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A Relative Comparison of the Local and Foreign Shocks in a Small Open Economy: The Case of Pakistan

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Monetary Policy, Open Economy, SVAR

ABSTRACT

This study has analyzed the impact of external and trade shocks on the domestic output of Pakistan's economy using the Structural Vector Auto-Regression (SVAR) model with monthly data from 1991 to 2013. The main findings of the study are that although domestic shocks are the primary source of macroeconomic fluctuations in Pakistan, foreign shocks also play a considerable role in explaining the variability in output growth and domestic inflation. Shocks to domestic interest rate and oil price inflation have a notable effect on the growth of domestic output. The impact of foreign output shock on domestic output is not noteworthy. Further, the impacts of oil price inflation and the effective federal funds rate shocks on domestic interest rates are remarkable. The foreign shocks are transmitted to the domestic economy mainly through the trade channel.

INTRODUCTION

To reduce external deficits and domestic financial imbalances, Pakistan implemented structural reforms and economic stabilization policies in 1988. However, proper channels to implement these policies were not established due to inconsistency. As a result, Pakistan's economy continued to experience low growth, savings, and investment. As an imperative step towards a free-market approach, Pakistan implemented trade and structural adjustments as enforced by IMF and World Bank in the early 1980s. Pakistan showed a great inclination for a free-market economy and accepted different conditions imposed by the international organizations to acquire financial support. As a result, trade reforms were executed during the mid- 1980s. These trade liberalization and trade reforms policies involved reduced tariffs, uniform tariff structures, fewer quantitative restrictions, and reduced taxes on international trade. This process of implementation and trade liberalization continued till the early twenties. Since 2003, Pakistan encountered the problem of trade deficit mostly due to high energy imports. In recent times, Pakistan's largest trading partner has been China replacing the United States. Pakistan registers trade surpluses with the United States, Germany, Afghanistan, and United Kingdom. The major trade deficits were recorded with China, United Arab Emirates, India, Saudi Arabia, Malaysia, and Kuwait in recent years. Balance of trade in Pakistan averaged -33151 PKR million from 1957 until 2017, reaching a record low of -362902

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PKR million in May of 2017and an all-time high of 6457 PKR million in June of 2003. Pakistan noted a trade deficit of 320278 PKR million in October of 2017. Most of the economic issues faced by the Pakistan economy during the past four decades were home-grown, mainly driven by the thirty years long ethnic conflicts, political instability and social unrest, weak fiscal and monetary policy, unfavorable weather conditions, and natural disasters. Nevertheless, Pakistan is becoming increasingly exposed to foreign shocks through trade and financial market linkages with the rest of the world. Conversely, the economic policy of Pakistan, particularly the monetary policy, may not be geared towards strengthening the country's resilience to external disturbances. Given this backdrop, the primary objective of this thesis is to deepen our understanding of the impact of external and trade shocks on the Pakistan economy and the shock propagation mechanisms of these shocks.

LITERATURE REVIEW

Several studies have shown that the effect of terms of trade shocks on macro-economic variables is influenced via the structural characteristics of the domestic economy. Applying a semi-structural VAR model to a panel of 88 countries, Loayza and Raddatz (2007) investigate how the local structural characteristics related to product and factor market flexibility and openness influence the effect of terms of trade shocks on aggregate output. They discover that great trade-openness increases the effect of terms of trade shock on output while financial-openness diminishes the effect. Further, the flexibility of labor markets dampens the adverse outcome of terms of trade shocks and the easiness of firm entry in the market magnifies the progressive effects. Broda and Tille (2003) indicate that the countries with flexible exchange-rate regimes are less susceptible to terms of trade shocks than the countries with fixed exchange rate regimes. Broda (2004) also asserts that the output, price, and exchange rate responses of a country to terms of trade shock significantly differ across different exchange rate regimes. These studies indicate that the effect of terms of trade shocks on an economy is by and large country-specific depending on the country's structural characteristics.

Harberger (1950) and Laursen and Metzler (1959) were some of the first to explore the link between terms-of-trade shocks and the macro-economy. They assert that a decline in the terms of trade would reduce the real income (or raise the real expenditure for a given level of real income) of a country leading to reduced savings (and a worsening of the current account) through consumption smoothing behavior. This hypothesis is renowned as the Harberger-Laursen-Metzler effect. Otto (2003) finds strong evidence to support the Harberger-Laursen-Metzler hypothesis. This concept is further extended by Obstfeld (1982) and Kent and Cashin (2003), who suggest that the length of persistence of terms of trade shocks is crucial in defining their influence on an economy. They suggest that unanticipated and permanent deterioration in terms of trade would lower the real income of a country permanently, leading to a permanent reduction in consumption without disrupting the country's savings plan or the current account balance. On the other hand, if the unanticipated terms-of-trade deterioration is more transitory in nature, real income, current account, consumption, and savings would behave as foretold by the Harberger-Laursen-Metzler hypothesis. Mendoza (1995) examines the association between the terms of trade and macroeconomic variations in small open economies. He observes the movements in terms of trade and macro variables and compares them with the predictions of a theoretical model. Mendoza (1995) asserts that a large part of the variance in output and exchange rate fluctuations can be explained by terms of trade shocks. Kose (2002) extends Mendoza (1995)'s work by developing a model that better captures the characteristics of developing countries, such as large trade deficit, higher debt-to-GDP ratio, and large non-traded goods sector in the economy, and reports similar findings. Numerous other studies have shown that terms-of-trade volatility accounts for a large fraction in the variance of output, output growth, current account, consumption, and public and private savings in developing economies (Easterly et al., 1993, Agénor et al., 2000). Jaaskela and Smith (2013) posit that the export and import prices (and in turn, terms of trade) of Australia are affected by commodity-specific, world-demand shocks and globalization shocks. Their 'world sector' consists of three variables, i.e., export and import prices of Australia and world output. World demand shock is common to both export and import prices and is associated with the global business cycle. In contrast, commodity-specific shocks are limited to export prices and may or may not influence import prices. The third shock considered by Jaaskela and Smith (2013), i.e., globalization shock, allows export and import prices to move in opposite directions. This shock captures the effect of the entry of large emerging economies to global markets, which leads to an increase in export prices and world output and a decrease in import prices. On the other hand, Karagedikli and Price (2012) incorporate world output, the commodity factor, world prices, export prices, and import prices of New Zealand as global variables. They assume that the term of trade of New Zealand is affected by the world demand, world supply, and globalization shocks. They specify world supply shocks as a decrease in world output and an increase in commodity factor and export prices.

In the more recent literature, it is claimed that the reaction of macro-variables to the fluctuations in certain external variables depends on the characteristics of the underlying shock. For example, the effects of oil price fluctuations on the US and European economies are highly dependent on the nature of the shock (Kilian, 2009, Peersman and Van Robays, 2009 and Melolinna, 2012). As Kilian (2009) points out, the approach of modeling the oil price shocks as uncorrelated shocks to the rest of the foreign variables in a VAR model is fundamentally incorrect. This is because the oil prices are determined endogenously rather than exogenously within global markets depending on the underlying shocks, such as aggregate demand shocks and supply shocks. Therefore, it is essential to specify these underlying shocks in the VAR model to properly investigate the effect of oil price fluctuations on the domestic economy. Mangadi and Sheen (2016) suggest that the same idea can be applied to the terms of trade shocks as well. Even though the term of trade is exogenous for a small open economy, this variable will be determined endogenously within the global market. If the underlying shocks that cause terms of trade fluctuations are not specified in the VAR model, the reverse causality coming from other global variables to the terms of trade may not be captured. Therefore, Karagedikli and Price (2012) and Jaaskela and Smith (2013) and assume that the import and export prices, which are affected by various external shocks, would affect the Australian and New Zealand economies directly as well through the terms of trade.

