71.29375	3.975417	7.345262	5.787165	10.69758	0.900821
5	0.059963	62.12186	3.463128	7.545209	10.16996	15.86630	0.833537
6	0.061120	59.79716	3.513878	10.57443	9.847514	15.43147	0.835542
7	0.062073	58.01814	3.409328	10.42613	9.674826	17.64535	0.826221
8	0.062407	57.48544	3.476194	10.48839	9.746311	17.98624	0.817428
9	0.062684	57.41524	3.468955	10.63639	9.697404	17.85216	0.929852
10	0.062816	57.34742	3.584599	10.59198	9.657192	17.85385	0.964960

Source: Author's Own Estimations

Most of the variations in the petrol price in our six variable SVAR model is explained by its own shock, the shocks of the monetary policy in the shape of SBP projections and discount rate, and the supply and demand side shock from 2nd month. Variations in the petrol prices have minor impact upon the household expectations. Short run impacts are weak in all the variables, but the fluctuations persist over the time. The variations in petrol prices explained by its own shock are persistent up to 57 percent in the long run. If we look at the other variables, the long run impact of the petrol prices over the monetary policy shocks like SBP projections and discount rate is about 11 and 10 percent respectively. The variations in the supply-side shock (core inflation) do not show any significant impact and explains only about 1 percent in the long run. The possible reason for it is that core inflation counts for non-energy inflation. Whereas variation in the petrol prices with respect to demand side shock (output gap) is explained about 17 percent. However, the impact over household expectations is merely about 3.58 percent in the long run.

4.5.2 Impulse Response Functions and Variance Decomposition of Households Inflation Expectations to Shocks in all other Variables:

Figure 4.5.2 shows the one standard deviation positive response of the inflation expectations of the households to the shocks of all other macroeconomic variable in the given SVAR structure. The response of household inflation expectations to the petrol prices is positive in the start and it reaches zero in the 3rd month and then becomes negative till the 5th month. It remained positive from 5th to 8th period and became negative afterwards. It shows a significant influence because household raise their inflation expectation due to rise in the prices of the petrol as petrol is used as life blood of an economy.

The response of household's inflation expectations to its own shock is significant in the start and then became negative from 3rd to 5th month of forecast horizon. Onward from the 6th month, it did not show any significant variation. Response of household inflation

expectations to the SBP projections does not show any significant variation in the whole forecast horizon as survey of formation of expectation index of households made independently than the SBP projections about inflation.

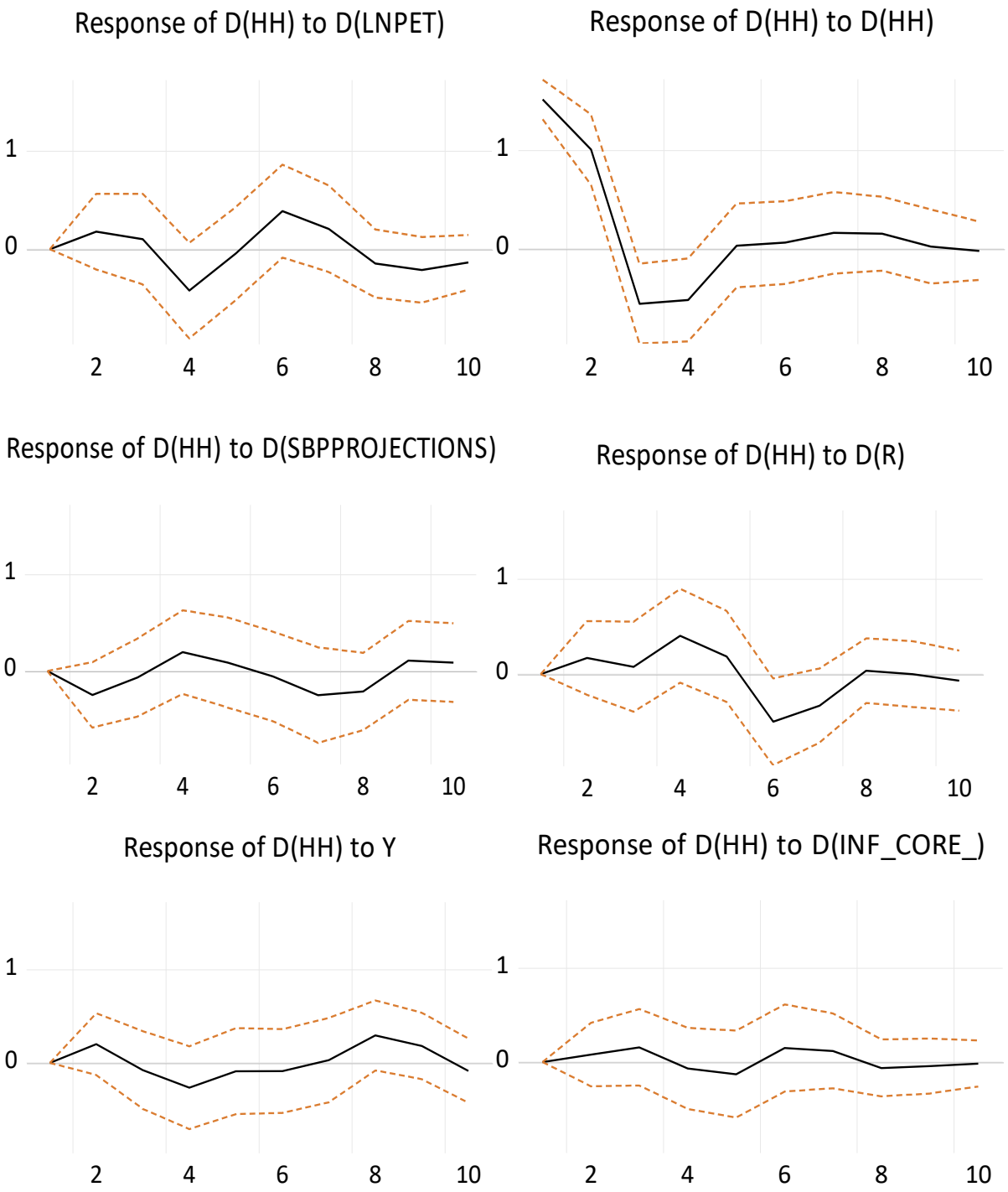

Figure No. 4.5.2: IRFs of House Expectations to the shocks of all other Variables

Whereas the response of discount rate to the inflation expectations of the households is positive and significant till the 5th month of forecast horizon which is not as per economic

theory. It became negative from the 5th to the 8th which is significant and showed that the increase in the discount rate will make the banks less profitable to borrow from the SBP and households shall expect less inflation in the economy. Influence of household's expectations over the demand side shock (output gap shock) shows the negative trend from the 3rd to 7th period, after that it has increasing trend. The response of household inflation expectations to core inflation starts from zero and then it remains positive till the 3rd period. Afterwards, it became negative till the 5th period and then remained positive till the 8th period.

However, the response of household inflation expectation does not show any significant variations to the core inflation. The possible reason behind it might the concern of the households about the food and energy prices which are not the part of core inflation. Another possible explanation of such behavior could be that less educated Pakistani households with low knowledge of economics do not form their expectations rationally. The results are consistent with the findings of Goyal & Parab (2021). The above stated analysis can be confirmed from the figure (4.5.2).

Whereas Forecast Error in Variance Decomposition (FEVD) confirm the above stated analysis too which is given in the following table.

Table No.4.5.2: FEVD of Household Expectations over the other Variables

Forecast Horizon	S.E.	D(LNPET)	D(HH)	D(SBPPROJECTIONS)	D(R)	Y	D(INF_CORE)
1	1.519729	4.471630	95.52837	0.000000	0.000000	0.000000	0.000000
2	1.872815	2.952556	93.12007	1.306359	1.153610	1.327132	0.140270
3	1.965384	3.913280	91.67551	1.186809	1.365834	1.245436	0.613126
4	2.089064	3.979649	86.59142	2.504480	3.463271	2.838840	0.622339
5	2.100876	3.965284	85.65021	2.630698	3.739450	3.113896	0.900459
6	2.151846	4.219085	81.64916	2.630556	7.246491	3.024504	1.230208
7	2.190917	4.070016	79.20841	3.967275	8.360152	2.984129	1.410013
8	2.234458	4.364374	76.73106	5.022200	8.080522	4.385099	1.416748
9	2.249250	4.886795	75.73455	5.089562	7.975663	4.888740	1.424685
10	2.259082	5.304596	75.10078	5.167781	8.019152	4.991810	1.415877

Source: Author's Own Estimations

About 75 percent variation in household expectations are explained by itself. Monetary policy shocks are not significant in short run whereas in long run variations in household expectations are explained by the discount rate and SBP projections are just 5 and 8 percent respectively. The influence of demand side shock (output gap) is about 5 percent. Our analysis to explore the expectation channel of the monetary policy is linked with the impact of household expectation over the actual inflation. The variations in household expectations about the inflation is explained by the shock of core inflation is about 1.41 percent. It is not in concurrence with the theory as expectation about inflation by the Pakistani household are not formed rationally which is supported by the study of Nasir et al., (2020) by arguing that there are non-linearities between the inflation and inflation expectations. Similar results are found by Goyal & Parab (2021) as well in the case of India where the influence of the inflation expectations of Indian households did not significantly impact any of macroeconomics indicator.

