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Underlying Factors of Inflation in Pakistan: Dynamic Effects and Contributions

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Underlying Factors of Inflation in Pakistan: Dynamic Effects and Contributions

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Contents

Underlying Factors of Inflation in Pakistan: Dynamic Effects and Contributions

Fida Hussain, Shah Hussain and Sajawal Khan

Abstract:

This paper attempts to estimate the impact of underlying factors of inflation and their contribution to inflation overtime. Using structural VAR on monthly data from June 2002 to June 2024, we first estimate the pass-through effects of the main drivers of inflation and then decompose the historical movements in inflation into identified structural shocks. The findings show that pass-through of commodity prices and inflation expectations shocks to inflation is relatively quick but larger in case of exchange rate and money supply, whereas it is gradual and smaller for fiscal policy shock. The historical decomposition shows that shocks to inflation are majorly explained by global commodity prices, money supply and fiscal stance. The impact of exchange rate and uncertainty have been significant, though irregular, at times. The role of inflation expectations has also become prominent in recent years, explaining significant part of post-COVID surge in inflation. Contribution of other factors, including input costs and floods has been relatively lower. The results underscore the importance of fiscal prudence to complement the monetary policy stance to successfully achieve and maintain price stability. The findings also point to appropriately anchor inflation expectations.

Non-technical Summary

Price stability, low and stable inflation, is considered as precondition for higher and sustainable growth. Besides having positive social impacts, price stability encourages saving and investment as it provides a stable environment for economic agents to make decisions about consumption, savings and investment with confidence. Therefore, maintaining price stability has become the primary objective of most of the central banks in the world and State Bank of Pakistan is no exception.

Several supply and demand side factors impact inflation with varying intensity over time. A thorough understanding of the factors driving inflation is important to formulate and implement monetary policy to effectively achieve and maintain price stability. In this backdrop, this paper attempts to first evaluate the effects of changes in different underlying factors on inflation by estimating pass-through coefficients, and second, to decompose the historical movements in inflation due to shocks to the drivers of inflation in order to quantify their contribution over time. For estimation purpose, we use structural VAR on monthly data from June 2002 to June 2024.

Besides commonly used factors, the paper includes additional determinants of inflation like fiscal policy stance, uncertainty, inflation expectations, and impact of climate change in one encompassing model in order to appropriately capture their spillover effects. The results indicate strong pass-through of shocks to inflation expectations, exchange rate and money supply, leading to inflation. The impact of changes in fiscal stance is found to be slow but persistent. Nonetheless, the role of fiscal consolidation to complement monetary policy stance to maintain price stability on a sustainable basis is equally important due to the sheer size of changes in public expenditure.

The decomposition changes in inflation over time shows that global commodity prices, money supply, and fiscal policy stance as the major drivers of movements in inflation during the sample period. Exchange rate, inflation expectations, and uncertainty are other factors that have emerged as major contributors to inflation in the post-COVID inflationary episode. The contribution of exchange rate to inflation movements has been found significant during the periods of large adjustments (FY09, FY19, and FY23) compared to periods of gradual adjustment, FY17 and FY18.

Uncertainty, though not a regular feature, has negative implications for overall economic conditions and inflation. The contribution of uncertainty is observed to be significant during 2005-06, 2008, 2020 and 2022-23 periods. The impact of climate events is found to be transitory in nature, but given recurring climate events precautionary measures are required to counter the adverse effects of climate change in future.

Inflation expectations are another factor that has played a significant role in explaining inflation during recent years. This suggests that while tight monetary policy stance has been effective in recent disinflation, effectively anchoring inflation expectations can further strengthen monetary policy transmission. The results also highlight the significance of fiscal discipline to complement monetary policy stance to achieve and maintain price stability.

I. Introduction

Inflation is a source of concern for policymakers, central banks, general public, as well as, researchers. Therefore, maintaining price stability has unanimously emerged as the primary objective of the central banks around the globe, and Pakistan is no exception. Achieving low and stable inflation is a matter of utmost importance for central banks as high inflation has economic and social consequences. High and volatile inflation creates uncertainty about future economic outcomes and lowers investment prospects in the economy, having implications for sustaining higher growth over the medium to long term. Nevertheless, the sources of inflation may vary across economies and are likely to change from period to period as well.

The movements in inflation are generally explained in terms of shocks to domestic demand and supply. The demand shocks, including increase in real income, expansion in money supply, higher fiscal spending, etc., are thought to have lasting impact on inflation over the medium term. Against this, the impact of supply shocks like floods, surge in commodity price, exchange rate movements, and input costs is perceived to be transitory as it dissipates relatively quickly over the short run. More recently, the role of expectations is also becoming increasingly prominent.

A thorough understanding of the factors causing movements in inflation is crucial for effective formulation and implementation of monetary policy. It is particularly important to identify the shocks that play a dominant role in explaining inflation dynamics, so as to facilitate decision-makers about reacting to a particular shock in a measured way. The case in point is the post-Covid surge in global inflation when several factors were at play, including unprecedented fiscal and monetary support during the Covid, and post-Covid commodity price super cycle and supply disruptions. However, inflation in Pakistan was not only higher and more volatile but also persisted at higher levels in contrast to disinflationary trends observed in advanced as well as in emerging and developing economies.

Inflation in Pakistan is generally considered a supply-side phenomenon. Oil prices are believed to play a significant role since Pakistan depends on imported oil to meet most of its domestic needs. Further, given that Pakistan is a small open economy with balance of payments constraints, domestic inflation is believed to be influenced by exchange rate movements. Moreover, Pakistan is also prone to weather and natural calamity led swings in food supplies, which push food inflation higher. Food accounts for more than one-third of the CPI, as is the case in most emerging markets and developing economies. In addition, dependence on food imports also contributes to domestic food inflation during upswing in global commodity prices. The increase in food and energy prices also seep into the core goods and services prices – the second round effects.

This general perception is somewhat consistent with the empirical literature available till date (see **Table 1**). For instance, Khan and Hanif (2012) using SVAR found that the impact of supply side shocks

is more pronounced than nominal (monetary) and real demand shocks.[1] They also found that the impact of supply shocks lingers for much longer than demand shocks and, within supply shock, global oil price has the dominant role. Hanif, Javed and Zaheer (2022) and Naafey and Hyder (2022) also found that inflation is more responsive to oil price than other commodity prices. These findings are consistent with the results of Hesary, Rasoulinezhad, and Yoshino (2019) that shows strong association between inflation and oil and food prices in Asia (including Pakistan). Hyder and Shah (2004) also included a range of variables representing demand and supply shocks. However, the overwhelming focus of the study was exchange rate pass-through to inflation. Similarly, a large body of literature on inflation in Pakistan has mainly focused on external shocks, particularly exchange rate and oil prices.

