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International Shocks and Monetary Policy in Pakistan: The Chinese Effect

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Abstract: The previous literature reveals that, in an open economy framework, the assessment of monetary policy was based solely on the United States in Pakistan's external sector. Ignoring all other large economies such as China, etc., in the external sector of Pakistan puts a question mark on the assessment of the external shocks to the economy of Pakistan. The reason is that China is one of the major trade partners and the second largest economy in the world. This paper therefore quantifies the intensity of the foreign shock in the presence of both China and the US in the external sector of Pakistan. To precisely measure the pressure of foreign shocks on the domestic economy for the proper response of the central (state) bank of Pakistan, China has been added to the external sector of Pakistan besides the US. For this purpose, monthly data for the period from January 1994 to February 2017 was utilized for empirical analysis, applying the structural vector autoregression (SVAR) model. The significance of including China in the external sector of Pakistan has been assessed by comparing the results of US influence on Pakistan via two regional models (direct effect) with the results obtained via three regional models for the same purpose. It is concluded that the direct effect of the US shocks overstates the foreign shock pressure on the Pakistani economy, where the state bank of Pakistan may overreact to the foreign shocks (from the US). It is, therefore, recommended that for the accurate assessment of foreign shocks, it is mandatory to specify more accurately (by more accurately defining the external sector of Pakistan) the global SVAR model (and other related models) for the accurate assessment of monetary policy analysis in Pakistan.

Keywords: SVAR; Global Shocks; Monetary Transmission Mechanism; Foreign Shock

1. Introduction

Because of globalization, macroeconomic and financial variations in the large economies influence the small economies in the world. The influence of large economies over small economies depends upon the degree of connection between macroeconomic and financial matters. In this sense, the two largest economies in Pakistan's external sector are China and the United States, even though the United Kingdom and the European Union are also substantial economies with significant trading links with Pakistan. There are a couple of reasons behind this. China is significant because it is Pakistan's largest trading partner. Because of the China-Pakistan economic corridor, China's relevance to Pakistan's economy is growing by the day. Earlier studies, such as (Khan, 2011; Nizamani, 2016), undertaken for the macroeconomic assessment of Pakistan, used the United States as the world economy's leader in the external sector. The United States was chosen because it is the world's largest economy and is widely considered as a proxy for the global economy. Furthermore, the United States is Pakistan's second-largest trading partner.

Pakistan has extensive trading ties with the United Kingdom and the European Union, although these are not counted in Pakistan's external sector (Zamir, et. Al. 2017). Because incorporating too many countries in the external sector raises the issue of the degree of freedom problem in assessment, the United Kingdom is not included. There is no evidence in the literature to support and justify the inclusion of more than two significant economies and their theoretical ties. Furthermore, Pakistan has had GSP-Plus status since 2014, and its exports to the European market have expanded dramatically since then. However, the European Union is not included in Pakistan's external sector because Pakistan's GSP-Plus status is just temporary and cannot be assured beyond 2022. The econometric analysis sample span is only three years after Pakistan was granted GSP-Plus status. Table 1.1 shows Pakistan's export and import percentages with China, the United Kingdom, and the United States. According to the table, the United States and China appear to be Pakistan's most important trading partners for the period 2003-2018.

Table 1 Percentage Shares of Exports and Imports with Large economies

	China		***United Kingdom***		***United States***	
Years	Imports	Exports	Imports	Exports	Imports	Exports
2003	7.34	2.18	3.09	7.06	6.04	23.06
2004	7.39	2.28	2.79	7.55	8.56	23.18
2005	9.36	2.71	2.87	5.65	6.10	24.79
2006	9.77	2.99	2.49	5.53	6.32	25.65
2007	12.78	3.44	2.13	5.42	8.00	21.60
2008	11.19	3.58	2.05	4.93	4.87	18.02
2009	11.97	5.68	2.47	5.37	5.70	18.35
2010	13.98	6.71	1.69	5.20	4.34	17.16
2011	14.85	6.62	1.34	4.97	4.02	15.15
2012	15.26	10.64	1.69	5.07	3.45	14.90
2013	15.14	10.56	1.24	5.70	3.81	14.91
2014	20.17	9.11	1.26	6.69	3.79	14.75
2015	25.05	8.76	1.39	7.12	4.36	16.58
2016	29.11	7.75	1.33	7.59	4.27	16.70