4.5.3 Impulse Response Functions and Variance Decomposition of SBP Projections to Shocks in all other Variables:

In this section, the impulse response functions, and variance decomposition of SBP projection to the shocks of all other macroeconomic aggregates has been estimated. Figure 4.5.3 shows us the one standard deviation positive responses of SBP projection over the shocks of itself and all other variables. The positive one standard deviation response of the SBP projection to the petrol prices was initially negative and then it became positive after 3rd month. It remains positive but insignificant throughout the remaining period of the forecast horizon. Response of SBP projections to the shock of inflation expectations of the households remained negative and declining in the start. Then it began increasing after the 3rd month, and it became positive after the 7th month and remained positive only for two months.

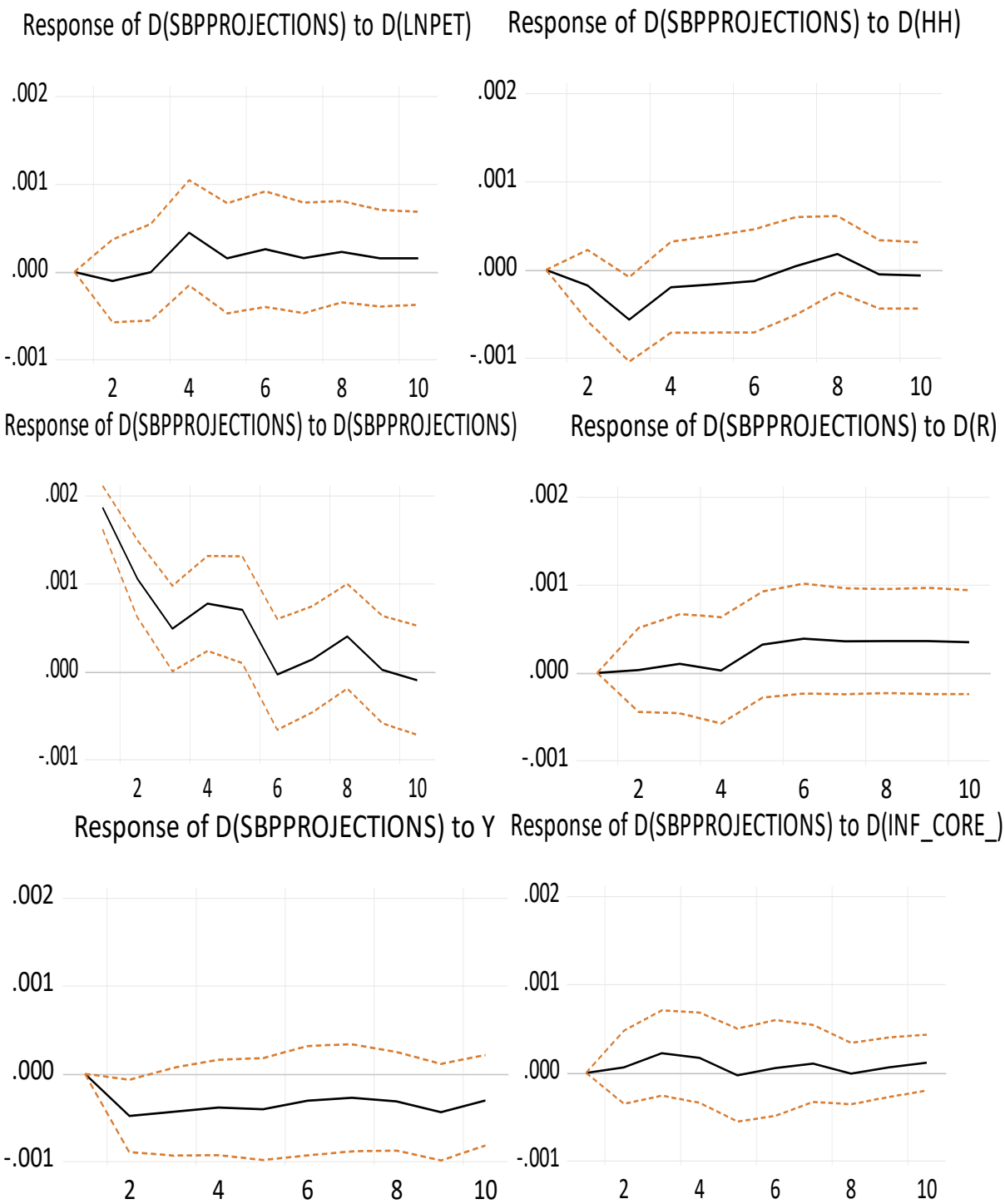

Figure No. 4.5.3: IRFs of SBP Projections to the shocks all other Variables, *(Author's estimates)*

The one standard deviation positive response of SBP projections to the inflation expectations of households is negative and insignificant till the 7th month and then it became positive. It shows that the working of expectations channel via SBP projections is weak. SBP projections explained significant response to its own shock which is declining over the time. It remained

positive but declined till the 6th month and then after becoming zero in the 6th month, it starts increasing again, which shows a significant response to itself. For the discount rate, its response remained above zero and increasing. After the 5th month, it became stagnant for the rest of the forecast time. The response of SBP projections to the discount rate is significant which shows that the SBP incorporates all the possible information that can impact inflation while making the forecast about inflation.

The response of the SBP projections to the shock of output gap remained negative and insignificant throughout the timeline of forecast. Whereas the one standard deviation response of SBP projections to the core inflation is positive and persistent over the time period. The variation is not too significant, but its impact remains positive. The analysis is shown in figure 4.5.3.

These findings and responses can also be confirmed from table 4.5.3 as well where the forecast error of variance decomposition is given.

Table No.4.5.3: FEVD of SBP Projections over the other Variables

Forecast Horizon	S.E.	D(LNPET)	D(HH)	D(SBPPROJECTIONS)	D(R)	Y	D(INF_CORE)
1	0.001870	2.269313	0.227134	97.50355	0.000000	0.000000	0.000000
2	0.002231	1.621842	1.240499	92.88650	0.000451	4.192241	0.058462
3	0.002422	1.789914	6.414904	84.94992	0.230438	5.919511	0.695309
4	0.002661	5.775958	6.041465	80.57334	0.209868	6.510354	0.889011
5	0.002837	6.811047	5.690598	78.10026	0.878616	7.730374	0.789103
6	0.002900	8.340971	5.531168	74.78237	2.179170	8.384285	0.782033
7	0.002954	8.880042	5.394735	72.77954	3.323505	8.770949	0.851233
8	0.003047	9.707851	5.436475	70.76637	4.017798	9.270947	0.800557
9	0.003103	10.02063	5.247844	68.40561	4.802022	10.72081	0.803084
10	0.003142	10.37660	5.122578	66.71484	5.704922	11.19828	0.882792

Source: Author's Own Estimations

Variations in SBP projections have a great influence over its own shock and it is declining in long run. The variations in SBP projections over the shock of core inflation are explained by

less than one percent in short run and if goes merely about 1 percent in long run. The variations in SBP projections have been explained by the shocks of household inflation expectation and petrol prices are given as up to 5 and 10 percent respectively. Whereas the impact of variations in SBP projections explained by the output gap and discount rate goes up to 11 and 6 percent respectively in long run.

4.5.4 Impulse Response Functions and Variance Decomposition of Discount Rate to Shocks in all other Variables:

The positive one standard deviation response of the discount rate over the other macroeconomic aggregates is given in the figure 4.5.4. It is the main variable of interest as analysis for the exploration of the expectations channel is conducted either through the SBP projections or through the policy rate. The response of discount rate to shocks of petrol prices remains increasing and positive till the 5^{th} month and then becomes declining but remains positive throughout the forecast horizon. The positive one standard deviation response of discount rate to the inflation expectations of the households remained negative till the 5^{th} time period and showed significant response. It shows that the working of expectations channel is relatively better via discount rate than the SBP projections. Findings are similar to the study of Guler (2016) where the central bank policy rate significantly respond to the inflation expectations of households better than the other tools in turkey. The response of discount rate to the SBP projections is positive and increases till the 2^{nd} month and then became decreasing till the 4^{th} month. It remains negative from the 5^{th} month to the 9^{th} month and shows insignificant variations. The response of discount rate to its own shock shows a mixed trend but remained positive and significant throughout the forecast period.