Table 1: Literature on Inflation Determinants in Pakistan

Study	Data	Methodology	Variables	Results	
Choudhry and Khan (2002)	Quarterly (1991-2015)	ECM	CPI, NER and Foreign inflation	No significant response of inflation to exchange rate depreciation	
Hyder and Shah (2004)	Monthly (1988-2003)	Recursive VAR	Oil price, output gap, M2, ER, WPI and CPI	Moderate exchange rate pass-through to CPI	Stronger pass-exchange rate through to WPI
Khan and Hanif (2012)	Monthly (1992-2011)	SVAR	IPI, REER, RIR and CPI	Demand shocks explain 52% inflation	Supply shocks (oil price) explain 48% inflation
Jaffri (2010)	Monthly (1995-2009)	OLS	CPI, NEER, Foreign inflation and NER misalignment	Insignificant impact of depreciation on inflation	Positive impact of foreign inflation
Khan and Malik (2016)	Monthly (1991-2015)	Recursive VAR	Oil price, output gap, M2, ER, WPI and CPI	Oil price pass-through is 0.35% on CPI after 12 months	Oil price pass-through is 0.93% on WPI after 12 months
Shehzad and Jaffri (2019)	Monthly (2007-2018)	OLS	Global energy price index, output gap, ER, and CPI	ER has 16% and 42% pass-through effect on CPI in short and long run	Output gap has positive but insignificant effects on CPI
Ejaz, Hanif and Arby (2021)	Quarterly (1992-2017)	ECM	CPI, ER, unit labor cost, output gap and electricity charges	1% depreciation causes 0.62% increase in CPI.	Asymmetric impact concluded

Most of these studies show mix results about the strength of exchange rate pass-through in Pakistan. Further, the empirical analysis has mainly focused on examining the impact of exchange rate or oil price. To the best of our knowledge, none of the earlier studies have comprehensively explored several possible determinants of inflation in a cohesive model in Pakistan.

[1] To be specific, demand shocks explain 52 percent of the variation in inflation.

In this background, the objective of this paper is two-fold. First, we estimate the pass-through coefficients to examine the speed and intensity by which a shock to main drivers reflects in inflation.[2] Second, we decompose the historical movements in inflation due to shocks to the main drivers of inflation for understanding the relative importance of various determinants in explaining movements in inflation and quantify their contribution over time.

For this purpose, we use structural vector auto regression (SVAR) on monthly data from June 2002 to June 2024. To identify structural shocks, we follow recursive ordering as suggested by McCarthy (1999) for generating impulse responses and estimating cumulative pass-through coefficients. For historical decomposition, we follow Burbidge and Harrison (1985) that help in explaining the path of endogenous variable(s), over the sample period, in term of innovations (shocks) in all the variables included in the system.

This paper contributes to the existing literature on understanding drivers of inflation in Pakistan in several ways. First, we attempt to include the main determinants of inflation in one encompassing model for estimation as a system in order to appropriately capture their spillover effects. Here, we consider several domestic and external factors as potential drivers of domestic inflation. Second, we include fiscal policy stance, in line with the prediction of the fiscal theory of price level (FTPL)[3], as one of the drivers of inflation, which is not tested in the previous studies in a system accounting for the impact of other important determinants. In theory, fiscal expansion- increase in government spending or cut in taxes- fuels inflation via income and wealth effect. Third, in countries with fiscal dominance, money creation is usually backed by fiscal stance. Therefore, to disentangle the impact of monetary policy induced money creation from that of fiscal-led, we have adjusted government borrowings from M3 measure of money supply.

Fourth, to best of our knowledge, we are the first to measure the contribution of uncertainty as driver of inflation. The literature points to positive association between uncertainty and inflation. Findings of Pantelis (2023) show heightened uncertainty leads to increased market power, which implies higher mark-ups and thus prices. Similarly, Aisen and Veiga (2005) using panel data of 100 countries from 1960 to 1999 find strong association between high degree of political instability and higher inflation. In case of Pakistan, a similar work by Khan and Saqib (2009) shows political instability significantly drives inflation above its average.

Fifth, we examine the role of inflation expectations, measured from business and consumer confidence surveys. Recent literature suggests that inflation expectations have emerged as an important determinant of inflation across advanced and developing countries. Albrizio et al (2023) show increasing role of inflation expectations (of households and businesses) in driving inflation in recent years. Lastly, we have incorporated the impact of climate change – the impact of recurring floods and drought on inflation in Pakistan. The floods, beside a transitory increase in prices of food items, may cause general increase in prices via destruction of agriculture produce and supply chain disruptions.

[2] The words Drivers, determinants and factors are interchangeably used.
[3] See for example, Cochrane (2022).

The rest of the paper is organized as follows. Section II explains the construction of variables and methodology. Estimation results are discussed in Section III. Section IV concludes the paper.

II. Data and Methodology

In order to evaluate the pass-through impact of various determinants on inflation, we use Structural Vector Autoregressive (SVAR) modeling. To identify the structural shocks, we follow recursive ordering as suggested by McCarthy (1999) for generating impulse responses and estimating cumulative pass-through coefficients. In the latter part of the study, we employ Historical Decomposition (HD) approach to estimate the period-wise contribution of shocks to various determinants in overall inflation shock.