There is a growing body of literature that investigates the effect of external shocks and their transmission channels in advanced and emerging economies. Many studies such as those conducted by Kim (2001), Canova (2005), Maćkowiak (2007), Allegret et al. (2012), and Sato (2011) have shown that external shocks cause significant macroeconomic fluctuations in both developed and emerging markets. However, Raddatz (2007) posits a contradictory viewpoint regarding low-income countries using a panel VAR approach. He finds that internal reasons are the key source of variations in output, while external shocks can explain only a minor portion of output variances in a classic low-income country. Numerous studies have focused on the cross-border transmission of foreign monetary policy shocks, particularly the US monetary policy shocks. Kim (2001) inspects the worldwide transmission of US monetary policy shocks using SVAR models for G-6 countries and concludes that expansionary monetary policy in the US leads to booms in non-US, G-6 countries. Further, he claims that variations in trade balance appear to show a slight role in the transmission process but a reduction in world (real) interest rate appears more significant for output expansion in non-US, G-6 countries. Using SVAR models with sign restrictions, Canova (2005) also finds similar results for Latin American countries. He shows that US monetary-policy shocks cause important fluctuations in numerous Latin-American macro-economic variables though the US supply and demand shocks fail to make notable responses in a Latin American economy. Canova (2005) also asserts that the interest rate channel contributes more to foreign shocks transmission than the trade channel. Maćkowiak (2007) uses SVAR models with block homogeneity assumptions for several emerging markets and finds that US monetary policy shocks affect the interest rate and exchange rate of these economies quickly and strongly.

Interestingly, output and price levels in emerging markets respond more strongly to US monetary policy shocks than the US output and US price levels. In contrast to the findings of Kim (2001) and Canova (2005), Maćkowiak (2007) conclude that other external shocks affect the emerging economies more than the US monetary policy shocks. Allegret et al. (2012) also find similar results for East Asian economies using an SVAR model with block homogeneity and short and long-run restrictions. They find that US GDP shocks and (real) oil price shocks have a high impact on the output variability in East Asian economies than the US monetary policy and financial shocks. On the other hand, Dungey and Pagan (2000), who have modeled the Australian economy by imposing a block homogeneity assumption and short-run restrictions, posit that both foreign output and asset prices have a considerable effect on the growth of the Australian economy, even though the Australian business cycle is not fully synchronized with the foreign business cycle. These ambiguous past findings suggest that the relative importance of different external shocks and their transmission channels are by and large country-specific depending on the economy's trade and financial market links with the rest of the world.

RESEARCH METHODOLOGY

The analysis starts from testing the unit root in the data. Augmented Dickey-Fuller Test (ADF) is performed to check that the data set has the characteristic of stationarity. For this test, it is assumed that no autocorrelation exists among the error terms when the lags number has to be decided in a series to test for the unit root. However, different studies have suggested testing the hypothesis of unit root against a time series stationary that displays breaks (Perron, 1989; 1997; 2005) or nonlinearities (Balke and Fomby, 1997). Evaluating the optimal lag length of autoregressive procedure for a time series is an important econometric step because the estimation of the model is highly sensitive to the lag length of data. For an estimated VAR model, the optimal lag length can be decided based on different criteria i.e., Akaike information criterion (AIC), Schwarz's Bayesian information criterion (SBIC), and Hannan-Quin information criterion (HQ). AIC is mostly used for small sample sizes while for large sample sizes, mostly BIC criteria are used.

Econometric Model

A structural auto-regression (SVAR) model is theoretically reliable for investigating small open economies and studying the dynamic interaction of macroeconomic variables. It relies on economic theory to enforce restrictions on the contemporaneous unexpected association of the variables. This fact makes SVAR desirable over VAR to analyze the macroeconomic response.

A structural VAR (SVAR) uses additional identifying restrictions and estimation of structural matrices to transform VAR errors into uncorrelated structural shocks. Obtaining structural shocks is vital to a varied range of VAR analyses, including impulse response, forecast variance decomposition, historical decomposition, and other forms of underlying analysis.

The VAR representation of the structural model can be written as.

$$A\, y_t = A_1^a y_{t-1} + \dots + A_p^a y_{t-p} + C^a x_t + B\, u_t \qquad (1)$$

Where A, all the A_i^a, and C^a are the structural coefficients, and the u_t are the orthonormal unobserved structural innovations with $E(\epsilon_t \epsilon_t') = I_k$.

Structural Identification

It is worth mentioning that the system has not imposed any lagged structural parameter restrictions and has only imposed contemporaneous restrictions on structural parameters. The world oil prices are the most exogenous variable and thus it does not depend on any domestic or foreign variable. For that reason, the world oil price is first in the system. Oil price inflation is assumed to be not affected by other foreign shocks contemporaneously (Allegret et al., 2012). This results in two additional restrictions. The effective federal funds rate is assumed to be responding to oil price inflation (Leeper et al., 1996, Bernanke et al., 1997 and Allegret et al., 2012) contemporaneously. Moreover, US IPI growth is assumed to respond to world oil prices and federal funds rates simultaneously. This assumption provides another restriction. Both domestic monetary policy that is represented by the short-term interest rate (MMR) and the real effective exchange rate are assumed to react contemporaneously to external shocks. Import price is assumed to respond to oil price inflation and provides another restriction. In addition, import prices also depend on domestic monetary policy and output growth. Export price simultaneously depends on both domestic and foreign variables. The consumer price index (CPI) is referred to as domestic inflation. It is assumed that CPI reacts simultaneously to oil prices and monetary policy changes. The domestic price level reacts positively to the changes in foreign variables. The domestic block follows the identification scheme in Bjørnland (2009). Accordingly, all domestic variables are affected by the foreign shocks contemporaneously, but domestic IPI growth is affected by other domestic variables only after one quarter. Variance decomposition is a technique that splits the variations that occurred in the endogenous variables into their component shocks to the VAR system. The importance of the effect of each random shock on the variables is illustrated in the VAR system with the help of variance decomposition. This technique also outlines the forecast error which conveys the proportion of the movements in a sequence due to its shocks versus the shocks to the other variable.

1-period forecast error is given as $x_{t+1} - Ex_{t+1} = \Phi_0\varepsilon_{t+1}$ and the n-period forecast error can be given as;

$$x_{t+n} - Ex_{t+n} = \Phi_0\varepsilon_{t+n} + \Phi_1\varepsilon_{t+n-1} + \Phi_2\varepsilon_{t+n-2} + \dots + \Phi_{n-1}\varepsilon_{t+1} = \sum_{i=0}^{n-1} \varepsilon_{t+n-i} \quad (2)$$

The variance of its n-step-ahead forecast error is:

$$\sigma^2_{y,n} = \underbrace{\sigma^2_y(\phi^2_{11,0} + \phi^2_{11,1} + \dots + \phi^2_{11,n-1})}_{\text{proportion of variance due to own shock; Decreases over time}} + \underbrace{\sigma^2_z(\Phi^2_{21,0} + \Phi^2_{21,1} + \dots + \Phi^2_{21,n-1})}_{\text{proportion of variance due to a z shock; Grows over time}} \quad (3)$$

Variables Description

World Oil Prices/ Oil price inflation (WOP): OIL is the oil price inflation compared to the preceding quarter. The prices of the WTI Crude and the Colombo Consumer Price Index are used to calculate the oil price and domestic price inflation. Both inflation rates are defined as inflation relative to the preceding quarter.

Foreign output growth: Industrial production index (IPI) for the US is used as a proxy for foreign output growth. IPI is referred to the measurement of the real output production of manufacturing, mining, and utilities.

The foreign interest rate: Initially, the effective federal funds rate (EFFR) is used to represent the foreign monetary policy. FFR is the quarterly effective federal funds rate in the US. It is the central interest rate in the US financial market that affects other interest rates such as prime rate etc.

Industrial Production Index (IPI): IPI is referred to the measurement of the real output production of manufacturing, mining, and utilities. IPI is used as a proxy for GDP. GDP is the output growth rate relative to the previous quarter of Pakistan. Data is collected from the FRED database.

Domestic consumer price inflation (CPI): INF is the inflation in Pakistan's CPI compared to the preceding quarter. It can be defined as the inflation measured by the consumer price index which reflects the annual percentage change in the average consumer cost of obtaining a basket of goods and services that may be changed or fixed at specified intervals.

Short-term interest rate/ Money Market Rate (MMR): The MMR is the quarterly money market rate in Pakistan. The money market rate is used as a proxy for the domestic short-term interest rate. The money market rate can be defined as the interest rate on loans having a maturity of less than one year.

Real effective exchange rate (REER): REER is the real effective exchange rate. It is the weighted average of currency of a country comparative to a basket or index of other main currencies (adjusted for inflation effects).

Export prices (XP)/ Import prices (MP): import/ export prices index is a monthly report that measures inflationary pressures created by international demand and foreign exchange rates for foreign products.