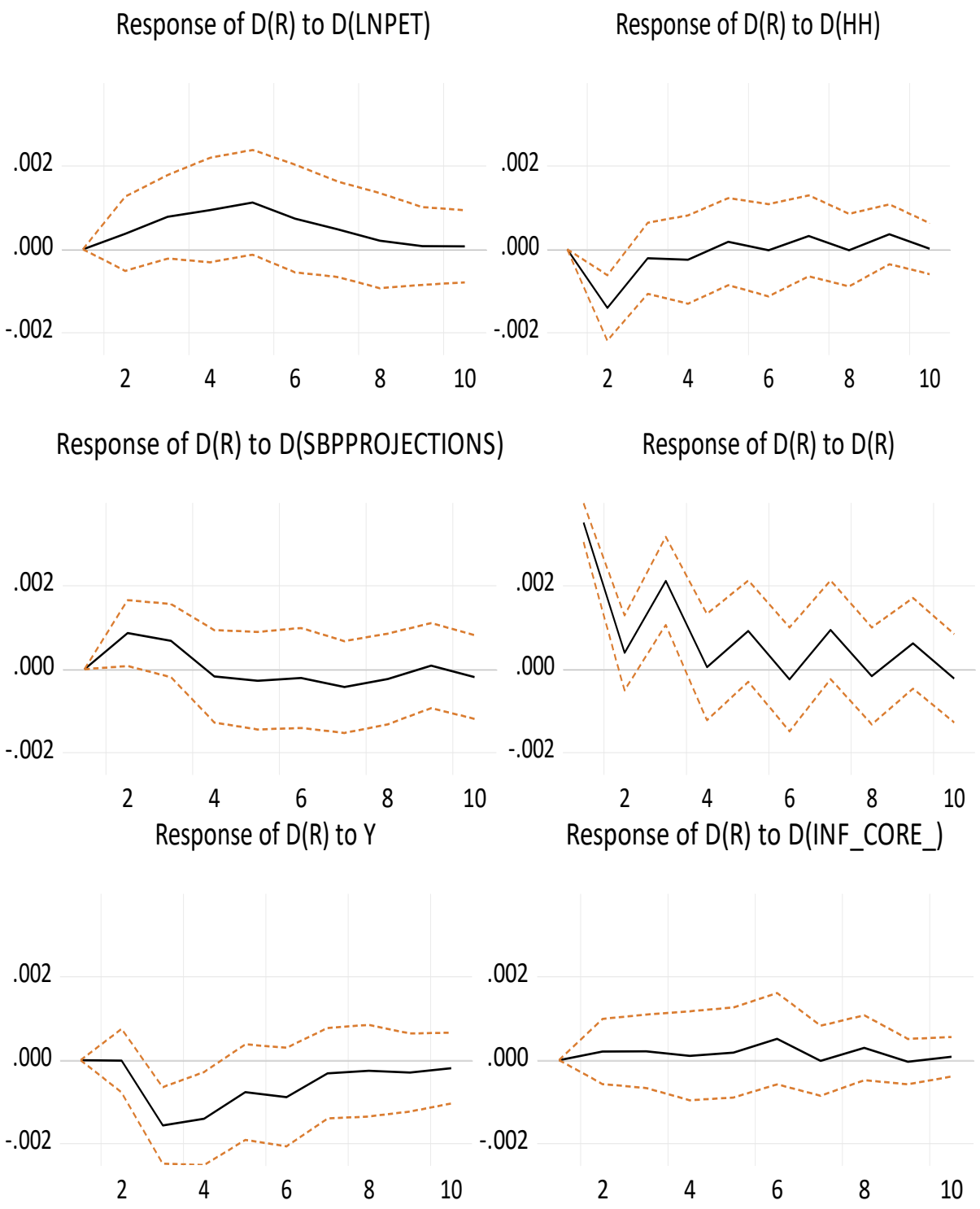

Figure No. 4.5.4: IRFs of Discount Rate to the shocks all other Variables, *(Author's estimates)*

Whereas the response of the discount rate to the shock of the output gap shows negative and insignificant impact throughout the timeline of 10 months. In a nutshell, the response of the discount rate to the core inflation is positive but not significant as expected. Guler (2016) confirms that the central bank policy rate doesn't influence inflation rates.

Table 4.5.4 confirms this analysis too where the variations in the discount rate is explained by its own shocks and the shocks of the other macroeconomics aggregates.

Table No. 4.5.4: FEVD of Discount Rate over the other variables

Forecast Horizon	S.E.	D(LNPET)	D(HH)	D(SBPPROJECTIONS)	D(R)	Y	D(INF_COR)
1	0.003518	15.93114	1.135936	1.902796	81.03013	0.000000	0.000000
2	0.004031	17.55941	12.22524	7.226422	62.78130	0.007416	0.200208
3	0.005045	20.62016	7.816820	9.804575	52.80320	8.695137	0.260105
4	0.005292	21.00270	7.365487	8.912014	48.00541	14.44998	0.264416
5	0.005561	24.43439	6.914864	8.075254	45.53252	14.72129	0.321687
6	0.005649	24.30927	6.702788	7.825687	44.19125	16.03389	0.937104
7	0.005779	24.64391	6.944166	7.700561	44.20034	15.61497	0.896048
8	0.005791	24.55459	6.917404	7.737809	44.04670	15.65081	1.092685
9	0.005843	24.26796	7.269098	7.701065	44.04811	15.63774	1.076020
10	0.005852	24.20871	7.245611	7.769441	44.01776	15.67133	1.087150

Source: Author's Own Estimations

The variations in the discount rate are not significantly explained by the shock of core inflation which constitutes only 1 percent in the long run. The fluctuations in the discount rate are highly explained by the petrol prices and output gap which are 24 and 16 percent respectively. The shocks of household inflation expectations explain the variations in the discount rate about 7 percent in long run which is relatively better than SBP projections.

4.4.5 Impulse Response Functions and Variance Decomposition of Output Gap to Shocks in all other Variables:

In figure 4.5.5, the impulse response function of output gap to the shocks of all other variables has been estimated. One standard deviation positive response of output gap over the shocks of most of the macroeconomic variables is insignificant. The response of output gap to the petrol prices is negative in the start and then it becomes positive from the 3rd month which remain positive till the 8th month. Its response to the household's inflation expectations was initially at zero and then it became negative. It remained positive from the 3rd month to

5th month and showed mixed but insignificant trend. The response of output gap to the discount rate remained insignificant for most of the time period of the forecast horizon. It was positive in the start and then became negative from the 3rd month till the last period.

The above stated analysis can be shown in the following figure 4.5.5.

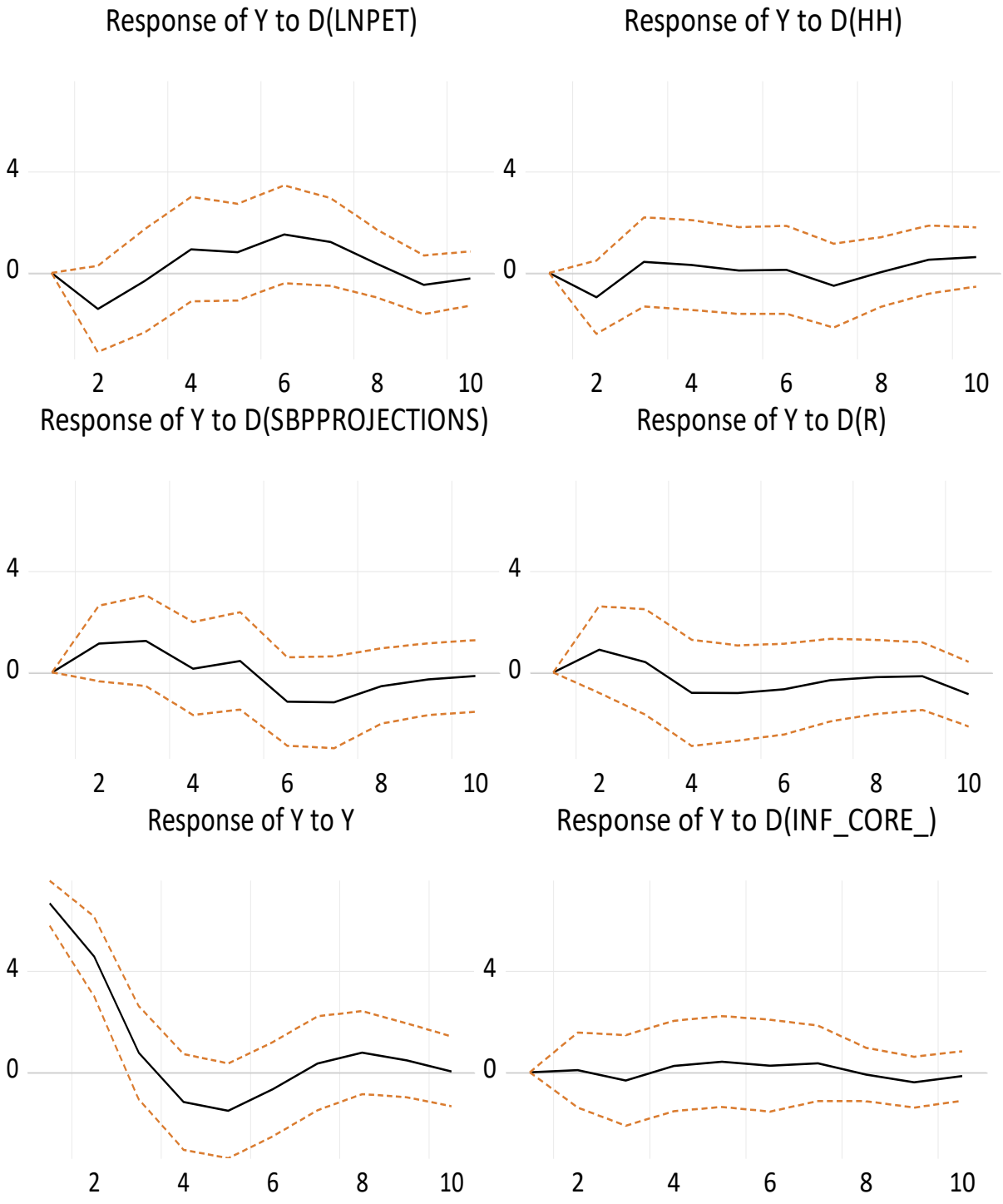

Figure No. 4.5.5: IRFs of Output Gap to the shocks all other Variables, *(Author's estimates)*