1.1. Data and Explanation of Variables

We use monthly data from June 2002 to June 2024. The variables included in the analysis are output gap, exchange rate, money supply, fiscal stance, uncertainty, inflation expectations, global commodity prices, input prices (WPI), floods/droughts and consumer price index. The data sources include State Bank of Pakistan (SBP) for exchange rate, expectations, and interest rate spread; Pakistan Bureau of Statistics (PBS) for prices (CPI, WPI inflation) and output (LSM index); World Bank (WB) for data on monthly rain; and, International Monetary Fund (IMF) for global commodity prices. The explanation of variables and justification of including these in the model is given as follows:

Money supply: Money supply is one of the key factors determining inflation, as Friedman stated "inflation is always and everywhere a monetary phenomenon". Growth in money supply in excess of production capacity of the economy puts upward pressure on prices. Increase in money supply lowers market interest rates, which incentivizes increased borrowing by the households and firms. This raises demand for goods and services in the economy by altering savings – investment gap. We have used M3 as a measure of money supply. Given that government borrowing from the banking system most of the time results in excessive money creation in the economy, we have subtracted budgetary borrowings from money supply in order to see the impact of money supply induced by changes in monetary policy stance rather than influenced by fiscal position.[4]

Fiscal stance: In a fiscally dominant economy like Pakistan, fiscal policy plays a complementary but an important role in driving inflation. Increase in public spending or reduction in taxes increase aggregate demand leading to upward pressure on inflation. Likewise, expansion in public expenditure leading to higher fiscal deficit may result in increased government borrowing from both domestic and external sources. Higher government borrowing from domestic sources often crowds out the private sector, leading to backward shift of aggregate supply curve, and thus upward pressure on prices. In the absence of monthly data, we define fiscal policy stance as ratio of government borrowing to federal taxes – both of which are available on a monthly basis. Increase in the ratio indicates expansionary fiscal policy, and vice versa. This is in line with the literature; for example, Giovanni et al (2023) used public spending to examine the contribution of fiscal policy to inflation in

[4] Budgetary borrowings as percent of M3 averaged at 40 percent over the estimation period. it has increased from 29.1 percent of M3 in July 2002 to 75 percent in June 2024.

case of Algeria and US. Similarly, Cochrane (2023) suggest government borrowing, raising of debt via bonds, as measure of fiscal stance.

Output gap: The output gap is used to capture the impact of shock to domestic demand in the economy. Increase in demand for consumption and investment lead to higher domestic demand for goods and services relative to supply. Excess domestic demand creates likely upward pressure on prices. Moreover, higher domestic demand may also translate to tighter conditions in labor and inputs markets, which drive up production costs. The output gap is measured based on the monthly industrial production index by applying HP filter. While we have included fiscal policy stance and money supply as well, we are keeping output gap as an explanatory variable to capture employment dynamics in the absence of data series on unemployment and wages.

Inflation expectations: Inflation expectations has gained prominence in the recent literature on inflation determinants. When firms and consumers anticipate increase in future prices and accordingly start to adjust these in their decisions, it may become self-fulfilling prophecy. For example, when workers expect increase in inflation, they are likely to demand higher wages to compensate for the cost of living. Similarly, when households anticipate higher inflation, they rush to buy goods to avoid higher prices. On the other hand, if business have the same sentiments, they either increase product prices or hold their stocks. Thus, the anticipated increase in prices translates into higher inflation today. We have used inflation expectations index based on SBP consumer confidence survey conducted on bi-monthly basis from 2012. The missing data was calculated as the average of the adjacent month. Moreover, the data from 2002 to 2012 has been back casted using standard statistical approach on the basis of available data.

Uncertainty: The recent literature shows that uncertainty has profound impact on economic activity and inflation. As stated in Pantelis (2023), uncertainty is associated with higher market power leading to decrease in production, an6d hence upward pressure on prices. To capture the impact of uncertainty, we have used spread between short-term and long-term secondary market interest rates. We have observed that short-term interest rates are sensitive to uncertainty but have relatively lower noise compared to volatility in stock prices, exchange rate volatility, kerb market premium, etc.

Exchange rate: The exchange rate movements affect inflation through various channels i.e. increased prices of imported inputs and final consumption goods, increasing external debt in domestic currency and having fiscal impacts as well.

Global commodity prices: These contribute to inflation both via higher prices of imported inputs and consumption goods. Mostly oil price shock is used in empirical literature to analyze the impact of external shocks on inflation. However, we use overall global commodity price in order capture the impact of other imported items, especially food items.

Last but not the least, floods or droughts have significant impact on inflation, specifically in the short-run. Floods/droughts are expected to have significant effect on inflation through loss in output especially agriculture produce, however, the impact is expected to taper down in the subsequent

periods. Using rain data from World Bank, we measure floods as deviation of rain in a certain month from the average of that month over the sample period.

Statistical Tests:

Before moving to model specification and estimations, the time series properties of the data i.e. stationarity of the variables – prerequisite for time series analysis – are tested. Augmented Dickey-Fuller (ADF) unit root tests is used to check whether variables are stationary at levels or first differences. The test results presented in **Annexure A** suggest that all the variables are integrated of order one, i.e. I(1), except for output gap and fiscal policy stance that are stationary at levels.

Moreover, standard lag-length selection criteria including sequential modified likelihood ratio (LR) test, the Akaike information Criterion (AIC) and the Final Prediction Error (FPE) are applied to choose appropriate number of lags used in VAR model. Furthermore, diagnostic tests such as Roots of the Characteristic Polynomial and LM test are used to check for stability and serial correlation. The results satisfy stability conditions and no serial correlation exists in the residual term.

Model Specification

We use structural vector auto regression (SVAR) model to estimate the cumulative impact of a shock to each of the determinants on inflation dynamics. The variables included in the analysis are ordered according to their relative degree of exogeniety, i. e. most exogenous variable comes first while most endogenous variable (inflation) is placed last. The SVAR system in reduced form can be represented as follows:

$$y_t = C + A(L)y_t + u_t \qquad (1)$$

Where y_t, C, u_t and A are vector of endogenous variables, matrix of constants, matrix of structural coefficients and vector of innovations respectively.

Shocks to floods/droughts and global commodity prices are assumed to be most exogenous, followed by uncertainty, output gap, money supply, fiscal stance, inflation expectations, and input prices, with CPI inflation encompassing all the rest of the shocks. The estimated system is outlined as follows:

$$Rain_{it}^{rain} = E_{t-1}\left(Rain_{it}^{rain}\right) + \varepsilon_{it}^{rain}$$

$$CMP_{it}^{cmp} = E_{t-1}(CMP_{it}^{CMP}) + a_1\epsilon_{it}^{rain} + \varepsilon_{it}^{cmp}$$

$$UNTY_{it}^{unty} = E_{t-1}\left(UNTY_{it}^{unty}\right) + a_1\epsilon_{it}^{rain} + \varepsilon_{it}^{cmp} + \varepsilon_{it}^{unty}$$

$$ygap_{it}^{ygap} = E_{t-1}\left(ygap_{it}^{ygap}\right) + a_1\epsilon_{it}^{rain} + \varepsilon_{it}^{cmp} + \varepsilon_{it}^{unty} + \varepsilon_{it}^{ygap}$$