2017	26.78	6.89	1.33	7.47	4.95	16.27
2018	24.18	7.69	1.44	7.32	4.90	16.09

Source: WDI (2018)

Pakistan has an unvaryingly large trade relationship with China like the United States, yet in the previous studies piloted for Pakistan, for example, (Khan & Ahmed, 2011; Nizamani, Karim, Zaidi, & Khalid, 2016a) have only considered the United States as an explanatory variable in the external sector of Pakistan. For the efficient conduct of monetary policy, especially in developing economies, it is important to more accurately assess the effects of foreign shocks (Mardi Dungey & Fry, 2003c). Therefore, to avoid misspecification, even further, to improve the efficiency of the macroeconomic model, it is imperative to include China in the external sector of Pakistan alongside the US. The inclusion of China and the US in the external sector of Pakistan, in the structural vector autoregression framework, would not only quantify the implications for Pakistan but also their mutual implications for each other.

2. Literature Review

After the financial crunch of the 2007 and 2009 monetary policy gained momentum, the study of monetary transmission mechanisms gained attention. The fundamental debate at the time was whether monetary policy could operate in the face of a financial crisis. If so, what factors affected the monetary transmission mechanism during the financial crisis? What factors can we use to evaluate the efficiency of the monetary transmission mechanism during a crisis? To answer these problems, additional work is needed to conduct a more critical analysis of monetary policy transmission. In the case of Pakistan, there are numerous studies in the literature that have looked at monetary policy in an open economy setting. Khan and Ahmed (2011), for example, investigated Pakistan's monetary transmission mechanism. Aside from monetary policy shocks at home, foreign channels including global food and oil price shocks were investigated. Monthly data from January 1990 to July 2011 were used to conduct the empirical analysis. Domestic and international shocks in the economy were assessed using a structural vector autoregression model. The rise in global oil prices has been shown to have a detrimental impact on industrial production, as well as an appreciation in the exchange rate, interest rate, and inflation rate. The exchange rate was influenced by either oil price shocks or food price shocks in the economy, according to the generalized impulse response function. Foreign shocks, including global oil and food price shocks, were found to play a significant role in explaining industrial production, inflation, currency rate, and interest rate. In Pakistan, it revealed that the currency rate was the most influenced variable by external shocks. (Haider & Khan, 2008) evaluated a dynamic stochastic general equilibrium model in an open economy framework to see if it represents the economy of Pakistan realistically. Quarterly data from 1984:01 to 2007:04 were used for this analysis. According to the empirical findings, inflation in Pakistan did not have a substantial impact on consumer spending. The State Bank of Pakistan increased its policy rate in order to keep inflation under control. The exchange rate appreciates in both cases of local and imported inflation. Tight monetary policy reduces both types of inflation while also increasing the value of the currency. The currency rate has a very little pass-through

influence on local prices. (Nizamani et al., 2016a) looked into Pakistan's monetary transmission in an open economy framework. Unlike earlier research, this study analyzes international commodity prices as well as traded weighted interest rate and output factors in Pakistan's external sector. Quarterly data from 1992:01 to 2014:04 was used to conduct the empirical analysis. The data was examined using a structural vector autoregression model to assess both internal and external shocks to Pakistan's economy. According to the empirical research, monetary policy effectiveness in Pakistan is limited in terms of its ability to stabilize important macroeconomic variables. Furthermore, in the short run, the interest rate channel of the monetary transmission mechanism is observed to be active. The credit channel, on the other hand, is effective in both the short and long term. The State Bank of Pakistan should also employ the interest rate channel to control inflation and the credit channel to boost economic growth, according to the report. The majority of studies on Pakistan's monetary transmission mechanism focus solely on domestic's surprises (Malik, 2006; Malik & Ahmed, 2010). So far, just one study (Alam, & 2006,) has been published in Pakistan to examine the sectorial implications of monetary policy.