Response of output gap to the shock of SBP projections was positive in the start and from 5th month onwards, it remained negative throughout forecast horizon. Response of output gap to the shock of its own self is significant but it dies out over time. It remained significant and positive at the start and then remain negative from the 4th month to the 7th month. Onwards from the 8th month, it becomes positive for the rest of the periods of forecast timeline. The output gap did not respond to the core inflation for the first two months. Onwards from the 3rd month, it slightly and negatively responded to the core inflation for a month and then from the 4th month, it became positive till the 8th month. But the response remained insignificant throughout the timeline. Results are not consistent with the economics theory.

In table 4.5.5, Forecast Error of Variance Decomposition (FEVD) is given which states that the variations in the output gap are significantly explained by its own shock that remains at 80 percent in the long run.

Table No. 4.5.5: FEVD of Output Gap over the other Variables

Forecast Horizon	S.E.	D(LNPET)	D(HH)	D(SBPPROJECTIONS)	D(R)	Y	D(INF_CORE)
1	6.705431	1.789248	0.125095	0.623485	1.227707	96.23446	0.000000
2	8.286205	1.182616	0.875779	1.627660	3.436582	92.86893	0.008430
3	8.414064	1.153226	1.088391	3.416898	3.505813	90.71284	0.122832
4	8.538388	1.327706	1.103566	3.372074	4.253626	89.76048	0.182542
5	8.719946	1.393088	1.060859	3.667178	4.871544	88.65747	0.349858
6	8.884881	2.481220	1.033476	5.094163	5.137267	85.85163	0.402245
7	9.045409	3.718979	1.233952	6.514343	4.978034	83.04967	0.505020
8	9.105678	3.785299	1.222221	6.936992	4.926699	82.62264	0.506149
9	9.165299	4.154288	1.497197	7.077531	4.915562	81.71300	0.642420
10	9.250259	4.667027	1.785125	7.058481	5.619437	80.21891	0.651017

Source: Author's Own Estimations

The impact of the rest of the variables is not significant. The variation in output gap is explained by the shocks of petrol prices is not significant in the short run however, it moves up to 4 percent in the long run. The variations in the output gap is explained by households'

inflation expectations up to 2 percent in the long run. The fluctuations explained by the monetary policy shocks i.e., discount rate and SBP projections are merely 5 and 7 percent respectively in the long run. The variations in the output gap in the shocks of core inflation are explained hardly 0.65 percent in the long run which is almost round to zero and less among all the macroeconomic aggregates. Table 4.5.5 shows the above stated analysis.

4.5.6 Impulse Response Functions and Forecast Error Variance Decomposition of Core Inflation to shocks in all other variables:

Here in figure 4.5.6, we can observe that the one-unit standard deviation positive response of the core inflation to the shock of the petrol price is significant and positive over the time. The response of core inflation is not significant to the shock of the household inflation expectations. The response of core inflation to the shock of the inflation expectations of the households remained below zero till the 4th month and then became positive for a further 3 months of forecast horizon but it remained insignificant. Afterwards, it remained negative till the last month.

Similarly, the response of the core inflation to the SBP projections and output gap remained insignificant and negative most of the timeline of forecast. It becomes positive only from the 5th month to the 8th month of forecast horizon for SBP projections. The core inflation responded to its own shock significantly whereas the response of core inflation to the policy rate was positive in the start and from the 5th period, it became positive till the last month. The above stated results are given in figure 4.5.6.

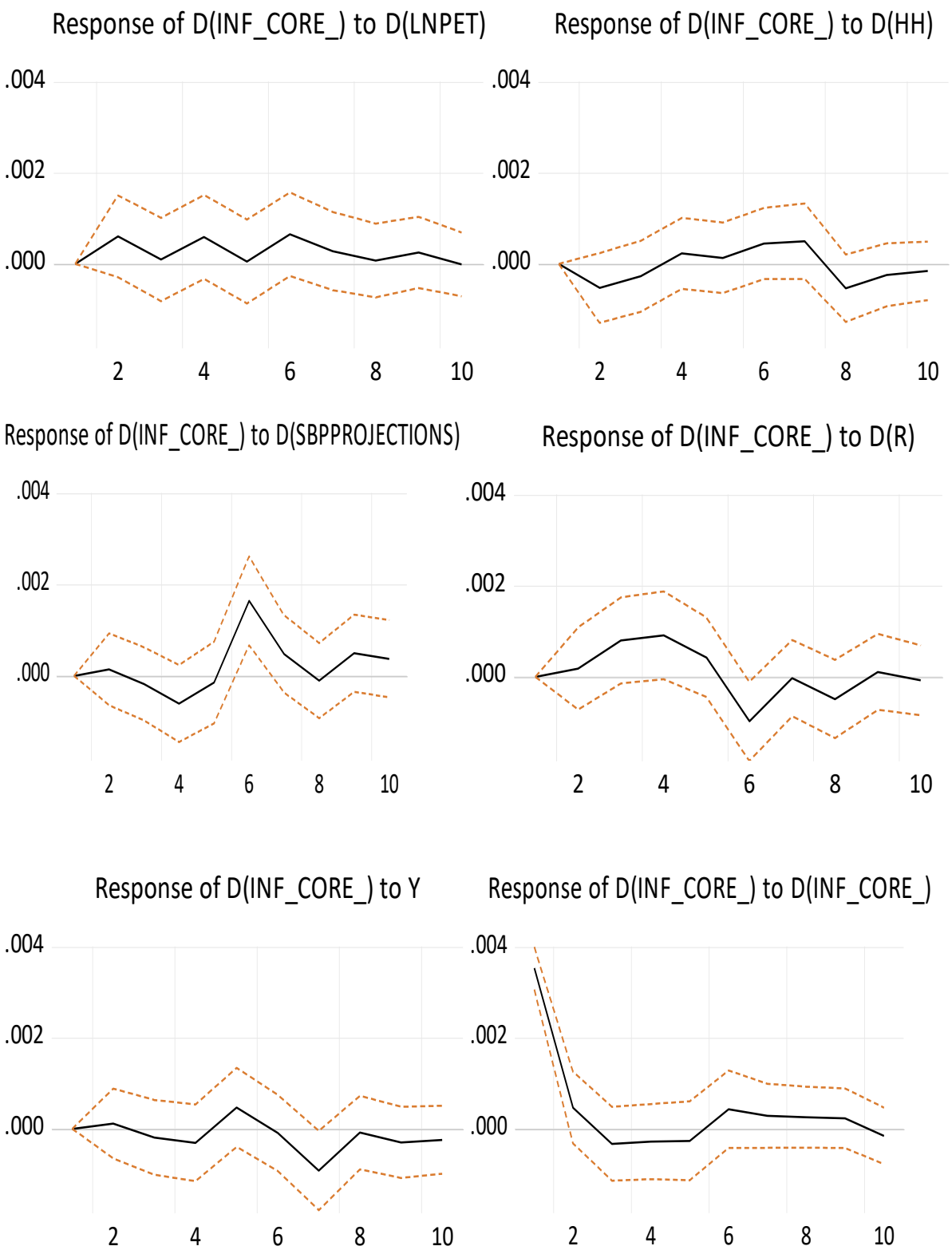

Figure No. 4.5.6: IRFs of core inflation to the shocks all other variables, *(Author's estimates)*

Similar analysis can be confirmed through the Forecast Error of Variance Decomposition (FEVD) in table 4.5.6, we may reach to conclusion that the variations in the core inflation is explained by the shock of its own significantly and consist of 45 percent in the long run.

