BB Working Paper Series: WP No. 2602

Permanent Monetary Policy Shocks and Exchange Rate Pass-Through (ERPT) in Bangladesh

Saidul Islam
Md. Mokhlesur Rahman
Raju Ahmed

Chief Economist's Unit
Bangladesh Bank

February 2026

Permanent Monetary Policy Shocks and Exchange Rate Pass-Through (ERPT) in Bangladesh

Saidul Islam[a], Md. Mokhlesur Rahman[b] and Raju Ahmed[c1]
[a] Joint Director, Chief Economist's Unit
[b] Additional Director, Chief Economist's Unit
[c] Joint Director, Chief Economist's Unit

Abstract

This study empirically examines how exchange rate pass-through to consumer prices in Bangladesh depends on the underlying shocks driving exchange rate fluctuations, addressing a key challenge in predicting the inflationary effects of exchange rate movements. Using a six-variate Bayesian structural vector autoregression model identified with sign restrictions, the analysis quantifies the contributions of six structural shocks to exchange rate pass-through. The study's main contribution lies in separately identifying permanent and transitory monetary shocks and assessing their relative roles in shaping pass-through dynamics. The results show that transitory monetary shocks generate substantially higher pass-through to consumer prices than permanent monetary shocks, while exchange rate movements are influenced by a broad set of structural shocks rather than a single dominant source. These findings are robust to alternative sign-restriction horizons, lag specifications, and interest rate measures. Overall, the analysis provides important insights into the drivers of exchange rate pass-through, with meaningful policy implications for the monetary authority.

Key Words: Transitory Monetary Shocks, Permanent Monetary Shocks, Exchange Rate Pass-through

1.0. Introduction

The exchange rate fluctuations can profoundly impact economic circumstances and inform decision-making. In the modern era, economists and policymakers endeavor to ascertain the magnitude of exchange rate fluctuations and their ramifications on diverse economic variables, including price levels and output. The extant literature justifies the relationship between the exchange rate and prices. For instance, Krugman (1986) and Dornbusch (1985) have done the earlier theoretical work on the link between the exchange rate and price. Since then, many cross-country empirical studies have been conducted, including by Campa (2005) and Goldberg (2010). Recently, Burstein and Gopinath (2014) highlighted the relationship between exchange rates and prices using detailed goods-level pricing data.

Despite advances in the theoretical framework of the relationship between exchange rate pass-through and price, few studies have incorporated the factors affecting the degree of exchange rate pass-through to consumer prices over time. Shambaugh (2008) and Forbes et al. (2018) have worked specifically on this issue. In addition, several studies have pointed out the factors that affect the degree of exchange rate pass-through, including Gopinath et al. (2010),

[1] Corresponding author: saidul914@gmail.com. The views expressed in this article are those of the authors and do not necessarily reflect the official position of Bangladesh. The authors are grateful to Dr. Ahsan H. Mansur, Honorable Governor; Dr. Md. Habibur Rahman, Deputy Governor; Mohammad Akhtar Hossain, PhD, Chief Economist; and other respected officials for their insightful comments provided during the paper presentation seminar.

Amiti et al. (2016), Berger and Vavra (2013), and Devereux et al. (2015). Some literature used a rule of thumb based on historical relationships to estimate how exchange rate movement affects the price (Forbes, 2016; Fischer, 2015; and Savoie-Chabot and Khan, 2015).

In the context of Bangladesh, a few research papers have investigated the exchange rate pass-through to consumer prices or inflation. Chowdhury & Siddique (2006) found a modest and insignificant impact of exchange rate fluctuations on domestic consumer and wholesale prices in Bangladesh (Chowdhury & Siddique, 2006). Additionally, Saha et al., (2025) confirmed that the exchange rate movement has limited direct impact on consumer price in Bangladesh. There is a lack of empirical analysis to estimate the degree of exchange rate pass-through on consumer price or inflation in Bangladesh. Moreover, the existing literature did not focus on the shocks that influence this pass-through effect and their subsequent repercussions on consumer prices or inflation. The present study aims to address these two gaps.

Specifically, this paper assesses how different shocks affecting the exchange rate lead to varying degrees of pass-through to consumer prices in Bangladesh using a Structural Vector Autoregression (SVAR) model identified with sign restrictions. This identification strategy follows Forbes et al. (2018) estimated for the United Kingdom (UK). However, our approach differs nontrivially from that of Forbes et al. in several ways. Firstly, our study uses a different set of shocks. Specifically, unlike Forbes et al., we distinguished between two types of monetary shocks—temporary and permanent—based on their persistence. Secondly, our shock identification method differs from that of the Forbes et al.. While some shocks in the Forbes model were identified using a "zero impact" restriction, we identify most shocks using the sign restrictions. Thirdly, this study uses foreign remittances in the SVAR model to make a compelling case for the Bangladesh economy. The foreign remittance flow has a significant bearing on the exchange rate of Bangladesh local currency.

Schmitt-Grohé and Uribe (2022) highlight that monetary shocks with different degrees of persistence lead to diverse outcomes for the exchange rate: transitory shocks lead to an appreciation of the nominal exchange rate in domestic currency against the primary foreign currency in the short run, while permanent shocks cause a depreciation of the nominal exchange rate in domestic currency against the primary foreign currency in the long run, even in the short run. Carvalho et al. (2023) also examined the impact of two types of monetary policy shocks on the exchange rate. They find results similar to those of Schmitt-Grohé and Uribe, indicating that transitory and permanent monetary policy shocks have opposite effects on the US nominal exchange rate. The temporary monetary policy shock leads to a temporary appreciation of the USD against foreign currencies under analysis. The permanent shock led to a depreciation of the USD against foreign currencies.

This study employs sign restrictions based on theoretical evidence to identify shocks. It imposes minimal restrictions on the structural impulse response of variables to identify various shocks, including domestic demand, domestic supply, temporary domestic monetary shocks, permanent domestic monetary shocks, exchange rate shocks, and global shocks. To use the sign restriction, the study does not limit the response of critical macroeconomic variables; instead, it assumes a method for identifying the variable's response to shocks. Theory-implied restrictions avoid the problem of exclusion restrictions often employed in the SVAR literature.

The present paper has the following findings. This study reveals that all shocks yield statistically significant results for the sign-restricted variables. Specifically, in line with sign restriction and economic theory, the temporary monetary policy shock leads to a decline in GDP and CPI. At the same time, the interest rate rises and the exchange rate appreciates. However, the

permanent monetary policy shocks lead to depreciation of the nominal exchange rate following sign restriction, which is also consistent with the Schmitt-Grohé& Uribe's findings.

This study recalibrates each shock to cause a cumulative appreciation of 1% in the exchange rate within the first four quarters. The results suggest that the different shocks inducing a 1% appreciation of the exchange rate after one year have varying degrees of pass-through to consumer prices. More specifically, the temporary monetary shock yields the highest pass-through, with consumer prices declining by approximately 68% in the first quarter following a 1% appreciation in the exchange rate. The magnitude, however, decreases gradually and remains steady at 40% throughout the impulse horizon. The permanent monetary shock has a lower pass-through impact on consumer prices than its transitory counterpart, accounting for approximately 25% of the pass-through. Further, the forecast error variance decomposition reveals that the exogenous exchange rate does not serve as the sole determinant of fluctuations in exchange rates; rather, it is evident that all shocks exert a substantial influence on variations in the exchange rate. Approximately 80% of the observed variability in the exchange rate is due to shocks other than the exogenous exchange rate shock.