3. Research Methodology

Econometric Model (SVAR Model)

The inclusion of US in the sector of Pakistan in the SVAR framework, measures the direct impact of the US shock to the economy of Pakistan ignoring the indirect shocks that transmits from US to China (the major trade partner of Pakistan) and from China to Pakistan which may offset the intensity of direct influences of the US shocks to the economy of Pakistan. To assess the influences of the US shocks more accurately to the economy of Pakistan beside China, a Structure vector auto regression model is developed that considers the influence of the two major economies on the economy of Pakistan. Since there are two economies in the external sector of Pakistan, therefore it is mandatory to impose restrictions both on the contemporaneous and dynamic (lag) structure of the model to avoid the degree of freedom problem. For this purpose, block exogeneity is being imposed both on the contemporaneous and lag structures in the SVAR model. The US economy is a large economy, so it acts like an anchor for the system and is kept exogenous to both China and Pakistan.

The US economy can influence the Chinese economy, but besides the US, the Chinese economy is also exogenous to the economy of Pakistan. Hence, being a small open economy, Pakistan cannot influence neither of the US and Chinese economies. The placement of China at the center is in line with the empirical literature. This means that the US shocks can influence China and China can influence Pakistan's economy, but neither Pakistan's economy influences China nor can the Chinese economy influence the US (Horiye et al., 1987; Selover & Round, 1996)**.** Such restrictions of block erogeneity have been commonly used in two open economy models. The complete derivations and details of the structural vector autoregression model is given in appendix L. Currently following the work of (Cushman & Zha, 1997; Zha, 1999).

Table 2 Key Variables for Global SVAR

Variables	*Definition*	*Abbreviation*
World Commodity Prices	World Commodity Price Index, Log	LWCP
US Block		
Output	Industrial production Index, log	LGDP_US
Inflation	Inflation Rate, Percentage	INF_US
Interest Rate	Federal Fund Rate, Percent	FFR_US
CHINA Block		
Output	Industrial Production Index, Log	LGDP_CH
Inflation	Inflation Rate, Percent	INF_CH
Interest Rate	Discount Rate, Percent	MIR_CH
Exchange Rate	Real Effective Exchange Rate (USD/Yuan)	LRER_CH
Pakistan Block		
Demand	Gross National Expenditure, log	AD_P
Output	Industrial production Index, log	LGDP_P
Inflation	Inflation Rate, Percent	INFL_P
Interest Rate	Money Market Rate, Percent	MMR_P
Exchange Rate	Real Effective Exchange Rate (USD/Rupee)	LRER_P

Source: Author, 2021

Following the work of (Dungey & Vehbi, 2011; Dungey & Fry, 2003b; Dungey et al., 2000; McKibbin & Dungey, 2014), the contemporaneous and lag structure of the SVAR model is presented in table 3.1 and 3.2. The first column of both the tables reports the dependent variables. The rows in the tables show independent variables. There are as many equations/dependent variables as the number of rows in the tables. Empty means the absence of independent variabl means the inclusion of both, that is first lag and second lag. Whereas ** means the inclusion of second lag only.

Table 3 Contemporaneous Structure of the International SVAR

	Independent Variables												
	US				***China***				***Pakistan***				
Dependent Variables	*LCP*	*LGDP_us*	*INF_us*	*FFR_us*	*LGDP_ch*	*INF_ch*	*MIR_ch*	*RER_ch*	*AD_p*	*LGDP_p*	*INF_p*	*MMR_p*	*RER_p*
LCP													
LGDP_us	*												
INF_us	*	*	*										
FFR_us		*											
LGDP_ch	*	*											
INF_ch	*				*								
MIR_ch					*	*							
RER_ch	*	*	*	*	*	*	*						
AD_p													
LGDP_p		*			*				*				
INF_p									*				
MMR_p									*		*		
RER_p	*	*	*	*	*	*	*	*	*	*	*	*	

*Represents the inclusion of independent variable.