$$MS_{it}^{ms} = E_{t-1}(MS_{it}^{ms}) + a_1\epsilon_{it}^{rain} + \varepsilon_{it}^{cmp} + \varepsilon_{it}^{unty} + \varepsilon_{it}^{ygap} + \varepsilon_{it}^{ms}$$

$$BBTax_{it}^{bbtax} = E_{t-1}\left(BBTax_{it}^{bbtax}\right) + a_1\epsilon_{it}^{rain} + \varepsilon_{it}^{cmp} + \varepsilon_{it}^{unty} + \varepsilon_{it}^{ygap} + \varepsilon_{it}^{ms} + \varepsilon_{it}^{bbtax}$$

$$e_{it}^{ner} = E_{t-1}(e_{it}^{ner}) + a_1\epsilon_{it}^{rain} + \varepsilon_{it}^{cmp} + \varepsilon_{it}^{unty} + \varepsilon_{it}^{ygap} + \varepsilon_{it}^{ms} + \varepsilon_{it}^{bbtax} + \varepsilon_{it}^{ner}$$

$$EPI_{it}^{epi} = E_{t-1}\left(EPI_{it}^{epi}\right) + a_1\epsilon_{it}^{rain} + \varepsilon_{it}^{cmp} + \varepsilon_{it}^{unty} + \varepsilon_{it}^{ygap} + \varepsilon_{it}^{ms} + \varepsilon_{it}^{bbtax} + \varepsilon_{it}^{ner} + \varepsilon_{it}^{epi}$$

$$WPI_{it}^{wpi} = E_{t-1}\left(WPI_{it}^{wpi}\right) + a_1\epsilon_{it}^{rain} + \varepsilon_{it}^{cmp} + \varepsilon_{it}^{unty} + \varepsilon_{it}^{ygap} + \varepsilon_{it}^{ms} + \varepsilon_{it}^{bbtax} + \varepsilon_{it}^{ner} + \varepsilon_{it}^{epi} + \varepsilon_{it}^{wpi}$$

$$CPI_{it}^{cpi} = E_{t-1}\left(CPI_{it}^{cpi}\right) + a_1\epsilon_{it}^{rain} + \varepsilon_{it}^{cmp} + \varepsilon_{it}^{unty} + \varepsilon_{it}^{ygap} + \varepsilon_{it}^{ms} + \varepsilon_{it}^{bbtax} + \varepsilon_{it}^{ner} + \varepsilon_{it}^{epi} + \varepsilon_{it}^{wpi} + \varepsilon_{it}^{cpi}$$

Where ε_{it}^{rain}, ϵ_{it}^{cmp}, ϵ_{it}^{unty}, ϵ_{it}^{ygap}, ϵ_{it}^{ms}, ϵ_{it}^{bbtax}, ϵ_{it}^{ner}, ϵ_{it}^{epi}, ϵ_{it}^{wpi}, and ϵ_{it}^{cpi} are shocks related to floods/droughts, global commodity price, uncertainty, output gap, money supply, fiscal policy stance, exchange rate, inflation expectations, input costs and inflation persistency. Moreover, $E_{t-1}(\cdot)$ represents the expectation of a variable, which is the function of information set at the end of period *t-1*.

The structure of the model follows recursive VAR framework. Pakistan being a small open economy, the global commodity prices are assumed exogenous because no other variable except flood contemporaneously affects it in the model.

1.2. Historical Decomposition

In SVAR models, impulse response functions and variance decomposition measure the average movements in the data (Finck and Tillmann 2019). Historical Decomposition (HD), developed by Burbidge and Harrison (1985), allows to examine the role of various factors driving changes in endogenous variables over time. The HD helps to explain the historical fluctuations in modelled endogenous variables in terms of identified structural shocks (Wong 2017). Therefore, in order to estimate the period-wise contribution of shocks to various drivers of inflation shock, we employ HD approach as explained below.

After simple algebraic manipulation, equation (1) can be re-written in reduced form as:

$$Y_t = \Pi(L)^{-1}e_t = C(L)e_t = \sum_{s=0}^{\infty} C_s e_{t-s} \qquad (2)$$

Where $C(L)e_t$ is the moving average and $C_0 = I$. In structural shocks representation, equation 2 can be expressed as under:

$$Y_t = \sum_{s=0}^{\infty} [C_s(I - A_0)^{-1}](I - A_0)e_{t-s} = \sum_{s=0}^{\infty} D_s \mu_{t-s} \qquad (3)$$

Where $D_s = C_s(I - A_0)^{-1}$ and $\mu_t = (I - A_0)e_t$. Moreover, for a specific period $t + j$, equation 3 can be decomposed as:

$$Y_{t+j} = \sum_{s=0}^{j-1} D_s \mu_{t+j-s} + \sum_{s=j}^{\infty} D_s \mu_{t+j-s} \qquad (4)$$

Where first term on the right side represents the sum of all structural shocks while the second term on right hand side are initial values or the base projections of the concerned variable. The overall Equation (4) represents HD, where actual data at period *t* is expressed as the sum of base projection and weighted structural innovations to all endogenous variables in the system. [5]

[5] For detail discussion on Historical Decomposition (HD), see Fackler and McMillin (1998).

III. Estimation Results

This section summarizes and explains empirical results: the pass-through coefficients of shocks to main drivers of inflation and their role in explaining movement in inflation.

2.1. Cumulative pass-through coefficients

Cumulative pass-through coefficients help identify the direction and the extent of pass-through of shocks to various determinants of inflation. The pass-through coefficients are defined as the model's predicted adjustment of prices to a shock after accounting for disturbances of other endogenous variables in the model (Duma, 2008).[6] **Figure 1** exhibits cumulative pass-through coefficients for CPI inflation to a one percent innovation in floods/droughts, commodity prices, money supply, fiscal policy stance, output gap, exchange rate, uncertainty, and inflation expectations. The graphs also include the impact of shock to input prices (wholesale prices) as well as lagged impact of CPI inflation, i.e. inflation inertia or persistence.

The estimation results demonstrate that the pass-through of a shock to global commodity prices to CPI inflation is positive and immediate. The pass-through of one percent shock to commodity prices peaks at 0.07 percent in four months' time, and falls to less than half of this in next three months before stabilizing around 0.04 percent from eighth month onwards. Moreover, the results for changes in commodity prices, especially oil price, suggest limited impact on domestic inflation. This could be due to government interventions by providing implicit and explicit subsidies to protect domestic consumers from adverse movement in international commodity prices, especially the energy and food commodities.