This paper proceeds as follows. Section 2 provides an extensive review of the related literature. Section 3 discusses the data and methodology used in this paper. A detail discussion on estimation results is provided in section 4. Following this one, section 5 discusses the robustness of the baseline results. Finally, the paper ends with a conclusion at section 6.

2.0. Literature Review

Research on exchange rate pass-through (ERPT) and monetary policy in Bangladesh has evolved from foundational analyses of monetary transmission mechanisms to the application of advanced econometric models. Initial studies focused on the relationships among monetary aggregates, inflation, and exchange rates. More recent research employs methodologies such as Structural Vector Autoregression (SVAR), Vector Error Correction Models (VECM), and Global Vector Autoregression (GVAR) to examine the effects of various shocks and policy interventions on key macroeconomic indicators.

2.1. Literature on Bangladesh

Exchange Rate Pass-Through (ERPT) and Inflation Dynamics

Recent studies highlight that ERPT in Bangladesh is complex and context dependent. Saha et al. (2025) find that fluctuations in exchange rates have a minimal direct effect on consumer prices, while factors like money supply and global commodity prices are more influential in driving inflation. The study employed VECM and cointegration techniques, revealing that industrial production also exhibits an unexpected positive relationship with the CPI, which underscores a more complex relationship between production and inflation. In contrast, Huq (2024) reported significant, asymmetric, and rapid ERPT in the short run, especially for primary exports, but not for ready-made garments, where pricing-to-market dominates. Hossen (2023) utilized firm-level, high-frequency data and found a minimal response in export price to exchange rate changes, suggesting that currency devaluation may not significantly affect exporters. In the early literature on exchange rate pass-through (ERPT) to domestic prices in Bangladesh, Chowdhury and Siddique (2006) elucidated that the degree of ERPT to consumer prices (CPI) and wholesale prices (WPI) was modest and insignificant over the period spanning July 1997 to March 2005. Employing a recursive Vector Autoregression (VAR) model, their analysis underscored that, despite fluctuations in the exchange rate, the pass-through effect on

domestic inflation was limited. This finding suggests that the exchange rate did not have a substantial immediate impact on domestic price levels in Bangladesh during the studied period.

Monetary Policy Shocks and Transmission

Bhuiyan (2012), utilizing a Bayesian SVAR for Bangladesh, found that monetary policy shocks have immediate effects on liquidity and exchange rates, but their impacts on industrial production and inflation are delayed. Notably, it is also important to note that these monetary policy shocks are not the primary drivers of output fluctuations. Alam (2015), employing an SVAR with short-run restrictions, demonstrated that policy rate increases result in output declines and currency appreciation; however, these effects were statistically insignificant, indicating limited short-run policy effectiveness. Suranjit (2016) observed that policy interest rate shocks do not significantly influence major output components, with the investment channel proving more effective than the consumption channel. Conversely, exchange rate shocks primarily affect the real economy mainly through consumption, while investment channels are less responsive. Tasnim (2024), using a Structural Vector Autoregression (SVAR) model, examined the effects of bank lending rates and money supply on the economy. Their findings indicate that capping interest rates may stimulate investment but adversely affects inflation and exchange rates. The study link policy shocks to exchange-rate volatility and investment, without distinguishing between permanent and transitory monetary policy effects.

Joint Analysis of Monetary and Exchange Rate Policy

Khan and Rahman (2017) employed a SVAR model to jointly examine monetary and exchange rate intervention policies. Their results indicate that shocks from foreign exchange interventions exert a greater influence on exchange rates than those from monetary policy. Furthermore, the study highlights significant interactions between these two policy instruments. The authors also observe that monetary policy, when implemented in isolation, has a limited effect on overall economic activity.

External Shocks and Global Influences

Younus (2009) and Kamal & Hossain (2022) highlighted the importance of external shocks, such as foreign money supply and global output shocks, in influencing Bangladesh's macroeconomic aggregates. Utilizing a global vector autoregression (GVAR) model, Kamal and Hossain (2022) found that Bangladesh's inflation is highly responsive to external inflation shocks, underscoring the potential necessity for increased exchange rate flexibility.

Methodological Differences and Variable and Informational Differences

The literature exhibits methodological diversity, with studies employing vector autoregression (VAR), structural VAR (SVAR), vector error correction models (VECM), and global VAR (GVAR) frameworks, as well as varying data frequencies (annual, quarterly, monthly, or firm-level). Hossen (2023) emphasized the importance of high-frequency, firm-level data to address aggregation bias, whereas other studies utilize macro-level time series. Identification strategies also vary, with some studies applying exclusion restrictions and others, like the proposed study, advocating for sign restrictions based on economic theory.

Variables commonly used across studies include real GDP, inflation, policy rates, exchange rates, money supply, industrial production, and global commodity prices. Some studies focused on export prices and sectoral differences such as garments versus primary exports, while others examined broader macroeconomic aggregates.

2.2.International Evidence

A substantial body of international research has examined the effects of permanent monetary policy shocks on exchange rate pass-through (ERPT) to domestic prices. While early studies concentrated on the average magnitude of ERPT, more recent research emphasizes the shock-dependent nature of pass-through, the importance of monetary policy credibility, and the impact of country-specific factors such as inflation targeting frameworks and exchange rate regimes.

Shock-Dependent Pass-Through

Numerous studies, both in Bangladesh and on a global scale, have explored the mechanisms through which various shocks—monetary, supply, demand, and external—affect ERPT. For Bangladesh, Khan and Rahman (2017) and Bhuiyan (2012) demonstrated that the nature and source of shocks (policy vs. intervention vs. external) matter for the magnitude and persistence of pass-through. In broader international literature, it has been established that the central bank's optimal response to shocks depends on the degree of pass-through and nominal rigidities.

Forbes et al. (2018), utilizing a standard open-economy model and a SVAR framework with both short-run and long-run identification restrictions for the United Kingdom, demonstrated that exchange rate pass-through (ERPT) is significantly higher when exchange rate movements are driven by monetary policy shocks rather than demand shocks. The study underscores the importance of the underlying shocks in forecasting the inflationary consequences of currency fluctuations and notes that pass-through can vary over time depending on the nature of the shocks. In a subsequent cross-country analysis, Forbes et al. (2020) confirmed that monetary policy shocks consistently correspond to higher ERPT than demand shocks and have become increasingly influential in determining exchange rates in advanced economies since the global financial crisis. In the euro area, Comunale and Kunovac (2017) applied Bayesian VARs with sign and zero restrictions, finding that ERPT is strongest when exchange rate changes are induced by monetary policy shocks, although pass-through to consumer inflation remains generally small and volatile. In Latin America, Rossi and da Costa (2023) used a Bayesian global VAR (GVAR) and found that the degree of ERPT varies by shock type, with demand shocks producing the highest pass-through and monetary policy shocks associated with comparatively lower pass-through.

Role of Monetary Policy Credibility and Regimes

Ha, Stocker, and Yilmazkuday (2020), in an analysis of 47 countries, found that exchange rate pass-through (ERPT) is lower in economies with flexible exchange rate regimes and credible inflation targeting frameworks. In the cases of Uruguay and Chile, Cuitiño et al. (2022) employed New Keynesian models to demonstrate that ERPT is reduced when monetary policy credibility is high and when shocks have offsetting effects on aggregate demand. In Chile, well-anchored inflation expectations further contribute to low ERPT.

Theoretical and Methodological Advances

In a calibrated open-economy dynamic stochastic general equilibrium (DSGE) model for the euro area, Smets & Wouters (2002) demonstrated that incomplete ERPT resulting from sticky import prices, alters the optimal monetary policy response to shocks and improves the inflation-output trade-off. Adolfson (2001) analyzed incomplete ERPT within an inflation-targeting framework, finding that lower pass-through leads to higher exchange rate volatility while improving the trade-off between inflation and output.