Table 4 Lag Structure of the International SVAR

	Independent Variables												
	US				China				Pakistan				
Dependent Variables	***LCP***	***LGDP_us***	***INF_us***	***FFR_us***	***LGDP_ch***	***INF_ch***	***MIR_ch***	***RER_ch***	***AD_p***	***LGDP_p***	***INF_p***	***MMR_p***	***RER_p***
LCP	*												
LGDP_us	*	*	*	**									
INF_us	*	*	*	**									
FFR_us	*	*	*	*									
LGDP_ch	*	*			*	*	**	*					
INF_ch	*				*	*	**	*					
MIR_ch					*	*	*						
RER_ch	*	*	*	*	*	*	*	*					
AD_p									*	*	*	**	*
LGDP_p		*			*				*	*	*	**	*
INF_p									*		*	**	*
MMR_p	*								*		*	*	
RER_p	*	*	*	*	*	*	*	*	*	*	*	*	*

* Represents the inclusion of one & two lags whereas ** represents the inclusion of just two lags.

Choice of Variables and Structural Equations of the Model

The selection of the variables for the structural vector autoregression model is motivated by prior knowledge of monetary transmission mechanisms. Three variables including interest rate output in inflation are included each for Pakistan, China, and the United States. Exchange rate and aggregate demand variables are included in the Pakistani module, additionally, and the exchange rate is also included for China only. Since the United States is numeraire in the model so the exchange rate is not included for the United States. Moreover, commodity prices are also included in the model for global transmission.

To measure real output, industrial production has been taken for all the three countries: The United States, China, and Pakistan. Moreover, it is taken in log form. (Dungey & Pagan, 2000) (Dungey & Fry, 2003c) found that the inclusion of both the aggregate demand and output improves the efficiency of SVAR model for the Australian economy, so the same is exercised in this study. Inflation (*Inf_US, Inf_ch and Inf_P)* is used to represent prices level. The use of inflation rate in empirical research relative to consumer price index has increased over time. For example (Mardi Dungey & Pagan, 2000; Garratt, Lee, ..., & 2003,), have used the inflation rate in the monetary policy analysis. So, inflation is taken as a targeted variable for the State Bank of Pakistan. There are also some studies in the literature which use price level in the monetary policy assessment (Sims, 1992).

Interest rates show the monetary policy instruments in all three countries. The use of the monetary aggregates has been avoided to preserve the degree of freedom in estimation of the model. The inclusion or exclusion of the monetary aggregate variables is a contentious area of monetary research (Brischetto & Voss, 1999; Leeper & Zha, 2001; McCallum, 1999; Rudebusch, 1998b, 1998a; Sack, 2000). Exchange rate for the currency of Pakistan (Rupee) is defined as the number of rupees to be exchanged for one dollar and so for China, the number of Yuan to be exchanged for one dollar. Literature allows the use of both types of exchange rates: real effective exchange rate as well as a nominal effective exchange rate. International SVAR models for monetary policy analysis (Dungey, 1998) and (Eichenbaum & Evans, 1995), however, used the real effective exchange rate.

And commodity price index in the structural vector autoregression model to capture inflationary expectations. Some of the countries have used it to measure the term of trade effects (Sims, 1992)(Gruen & Shuetrim, 1994)(Brischetto & Voss, 1999). Some economists are of the view that the inclusion of the commodity price index helps to overcome the problems of the closed economy vector auto regression models (Sims, 1992). Sims (1992) was of the view that inclusion of the commodity price index solves the problem of the price puzzle, which means increase in the prices in response to exogenous shocks to the interest rate.

Estimation Strategy

Let y_t be a matrix covering the set of all the variables for the United States, China and Pakistan that is for the variables in (4) can be conveniently present in the following SVAR set up.

$$B_0 y_t = B_1 y_{t-1} + B_2 y_{t-2} + \varepsilon_t \quad (1)$$

Where ε_t white noise vector with zero mean and constant diagonal variance-covariance vector, D. the matrix B_0 has unit diagonal and off diagonal elements reported in table 2. The coefficient matrices B_1 and B_2 denoted the coefficients of lag variables reported in Table 3.