All variables are in percentage terms except REER, XP, and MP which are in natural logarithm. The global price of WTI Crude, the Colombo Consumer Price Index, the IPI of Pakistan, Import/export prices, US IPI, and real effective exchange rate data are already seasonally adjusted. The nine variables utilized in the current research are partitioned into two blocks, that is a foreign block and a domestic block. Three external variables are considered in the foreign block of this model, namely, oil price inflation (OIL), foreign output growth, and the foreign interest rate. The domestic variables block consists of six variables, viz., domestic real GDP growth (GDP), domestic consumer price inflation (INF), short-term interest rate (INT), import prices (IMpr), export prices (EXpr), and real effective exchange rate (REER).

1. Empirical Findings

The analysis starts from the description and summarization of the variables under study. The summary statistics of the variables under study are reported in Table 1 below. Table 1 represents the descriptive statistics of the data. A total of 288 observations were studied for 22 years. The mean values simply represent the average value of each variable used in the data. Similarly, the median represents the middle value after sorting observations; and the mode shows the most appeared value in the data set of each variable. The standard deviation shows that how far observations deviate from the sample average. For example, the standard deviation of FFR is 2.1 percent which means that FFR deviates only 2.1 percent from the average of 3.61 for sample data. The descriptive statistics also show Kurtosis and Skewness values which are the measures of normality. Kurtosis measures the peakedness or flatness of the distribution of the series. Skewness measures the degree of asymmetry of the data series. For normal skewness, the value should be equal to zero. It can be observed that all the variables in the table mirror positive skewness except MMR. The kurtosis values for each value are calculated to be lower than 3 except MMR which is 3. It means that the variables are platykurtic and most of the values in the data are lower than the mean values. Jarque-Bera statistics measure the difference of the skewness and kurtosis of the series with those from the normal distribution. The null hypothesis for this test is that the distribution is normal. Apart from MMR, the probability value for the other variables is significant so it means that the null hypothesis of the normal distribution is rejected.

Table 1 Descriptive Statistics

Summary	IPI	WOP	USIPI	FFR	CPI	MMR	REER	MPRT	XPRT
Mean	70.27	48.6	94.78	3.61	55.36	8.98	103.66	114048.1	65096.9
Median	61.77	28.64	98.21	3.74	44.96	9.49	99.36	54476	47898.4
Maximum	122.39	133.9	120.3	8.29	136.32	20.03	124.18	369643.1	164284.6
Minimum	30.28	9.8	65.77	0.11	16.76	0.74	89.75	10708	7362.1
Std. Dev.	27.2	35.88	15.94	2.11	32.01	3.49	9.75	109555.1	48483.76
Skewness	0.26	0.78	-0.367	0.102	0.99	-0.199	0.47	0.97	0.66
Kurtosis	1.47	2.129	1.99	2.019	2.93	3.14	1.72	2.48	2.04
Jarque-Bera	31.18	38.42	18.57	12.04	47.91	2.15	30.64	49.05	32.43
Probability	0	0	0.000093	0.0024	0	0.339	0	0	0
Sum	20240.31	13998.22	27299	1042.01	15945.83	2588.85	29854.4	32845855	18747908
Sum Sq. Dev.	212473	369545.3	72924.47	1280.59	294210.7	3502.818	27284.4	3.44E+12	6.75E+11
Observations	288	288	288	288	288	288	288	288	288

Unit Root Test Results

All variables are checked for stationarity using Augmented Dicky Fuller (ADF). A summary of these tests is given in Table 2; models (constant and trend) are used for checking the stationarity of the data. If the p-value is less than 0.05 so the data will be stationary. Oil and domestic price inflation rates and foreign and domestic output growth rates are I(I) variables but interest rates are I(0) and real effective exchange rates are $I(1)$ variables.

From the table, at level (with constant), the p-values of the variable are greater than 0.05, so we accept the null hypothesis of non-stationarity in the data. To make the data stationary, the first difference of all the non-stationary data is taken using 2 models i.e., with constant and with constant and trend. To apply the restriction of long-run neutrality of monetary policy on the real exchange rate, a stationary monetary policy variable is required. Therefore, both interest rate variables are incorporated in the model in their first difference terms. Further, an exchange rate also enters the model in the first difference term to apply the long-run restriction. By applying the long-run restriction to the first differenced exchange rate, the effects of monetary policy shocks on the level of the real exchange rate will eventually add up to zero (Blanchard and Quah, 1989).

Table 2 Unit Root Test

Variables	Lag	Trend	P-Value	Order of Integration
LCPI	4	No	0.93	I (I)
ΔLCPI	3	No	0.00	I(0)
FFR	8	Yes	0.01	I(1)
ΔFFR	2	No	0.00	I(0)
LIPI	12	No	0.90	I(I)
ΔLIPI	11	No	0.00	I(0)
LMP	12	Yes	0.90	I(I)
ΔLMP	11	No	0.00	I(0)
LREER	4	Yes	0.40	I(I)
ΔLREER	7	No	0.00	I(0)
LUSIPI	15	No	0.40	I(I)
ΔLUSIPI	14	No	0.00	I(0)
LXP	12	Yes	0.40	I(I)
ΔLXP	11	No	0.00	I(0)
MMR	10	No	0.30	I(0)
ΔMMR	10	No	0.00	I(0)
LWOP	13	Yes	0.70	I(I)
ΔLWOP	12	No	0.00	I(0)

Multi-Variate Granger Causality Test Results

The causality among all the variables can be examined using the Wald test. By using the null-hypothesis that there is no relation among the variables (if the p-value is less than 0.05), we summarize the causality test in Table 3:

It is evident from the above table that world oil prices are independent and have no relation with the other variables. FFR has a significant relation with REER only and other variables are insignificant. Similarly, USIPI shows causality with FFR and XP only. CPI and MP show dependence on MP IPI respectively. IPI shows a relation with all the variables except REER, MP, and CPI. MMR has a relation with four other variables i.e., WOP, FFR, USIPI, and XP. Also, the WALD test showed that XP or export has a significant relationship with all other variables except WOP, FFR, and CPI.

Analysis from Impulse Response Functions

An impulse response function describes the dynamic response of one variable in the VAR system to a shock in one of the structural form equations. In the structural VAR system, certain identified restrictions are being imposed on the variables. The following figures illustrate the one standard deviation responses of the variables over 2 years' horizons. All these figures have 2 dotted red lines representing 95 percent of the confidence interval. The blue line represents the dynamic response of all the variables to the dynamic shocks. The zero line shows the mean value and at that line, the trade shock does not have any impact on the variables and the variables will continue to move in the same path if there is no shock. However, a positive or negative movement specifies that the shock had moved the variable above or below its natural value.

Table 3 Multi-Variate Granger Causality Test Results

	Exogenous Variables								
Endogenous Variables	**LWOP**	**FFR**	**LUSIPI**	**MMR**	**LREER**	**LCPI**	**LMP**	**LXP**	**LIPI**
LWOP		0.2	0.54	0.0002	0.04	0.25	0.08	0.03	0.007
FFR	0.3		0.01	0	0.08	0.27	0.98	0.13	0.026
LUSIPI	0.15	0.15		0.001	0.015	0.28	0.78	0.7	0.031
MMR	0.16	0.85	0.12		0.57	0.36	0.79	0.02	0.001
LREER	0.45	0.0004	0.45	0.2		0.67	0.44	0.03	0.42
LCPI	0.92	0.37	0.07	0.005	0.28		0.006	0.002	0.27
LMP	0.64	0.15	0.13	0.14	0.1	0.002		0.005	0.005
LXP	0.29	0.28	0.003	0.01	0.64	0.3	0.47		0.01
LIPI	0.1	0.68	0.6	0.15	0.007	0.76	0.004	0.001	

1. **Effect of WOP Shocks:**

Figure 3 shows the impulse responses of Pakistan variables to a one standard deviation shock in oil price inflation. Shocks of oil prices to the other variables are investigated up to 24 months in impulse response function.

1. **FFR Response to WOP Shock:** It can be seen in the figure that FFR starts increasing in response to one positive one standard deviation WOP shock. This increasing pattern seems to reach its peak point at 6th month. After that, it shows no significant movement till the end of the forecast period.

2. **USIPI Response to WOP Shock:** A positive one standard deviation WOP shock causes a sharp decline in USIPI. After 3 months, the USIPI path reaches its peak point above the zero line but by the 4th month, it reaches zero line. Between the 6th and 8th month period, the USIPI path again displays a slight increase and immediate decrease in its path. After the 10th month, USIPI stays negative throughout the whole forecast period.