Similar results are reported by Duma (2008) and Lueth and Arranz (2007) in case of Sri Lanka. Moreover, our estimates are also in line with Rodriguez and Zumaquero (2022) where the cumulative pass-through of shock to commodity prices to inflation is estimated at 0.13 percent for emerging economies. In their view, the limited pass-through of commodity prices to inflation indicates certain degree of adaptability of producers to assume rise in the production cost.

The result about exchange rate pass-through to inflation shows that it peaks at 0.4 percent in 6 months and then gradually decreases to 0.3 percent in 12 months. These results are comparable with Leigh and Rossi (2002) and Khan and Malik (2016). Lian (2006) and Faruqee, Hakura and Choudhry (2002) reached the conclusion that exchange rate pass-through overshoots in some countries and then declines after hitting the maximum.

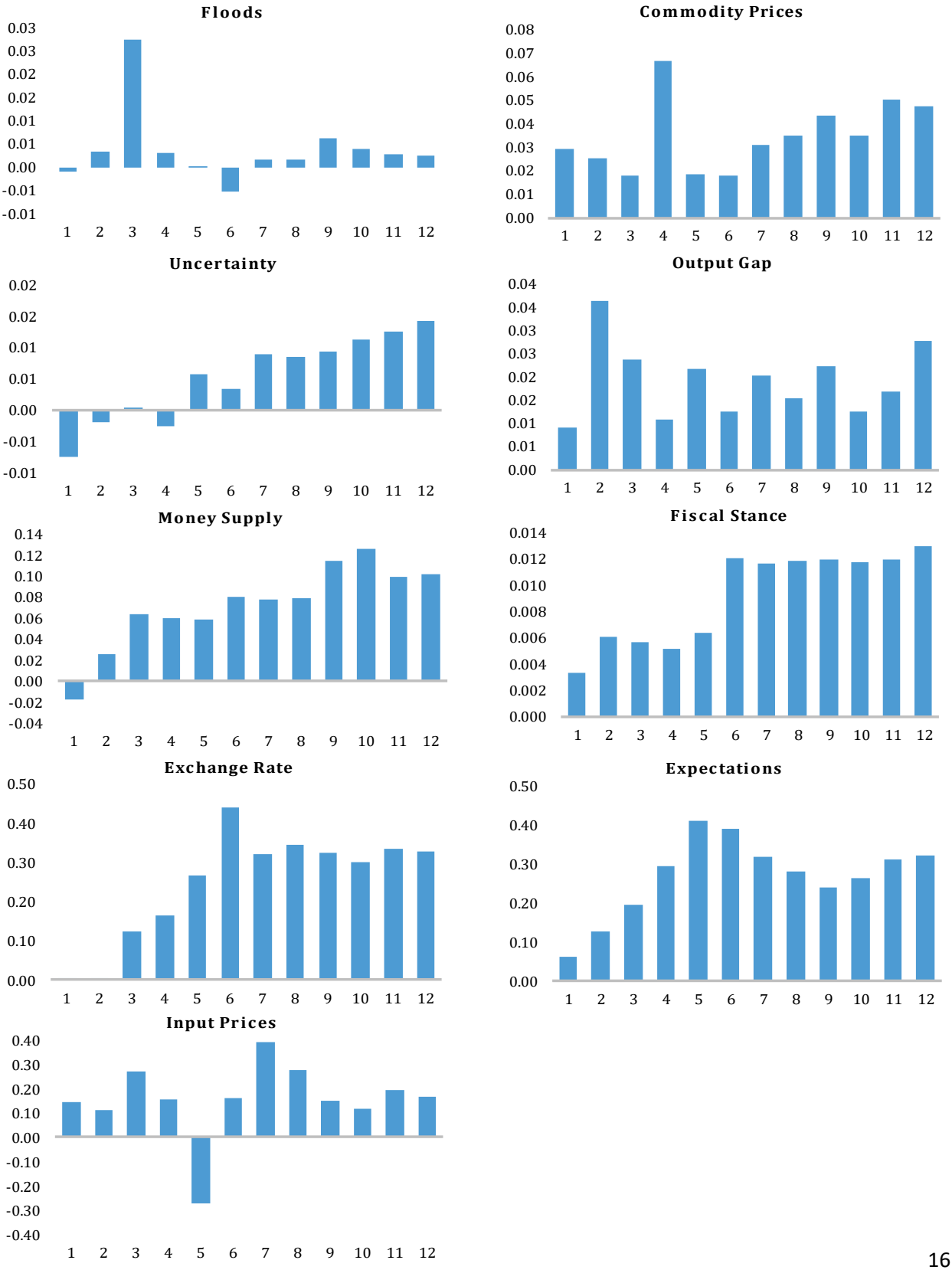
Moreover, Choudhary and Hakura (2001) concluded that exchange rate pass-through is larger in high inflation regimes due to persistent effects of monetary shocks. In addition, findings of Mirdala (2014) highlighted an interesting point that higher exchange rate responsiveness to the external price shocks decreases the transmission of commodity price shock to the domestic prices, which is aligned with our results for commodity price in **Figure 1**.

[6] Cumulative pass-through coefficients are estimated as cumulative impulse response of inflation to a shock in a certain variable divided by the cumulative response of the variable to its own shock.

The pass-through of a shock to excess demand (ygap)[7] to inflation is not only insignificant but also ambiguous. Probably, aggregate demand proxied by monthly LSM index is not a true representative of domestic demand in the economy. Almost same results are found by Longwanich and Park (2008) for Indonesia, Malaysia and Thailand. Our results are also in line with Duma (2008) for Sri Lanka. Moreover, Lian (2006) hypothesizes that a shock to exchange rate (more depreciation) causes imported goods to become expensive while exported goods become less expensive, leading to cancelling out the impact on demand (output gap) and to domestic prices.

[7] Excess demand is measured by the output gap (ygap) which is the difference between the actual and potential level of large-scale manufacturing (LSM) index. We estimated the potential level by using HP filter.