The effects of permanent monetary shocks on exchange rates

Schmitt-Grohé and Uribe (2022) provide a comprehensive analysis of the effects of permanent monetary shocks on exchange rates and uncovered interest rate differentials within a

modern open-economy framework. Utilizing a new Keynesian open economy model with portfolio adjustment costs, the authors demonstrated that a permanent increase in the nominal interest rate leads, in the short run, to a depreciation of both nominal and real exchange rates. This finding is significant because it contrasts with the effects of transitory interest rate increases, which typically cause currency appreciation. The model further predicts a deviation from uncovered interest rate parity (UIP) against the tightening country, indicating that expected exchange rate changes do not fully offset the interest rate differential. Based on post-Bretton-Woods data from the United States, United Kingdom, Japan, and Canada, the study estimated impulse responses to permanent U.S. monetary policy shocks that are qualitatively consistent with the theoretical predictions. Specifically, permanent monetary shocks cause the domestic currency to depreciate and generate persistent deviations from UIP. These effects are opposite in sign to those produced by transitory monetary shocks, which tend to appreciate the currency and align more closely with UIP

These findings challenge conventional wisdom by showing that permanent monetary tightening can weaken a currency and disrupt UIP, rather than strengthen it as standard models suggest for temporary shocks. The results underscored the necessity of distinguishing between the duration and nature of monetary policy changes when analyzing international financial markets and exchange rate dynamics. The authors provide robust theoretical and empirical evidence that permanent monetary shocks have unique and counterintuitive effects on exchange rates and interest rate differentials, emphasizing the need for policymakers and researchers to account for the permanence of policy actions in open-economy analysis.

Carvalho et al. (2023) conduct a rigorous empirical analysis of the distinct effects of permanent and temporary monetary policy shocks on exchange rate dynamics. Addressing a critical gap in international macroeconomics, the study differentiates between the short- and long-term impacts of these shocks using monthly data from several advanced economies spanning 1971 to 2019. By employing a structural vector error correction (SVEC) model, the authors disentangle the effects of temporary and permanent monetary policy shocks on exchange rates, enabling a nuanced assessment of both transitory and enduring policy changes.

The findings indicated that a temporary increase in U.S. nominal interest rates leads to a temporary appreciation of the U.S. dollar against other major currencies, consistent with conventional asset-pricing models in which higher short-term rates attract capital inflows strengthening the currency in the short run. Conversely, a permanent rise in nominal interest rates, such as those associated with policy normalization after an extended period at the zero lower bound, results in a depreciation of the U.S. dollar in both the short and long term. This finding is counterintuitive, suggesting that markets may interpret permanent rate hikes as signals of higher future inflation or diminished policy credibility, leading to a weaker currency and potentially higher inflation even in the short term. The study's results challenge traditional views and underscore the importance of distinguishing between the duration and perceived permanence of monetary policy actions. Policymakers must recognize that permanent policy shifts can have unintended consequences for exchange rates and inflation expectations. Carvalho et al. (2023) made a significant contribution by empirically demonstrating that permanent and temporary monetary policy shocks have opposite effects on exchange rates. Their findings underscore the necessity for careful policy communication and further research into the channels through which expectations and credibility shape international monetary transmission.

Sign Restriction Literature

A considerable amount of literature is available on the use of sign restrictions to identify structural shocks. For example, Scholl and Uhlig (2008) employed dynamic, static, and shape restrictions on the selected impulse response to determine monetary policy shocks and understand the impulse response of nominal exchange rates. Kilian and Lee (2014) used sign restrictions on the impact responses of four observables to identify three structural shocks: flow supply of oil, flow demand for oil, speculative demand for oil, and residual shocks. Islam (2024) used this approach to identify neutral technology, investment-specific technology and monetary policy shocks in the context of Bangladesh.

3.0.Methodology

3.1. The Bayesian Structural Vector Autoregression Model

A structural model typically separates purely exogenous shocks and demonstrates the responses of endogenous variables to these shocks. The structural vector autoregressions (SVAR) model effectively integrates economic theory with time series analysis. This model is utilized to examine the dynamic responses of economic variables to various shocks that impact the economy. The SVAR model has been utilized for over four decades due to its significant role in policy analysis, helping to interpret business cycle fluctuations and understand the impacts of various economic policies, including monetary and fiscal strategies.

Let us explore the general form of an SVAR model, referencing the works of Rubio-Ramirez et al. (2010) and Arias et al. (2018) to gain a deeper understanding of its structure and applications.

$$y_t^{'}A_0 = \sum_{l=1}^{p} y_{t-1}^{'} A_t + c + \varepsilon_t^{'} for\ 1 \le t \le T \quad (1)$$

In this context, y_t denotes an $n \times 1$ vector of endogenous variables; where ε_t represents an $n$vector of uncorrelated exogenous structural shocks; $A_l$is an $n \times 1$ matrix of parameters for $0 \le l \le p$; A_0 is an invertible matrix; c is a $1 \times n$vector of parameters; p is the lag length; and T denotes the sample size. The vector of structural shocks, ε_t , is Gaussian with mean zero and its covariance is represented by the $n \times n$ identity matrix,I_n. Compact representation of the model equation 1 can be expressed as follows:

$$y_t^{'}A_0 = x_t^{'}A + \varepsilon_t^{'} for\ 1 \le t \le T \quad (2)$$

In equation 2, we use $x_t^{'} = \left[y_{t-1}^{'} \dots \dots y_{t-p}^{'}\ 1\right]$ for $1 \le t \le T$, and $A^{'} = \left[A_1^{'} \dots \dots A_p^{'} c^{'}\right]$. The matrix A is defined with dimension $m \times n$ where $m = np + 1$. However, representation 2 has a notable limitation; the values for the parameters cannot be determined directly since the SVAR models are not directly estimable and are not observable. To effectively address this limitation, it is advisable to estimate the reduced form of the SVAR model. An algebraic manipulation of equation 2 results in the following reduced-form representation of the SVAR model.

$$y_t^{'} = x_t^{'}B + u_t^{'} for\ 1 \le t \le T \quad (3)$$

where $B = AA_0^{-1}$, and $u_t^{'} = \varepsilon_t^{'}A_0^{-1}$. The challenge associated with this reduced (unidentified) form VAR lies in the fact that, although the error terms (u_t) are serially uncorrelated and exogenous, their variance-covariance matrix (Σ) is not diagonal. Consequently, the innovations u_t, do not possess a clear structural interpretation. We can write the variance-covariance matrix as follows.

$$E[u_t u_t^{'}] = \sum = \left(A_0 A_0^{'}\right)^{-1}$$

The matrix Σ is a positive definite n × n variance-covariance matrix. In this matrix, the diagonal elements represent the variances of the errors, while the off-diagonal elements indicate the covariances among the error terms. Matrices B and Σ are defined as reduced-form parameters. Our objective is to estimate these parameters accurately in order to recover the structural parameters AandA_0. We have the following representation of the VAR model when we express equation 3 with different notations and use these relationships: $Y = y_t^{'}, X = x_t^{'}$ and $U = u_t^{'}$.

$$Y = XB + U \tag{4}$$

We can consider another approach to vectorize equation 3 and then write it compactly as

$$y = \bar{X}\beta + u \tag{5}$$

with: $y = vec(Y), \bar{X} = I_n \otimes \mathrm{X}$, $\beta = \mathrm{vec(B)}, \mathrm{u} = \mathrm{vec(U)}, \mathrm{u} \sim \mathrm{N}\left(0, \bar{\sum}\right)$where, $\bar{\sum} = \sum \otimes I_T$.
This study employs a Bayesian approach to estimate the parameters, β and Σ, as this method is particularly well-suited for analyses involving small sample sizes.