3. **MMR Response to WOP Shock:** A positive one standard deviation shock displays an immediate negative response towards WOP shock. This response remains negative throughout the 24-month forecast period. Apart from showing a sharp negative increase and then decreasing the response, it remains

negative till the 20th month. At the end of the 24-month horizon, the response becomes positive after reaching the zero line.

4. **REER Response to WOP Shock:** The figure shows that the initial response of REER towards positive WOP shock is positive, but it immediately starts declining and continues to decline until the 19th month forecast period. After that, the response becomes positive and starts increasing after 20 months.

5. **CPI Response to WOP Shock:** CPI response towards positive WOP shock remains positive through the 24-month forecast horizon. It shows a slight positive decrease between 3-7 months but apart from that, CPI continues to appreciate during the forecast period.

6. **MP response to WOP Shock:** the figure shows that MP response towards (positive) one standard deviation WOP shock in positive during the 24 months horizon. After reaching the peak point at 10th month, it becomes insignificant and shows no further movement in its path.

7. **XP Response to WOP Shock:** During the initial 6 months, XP responds irregularly towards positive one standard deviation WOP shock. The initial response is negative towards WOP shock but there is a sharp increase in the XP path, and it reaches the peak after 3 months. After that, it gradually starts declining till the 7th month and becomes insignificant.

IPI Response to WOP Shock: The figure shows that IPI responds positively towards positive WOP shock but immediately reaches the zero line after 3rd month. After that, the response showed positive movement throughout the 24 months forecast horizon. But the response seems to be long-term as the path movement remains way above the zero line during the forecasting period.

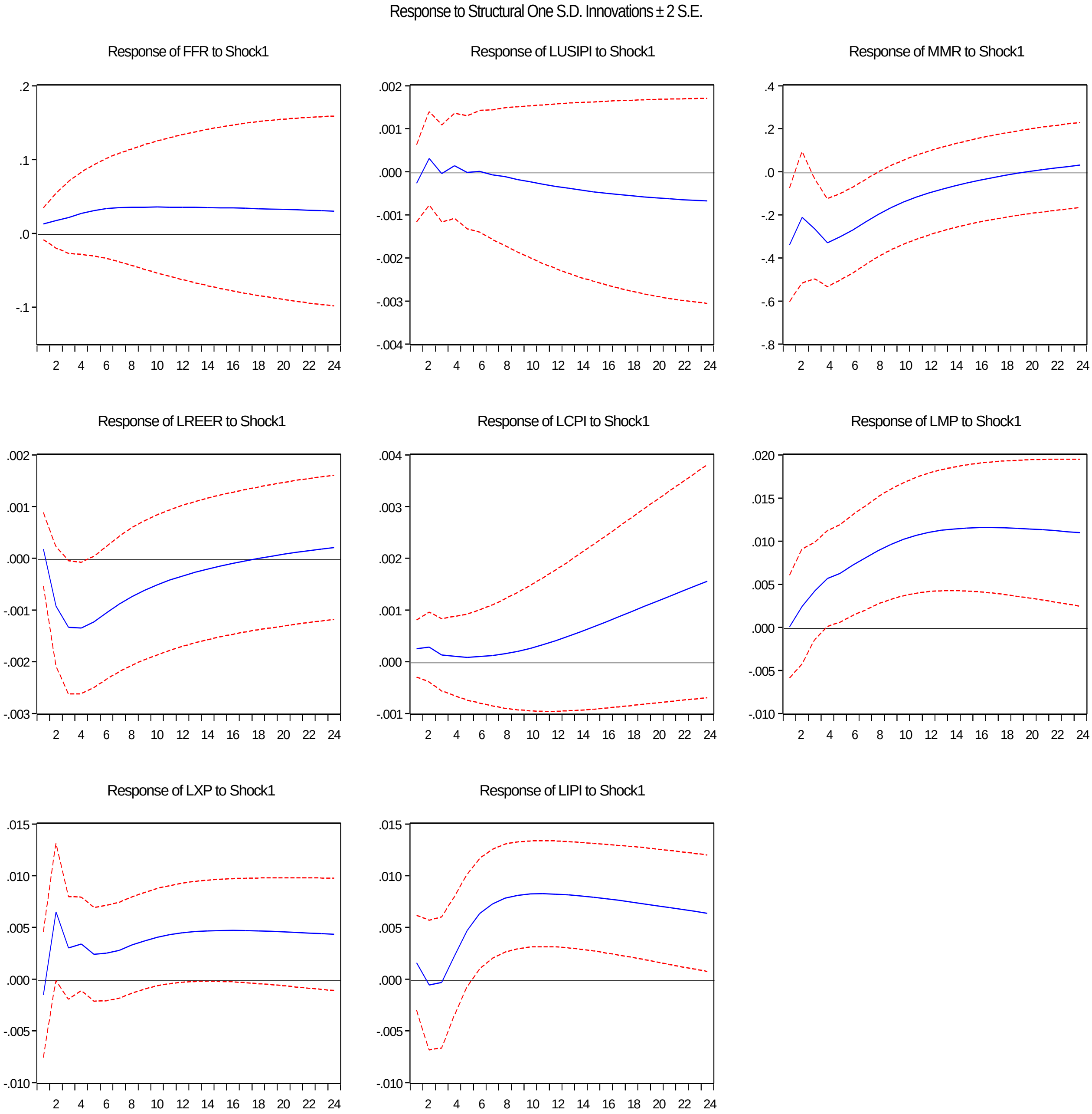

Figure 3: Impulse Response Functions of Structural VAR (WOP Shock)

2. Impulse Responses to FFR Shocks:

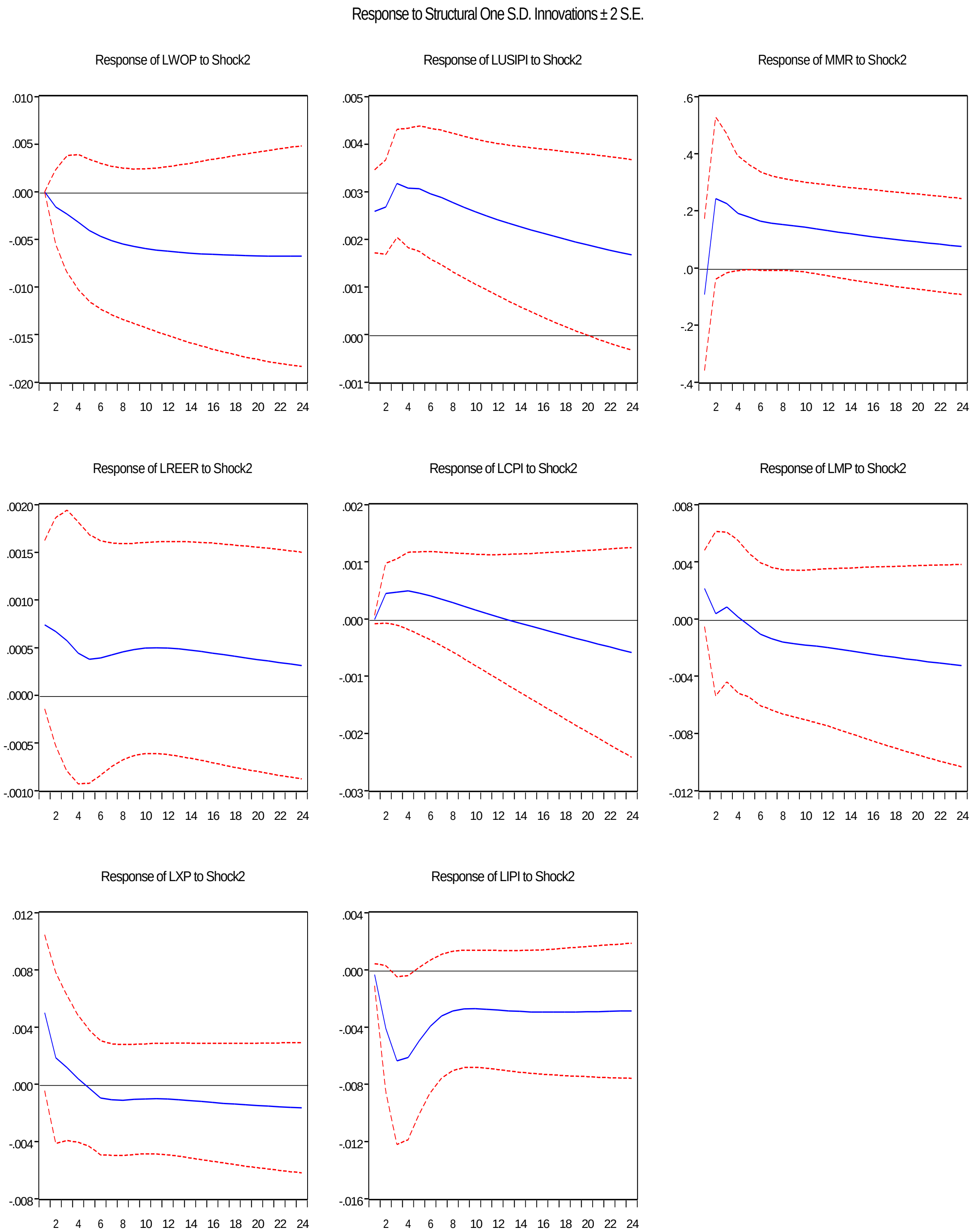

Figure 4: Impulse Response Functions of Structural VAR (FFR Shock)

Figure 4 depicts the impulse responses of domestic variables to a one standard deviation shock to the effective federal funds rate.