Figure 1: Cumulative Pass-through Coefficients
(percentage points on y-axis; months on x-axis)



As expected, the estimated pass-through of a shock to money supply (M3) is significant and more persistent. The cumulative pass-through of one percent shock to money supply increases from negative 0.02 percent in the month of shock to 0.13 percent in 10 months. As reported in Aisen et al (2021), the anticipated pass-through effects of money supply also possibly captures the impact of excess aggregate demand, which is not appropriately captured by the measure of output gap (ygap), as discussed above.

These results are in line with Souissi (2017), wherein money supply has positive effect on inflation both in the short-run and long-run. Similarly, the findings in Kinlaw et al (2023) confirm positive impact of money supply, nevertheless, the effects vary during different inflationary episodes. Moreover, the estimated results in Grauwe and Polan (2005) support the monetarists' expression that inflation is always and everywhere a monetary phenomenon, specifically in the high inflationary economies. The relatively higher pass-through of shocks to money supply indicate the role of money supply in explaining domestic inflation and that monetary policy is effective in fighting inflationary pressure in Pakistan.

The pass-through of inflation expectations is found to be quick: it increases from 0.06 percent in the month of shock to around 0.4 percent in 6 months. The pass-through then gradually decreases to 0.3 percent in 12 months. The findings in Bernanke and Blanchard (2024) suggest that dynamic effects are limited by well-anchored inflation expectations.

The pass-through of shock to fiscal stance is immediate, and persistently increases over time. The impact of one percent shock to fiscal stance increases from 0.003 percent in the first period to 0.013 percent in 12 months, peaking in 20 months. These results indicate that shock to fiscal policy stance takes longer to completely pass-through to inflation. This also means shock to fiscal policy stance contributes to inflation over a longer period of time.

Kinlaw et al (2023) shows that fiscal stance could have had a large influence because it was larger than average, as was the case in the latter months of the Covid pandemic, or because it was smaller than average, as it was late in the Global Financial Crisis. Catao and Terrones (2003) stated that the fiscal view of inflation has been prominent in the developing country literature, which recognized that less efficient tax collection, political instability, and limited access to external borrowing tend to lower the relative cost of seigneiorage and increase dependence on inflationary tax. Similarly, Blanchi and Melosi (2022) conclude that the recent fiscal interventions in response to the COVID pandemic have increased fiscal inflation. This increase in inflation could not have been averted by simply tightening monetary policy. The conquest of post-pandemic inflation requires mutually consistent monetary and fiscal policies.

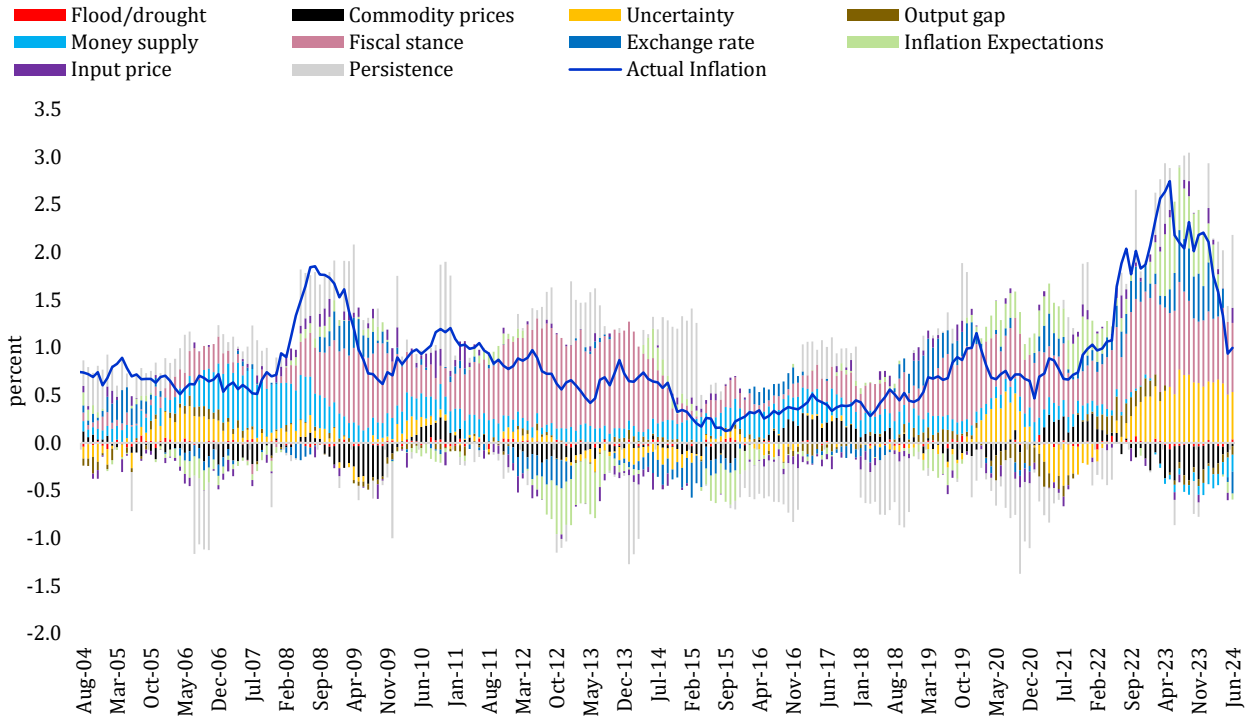
The estimation results also show that the pass-through of floods/droughts is temporary: it peaks in 3 months from the occurrence of shock (either a flood or severe drought) and then quickly dissipates.

2.2. Historical Decomposition

The second objective of this study is to historically decompose observed movements in inflation into its various determinants. The HD estimates the period-wise contributions of the structural shocks to

inflation. **Figure 2** pesents the estimated contribution of shocks to different variables to inflation shocks during 2006 to 2024.

Figure 2: Historcal Decomposition of Monthly Inflation Shock*



* Used 12-month moving averages to smooth the series

The results show that money supply, fiscal policy stance, global commodity prices, and exchange rate play significant role in explaining inflation dynamics. Moreover, uncertainty and inflation expectations have also contributed occasionally, with the role of the latter becoming increasingly significant in recent years. Focussing on the current inflationary episode, the contribution of money supply has turned negative subsequent to maintaining tight monetary policy stance. However, the expansionary fiscal stance notwithstanding consolidation during FY23 and FY24 is still contributing significantly to inflation due to sheer size of the deficit. While the pass-through coefficient of the fiscal stance is low but more persistent, the hefty change in public borrowing makes the impact larger relative to other drivers.