3.2. Identification Strategy

Our empirical models identify six shocks: domestic supply, domestic demand, domestic temporary monetary policy, exogenous exchange rate, global, and domestic permanent monetary policy shock and estimate their impact on the exchange rate and consumer prices. The modeling approach closely follows Forbes et al. (2018) for four of the six shocks—domestic supply, domestic demand, exogenous exchange rate, and global shock. Temporary and permanent monetary shocks are identified using the methodology of Schmitt-Grohé and Uribe (2022) to identify.

To investigate the impact of shocks on the exchange rate and to examine exchange rate pass-through to domestic prices, a combination of zero long-run restrictions and sign restrictions is applied, similar to the approach of Forbes et al. (2018).This methodology addresses the shortcomings of the existing literature. Economic theories, specifically standard small open economy models, primarily guide the sign restrictions on the impulse responses of the endogenous variables. Table 1 summarizes these restrictions. The identification strategy is outlined as follows.

We assume that domestic supply shocks, which capture improvements in domestic productivity, and global shocks, which reflect changes in oil or commodity prices, affect the level or growth rate of output in the long run. This identification strategy is consistent with the existing SVAR literature, such as Blanchard and Quah (1989) and Gali (1999), and is based on the idea that technological improvements have a long-term impact on the economy. Drawing on insights from small open economy dynamic stochastic general equilibrium (DSGE) models, the shocks are identified by imposing several short-run sign restrictions on all shocks except the global shock.

Specifically, we identify domestic supply shocks by allowing GDP and CPI to be negatively correlated in the first two periods, including the impact period. Previous literature based on a

large class of micro-founded macro models, supports this combination of sign restrictions (Forbes et al. 2018; Canova and De Nicolò, 2003). We assume the positive demand shock leads to increases in GDP and CPI, accompanied by counter-cyclical interest rate and exchange rate appreciation. We also consider the exogenous appreciation of the exchange rate leading to a fall in the CPI and interest rates. The central focus of this study is the identification of temporary and permanent monetary policy shocks. Our study closely follows Schmitt-Grohé and Uribe (2022) in identifying the two monetary policy shocks. The essence of identifying temporary monetary shocks is that the transitory increase in the interest rate leads to a short-run appreciation of the domestic currency and is associated with lower CPI and GDP. In contrast, permanent monetary shocks, reflected in the permanent increase in the interest rate, lead to a short-run depreciation of the domestic currency and are inflationary and non-contractionary. Finally, we leave the global shock unrestricted, allowing the data to determine the propagation of the shock.

Table 1: Short-run Sign Restrictions and Zero Long-run Restrictions

	Supply Shock	Demand Shock	Temporary MP Shock	Exchange Rate Shock	Global Shock	Permanent MP Shock
			Short-run (Long-run) restrictions			
GDP	+	+ (0)	- (0)	0		+(0)
CPI	-	+	-	-		+
Interest Rates		+	+	-		+
Exchange Rate		+	+	+		-
Global Commodity Price						
Remittance						

Note: A '+'('-') sign indicates the positive (negative) response of the variable of interest in the quarter the shock hits and the following quarter. A '0' implies the response of the variable remains restricted to zero in the long run.

3.3. Data and Estimation Methodology

We estimate the SVAR model using quarterly data from 2004Q2 to 2024Q2.The model includes six variables: real GDP growth, consumer price index inflation, call money rate, nominal exchange rate (units of dollars per unit of local currency), global price index of all commodities from the Federal Reserve Bank of St. Louis, and foreign remittances. The domestic variables sources are the Bangladesh Bureau of Statistics, the Bangladesh Bank, and the International Financial Statistics of the IMF. For estimation, we use the quarterly differences of the log-transformed values of all variables except the call money rate. We estimate the SVAR model with two lags of the endogenous variables using a Bayesian method with Minnesota-style priors. The sign restrictions described earlier are imposed for two periods—contemporaneously and the quarter thereafter for each shock[2].

The estimate approximates the distributions of the estimated parameters using a Bayesian simulation method known as Gibbs sampling. The Gibbs sampling algorithm requires the specification of the priors for the first and second moments of the VAR coefficients and the residual covariance matrix. It subsequently draws different values for the parameter vector from

[2] Our study adapts the replication code of Forbes, Hjortsoe, &Nenova (2018).

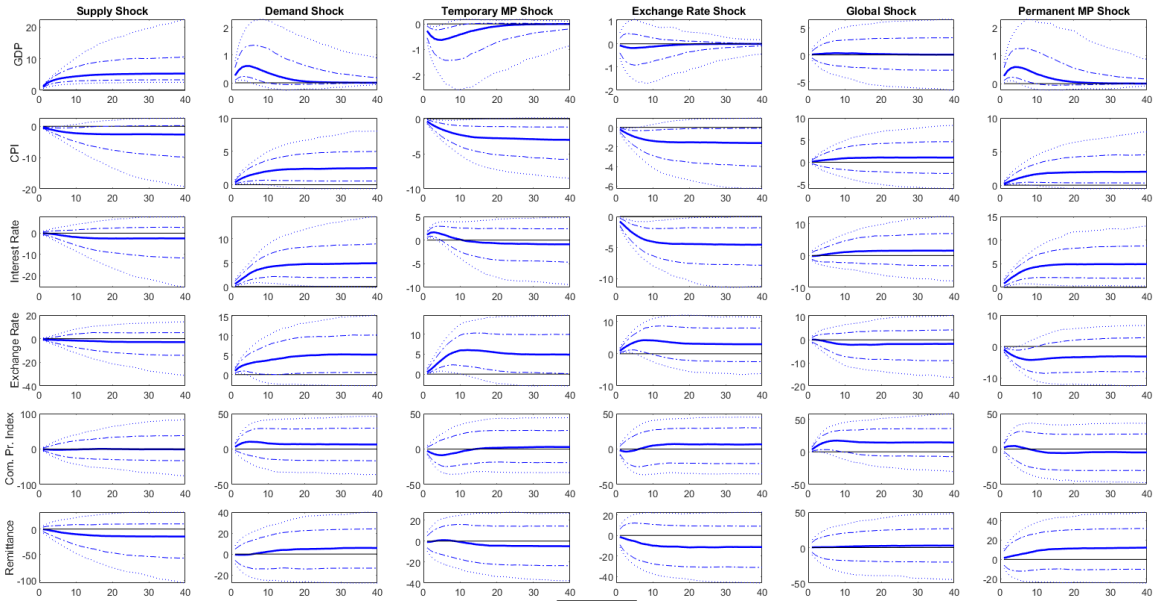
their posterior distributions. In consistent with Forbes et al. (2018), a Minnesota-style prior is employed. The diagonal assumption on the residual covariance matrix is relaxed by embedding this prior within the Gibbs sampler and drawing random covariance matrices. The algorithm repeats 11,000 times, keeping the final 1,000 draws and discarding the first 10,000 draws. Subsequent analysis, such as impulse response and forecast error variance decomposition, is based on the average of these 1,000 models.

4.0.Results and Discussion

4.1.Impulse Responses Analysis

Figure 1 shows the estimated structural impulse responses of endogenous variables to all shocks. Specifically, it illustrates the median (blue solid lines), the 5th and 95th percentiles (blue dotted lines), and the 16th and 84th percentiles (blue dashed lines) of the point-wise distribution of the variables' responses resulting from 1,000 retained and identified models.