Table No. 4.5.6: FEVD of Core Inflation over the other Variables

Period	S.E.	D(LNPET)	D(HH)	D(SBPPROJECTIONS)	D(R)	Y	D(INF_CORE)
1	0.003549	0.720872	0.500133	8.015073	9.806022	5.231447	75.72645
2	0.003721	5.186590	2.017376	7.921387	9.691985	5.115328	70.06733
3	0.003824	6.316710	2.183036	7.636878	11.64893	5.306010	66.90844
4	0.004043	9.614294	2.603263	8.527937	13.46563	5.563604	60.22527
5	0.004102	9.736192	2.726399	8.509395	13.83227	6.386409	58.80934
6	0.004516	8.710070	2.650563	19.96591	14.18302	5.270011	49.22043
7	0.004666	8.201134	3.426381	20.51807	13.29724	8.144611	46.41256
8	0.004719	8.026842	4.733220	20.08929	13.60226	7.961715	45.58668
9	0.004789	8.373414	4.845450	21.06721	13.29306	7.978216	44.44266
10	0.004817	8.282379	4.952882	21.31933	13.22736	8.204457	44.01359

Source: Author's Own Estimations

Variations in the core inflation have been explained by the monetary policy shocks in a well manner as SBP projections and discount rate amounts for 21 and 13 percent respectively. Fluctuations in the core inflation are caused less by the shock inflation expectation of households and consider for about 5 percent. The shocks of petrol prices and output gap counts for the similar fluctuations in the core inflation in the long run which is about 8 percent.

4.6 Discussion:

The empirical analysis conducted in this chapter can be concluded based on the application of channels of monetary policy transmission mechanism given in chapter 3. It can work through the policy rate channel which is as follows:

$$r_t \downarrow \rightarrow \pi^e_{t,\ldots.t+s} \uparrow \rightarrow \pi_t \, , i^e_{t,\ldots.t+s} \, , W^e_{t,\ldots..t+s} \uparrow \rightarrow \pi^e_{t+1}$$

Or it can be carried out through the SBP projections channel:

$$\pi^{e,SBP}_{t,\ldots t+s} \rightarrow \{\pi^e_{t,\ldots.t+s}\} \uparrow \rightarrow \pi_t \, , i^e_{t,\ldots.t+s} \, , W^e_{t,\ldots..t+s} \uparrow \rightarrow \pi^e_{t+1}$$

We figured out both channels by conducting the SVAR model diagnostics and estimations in which discount rate is significant in specific time which can boost the future expected inflation leading the actual inflation increased. It is proven through the impulse response functions and forecasting error of the variance decomposition. The variations explained by the discount rate shock over the inflation expectation by the household is about 8 percent (see table 4.5.2) in the long run. The increase in inflation expectations by the households can cause of increase in the expected increase in the nominal interest rate and expected nominal wages. Which in turn increases the inflation expectation in time t to one period ahead.

Likewise, the other channel works out through the SBP projections which too can increase the future expected inflation leading the actual inflation increase. SBP projections have significant impact over the long run inflation expectations having impact (significant in some of the variables, whereas insignificant in some others) over the other macroeconomic aggregates. The variations explained by the SBP projections in the shock of the inflation expectations of the households go up to 5 percent in the long run which in turn increase the inflation expectation in future period and causing the rise in actual inflation, expected nominal interest rate, and expected wages. This argument is supported by the study of Coibion et al., (2020) in which authors referred to the central bank's projections as policy tool.

CHAPTER 5

QUALITATIVE ANALYSIS

Analysis of data from secondary sources through SVAR estimation and diagnostics confirms that expectations channel of monetary policy transmission mechanism is not much effective is case of Pakistan. The expectations of Pakistani households are not too much rational to influence the macroeconomic aggregates during the timeline mentioned in the data sets. Furthermore, the expectations channel works relatively better via policy rate channel than the SBP projections.

To confirm our analysis with the primary sources, a questionnaire was circulated in the experts of monetary policy to collect the data of inflation expectations from professional forecasters. Survey has been conducted during the month of May-June 2022, which was high time in regards of our data analysis because inflation was about to reach at its higher peak all the time due to some political turmoil in the country. Exchange rate was at its all the time highest peak too with the petrol prices the same.

The data regarding inflation expectations has been collected through some experts of Monetary Policy Wing of State Bank of Pakistan (SBP), Academia from Pakistan Institute of Development Economics (PIDE) and School of Economics, Quaid'e Azam University (SOE, QAU) Islamabad. A special request is made to the professors on SBP memorial chairs in the above-mentioned institutes and some other renowned institutes of the country.

Questionnaire (see Appendix A) comprised of the questions about expectations of the commodity prices, energy prices, blame for rise in oil prices, about increase the future petrol prices etc. The questionnaire is attached in Appendix A. Responses received were more than 25. It cannot be made sure how many respondents were from academia and how many were from monetary policy committee of SBP. However, about 84 percent of the responses were in

the view that the prices of the commodities (daily use items) will rise in the next 6 months. Merely 16 percent were against the view might be having political faith in the ruling party. Because increase in the prices of daily use items is a common phenomenon during the time of survey.

Almost Hundred percent respondents' response to 'Yes', the question energy prices will grow up in the next six months. Fewer answers blame the Russia-Ukraine War for the increase of oil prices whereas majority of the answers blame the exchange rate and spot purchase to the increase in it. Most of the answers were in view that it is due to the inefficiency of government and lack of economic planning. The main variable of our concern about inflation expectations is petrol prices in which majority of the answers confirm that the increase in the oil prices (petrol prices) will increase inflation expectations of the households.

The response to the question of increase in the interest rate in next 6 months was 'Yes' with a 90 percent along with the answer of 'No' with a merely 10 percent. We deployed discount rate in our quantitative analysis. Discount rate is proved significant through the quantitative analysis done in the chapter 4 as well as it is supported by the study of Nasir et al., (2020) which states that the monetary policy shocks can influence the macroeconomic aggregates. The purchasing power of individuals may decline with the increase in the future expected inflation. The whole sample confirms it by responding to the decline in purchasing power.

Another salient question was the influence of the households' expectations regarding future inflation over the macroeconomic aggregates which is another main concern of the study. 80 percent of the respondents confirmed it whereas merely 20 percent decline it by saying that they are unsure about it. The significance of this question has been confirmed by the quantitative analysis in the previous chapter.

The question regarding the management of the core inflation through the better management of the expectations channel of the monetary policy remained suspicious. Only 33 percent of the respondents confirm it. Whereas 20 percent of the respondents says that it is not feasible in the case of Pakistan. The remaining 47 percent were against the argument. However, it has been confirmed through our analysis that expectations of Pakistani household are not too much rational to influence the monetary policy transmission mechanism. Whereas the impact of central bank projections is naively significant.

The question which is related to the change in the consumption pattern of the individual with the change in the inflation expectations is not significantly conversant with the argument as only 33 percent of the respondents confirmed it whereas 20 percent of the respondents said that it varies from person to person.

The credibility of the central bank is more important to have faith in central bank's communications and to achieve price stability. All the responses confirmed that the central bank' credibility is imperative to influence the expectations channel of the monetary policy transmission mechanism. The quantitative analysis done in the previous chapter is inadequately significant in this regard, which is a serious policy threat. The main reason for this insignificance is that our monetary policy does have a cohesive and stringent path. Central bank of Pakistan that is SBP is not used to disseminate some stable path of their policies. Based on that unstable path, you can predict some near future that is short run. But one cannot be able to predict the long run course of action. Furthermore, monthly data of inflation forecast of SBP is not available.

Recently when this study was conducted, there was complete banned on the imports of luxuries. Previously, there were restrictions on imported goods. Imports can influence domestic inflation, question regarding imports led inflation has been asked. 80 percent of the

respondents were on the view that a complete ban on imports is good, and it'll reduce the inflation. The remaining 20 percent said that the ban on imports will not create any impact.

In short, the qualitative analysis confirms too the importance of the expectations channel of the monetary policy transmission mechanism. The interviews of experts confirm that the central bank communications play an important role in the formation of inflation expectations of households. The influence of petrol prices over the inflation expectations of households and over core inflation is positive and significant. The discount rate is inversely related with the inflation expectations, and which can lead to the actual inflation to rise. Furthermore, market forces play an important role to control inflation because there are a lot of demand and supply side factors which are contributing to the inflation in the economy.

CHAPTER 6

SIGNIFICANCE OF THE RESEARCH AND POLICY RELEVANCE

6.1 Significance of the Research:

Expectations channel of monetary policy has emerged as a leading channel of monetary policy transmission mechanism after the outbreak of GFC (2007-08). Before this event, the importance of formation of expectations was not considered too much. In emerging economies like US, Japan, Italy and UK, the long run relationship between the inflation and inflation expectations can be used to handle the inflation in the economy (Chan et al., 2018). The gap between the inflation and inflation expectations can be reduced through the efficient working of the expectations channel of monetary policy transmission mechanism.

The significance of this study can be inferred through the importance of the channel discussed in the study. There are limited studies available in this area especially in the case of developing and third world countries where inflation is a very common phenomenon. Even the number of studies is not too wide-ranging in the case of rich and developed economies with all their charms and benefits. It shows that this channel of monetary policy transmission mechanism is still understudied. The analysis of efficiency of expectations channel of monetary policy transmission mechanism in case of Pakistan is a great contribution to the literature as inflation is threatening phenomenon in Pakistan and as per present study, the core inflation can be handled by managing the expectations channel of monetary policy transmission mechanism.