Estimated results show that global commodity prices are one of the main contributors to inflation, with significant impact during the recent commodity price supercycle. The historcial contribution of exchange rate shock has been irregular but significant in the periods of large adjustments, especially from mid 2008 to mid 2009 and then from July 2018 till date.

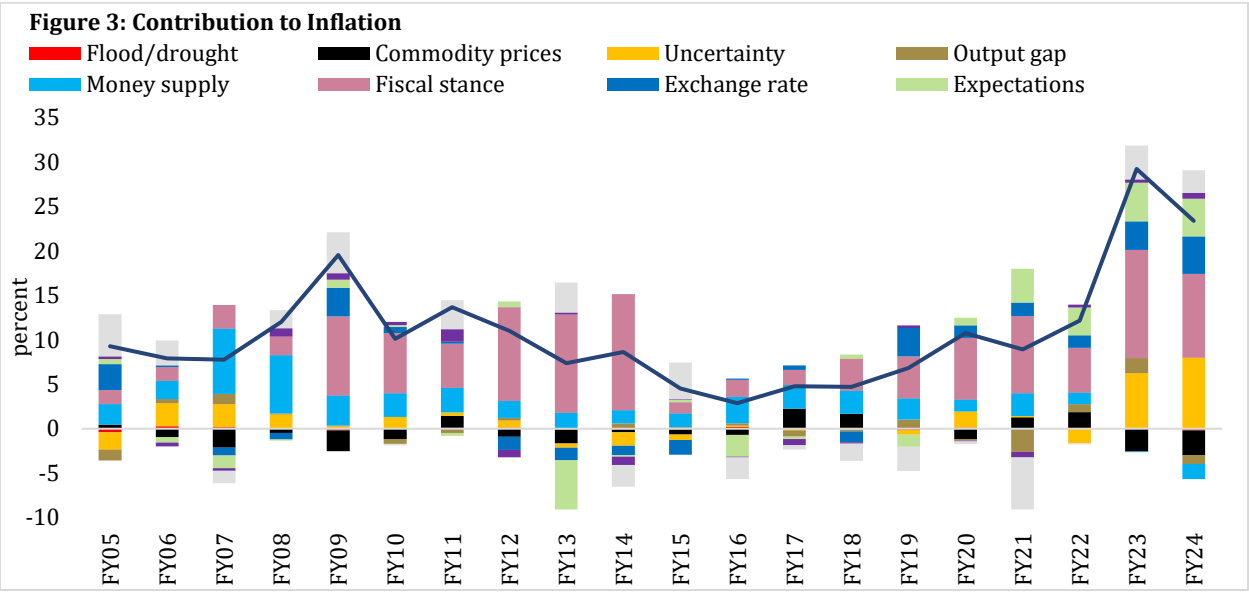
Uncertainity has emerged as major contributor to inflation in recent years. The shock to uncertainty (economic and political) contributed about 30.7 and 41.9 percent of the overall inflation during FY23 and FY20, the two years marked with heigntened uncretainity in recent past. Conversly, reduction in uncertainity after lifting of great lockdowns contributed negativey to inflation in 2021. Kazakis (2023) finds a similar estimate on uncertainity for major advanced economies. He argues that uncertainty is associated with concentration of market power, ultimately resulting in higher inflation.

Aisen and Veiga (2005), using a panel of 100 countries, find that a higher degree of political instability, measured using several political and institutional variables, generates higher inflation.

Similarly, the inflation expectations have emerged as an important driver of inflation during the recent inflationary episode. The inflation expectations have contributed about a quarter, on average, during the last four years, i.e. since FY21. Before FY20, the contribution of inflation expectations was on negative side most of the time.

The annualized contribution of floods is negligible as initial inflationary impact is almost equally offset by post-flood improved food supply (**Figure 3**). However, monthly estimates show significant positive contribution in the initial months from the occurance of floods. This shows that impact of floods is short lived and disappears within a year.

Figure 3: Contribution to Inflation



The estimated contribution of various determinants of inflation is found to track the actual movements in the variables during most of the past inflationary episodes (see **Appendix B**), which shows the robustness of the estimates. Further, the estimation results, pass-through coefficients and historical decmposition, remain steady for systematic data update from July 2023 end point to December 2023 and then to June 2024.

IV. Conclusion

This paper attempts to estimate pass-through coefficients of various determinants of inflation and then examine their role in explaining the movements in inflation over time. The estimates suggest strong pass-through of shocks to inflation expectations, exchange rate and money supply. The pass-through of fiscal shocks is relatively low and more gradual, which indicates that its impact lingers on.

The historical decomposition reveals global commodity prices, money supply, and fiscal policy stance as the major drivers of movements in inflation over the estimation period. In addition, exchange rate depreciation, elevated inflation expectations, and heightened uncertainty have emerged as major contributors to inflation in the post-Covid inflationary episode.

The results show that monetary policy stance has significant role in controlling inflation. The results also suggest that better anchoring of inflation expectations with the medium-term target would further enhance the monetary policy effectiveness. In this context, providing clarity about nominal anchor by adopting a well-defined monetary policy strategy, as committed in SBP's strategic plan 2028, would help in better anchoring long-term inflation expectations besides strengthening monetary policy transmission.

The estimates also suggest that exchange rate pass-through and its contribution to inflation is significant during the periods of large adjustments. This implies that orderly market-driven exchange rate adjustments are desirable from the standpoint of anchoring inflation expectations and maintaining price stability. The gradual adjustment, as observed during FY17 and FY18, is absorbed by the consumers and producers, is found to be less onerous.

Above all, the role of fiscal restraint to complement monetary policy in order to keep inflation low and stable on a sustainable basis can hardly be overemphasized. The contribution of fiscal policy stance, despite consolidation seen during the last couple of years, still remains considerable. This suggests that more aggressive fiscal consolidation is required to help reduce inflation. The results also imply that monetary policy often takes additional burden to control inflation during the period of expansionary fiscal policy.

While uncertainty is not a regular feature, it does influence overall economic conditions and prices whenever it reaches a certain threshold. This can be observed during high uncertainty periods like 2005-06, 2008, 2020 and 2022-23. Similarly, the impact of climate events has been of transitory nature. Nonetheless, given recurring climate events, the country need to prepare for mitigating the adverse effects of climate change.