Figure 1: Impulse Responses of Variables to Shocks



Source: Authors' estimation

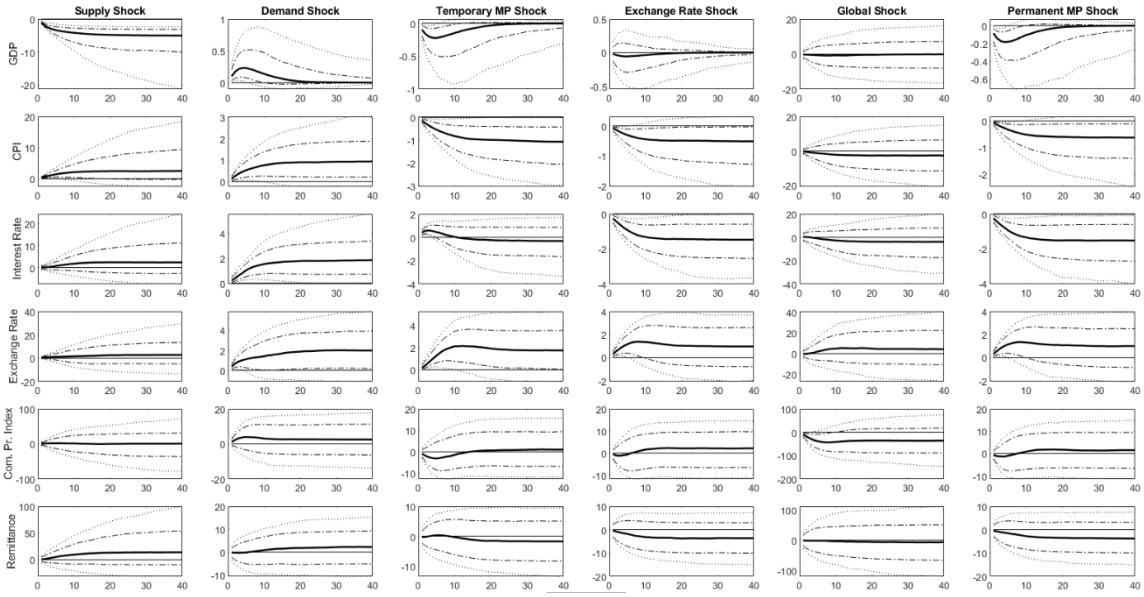
The median responses indicate that the supply shock yields statistically significant results for the sign-restricted variables. Specifically, GDP responds positively, while CPI moves in the opposite direction; both responses remain statistically significant throughout the impulse duration. Similarly, the demand shock has its intended effects: GDP, CPI, interest rates, and exchange rates increase on impact and in subsequent periods, and the responses remain statistically significant for at least some initial periods. According to the sign restrictions and consistent with the prevalent economic theory, temporary monetary shocks lead to a decline in GDP and CPI, accompanied by increases in interest rates and an appreciation of the exchange rate. An exogenous exchange rate shock causes declines in the CPI and interest rates, while appreciating the nominal exchange rate. Finally, following the sign restrictions and consistent with Schmitt-Grohé and Uribe (2022), the permanent monetary shock leads to a depreciation in the nominal exchange rate, resulting in non-contractionary and inflationary responses that persist

and remain statistically significant. Our results further demonstrate that the global shock exerts a statistically significant influence exclusively on world commodity prices. Under the imposed zero long-run restrictions, the impulse responses of GDP suggest that only supply and global shocks have persistent effects, whereas other shocks do not affect GDP in the long run.

4.2. Shock Recalibration and Cumulative IRFs

The cumulative impulse responses illustrate the impact of the shocks on the levels of the variables over time, as the responses of the growth forms of all variables, except interest rates, are accumulated. Additionally, we calibrate each shock to cause a cumulative 1% appreciation in the exchange rate within the first four quarters. Figure 2 illustrates the resulting exchange rate paths for each shock, with solid black lines, black dotted lines, and black dashed lines showing the median, the 5th and 95th percentiles, and the 16th and 84th percentiles of the point-wise distribution, respectively.

Figure 2: Cumulative Impulse Responses of Variables to all Shocks



Source: Authors' estimation

First, the positive supply shock leads to a 1% appreciation in the exchange rate, but with a wide confidence band. Second, consistent with our sign restrictions, the positive demand shock causes the local currency appreciation, with a narrow confidence band indicating the precise estimation. Third, both the transitory monetary shock and the exogenous exchange rate shock also result in exchange rate appreciation, with relatively narrow confidence bands. These results are broadly consistent with Forbes et al. (2018). In contrast, the global shock generates the widest confidence band around exchange rate appreciation. Finally, the permanent monetary shock similarly induces exchange rate appreciation, yielding a highly precise estimate.

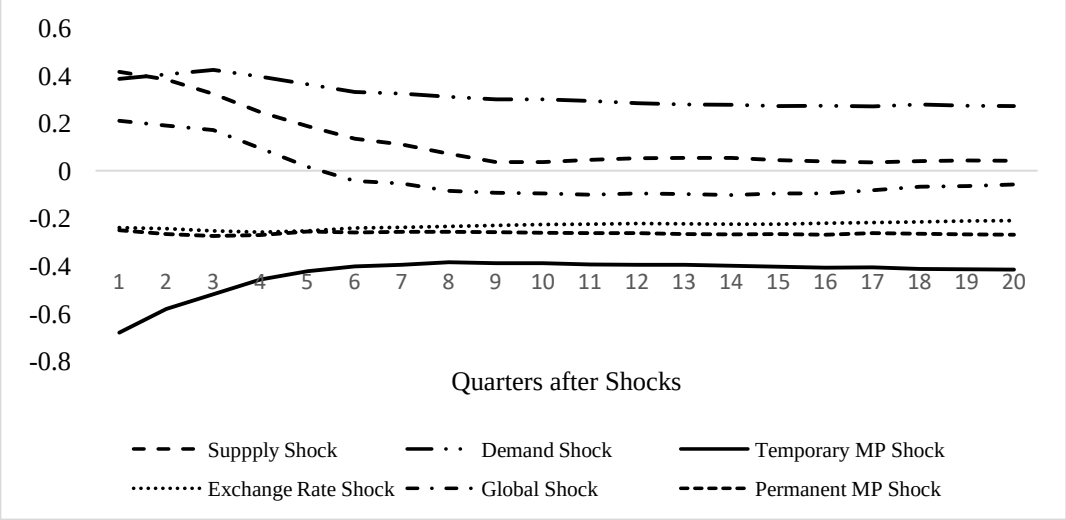
The supply shock produces positive cumulative CPI responses under exchange rate appreciation, regardless of the imposed sign restrictions, suggesting that factors other than appreciation in the nominal exchange rate dominate. In cases of demand, transitory monetary, and exchange rate shocks, the CPI responses conform to the imposed sign restrictions. Finally, although the period-by-period CPI responses to the permanent monetary shock align with the sign restrictions, the cumulative IRFs of CPI differ.