1. **WOP Response to FFR Shock:** It can be seen in the figure that WOP response towards a positive one standard deviation shock is negative throughout the forecast horizon of 24 months. WOP immediately responds negatively to the FFR shock. This effect of FFR on WOP seems to be long-lasting as the path does not converge towards its pre-shock level and becomes insignificant after the 8th month.

2. **USIPI Response to FFR Shock:** USIPI depicts a positive response towards FFR shock. The path shows both upward and downward movement which means that the response is significant towards FFR one standard deviation. The path reaches its peak by the 4th month. After that, it starts declining continuously even though the response remains positive throughout the complete forecast period.

3. **MMR Response to FFR Shock:** MMR response towards a positive one standard deviation shock in FFR is initially negative but there is a sharp increase in the path movement immediately after the 3rd month. After that, the path continues to be positive throughout the forecasting period. The MMR path reaches its peak point in the 4th month and at the end of 24 months, it starts to converge towards its pre-shock level.

4. **REER Response to FFR Shock:** The figure shows that REER's response towards the FFR shock seems to be significantly positive during the forecast horizon of 24 months. There is a slight decrease in the path movement after the 4th month above the pre-shock level. At the end of the forecasting period, the path starts to converge towards the zero line which means that the impact of REER seems to be temporary.

5. **CPI Response to FFR Shock:** CPI response towards FFR shock is initially positive and reaches its peak after the 4th month. There is a decline in the path movement of CPI above the pre-shock level and it reaches the zero line after 13 months. After that, the response towards FFR shock remains negative till the end of 24 months. The impact seems to be permanent as the path movement shows no sign of convergence towards the pre-shock level.

6. **MP Response to FFR Shock:** The initial response of MP is positively significant. The path shows a downward movement above the pre-shock level and reaches zero after 5 months. After that, the response towards FFR shock continues to be negative and becomes insignificant after 19 months.

7. **XP Response to FFR Shock:** The XP responds both positively and negatively towards positive one standard deviation FFR shock. The initial impact is a positive decrease in the path movement till it reaches the zero line after 5 months. Then, the response converts to negatively significant. After 8 months it depicts no further movement which means the impact becomes insignificant.

IPI Response to FFR Shock: The response of IPI towards the positive shock remains negative throughout the forecast horizon of 24 months. There is an immediate sharp decline in the path below the pre-shock level till 3 months. At the start of the 4th month, the impact remains negative but starts to increase till the 8th month.

3. **Impulse Responses to USIPI (Foreign Output) Shocks:**

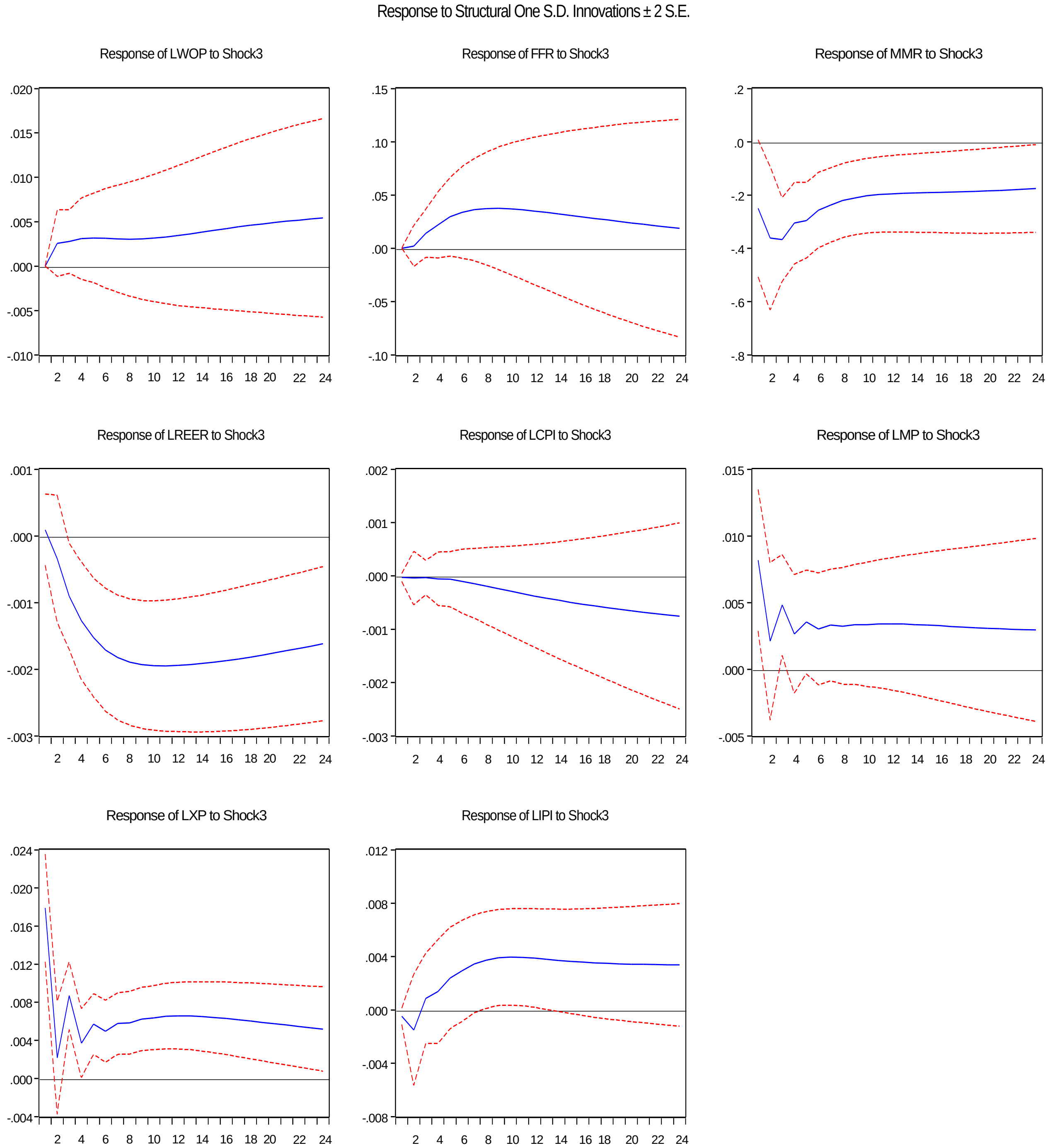

Figure 5: Impulse Response Functions of Structural VAR (USIPI Shock)

4.

Dynamic responses of domestic variables to a one standard deviation shock in foreign output are illustrated in Figure 5.

1. **WOP Response to USIPI Shock:** The figure showed that the WOP response towards a positive one standard deviation USIPI shock remains positive throughout the complete forecast horizon of 24 months. The response reaches its peak after 5 months, after which it slowly becomes insignificant and showed no further abrupt pattern in its response towards shock.

2. **FR Response to USIPI Shock:** FFR response towards shock depicts only positive movement during the complete forecasting period. FFR response reaches the highest point after the 6^{th} month. FFR path starts to converge towards the pre-shock level after 10 months. The response towards shock is significant and not permanent.

3. **MMR Response to USIPI Shock:** The MMR response towards positive shock remains negative during the whole period. It showed an immediate decline in its pattern below the pre-shock level and starts to negatively increase only after 3rd month. The response becomes insignificant only afterward 8 months of the forecasting period and showed no further changes in its response above the zero line.