6.2 Policy Relevance:

This study can be used as a policy instrument for the monetary policy wing of the central bank as expectations channel is one of the transmission mechanism tools of monetary policy. Fewer studies are available on the subject matter. As in the post COVID world, there is need

of curbing the menace of inflation with more rigor because whole world is observing higher inflation paths both in developed and developing arena. In the meantime, when this study was completed in Pakistan, the inflation in Pakistan was at its peak due to rise in the petrol prices and exchange rate. One of our research objectives is to lessen the gap between the expected inflation and core inflation through which we can manage the inflation in a right way. Expectations channel of monetary policy transmission mechanism in the case of Pakistan has been explored through the policy discount rate and SBP projections.

There are two issues that need to be addressed at the end of the policy makers. The first and foremost is with the measurement issue of the expectations of the households that involves a question that how the survey of inflation expectations of households has been conducted and how the results of the surveys have been interpreted. The data set used for the inflation expectations of households in the form of Expected Economic Conditions (EEC) is limited in scope and implies the questions upon the question-wise-indices. The second one is about the influence of the central bank's communications about inflation in terms of credibility and precise forecast to achieve price stability by following a consistent path as households and businesses form their expectations on the central bank communications. Such influence is meagre and naïve even in the developed and rich economies. Then how it is possible to have stringent and strong impact in the case of third world and developing countries like Pakistan. Coibion et al., (2020) document that massive policy announcements in the rich economies like UK, the US and Euro Zone have limited and meagre impact over the decisions of the households and firm's despite of widespread of the announcements.

In the context of the present study, some policy suggestions are as follows:

- This study is relevant to forming a policy to stabilize the actual inflation path. The government should form some real expectations index (at national level, good in

quantity and quality) for both inflation expectations of households and SBP projections. So, the impact of the inflation expectations by households and SBP projections can go in the right way to control the macroeconomic aggregates.

- SBP should disseminate some stable path of projections so that the households may manage their expectations accordingly. Normally historical data of SBP projections is not available as SBP does not publish such data. But in recent reports, the data of SBP projections is available. Our results are not in concurrence with the theory in the terms of SBP projections because of data issues.
- Government should arrange seminars to guide the masses about the importance of the expectation formation and its influence over the macroeconomic aggregates.
- Data of Survey of Professional Forecasters is not available in the case of Pakistan. We collected the data through the questionnaire filled in by experts on the subject which is limited due to time bound. It is available in the case of India. Royal Bank of India publishes the survey of professional forecasters. The government of Pakistan should compile and publish such type of data.
- The government should make the SBP independent of political influence. So, it may set the policies and projections in the favor of the economy.
- As per digital requirements, the government should make an app to conduct survey and public opinion regarding inflation expectations to anchor the inflation expectations in a better way.

6.3 Research Gap & Limitations:

This study has the following research gap and limitations to leave the space for the future studies:

- This study can be replicated over the rest of countries for the same time and by altering the time dimension. We can conduct the study for different countries even with comparative analysis of effectiveness of this channel as well.
- The analysis done in the present study is only for the expectations of households. It can be done with the inflation expectations of the firms, which can have more importance as the expectations of the firms can have more multiplier effect of inflation expectations than the inflation expectations of the households.
- This idea can be further used to explore the efficiency of the expectation channel of monetary policy transmission mechanism during the time of COVID-19. This study articulated few papers in the literature about it and it would have done in this study if it won't be restricted by the time bound.
- We can further extend this study to do comparative analysis of efficiency of the expectations channel of monetary policy with the rest of the channels like with asset price channel or all the other channels.

CHAPTER 7

CONCLUSION

Expectations while making economic decisions are now considered to be pertinent after the outbreak of global financial crises, monetary policy is no exception. The emergence of zero-bound interest rate made the new monetary policy design (expectations channel) inevitable. If the central bank can approach the inflation expectations in the right way, it may have implications for the change in the real interest rates without changing the nominal interest rate which further can influence the investment, consumption and saving decision (Coibion et al., 2020). The study of Lyziak and Paloviita (2017) shows that influence of the expectations while forming the monetary policy is more likely after the GFC as it was before. The expectations formations are based upon the credibility of central bank and price stability in the economy (Goyal and Parab, 2021).

Empirical analysis in the present study concludes that the core inflation is not a consistent function of the expected inflation of Pakistani households, and it can be controlled if expected inflation is managed in a right way with a policy intervention. Furthermore, it can be summed up that the convergence takes place more rapidly if we made the forecast in a precise way. This study further recommends that the effectiveness of monetary policy is primarily based upon the effective communications by the central bank of any economy. Because households and investors form their expectations on the basis of communications disseminated by the central bank and expectations have the primary role in economic decision making. SBP projections are important for two reasons; 1) to establish the credibility of the central bank, 2) to achieve price stability by following a consistent path as households form their expectations on the central bank communications.

This study provides genuine evidence about the effectiveness of expectations channel of monetary policy transmission mechanism in case of Pakistan. It suggests that central bank projections in the form of SBP projections and household inflation expectations can be used to handle the core inflation in the country. Present study practices SVAR model supported by the impulse response functions and forecast error of variance decomposition to figure out the impact of household inflation expectations and SBP projections over the shocks of all other macroeconomic aggregates in general and core inflation in particular, after that to estimate the impact of macroeconomic aggregates in the formation of expectations of Pakistani household and SBP projections.

The long run significant impact of the SBP projections and household inflation expectations over the actual inflation is quite enough to fulfil the main objective of our research to find out the fix points between the inflation and inflation expectations to lessen the gap between the two. Through this study, the path of inflation and inflation expectations can be made stable. The impact of SBP projections is naïve and needs to be managed effectively.

Impact of the expectations shocks (both expectations of Pakistani households and SBP projections) have been estimated over macroeconomic aggregates which is the first and foremost research question of present study. This question has been addressed and answered in chapter no. 4 in which the influence and responses of expectations shocks have been analyzed. Variations in the SBP projections have been explained significantly by the shocks of macroeconomic aggregates (See table 4.5.3) except core inflation where the forecast error of variance decomposition of SBP projections with respect to core inflation is merely 0.88 percent in the long run. Whereas the variations in the inflation expectations of Pakistani households have been explained by the rest of macroeconomic aggregates is given in table 4.5.2 where the percentage is not significant for the core inflation as well represents merely 1.41 percent. However, it can be confirmed that the impact of inflation expectations of the

households over the core inflation is explained relatively better than the impact of SBP projections. Such an analysis is similar to the findings of Goyal and Parab (2021) where the variations in inflation expectations of Indian households are not significantly explained by the core component of the headline inflation. Our analysis can be used to answer the third research question as well, which is about managing core inflation with the help of inflation expectations by making a policy intervention.

Empirical analysis confirms that the channel works better through the policy rate than the SBP projections which is the answer of second research question. One standard deviation positive response of the discount rate is negatively related to the inflation expectations of the households which shows the effective working of the channel. A decrease in the discount rate would make it more profitable for the banks to borrow from SBP, which will increase the money supply in the economy and households shall expect more inflation in the country. The FEVD of discount rate with respect to inflation expectations of households is about 8 percent in the long run which shows that variations in the discount rate is explained by the inflation expectations of households relatively better than the SBP projections as the percentage for the latter is 5 only in long run.

As far as the research objectives are concerned, empirical analysis fulfills all the three objectives of the present study. The first and foremost objective of the present study is to analyze the fixed points between inflation and inflation expectations has been fulfilled through the analysis done in the fifth chapter that states the core inflation is influenced by households' inflation expectations with a need of policy intervention. The variations in the core inflation are naively explained by the inflation expectations of Pakistani household and it reaches up to mere 5 percent in the long run (See table 4.5.6). Similar results are found by Hussain and Hayat (2016) where lead lag analysis confirms that the relationship between the

expected and actual inflation is insignificant in the long run for the Pakistani households. The policy response suggested in the previous chapter can make it influential.

The second objective is to evaluate the impact of shocks of macroeconomic aggregates over the formation of inflation expectations has been fulfilled as the responses of all the macroeconomic indicators have been observed through the impulse response function and the forecast error of the variance decompositions (See figure 4.5.2 and table 4.5.2). The responses of monetary policy shocks are significant and more influential than the demand and supply side shocks. The variations in the household's inflation expectations are explained by the SBP projections and discount rate is about 5 and 8 percent respectively. Whereas the variations caused by the output gap and core inflation constitute 5 and 1.41 respectively which is less than monetary policy shocks. The last but not the least objective is to examine the impact of the SBP projections and inflation expectations of the Pakistani households over the shocks of the macroeconomic aggregates has been satisfied too. It is confirmed through the empirical analysis that the variations in the macroeconomics aggregates have been explained better through the SBP projections than the inflation expectations of households.

In short, we can conclude that expectations channel of monetary policy transmission mechanism in case of Pakistan is not much effective at the end of expectations shocks (both inflation expectations of households and SBP projections). This issue needs to be addressed seriously by policy intervention. At the end of SBP projections, it is imperative to make SBP more credible and independent of the political influence. There is a need of dissemination of data by the SBP as inflation forecasts are imperative for the conduct of effective monetary policy. Monthly data of the SBP projections of the early periods of sample timeline was not available. It was not available for recent years too, but quarterly data was available for recent years. However, the channel works better via the policy rate than the SBP projections. As far as the impact of the expectations shocks over the core inflation is concerned, the impact of

the inflation expectations of Pakistani households is explained relatively better over the core inflation than that of SBP projections but there is a need of policy intervention too in this regard. The path of inflation and Inflation expectations can be made more stable if the forecast is made more concise. There is a need of high-quality survey of inflation expectations of households at national level which could have more cohesion and relevance to minimize the gap between the inflation and inflation expectations. The government should form a digital app for the data collection regarding expectations of the households as data is considered as king in the modern-day world of artificial intelligence.