4.3.Exchange rate pass-through for different shocks

This subsection addresses our central research question: Do different shocks driving exchange rate fluctuations explain the varying degrees of pass-through to consumer prices? We measure pass-through as the ratio of the impulse responses of consumer prices to those of the exchange rate across shocks in our SVAR model. Figure 3 graphs the median of these ratios implied by all the shocks. A glance at the figure reveals that different shocks inducing a 1% appreciation of the exchange rate after one year have varying degrees of pass-through. At the extreme, the temporary monetary shock yields the highest pass-through, with consumer prices declining by approximately 68% in the first quarter following a 1% appreciation in the exchange rate. The magnitude, however, decreases gradually and remains steady at 40% throughout the impulse horizon. Theoretically, a transitory increase in interest rates could dampen domestic demand, thereby putting downward pressure on consumer prices. The exogenous exchange rate and permanent monetary shock induce almost a similar degree of pass-through. The permanent monetary shock has a lower pass-through impact on consumer prices than its transitory counterpart, accounting for approximately 25% of the pass-through. This result reflects the agents' differential responses to a permanent increase in the interest rate, whereby they did not substantially reduce domestic demand. The global shock starts passing through the appreciation to consumer prices in the 5^{th} quarter after the shocks. Quantitatively, our results partially resemble Forbes et al. (2018).

Paradoxically, the remaining shocks did not pass through the exchange rate appreciation to consumer prices at all; instead, they led to higher CPIs. These contrasting results indicate that demand factors and domestic cost factors primarily drive inflation in Bangladesh. The positive pass-through coefficients for the appreciation corresponding to the demand shock are consistent with the theoretical prediction discussed in Forbes et al. (2018). The positive impact on the CPI of exchange rate appreciation associated with global shocks in the earlier period suggests that the shocks to world commodity prices captured by the global shock do not immediately translate into a decline in inflation. The finding could indicate that consumer prices are less sensitive to global developments and are relatively sticky.

Figure 3: Exchange rate pass through to consumer prices



Source: Authors' estimation

4.4.Forecast Error Variance Decomposition

This subsection examines the types of shocks and the extent to which they drive exchange rate fluctuations and consumer prices, based on forecast error variance decomposition. Table 2 reports the proportion of the variance of each of the variables in three different horizons caused by each of the shocks. The results indicate that the supply shock dominates the fluctuation of GDP, regardless of the forecast horizon. On the other hand, each of the shocks leaves a non-trivial contribution to the fluctuation of CPI, with demand and temporary monetary shocks accounting for the highest 21% fluctuation of CPI. Since the central focus of this paper is to gauge the extent of exchange rate pass-through to consumer prices over time, it is essential to focus on the estimates that explain the variations in the exchange rate. The results indicate that the exogenous exchange rate is not the only source of exchange rate fluctuations; rather, all shocks contribute significantly to variations in the exchange rate. Specifically, exchange rate shocks explain 21%, while each of the temporary and permanent shocks explains over 22% of the fluctuations in the exchange rate. This decomposition clearly indicates that about 80% of the variation in the exchange rate is due to shocks other than the exogenous exchange rate shock. Therefore, attributing all exchange rate fluctuations to exogenous exchange rate shocks cannot adequately capture the underlying dynamics.

Table 2: Forecast Error Variance Decomposition

Variable	Quarters	Percentage of forecast error variance explained by shocks to:					
		Supply	Demand	Temporary MP	Exchange Rate	Global	Perm MP
GDP	1	0.60	0.07	0.06	0.05	0.15	0.07
	5	0.62	0.06	0.06	0.04	0.17	0.05
	20	0.63	0.05	0.06	0.04	0.17	0.05
CPI	1	0.19	0.21	0.21	0.10	0.17	0.12
	5	0.21	0.19	0.20	0.11	0.16	0.13
	20	0.24	0.17	0.19	0.11	0.16	0.13
Interest Rate	1	0.07	0.11	0.28	0.19	0.17	0.18
	5	0.10	0.16	0.19	0.20	0.14	0.21
	20	0.16	0.16	0.18	0.17	0.14	0.18
Exchange Rate	1	0.09	0.22	0.11	0.21	0.14	0.22
	5	0.11	0.16	0.18	0.20	0.14	0.20
	20	0.17	0.14	0.18	0.17	0.15	0.18
Commodity Price Index	1	0.07	0.18	0.16	0.20	0.18	0.21
	5	0.11	0.17	0.15	0.19	0.18	0.19
	20	0.15	0.16	0.16	0.17	0.17	0.18
Remittance	1	0.09	0.13	0.14	0.23	0.19	0.22
	5	0.13	0.13	0.13	0.22	0.19	0.21
	20	0.17	0.12	0.13	0.20	0.18	0.19

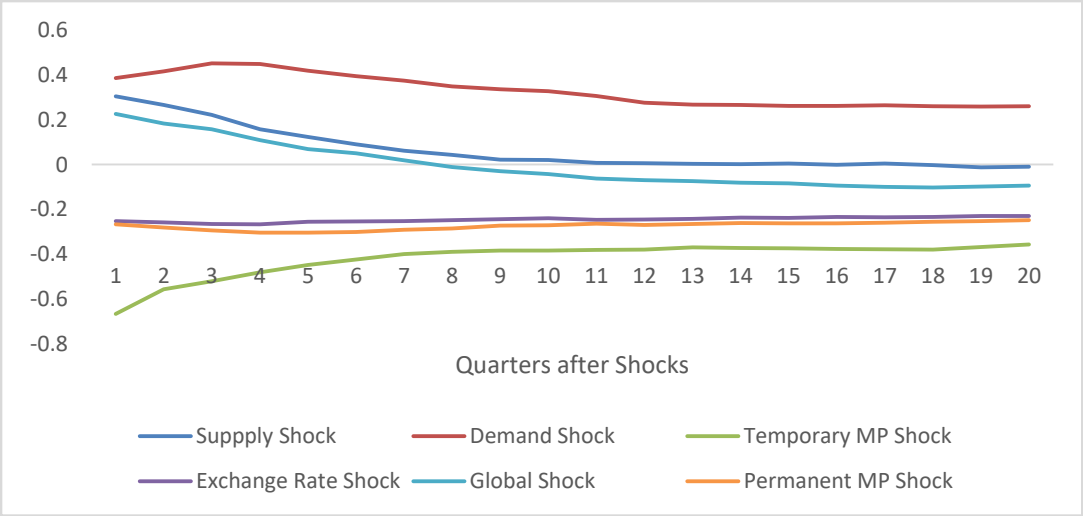
Source: Authors' estimation

5.0. Robustness

We verify the robustness of our results by choosing a lag order of 1 for the SVAR model, imposing sign restrictions only on the first period (i.e., the impact period), and using yields on 91-day Treasury bills in place of the call money rate. Figures 4, 5, and 6 illustrate the extent to