4. **REER Response to USIPI Shock:** Initially, the REER response is positive, but it sharply declines and remains negative during the forecast horizon of 24 months. The response seems to be long-lasting and becomes insignificant 10^{th} month.

5. **CPI Response to USIPI Shock:** The CPI response towards USIPI shock depicts only negative movement for 24 months. The effect remains permanent and shows no sign of convergence towards the pre-shock level.

6. **MP Response to USIPI Shock:** During the initial period, the MP response depicts sharp up and down movements in its pattern of the USIPI shock. These movements remain visible between the initial 2-8 months period. After which, the response becomes insignificant.

7. **XP Response to USIPI Shock:** Similarly, to MP response, the XP response towards shock remains positive during the whole forecasting period. The response almost follows the same pattern of imports response. It initially starts declining and then shows a sharp increase after 2^{nd} month. The response reaches the peak point after the 4^{th} month and shows an immediate decline in its pattern. The effect remains temporary and becomes insignificant after the 14^{th} month of the forecasting period.

8. **IPI Response to USIPI Shock:** The figure showed both positive and negative movements of IPI response towards shock. Initially, it showed a negative reaction below the zero line and starts moving above the pre-shock level after 3 months. The response reaches the peak point above the zero line after 8 months and then becomes insignificant.

Impulse Responses to MMR Shocks.

Figure 6 shows the dynamic response of domestic variables to a one standard deviation shock to the change in the domestic short-term interest rate, which is a monetary policy shock.

1. REER Response to MMR Shock: The real effective exchange rate depreciates instantaneously in response to a domestic monetary policy shock and gradually converges towards the mean position and becomes insignificant. The response remains positive during the complete forecasting period and reaches the peak point after the 7^{th} month above the pre-shock level.

2. CPI Response to MMR Shock: The consumer price inflation is mostly insignificant in response to an interest rate shock throughout the shock. It showed a slight upward and downward movement during the initial 4 months. The response converges towards the zero line, so the impact is temporary.

3. MP Response to MMR Shock: The import prices response towards the monetary policy shock is negative till 7 months but after that it becomes ineffective. Below the zero line, the response depicts a declining and immediate upwards movement till 5 months. The response reaches its peak point at the end of the 11th month and then becomes insignificant (Showing no further changes in the path).

4. XP Response to MMR Shock: The export prices decline initially in response to shock but the effect is short-lived and not statistically significant at the 90 percent confidence level. The effect remains negative during the 24 months and becomes insignificant after the 13th month.

IPI Response to MMR Shock: Domestic output growth declines during the forecast horizon of 24 months in response to short-term interest rate shock. IPI exhibits only negative movement (below the Zero line) and reached the peak after the 11th month.

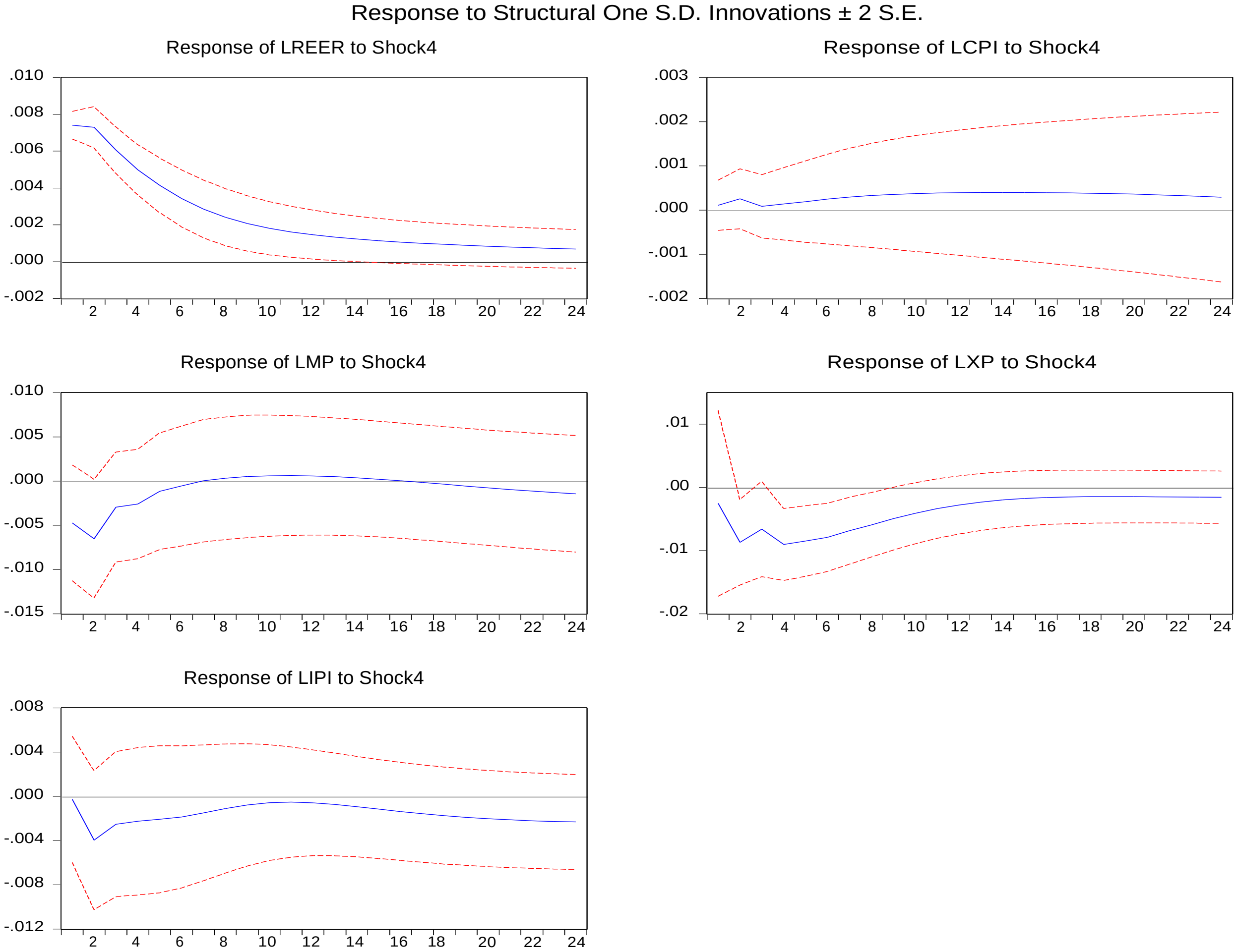

Figure 6: Impulse Response Functions of Structural VAR (MMR Shock)

Impulse Responses to LMP (Import) Shocks:

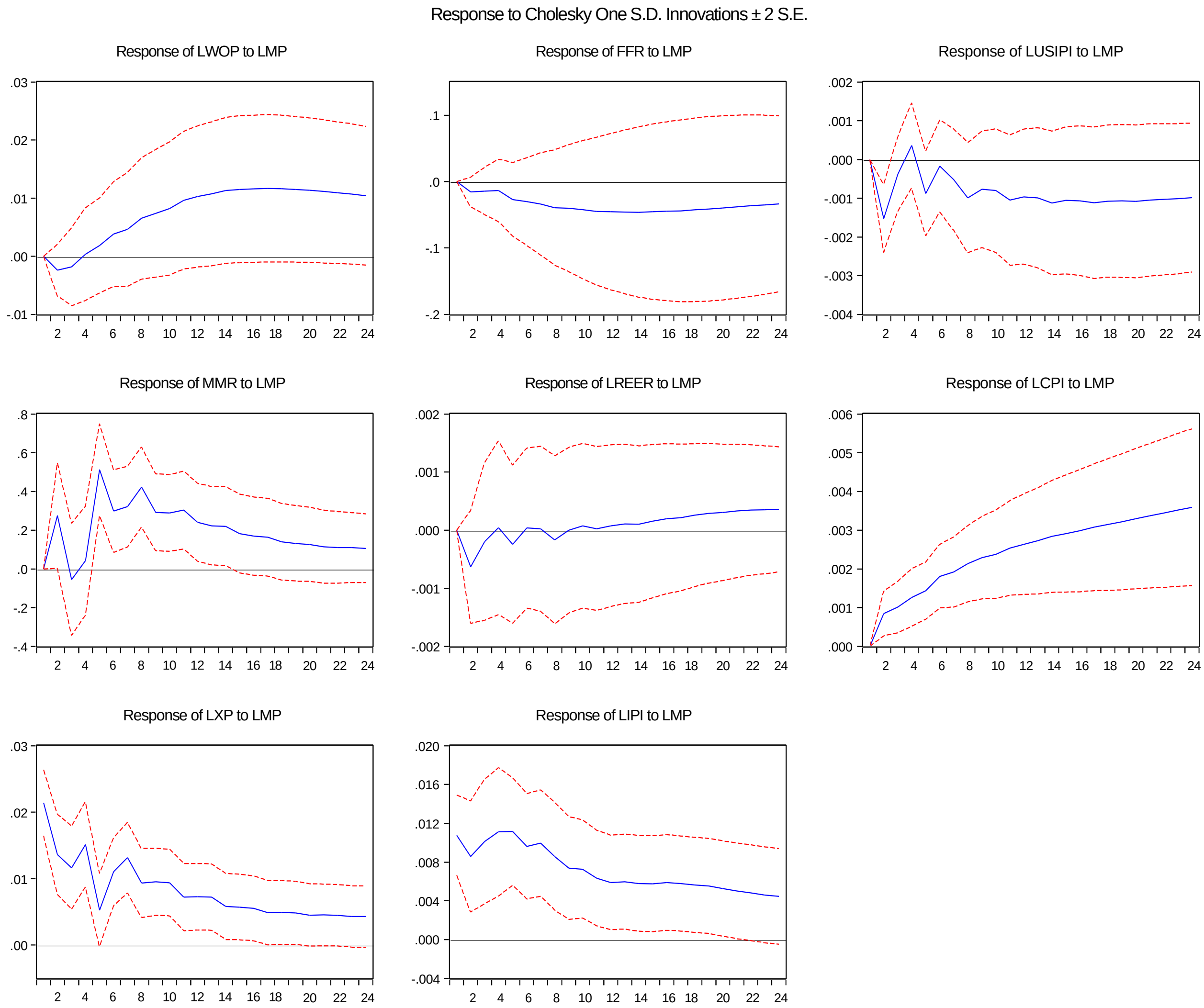

Figure 7: Impulse Response Functions of Structural VAR (LMP Shock)

Figure 7 depicts the impulse responses of domestic variables to a one standard deviation shock to the import prices.

1. **WOP Response to MP Shock:** The change in world oil prices is negative for 4 months but after that it becomes positive and increases in response to import price shock. The response reaches the peak point after the 12th month and then gradually converges towards the mean line above the pre-shock level. The effect seems to be permanent and showed only a slight inclination to converge.

2. **FFR Response to MP Shock:** Foreign federal funds rate decreases due to import price shock (it is statistically insignificant). The response remains negative and starts to converge towards the zero line after the 15th month. This effect is temporary and depicts an inclination to converge at the end of the forecasting period.

3. **USIPI Response to MP Shock:** The USIPI response towards the shock showed mostly a negative pattern during the forecast horizon of 24 months. It initially decreases below the zero line but takes an

immediate upward movement after 3 months. The response reaches its peak point after 5 months above the pre-shock level. After that, it again depicts a negative response towards the shock till the end of the 13th month, and then it becomes insignificant.

4. **MMR Response to MP Shock:** Short-term interest rate is mostly appreciating in response to hiking in import prices except for the initial 2 months period. Then, it starts a declining pattern above the pre-shock level and reached the peak point by the end of the 7th month. It again showed a decreasing movement in its path above the pre-shock level and then becomes insignificant after 19 months.

5. **REER Response to MP Shock:** Real effective exchange rate depicts both positive and negative responses during 24 months in response to an import price increase. It remains negative till 13 months (depicting both upward and downward patterns below the zero line). After the 14th month, the response becomes positive and starts to converge. The REER response towards MP shock seems to be temporary.

6. **CPI Response to MP Shock:** The CPI response towards MP shock remains positive during the complete forecast period. The CPI continuously depicts an increasing pattern above the mean line and showed no sign of convergence which means; this impact is long-lasting and permanent.

7. **XP Response to MP Shock:** Export prices remain positive throughout the forecast horizon of 24 months in response to the shock of the import price hike. The XP response consciously takes sharp turns in its path above the pre-shock level. Initially, it starts declining and reaches its lowest point by the 5th month. There is a sharp upward movement in XP response until 10 months, and then it again starts to decrease and gradually becomes insignificant.

8. **IPI Response to MP Shock:** Domestic output remains positive throughout the forecast horizon of 24 months in response to the shock of the import price hike. The response reaches the peak point after the 7th month; it then showed a downward pattern in the path movement until the 15th month. The IPI response becomes insignificant after that point and showed no further changes in its path.

Oil price shocks.

Figure 5 shows the impulse responses of variables to a one standard deviation shock in oil price inflation. The Pakistan economy is highly reliant on imported petroleum as a primary and secondary energy source. Generally, oil shocks can adversely affect the output growth of a net oil importing country through different mechanisms. First, oil prices can drive the marginal cost of domestic firms who may cut down their production leading to an output contraction. Second, the monetary authority may tighten monetary policy to curb potential inflation that in turn may reduce output growth as well. Third, the wealth of net oil-importing countries transfers to a net oil-exporting country with an increase in oil prices. This may lead to reduced savings and investments and low output growth in oil-importing countries. Therefore, we may expect a negative effect of oil price shock on output growth in Pakistan.

Interestingly, the results of this study reveal a different picture and domestic output growth improves due to a shock to oil price inflation for two months. This result is similar to the findings of Allegret et al. (2012) who also report a positive effect of oil price shocks on the output in several East Asian economies.

As Kilian (2009) points out there are different types of oil price shocks with varying underlying causes: oil price shocks driven by the strong aggregate demand emanating from a booming world economy, precautionary oil price shocks that are explained by precautionary oil demand shocks, and oil supply-side shocks driven by the disruptions to oil production. Kilian (2009) argues that the oil price escalations driven by strong aggregate demand may not result in output contraction in advanced economies such as the US though the latter two oil price shocks can potentially cause recessions. Further, Killian (2012) emphasizes that the surge in oil prices after 2003 was mainly driven by the positive global aggregate demand shocks rather than by the disruptions in oil production or precautionary demand shocks. Allegret et al. (2012) suggest that output expansion in advanced economies can have a positive impact on East Asian economies through trade linkages. Even Impulse responses of this study also support the argument of Kilian (2009) since they reflect a positive effect of oil price shocks on the US GDP growth. Although an oil price inflation shock is orthogonal to the US output shock in this model, an oil price shock may represent the aggregate demand shocks coming from all advanced economies. Therefore, Pakistan benefits from the output expansion in advanced economies during aggregate demand-driven oil price shocks. This result is similar to the East Asian economies in the Allegret et al. (2012) study.

While output growth in advanced economies can be beneficial for overall exports, an increase in oil price inflation is particularly favorable for Pakistan’s exporting sector. One of Pakistan’s major export categories is rice and textiles and sports-based products. Generally, food prices increase simultaneously alongside oil prices in the world market leading to higher demand for these products. Therefore, an increase in oil price inflation can have a positive impact on Pakistan’s output.

Domestic inflation instantaneously increases due to an oil price shock, but this effect is statistically insignificant. The effect of oil price shock on domestic inflation is relatively more persistent than the effect on domestic output growth. The domestic interest rate eventually increases in response to an oil price shock and this increase is statistically significant. The real exchange rate improves marginally in response to an oil price shock at the end of 24 months but is statistically insignificant. Foreign inflation can spike due to an oil price shock though this effect is not captured directly here since a foreign inflation variable is not included in the model. However, the effective federal funds rate increases in the event of an oil price shock, but on average this increase is slightly greater than the increase in domestic short-term interest rate. For Pakistan, oil constitutes an important part of their imports. As a result, the import prices appreciate marginally at the end of 24 months in response to oil price hikes.

Monetary Policy Shocks.

The focus of the research is to analyze the trade shocks through the interest rate channels. To better understand the propagation mechanism of interest rate shock, monetary policy is briefly discussed. Federal funds and money market rate (FFR and MMR) can explain foreign and trade shocks through fluctuation in the exchange rate which affects international and domestic trade. The main objective does not include monetary policy analysis, that's why money supply is not included in the present study.

Foreign monetary policy (FFR) shocks.