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APPENDICES

Appendix A: Questionnaire

Q 1. Do prices of daily use items will increase in next six months?

Q 2. Do the prices of energy will increase in next six months?

Q 3. Who in your opinion is to blame for the rise in oil prices?

Q 4. Do the petrol prices effect by the expected inflation rate?

Q 3. Do you think that interest rates will increase in the next six months?

Q 4. Describe the impact of the increase in inflation expectation on the purchasing power of public.

Q 5. Do the beliefs of economic agents about future economic outcomes can influence forward looking macroeconomic variables?

Q 6. Does Central bank's actions influence the macroeconomic variables?

Q 7. In your opinion, monetary policy succeeds largely through the better management of expectations channel or not?

Q 8. Does consumption pattern change by the change in expected inflation rate?

Q 9. What is your opinion about wage rate and inflation expectations?

Q 10. Does the Central bank's credibility effect the operations of expectations channel?

Q 11. What is your opinion about ban on import items and its impact on inflation?

Q 12. Do you think market forces play a very important role in inflation?

Note: This questionnaire containing open-ended questions was circulated in the shape of google forms to experts from monetary policy committee of SBP and academia.

Appendix B: Test for No Serial Correlation at Selected Lags

Null hypothesis: No serial correlation at lags h

Lag	LRE* stat	df	Prob.	Rao F-stat	Df	Prob.
1	16.35948	36	0.9980	0.442111	(36, 318.9)	0.9980
2	28.17855	36	0.8208	0.775184	(36, 318.9)	0.8216
3	34.54334	36	0.5379	0.959464	(36, 318.9)	0.5394
4	24.03076	36	0.9364	0.656958	(36, 318.9)	0.9368
5	35.91875	36	0.4725	0.999747	(36, 318.9)	0.4740

Null hypothesis: No serial correlation at lags 1 to h

Lag	LRE* stat	df	Prob.	Rao F-stat	Df	Prob.
1	16.35948	36	0.9980	0.442111	(36, 318.9)	0.9980
2	69.24209	72	0.5703	0.958079	(72, 364.9)	0.5763
3	96.34433	108	0.7816	0.875271	(108, 351.0)	0.7931
4	140.0528	144	0.5774	0.957468	(144, 323.5)	0.6131
5	184.9461	180	0.3846	1.013606	(180, 291.5)	0.4557

*Edgeworth expansion corrected likelihood ratio statistic.

Source: Author's Own Estimations

Appendix C: VAR Estimation Results

	D(LNPET)	D(HH)	D(SBPPROJECTIONS)	D(R)	Y	D(INF_CORE_)
D(LNPET(-1))	0.147645	3.968157	-0.002265	0.008280	-31.61226	0.013449
	(0.12664)	(4.25629)	(0.00524)	(0.00985)	(18.7798)	(0.00994)
	[1.16584]	[0.93230]	[-0.43241]	[0.84041]	[-1.68331]	[1.35325]
D(LNPET(-2))	0.048334	-1.001224	-0.000550	0.018998	20.64495	8.38E-05
	(0.13181)	(4.42982)	(0.00545)	(0.01025)	(19.5455)	(0.01034)
	[0.36671]	[-0.22602]	[-0.10090]	[1.85287]	[1.05625]	[0.00810]
D(LNPET(-3))	0.108097	-10.56566	0.010442	0.003431	8.267316	0.009482
	(0.12589)	(4.23100)	(0.00521)	(0.00979)	(18.6683)	(0.00988)

	[0.85866]	[-2.49720]	[2.00570]	[0.35031]	[0.44285]	[0.95984]
D(LNPET(-4))	-0.054097	6.728775	-0.005030	-0.008694	-10.17577	-0.016321
	(0.12472)	(4.19157)	(0.00516)	(0.00970)	(18.4943)	(0.00979)
	[-0.43376]	[1.60531]	[-0.97535]	[-0.89607]	[-0.55021]	[-1.66760]
D(LNPET(-5))	0.173940	-0.778073	0.000922	0.011203	43.37974	0.016837
	(0.12199)	(4.10003)	(0.00504)	(0.00949)	(18.0904)	(0.00957)
	[1.42582]	[-0.18977]	[0.18271]	[1.18050]	[2.39794]	[1.75873]
D(HH(-1))	-0.007401	0.664265	-0.000116	-0.000924	-0.638325	-0.000347
	(0.00321)	(0.10799)	(0.00013)	(0.00025)	(0.47649)	(0.00025)
	[-2.30329]	[6.15098]	[-0.87405]	[-3.69831]	[-1.33963]	[-1.37575]
D(HH(-2))	0.008020	-0.721869	-0.000275	0.000710	1.228132	0.000267
	(0.00393)	(0.13209)	(0.00016)	(0.00031)	(0.58282)	(0.00031)
	[2.04047]	[-5.46493]	[-1.69066]	[2.32080]	[2.10722]	[0.86715]
D(HH(-3))	-0.003776	0.277133	0.000321	-0.000169	-0.881046	8.78E-06
	(0.00440)	(0.14783)	(0.00018)	(0.00034)	(0.65226)	(0.00035)
	[-0.85847]	[1.87469]	[1.76616]	[-0.49455]	[-1.35077]	[0.02543]
D(HH(-4))	-7.32E-05	-0.131617	-0.000285	0.000121	0.541079	0.000100
	(0.00368)	(0.12368)	(0.00015)	(0.00029)	(0.54571)	(0.00029)
	[-0.01989]	[-1.06418]	[-1.87115]	[0.42177]	[0.99152]	[0.34799]
D(HH(-5))	0.001731	0.023727	0.000242	6.12E-05	-0.269667	0.000230
	(0.00305)	(0.10244)	(0.00013)	(0.00024)	(0.45200)	(0.00024)
	[0.56801]	[0.23161]	[1.92337]	[0.25824]	[-0.59661]	[0.96219]
D(SBPPROJECTIONS(-1))	5.033306	-132.4330	0.564526	0.463095	611.5547	0.079446
	(2.68926)	(90.3829)	(0.11121)	(0.20920)	(398.792)	(0.21104)
	[1.87163]	[-1.46524]	[5.07610]	[2.21361]	[1.53352]	[0.37645]
D(SBPPROJECTIONS(-2))	-1.314661	64.26976	-0.021481	-0.115539	-139.5727	-0.298362
	(3.09606)	(104.055)	(0.12804)	(0.24085)	(459.116)	(0.24296)
	[-0.42462]	[0.61765]	[-0.16778]	[-0.47972]	[-0.30400]	[-1.22801]
D(SBPPROJECTIONS(-3))	1.094023	34.99370	0.251644	-0.435211	-195.8682	-0.296860
	(3.08506)	(103.685)	(0.12758)	(0.23999)	(457.485)	(0.24210)
	[0.35462]	[0.33750]	[1.97243]	[-1.81343]	[-0.42814]	[-1.22618]
D(SBPPROJECTIONS(-4))	3.867062	40.81068	0.005127	-0.036714	474.0161	0.023574
	(3.18831)	(107.155)	(0.13185)	(0.24802)	(472.796)	(0.25020)
	[1.21289]	[0.38086]	[0.03889]	[-0.14803]	[1.00258]	[0.09422]
D(SBPPROJECTIONS(-5))	-6.575981	-63.39776	-0.217881	-0.041564	-913.6422	0.884976
	(3.51618)	(118.175)	(0.14541)	(0.27353)	(521.417)	(0.27593)
	[-1.87020]	[-0.53647]	[-1.49840]	[-0.15195]	[-1.75223]	[3.20721]
D(R(-1))	0.742458	48.51662	0.009174	0.111271	255.1791	0.052895
	(1.64234)	(55.1970)	(0.06792)	(0.12776)	(243.543)	(0.12888)
	[0.45207]	[0.87897]	[0.13507]	[0.87093]	[1.04778]	[0.41041]
D(R(-2))	2.527848	-26.06768	0.048128	0.621767	-39.62292	0.217775
	(1.64361)	(55.2398)	(0.06797)	(0.12786)	(243.732)	(0.12898)
	[1.53798]	[-0.47190]	[0.70807]	[4.86288]	[-0.16257]	[1.68840]