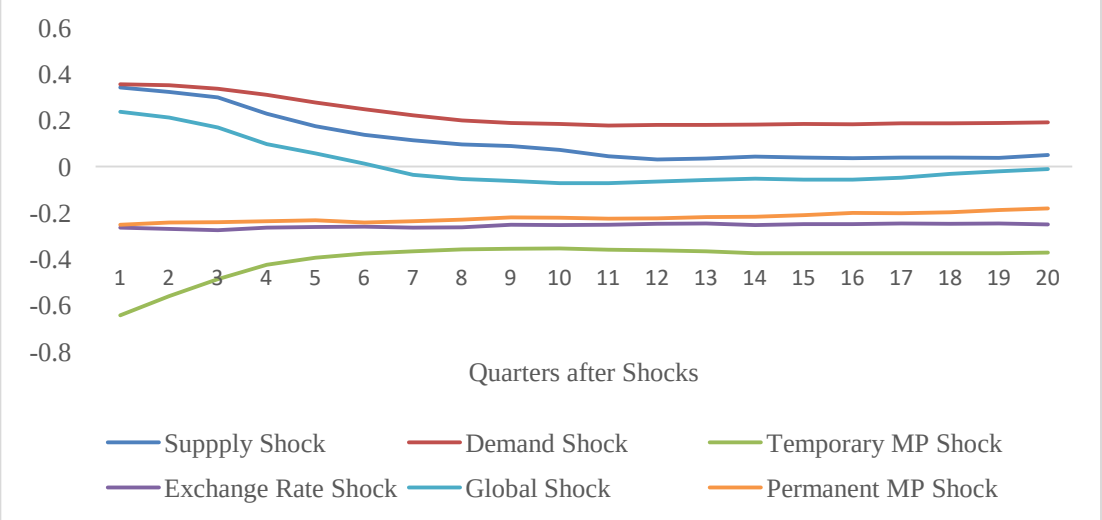
which exchange rate appreciation is passed through to consumer prices, resulting from the changes in our model. The results indicate that changing the model, either by varying the lag order, the sign restriction horizon, or using different series for the interest rate, does not materially alter our baseline results. More specifically, the transitory monetary shock leading to exchange rate appreciation is responsible for the highest degree of pass-through, as indicated in our baseline results. The exogenous exchange rate shock and the permanent monetary policy shock in models with a lag order of 1 and sign restrictions on the 1st period show a similar ranking to the baseline results in terms of the pass-through of exchange rate appreciation to consumer prices. Using the 91-day Treasury bill yield as the interest rate measure, exchange rate pass-through driven by temporary monetary and exchange rate shocks declines in the medium term. Quantitatively, however, our overall results differ somewhat from the initial findings.

Figure 4: ERPT in the SVAR model with lag 1.



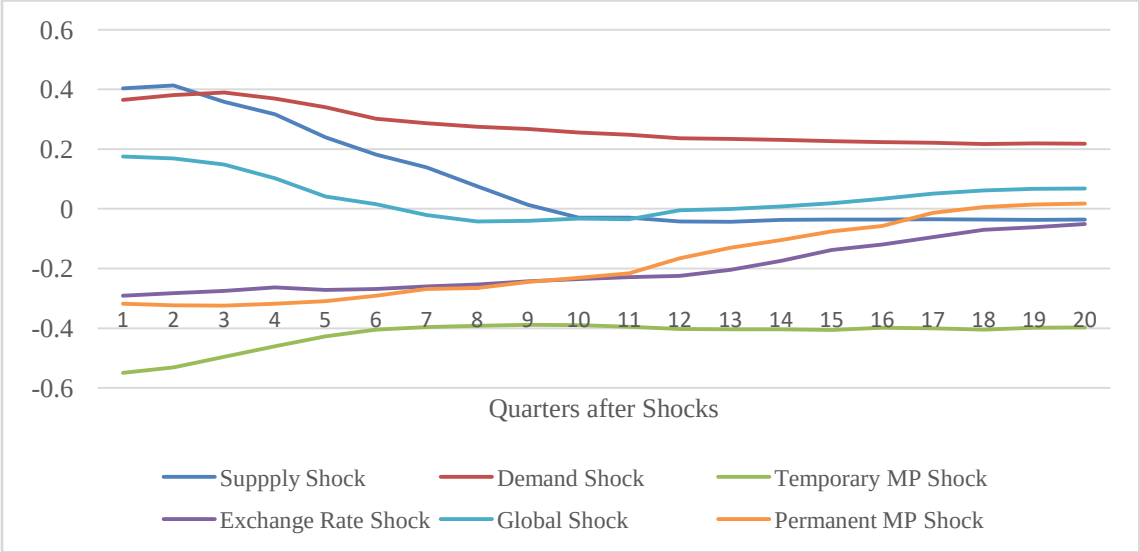
Source: Authors' estimation

Figure 5: ERPT in the SVAR model with sign restrictions on impact period.



Source: Authors' estimation

Figure 6: ERPT in the SVAR model using yields on 91-days Treasury Bills



Source: Authors' estimation

We can validate our results further by comparing the forecast error variance decomposition of the exchange rate. Table 3 shows that, across all models, the shocks account for exchange rate variation of a similar magnitude at every forecast horizon. Overall, our baseline findings remain robust under alternative model specifications.

Table 3: Forecast error variance decomposition of the exchange rate across models

Models	Quarters	Percentage of forecast error variance explained by shocks to:					
		Supply	Demand	Temporary MP	Exchange Rate	Global	Perm MP
Baseline	1	0.11	0.21	0.11	0.19	0.16	0.22
	5	0.12	0.18	0.15	0.20	0.15	0.20
	20	0.17	0.18	0.14	0.18	0.15	0.17
Lag 1	1	0.08	0.21	0.11	0.22	0.16	0.22
	5	0.11	0.16	0.17	0.21	0.14	0.20
	20	0.16	0.15	0.17	0.18	0.16	0.17
1st period sign restrictions	1	0.11	0.21	0.11	0.21	0.15	0.21
	5	0.12	0.17	0.18	0.21	0.14	0.18
	20	0.18	0.15	0.17	0.18	0.15	0.16
T-bill yield	1	0.10	0.25	0.12	0.18	0.15	0.19
	5	0.11	0.20	0.18	0.19	0.15	0.18
	20	0.16	0.18	0.17	0.17	0.15	0.18

Source: Authors' estimation

6.0. Conclusion

This study estimates the shocks-driven degree of exchange rate pass-through to consumer prices in Bangladesh, focusing on the transitory and permanent monetary shocks. Our paper

identifies the two monetary shocks by assuming that transitory and permanent monetary shocks affect the exchange rate of local currency in opposite ways. Transitory shocks precipitate an appreciation of the exchange rate, whereas permanent shocks engender depreciation. The transmission of transitory monetary shocks to consumer prices via the exchange rate channel is demonstrably higher than that of their permanent shocks. Empirical evidence reveals that a 1 percent appreciation in the local currency, induced by temporary monetary shocks, corresponds to an approximate 68 percent reduction in consumer prices in Bangladesh. Conversely, the pass-through effect attributable to permanent monetary shocks is approximately 25 percent less salient than that of transitory shocks. Also, the exogenous exchange rate shocks induce a similar degree of pass-through of monetary shocks on consumer prices in Bangladesh. An additional salient observation elucidated in this study is that the transmission of global shocks—exemplified by remittances as analyzed herein—to consumer prices via exchange rate appreciation manifests with greater latency, emerging conspicuously only in the fifth quarter subsequent to the initial perturbation. This empirical outcome lends partial corroboration to the conclusions posited by Forbes et al. (2018). Aside from these four shocks, we find no pass-through of exchange rate appreciation into consumer prices in Bangladesh, although they still lead to higher consumer prices. This result indicates that inflation in Bangladesh is primarily driven by demand factors and domestic cost factors.

The observed positive coefficients for exchange rate appreciation attributable to demand shocks are consistent with the theoretical postulations articulated by Forbes et al. (2018). Furthermore, the antecedent positive effect on the CPI arising from exchange rate appreciation linked to global shocks in the preceding temporal interval suggests that exogenous perturbations to world commodity prices, as encapsulated by the global shock variable, do not instantaneously reduce inflationary pressures.

The present inquiry provides a rigorous assessment of exchange rate volatility in response to a range of structural shocks. The empirical findings elucidate that exogenous exchange rate shocks do not constitute the sole impetus for observed exchange rate oscillations; rather, panoply of shocks exerts a substantial and statistically significant influence. More precisely, exogenous exchange rate shocks account for approximately 21 percent of the variance, whereas temporary and permanent shocks collectively explain in excess of 22 percent. This analytical decomposition thus reveals that an overwhelming majority, nearly 80 percent—of exchange rate variability emanates from extrinsic factors to direct exogenous exchange rate shocks. In sum, the exchange rate landscape is demonstrably shaped by a multiplicity of heterogeneous perturbations, underscoring the necessity of a holistic analytical framework that transcends a myopic focus on exogenous shocks alone.