Figure 6 depicts the impulse responses of domestic variables to a one standard deviation shock to the effective federal funds rate. Foreign monetary policy shocks tend to be persistent, taking more than 24 months to reach their initial level. Pakistan's interest rate increases gradually in response to a US monetary policy shock indicating a slower spill-over effect on the Pakistan economy compared to other emerging markets. The change in the domestic interest rate reaches its maximum after six months. This finding is different from the findings of Maćkowiak (2007) who reports an immediate and strong response of the domestic interest rate to US monetary policy shocks in emerging markets such as Korea, Malaysia, Singapore, and Mexico. The financial markets in Pakistan are not as well-developed or highly integrated with the US markets as the emerging markets considered by Maćkowiak (2007). Hence, the slower transmission of foreign monetary policy to Pakistan's economy is not a surprise.

With an expansionary foreign monetary policy shock, domestic inflation increases instantaneously. This result is different from the findings of Maćkowiak (2007) who report a decrease in domestic inflation in emerging markets in response to an expansionary monetary policy of the US, irrespective of the domestic exchange rate policy. He argues that domestic inflation rises due to the increased cost of production in the non-traded sector fuelled by the higher world interest rate. Therefore, he suggests that foreign monetary policy affects domestic inflation mainly through the interest rate channel rather than through the trade channel. But in the case of Pakistan, foreign monetary policy initially affects domestic inflation via the trade channel. Given the slow response of the domestic interest rate to foreign monetary policy shocks, the fall in domestic inflation can be explained only by the fall in imported inflation.

With an expansionary foreign monetary policy shock, the foreign inflation increases, ultimately increasing the import prices. Nevertheless, when the domestic interest rate increases slowly due to a higher world interest rate, consumer price inflation in Pakistan rises subsequently due to increased borrowing costs of the producers. This indicates a delayed transmission of foreign monetary policy through the interest rate channel.

Since inflation reduces in both foreign and domestic markets, the real exchange rate depreciates only marginally. With the marginal reduction in the real exchange rate, demand for domestic goods expands in the foreign markets. Domestic output growth decreases immediately in response to FFR shock. Therefore, expansionary foreign monetary policy affects domestic output growth negatively through the trade channel. However, with the gradual decrease in the domestic interest rate, the real exchange rate starts to depreciate from the second month onwards. As a result, the negative effect of foreign expansionary monetary policy shocks on domestic output growth diminishes after 7 months period.

Domestic monetary policy (MMR) shocks.

Figure 8 illustrates the dynamic response of domestic variables to a one standard deviation shock to the change in the domestic short-term interest rate, which is considered to be a monetary policy shock. The real effective exchange rate appreciates instantaneously in response to a domestic monetary policy shock and gradually depreciates thereafter. This is consistent with Dornbusch's (1976) exchange rate overshooting hypothesis, which states that an increase in an interest rate should cause an instantaneous appreciation of real exchange rate due to sticky prices in the short-run, and then depreciate steadily in line with the uncovered interest rate parity (UIP). In contrast, Perera (2013) reports an exchange rate puzzle for the Sri Lankan economy where the exchange rate depreciates in response to a contractionary monetary policy shock. Perera (2013) follows Kim and Roubini's (2000) identification scheme and incorporates contemporaneous endogeneity between interest rate and exchange rate.

The domestic output growth declines in response to an interest rate shock, but the effect is short-lived and gradually tapers off. On the other hand, domestic inflation increases following a domestic monetary policy shock, and the peak effect is achieved after two months but this effect also seemed to be short-lived. Both import and export prices decline in response to MMR shock. In the case of contractionary monetary policy, interest rate increase causes capital inflow in the economy which results in ER appreciation. The effective ER decreases due to price rigidity in short term. As a result, domestic products become less expensive which leads to a reduction in net exports and the GDP of the economy. In addition, the ER also has two indirect effects through aggregate demand and domestically produced goods that use imported inputs. When ER appreciates, the imported goods will be cheaper, and this will replace the domestic goods with comparable imported goods. As a result, aggregate demand will decrease. The second indirect effect is that the cost of domestically produced goods that utilizes imported inputs will decrease when ER appreciates land subsequently, their price will also fall.

Foreign output shocks.

Dynamic responses of domestic variables to a one standard deviation shock in foreign output are illustrated in Figure 7. The effect of foreign output shock on domestic output growth is pro-cyclical. However, both the positive innovation in foreign output and the effect on the domestic economy is short-lived. This is probably because the effective federal funds rate is raised to curb foreign output fluctuations. It is important to note that the increase in the federal funds rate in response to output growth shock is small in magnitude compared to its response to an oil price shock. Following a positive shock to foreign output growth, domestic inflation and domestic interest rate depreciate. Foreign output shocks do not have a strong, persistent effect on the Pakistan economy, except on domestic output, export, and domestic inflation. This result is somewhat like the findings for East Asian economies noted by Allegret et al. (2012), who reported a small positive effect on domestic output but an insignificant effect on domestic prices following a positive foreign output shock. In this study, exports and domestic inflation are also found to be statistically significant in response to foreign output shock.

Import Price Shock

Dynamic responses of domestic variables to a one standard deviation shock in import prices are illustrated in Figure 9. The impact of an increase in import prices on domestic variables such as domestic inflation, real effective exchange rate, and domestic output is quite negligible except for export prices. Pakistan is dependent on petroleum imports for energy. A considerable portion of Sri Lankan exports consists of less-value-added products. With the recent economic reforms introduced, Pakistan partly diversified its exports sector from the traditional agricultural commodities to labor-intensive manufacturing goods. Yet, a major portion of the country's exports during 2010-2014 still consisted of agricultural commodities. Also, the country's exports are concentrated in a few goods. During 2010-2014, textile and leather garments made up a large portion of the country's exports. Therefore, fluctuations in rice or textile prices in the world market have a considerable impact on the country's exports sector. Pakistan relies on imports for its intermediate and capital goods and fuel products. Therefore, prices of oil and fertilizers in the global market have a notable impact on the country's production and as well as on domestic prices. It is found that the import price shock has a significant impact on export prices. As illustrated in Figure 9, the import price shock would have a significant impact on exports and domestic output. The shock has a positive impact on export prices; as a result, exports fall due to low demand. The export prices rise with high input prices which depend heavily on the price of imported commodities. The positive effect on export prices becomes weaker in the subsequent months, so the effect slowly becomes insignificant.

CONCLUSION

This research has investigated the impact of external trade shocks on macroeconomic variables of Pakistan using a structural VAR model. Pakistan is a small open economy and, hence, the model incorporates the block homogeneity assumption. Further, the model is non-recursively identified with a combination of short and long-run restrictions. This thesis focuses on oil price inflation shocks, foreign output growth shocks, import price, and foreign monetary policy shocks. In most of the related literature, the effective federal funds rate has been used as a proxy for the US monetary policy.

Shocks to foreign output growth and oil price inflation have considerably influenced the increase in domestic output growth. On the other hand, the effective federal funds rate has a notable impact on foreign inflation, but the effect of foreign output growth shocks is minor. The impact of oil price inflation and foreign interest rate on domestic inflation was more prominent during the 2007 to 2008 period. Foreign interest rate shocks initially affect domestic inflation through the import prices and subsequently through the domestic interest rate. Therefore, the effects of foreign shocks are transmitted to the domestic economy through the trade channel as well as the interest rate channel. This is different from the findings for G-6 countries and Latin American countries where the interest rate channel played a key role in transmitting the US shocks to domestic economies (Kim, 2001, Canova, 2005). However, shocks to the real exchange rate have a remarkable effect on domestic short-term interest rates. Our analysis also revealed that 40 percent of the variation in domestic output growth is explained by domestic variables. Hence, policymakers should give high priority to both foreign and domestic variables, especially the real exchange rate, when setting domestic interest rates.

The results of this study highlight the importance of external trade shocks to a small open economy such as Pakistan. The country is not as highly integrated with global markets as other emerging economies yet. But due to recent trade projects and other structural reforms, Pakistan is considerably vulnerable to external trade shocks. Hence, it is crucial to consider such foreign shocks when modeling the Pakistan economy as well as in policymaking.

Policymakers need to consider external shocks before designing policies as the Pakistani economy is more open to external trade shocks. By considering these external factors such as oil price inflation and other external variables in the process of policymaking, an effective and more appropriate policy can be devised. The findings of this study can be considered for improving economic growth and price stability. State Bank of Pakistan should focus on the exchange rate channel by using the monetary policy more effectively. As we know that exchange rate has a strong influence on the economy through imports and exports.

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