D(R(-3))	-4.866634	109.2967	-0.003404	-0.154166	-386.3856	0.147980
	(1.83937)	(61.8189)	(0.07607)	(0.14309)	(272.761)	(0.14434)
	[-2.64582]	[1.76801]	[-0.04475]	[-1.07742]	[-1.41657]	[1.02519]
D(R(-4))	-3.256232	-1.610282	0.015646	-0.006986	-27.93773	0.064477
	(1.53512)	(51.5936)	(0.06348)	(0.11942)	(227.644)	(0.12047)
	[-2.12115]	[-0.03121]	[0.24645]	[-0.05850]	[-0.12273]	[0.53522]
D(R(-5))	2.205544	-143.7937	0.041880	-0.062073	-141.4240	-0.367959
	(1.58074)	(53.1267)	(0.06537)	(0.12297)	(234.408)	(0.12405)
	[1.39526]	[-2.70662]	[0.64066]	[-0.50479]	[-0.60332]	[-2.96625]
Y(-1)	8.68E-05	0.029996	-7.16E-05	-1.93E-06	0.685191	1.75E-05
	(0.00073)	(0.02460)	(3.0E-05)	(5.7E-05)	(0.10856)	(5.7E-05)
	[0.11864]	[1.21920]	[-2.36540]	[-0.03388]	[6.31188]	[0.30505]
Y(-2)	0.000507	-0.062088	2.86E-05	-0.000173	-0.289634	-2.74E-05
	(0.00090)	(0.03012)	(3.7E-05)	(7.0E-05)	(0.13290)	(7.0E-05)
	[0.56598]	[-2.06127]	[0.77034]	[-2.47749]	[-2.17929]	[-0.38924]
Y(-3)	-0.003104	0.036563	-2.51E-05	-7.50E-05	-0.010461	-3.88E-05
	(0.00096)	(0.03220)	(4.0E-05)	(7.5E-05)	(0.14206)	(7.5E-05)
	[-3.24001]	[1.13560]	[-0.63378]	[-1.00687]	[-0.07364]	[-0.51653]
Y(-4)	0.001055	0.001368	-1.92E-05	0.000117	-0.090568	0.000160
	(0.00100)	(0.03366)	(4.1E-05)	(7.8E-05)	(0.14851)	(7.9E-05)
	[1.05297]	[0.04063]	[-0.46362]	[1.49952]	[-0.60985]	[2.04137]
Y(-5)	-6.34E-05	-0.003422	1.40E-05	-5.40E-05	0.043110	-4.05E-05
	(0.00089)	(0.02982)	(3.7E-05)	(6.9E-05)	(0.13159)	(7.0E-05)
	[-0.07142]	[-0.11474]	[0.38014]	[-0.78177]	[0.32761]	[-0.58121]
D(INF_CORE_(-1))	1.358171	22.71478	0.017471	0.058404	24.63705	0.132367
	(1.41582)	(47.5839)	(0.05855)	(0.11014)	(209.952)	(0.11111)
	[0.95928]	[0.47736]	[0.29840]	[0.53027]	[0.11735]	[1.19135]
D(INF_CORE_(-2))	-0.855812	19.61610	0.057780	0.046904	-80.56096	-0.125609
	(1.42299)	(47.8250)	(0.05885)	(0.11070)	(211.016)	(0.11167)
	[-0.60142]	[0.41016]	[0.98188]	[0.42372]	[-0.38178]	[-1.12483]
D(INF_CORE_(-3))	0.818821	-19.10944	0.007295	-0.034787	60.15551	-0.047843
	(1.41335)	(47.5009)	(0.05845)	(0.10995)	(209.586)	(0.11091)
	[0.57935]	[-0.40230]	[0.12482]	[-0.31640]	[0.28702]	[-0.43135]
D(INF_CORE_(-4))	-0.247218	5.229749	-0.036782	-0.035119	12.36101	-0.118847
	(1.38879)	(46.6755)	(0.05743)	(0.10804)	(205.944)	(0.10899)
	[-0.17801]	[0.11204]	[-0.64044]	[-0.32507]	[0.06002]	[-1.09048]
D(INF_CORE_(-5))	0.551484	17.82099	0.014895	0.157095	82.00798	0.148202
	(1.34371)	(45.1605)	(0.05557)	(0.10453)	(199.260)	(0.10545)
	[0.41042]	[0.39461]	[0.26806]	[1.50287]	[0.41156]	[1.40545]
C	0.003239	0.079255	3.06E-05	-8.50E-05	-0.237795	-0.000317
	(0.00454)	(0.15245)	(0.00019)	(0.00035)	(0.67263)	(0.00036)
	[0.71409]	[0.51989]	[0.16293]	[-0.24078]	[-0.35353]	[-0.89137]
R-squared	0.461419	0.547452	0.618362	0.616771	0.470755	0.436112
Adj. R-squared	0.266751	0.383881	0.480421	0.478254	0.279462	0.232297
Sum sq. resids	0.169709	191.6947	0.000290	0.001027	3731.912	0.001045
S.E. equation	0.045218	1.519729	0.001870	0.003518	6.705431	0.003549
F-statistic	2.370289	3.346868	4.482792	4.452688	2.460906	2.139745

Log likelihood	209.3036	-191.3822	572.4596	500.4274	-360.6022	499.4305
Akaike AIC	-3.128133	3.901442	-9.499291	-8.235568	6.870214	-8.218078
Schwarz SC	-2.384079	4.645496	-8.755237	-7.491514	7.614268	-7.474024
Mean dependent	0.004178	0.094627	-0.000175	-0.000110	-0.067392	-0.000256
S.D. dependent	0.052807	1.936126	0.002594	0.004870	7.899473	0.004050

Determinant resid covariance (dof adj.)	6.36E-17
Determinant resid covariance	9.48E-18
Log likelihood	1263.711
Akaike information criterion	-18.90722
Schwarz criterion	-14.44289
Number of coefficients	186

Source: Author's Own Estimations

Appendix D: SVAR Estimations

Structural VAR is over-identified

Model: Ae = Bu where E[uu']=I

A =

1	0	0	0	0	0
C(1)	1	0	0	0	0
C(2)	0	1	0	0	0
C(3)	C(6)	C(9)	1	0	0
C(4)	C(7)	C(10)	C(12)	1	0
C(5)	C(8)	C(11)	C(13)	C(14)	1

B =

C(15)	0	0	0	0	0
0	C(16)	0	0	0	0
0	0	C(17)	0	0	0
0	0	0	C(18)	0	0
0	0	0	0	C(19)	0
0	0	0	0	0	C(20)

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	7.106991	3.076568	2.310038	0.0209
C(2)	-0.006230	0.003829	-1.626987	0.1037
C(3)	-0.031319	0.006775	-4.622879	0.0000
C(4)	-15.28597	15.33629	-0.996719	0.3189
C(5)	0.021496	0.007231	2.972904	0.0029
C(6)	-0.000268	0.000200	-1.341579	0.1797
C(7)	-0.079539	0.418518	-0.190049	0.8493
C(8)	-9.77E-05	0.000196	-0.497053	0.6192
C(9)	-0.262785	0.160611	-1.636158	0.1018
C(10)	348.4049	337.5483	1.032163	0.3020
C(11)	-0.494840	0.159196	-3.108361	0.0019
C(12)	-234.6405	194.5667	-1.205965	0.2278
C(13)	-0.321979	0.091918	-3.502911	0.0005
C(14)	-0.000123	4.40E-05	-2.806335	0.0050
C(15)	0.045218	0.002995	15.09967	0.0000
C(16)	1.485362	0.098370	15.09967	0.0000
C(17)	0.001849	0.000122	15.09967	0.0000

C(18)	0.003166	0.000210	15.09967	0.0000	
C(19)	6.577971	0.435637	15.09967	0.0000	
C(20)	0.003088	0.000205	15.09967	0.0000	

Log likelihood	1155.042		
LR test for over-identification:			
Chi-square(1)	0.265253	Probability	0.6065

Estimated A matrix:					
1.000000	0.000000	0.000000	0.000000	0.000000	0.000000
7.106991	1.000000	0.000000	0.000000	0.000000	0.000000
-0.006230	0.000000	1.000000	0.000000	0.000000	0.000000
-0.031319	-0.000268	-0.262785	1.000000	0.000000	0.000000
-15.28597	-0.079539	348.4049	-234.6405	1.000000	0.000000
0.021496	-9.77E-05	-0.494840	-0.321979	-0.000123	1.000000
Estimated B matrix:					
0.045218	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	1.485362	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.001849	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.003166	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	6.577971	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.003088
Estimated S matrix:					
0.045218	0.000000	0.000000	0.000000	0.000000	0.000000
-0.321365	1.485362	0.000000	0.000000	0.000000	0.000000
0.000282	0.000000	0.001849	0.000000	0.000000	0.000000
0.001404	0.000398	0.000486	0.003166	0.000000	0.000000
0.896937	0.211608	-0.530084	0.742975	6.577971	0.000000
-0.000301	0.000299	0.001006	0.001111	0.000812	0.003088
Estimated F matrix:					
0.068950	-0.005540	0.027910	-0.006708	-0.026215	0.007403
-0.675940	1.736696	-0.297810	-0.155243	0.376637	0.091756
0.004034	-0.000491	0.006637	0.002913	-0.004206	0.001087
0.007837	-2.17E-05	0.003309	0.007377	-0.005718	0.001693
0.063780	0.209535	-2.194209	-3.297394	12.52180	-0.227050
0.003595	0.000435	0.004366	0.002641	-0.001112	0.003847

Source: Author's Own Estimations