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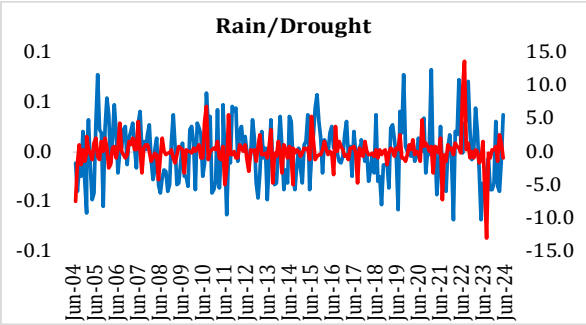
Annexure A: Unit Root Test (ADF) Results

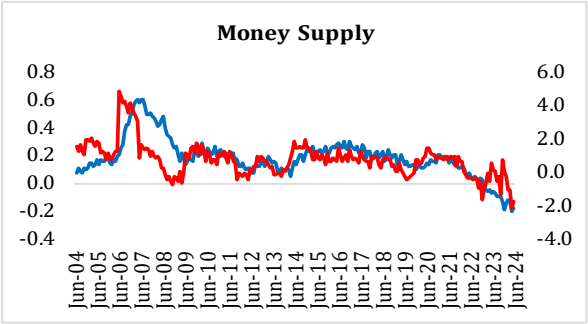
Variables*	Level	1st Difference	Critical Value
Consumer price	0.68	-18.85	-2.87
Global commodity price	-2.94	-13.04	-2.87
Output gap	-4.08	-7.66	-2.87
Exchange rate	1.80	-17.52	-2.87
Spread	-1.25	-10.62	-2.87
Wholesale price	0.66	-18.84	-2.87
EPI	0.30	-17.08	-2.87
Money supply (MS)	-2.48	-25.00	-2.87
BBTax	-15.26	-10.10	-2.87

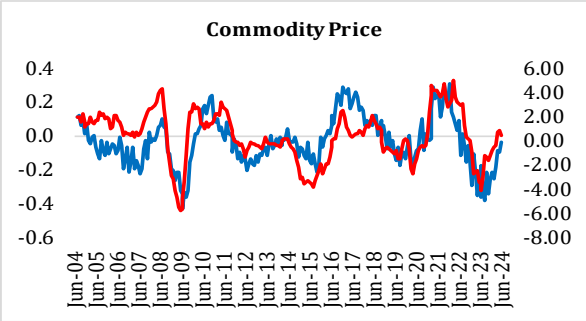
*All variables are in log form except spread and BBTax. MS is net of Govt. borrowing

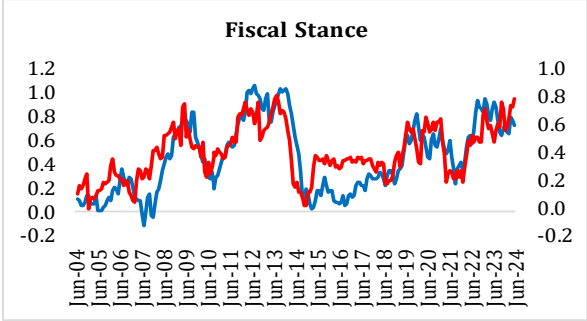
Annexure B: Esimated Contribution and Actual Trends of Drivers of Inflation*

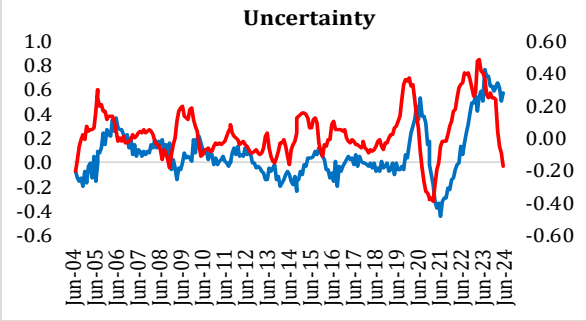
Red line shows actual trend on right scale and blue line its contribution on left scale

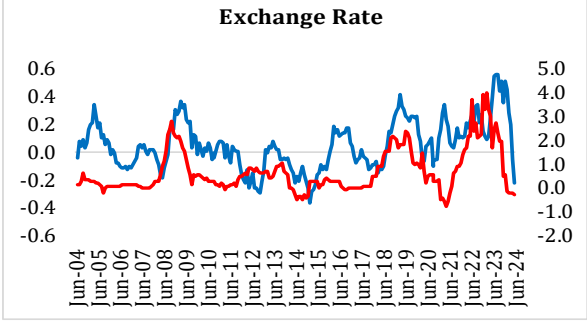


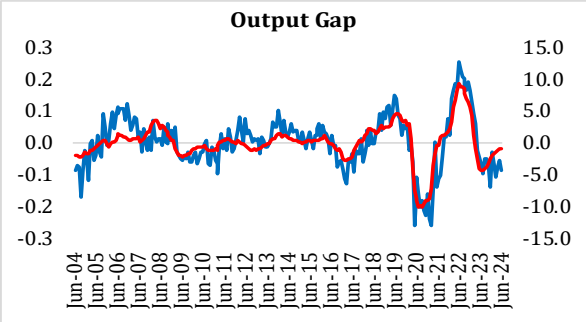


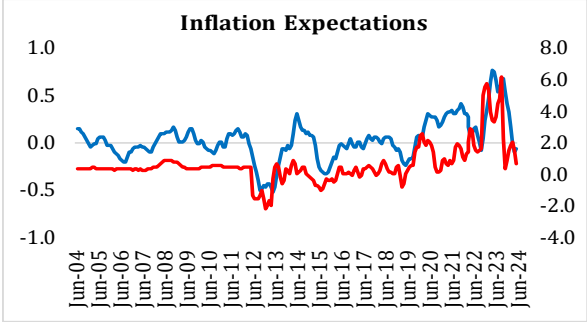


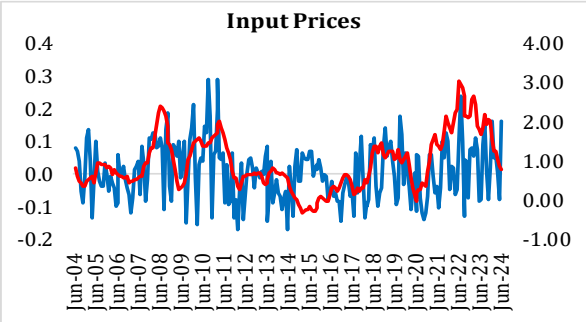












* To smooth series, we have used 12-m moving averages of the series