References

Adolfson, M. (2001). *Monetary policy with incomplete exchange rate pass-through* (No. 127). Sveriges Riksbank Working Paper Series.

Alam, M. R. (2015). Effectiveness of monetary policy in Bangladesh. *The Journal of developing areas*, *49*(2), 363-372.

Amiti, M., Itskhoki, O., & Konings, J. (2016). *International shocks and domestic prices: how large are strategic complementarities?* (No. w22119). National Bureau of Economic Research.

Arias, J. E., Caldara, D., & Rubio-Ramírez, J. F. (2019). The systematic component of monetary policy in SVARs: An agnostic identification procedure. Journal of Monetary Economics, 101, 1-13.

Berger, D., & Vavra, J. S. (2013). Volatility and Pass-through (No. w19651). Cambridge, MA, USA: National Bureau of Economic Research.

Bhuiyan, R. (2012). The effects of monetary policy shocks in Bangladesh: A Bayesian Structural VAR approach. *International Economic Journal*, *26*(2), 301-316.

Blanchard, O. J., & Quah, D. (1989). The dynamic effects of aggregate demand and supply disturbances: Reply. *The American Economic Review*, *83*(3), 653-658.

Burstein, A., & Gopinath, G. (2014). International prices and exchange rates. In *Handbook of international economics* (Vol. 4, pp. 391-451). Elsevier.

Campa, J. M., & Goldberg, L. S. (2005). Exchange rate pass-through into import prices. *Review of Economics and Statistics*, *87*(4), 679-690.

Canova, F., & De Nicolò, G. (2003). On the Sources of Business Cycles in the G-7. *Journal of international economics*, *59*(1), 77-100.

Carvalho, A., e Azevedo, J. V., & Ribeiro, P. P. (2024). Permanent and temporary monetary policy shocks and the dynamics of exchange rates. *Journal of International Economics*, *147*, 103871.

Chowdhury & Siddique (2006), Exchange Rate Pass-Through in Bangladesh, Bangladesh Bank Website.

Comunale, M., & Kunovac, D. (2017). *Exchange rate pass-through in the euro area* (No. 2003). ECB working paper.

Cuitiño, M. F., Medina, J. P., & Zacheo, L. (2022). Conditional exchange rate pass-through and monetary policy credibility: Insights from Uruguay and Chile. *Economic Modelling*, *114*, 105926.

Devereux, M. B., Tomlin, B., & Dong, W. (2015). *Exchange rate pass-through, currency of invoicing and market share* (No. w21413). National Bureau of Economic Research.

Dornbusch, R. (1985). *Exchange rates and prices* (No. w1769). National Bureau of Economic Research.

Fischer, S. (2015, November). The transmission of exchange rate changes to output and inflation. In *Monetary Policy Implementation and Transmission in the Post-Crisis Period conference, Federal Reserve System, Washington, DC*.

Forbes, K. (2016). Much ado about something important: How do exchange rate movements affect inflation?. *The Manchester School*, *84*(S1), 15-41.

Forbes, K., Hjortsoe, I., & Nenova, T. (2017). *Shocks versus structure: explaining differences in exchange rate pass-through across countries and time* (No. 50). External MPC Unit Discussion Paper.

Forbes, K., Hjortsoe, I., &Nenova, T. (2018). The shocks matter: Improving our estimatesof exchange rate pass-through. Journal of International Economics, 114, 255–275.

Forbes, K., Hjortsoe, I., &Nenova, T. (2020), International evidence on shock-dependent exchange rate pass-through, NBER working paper 27746.

Gali, J. (1999). Technology, employment, and the business cycle: do technology shocks explain aggregate fluctuations?. *American Economic Review*, *89*(1), 249-271.

Goldberg, L. S., & Campa, J. M. (2010). The sensitivity of the CPI to exchange rates: Distribution margins, imported inputs, and trade exposure. *The Review of Economics and Statistics*, *92*(2), 392-407.

Gopinath, G., & Itskhoki, O. (2010). Frequency of price adjustment and pass-through. *The Quarterly Journal of Economics*, *125*(2), 675-727.

Ha, J., Stocker, M. M., & Yilmazkuday, H. (2020). Inflation and exchange rate pass-through. *journal of International Money and Finance*, *105*, 102187.

Hossen, M. D. (2023). Exchange Rate Pass-Through and Data Frequency: Firm-Level Evidence from Bangladesh. *arXiv preprint arXiv:2303.04101*.

Huq, M. A. (2024). Exchange Rate Pass - through in Export Value-chain of Bangladesh. International Journal For Multidisciplinary Research.

Islam, S. (2024). Investment-specific technology shocks and business cycle: evidence from a sign restriction approach. Indian Economic Review, 59(1), 249-283.

Kamal, J. B., & Hossain, A. A. (2022). Investigation on the Effects of External Shocks on Bangladesh's Economy: An Application of the Gvar Modelling Approach. *The Journal of Developing Areas*, *56*(2), 275-293.

Khan, M. M. A., & Rahman, A. A. (2017). Interaction between monetary policy and exchange rate stabilization policy in Bangladesh: A joint analysis using svar model. *The Journal of Developing* Areas, 51(2), 119-136.

Kilian, L., & Lee, T. K. (2014). Quantifying the speculative component in the real price of oil: The role of global oil inventories. Journal of International Money and Finance, 42, 71-87.

Krugman, P. R. (1986). Pricing to market when the exchange rate changes.

Rossi, J. L., & da Costa, J. P. M. H. (2023). Shock Dependent Exchange Rate Pass-Through-An Analysis for Latin American Countries.

Rubio-Ramirez, J. F., Waggoner, D. F., & Zha, T. (2010). Structural vector autoregressions: Theory of identification and algorithms for inference. The Review of Economic Studies, 77(2), 665-696.

Saha, P. R., Sheykh, H., & Ahmed, S. (2025). Exchange Rate Pass-Through and Inflation Dynamics: Insights from Post-Pandemic Bangladesh. International Journal of Finance & Banking Studies, 14(2), 73-85.

Savoie-Chabot, L., & Khan, M. (2015). *Exchange rate pass-through to consumer prices: Theory and recent evidence* (No. 2015-9). Bank of Canada Discussion Paper.

Schmitt-Grohé, S., & Uribe, M. (2022). The effects of permanent monetary shocks on exchange rates and uncovered interest rate differentials. *Journal of International Economics*, *135*, 103560.

Scholl, A., & Uhlig, H. (2008). New evidence on the puzzles: Results from agnostic identification on monetary policy and exchange rates. Journal of International Economics, 76(1), 1-13.

Shambaugh, J. (2008). A new look at pass-through. Journal of International Money and Finance, 27(4), 560-591.

Smets, F., & Wouters, R. (2002). Openness, imperfect exchange rate pass-through and monetary policy. *Journal of monetary Economics*, *49*(5), 947-981.

Suranjit, K. (2016). Output Decomposition and the Monetary Policy Transmission Mechanism in Bangladesh: A Vector Autoregressive Approach.

Tasnim, A. The Effects of Monetary Policy Shock on Exchange Rate Volatility and Investment in Bangladesh.

Younus, S. (2009). *Impact of monetary policy changes in a semi-global economy: Evidence from Bangladesh* (No. id: 2084).