The estimation of the SVAR model is to be done in two parts. At the initial part, the parameters of VAR model would be estimated in the form of

$$y_t = \phi_1 y_{t-1} + \phi_2 y_{t-2} + \upsilon_t \quad (2)$$

Where,

$$\phi_i = B_0^{-1} B_i \qquad \text{for i=1,2} \quad (3)$$

$$\upsilon_t = B_0^{-1} \varepsilon_t \quad (4)$$

Each equation of the VAR model will be estimated via OLS and the VAR residual υ_t extracted. The equations estimated this way would produce consistent but asymptotically inefficient parameter estimates. This loss of efficiency in the parameter estimates arises from the zero restrictions reported in table 2.

The second part consists of a maximum likelihood estimation function choosing B_0 and D matrices conditional on the parameter estimates of the VAR in the first part. The likelihood function to be maximized at t^{th} observation is given as

$$\ln L_t = -\frac{1}{2}\ln(2\pi) - \frac{1}{2}\ln\left|B_0^{-1}DB_0^{-1'}\right| - \frac{1}{2}\nu_t'(B_0^{-1}DB_0^{-1'})^{-1}\nu_t \quad (5)$$

υ_t is the residual taken from the VAR estimation in the first part. The log likelihood function for the sample of t=1, 2, T observations is given by

$$\ln L = \sum_{t=1}^{T} \ln L_t \quad (6)$$

Furthermore, impulse response functions and forecast error variance decomposition are analyzed from the SVAR model to arrive at final conclusions.

4. Empirical Results

To investigate the implications of China in the external sector of Pakistan, besides the US, to measure the intensity of foreign shocks more accurately, an experimental approach has been followed in this section. For the sake of simplicity and concreteness, following the work of (Dungey & Fry, 2003a) and (Dungey & Pagan, 2000) etc., the foreign shocks have been divided into five categories: the US output shock, the US monetary policy (federal fund rate) shock, the non-fuel commodity price shock, the Chinese output shock and the Chinese monetary policy shocks. The US economy is taken as a large economy and any shock to the US economy has both direct and indirect implications for small open economies like Pakistan. Two types of models that is two country SVAR model (where shocks to the US economy have direct influence over the economy of Pakistan) and global SVAR model[1] have been estimated for empirical analysis.

A comparison is made between the direct and indirect implications of the foreign shocks via two and three countries SVAR model to measure the intensity of foreign shocks more accurately for an optimal monetary policy for the economy of Pakistan. The details of such experimentations, in this regard, are reported below. Before estimating the Structural vector autoregression model, it is mandatory to determine the order of integration and seasonal roots in the given time series data. For this purpose, Augmented Dicky-Fuller test has been applied to test stationarity and (Canova & Hansen, 1995) to test seasonality in the data set. The unit root test and seasonal root test results for all the variables used in SVAR model (Model-II) is reported in table 4.4 below.

Table 5 Unit Root (ADF) and Seasonal Root (Canova-Hansen Test) Test

	Level		First Difference		Order of Integration			
Variables	Lag	P-Value	Lag	P-Value	I ()	LM Stat	LM Sig. Level	Seasonal Root
LWOP	1	0.35	0	0.00	I(1)	4.35	2.75	Yes
LWCP	2	0.50	0	0.00	I(1)	4.37	2.75	Yes

[1] In Global SVAR model, China is also included in the external sector of Pakistan where the US has indirect implications for the economy of Pakistan. That is the US shocks would influence the Chinese economy and the Chinese economy would in turn influence the economy of Pakistan.

US								
LGDP_US	7	0.09	6	0.00	I(1)	3.73	2.75	Yes
INF_US	11	0.00	15	0.00	I(0)	1.02	2.75	No
FFR_US	15	0.50	14	0.00	I(1)	3.94	2.75	Yes
China								
LGDP_CH	15	0.33	12	0.00	I(1)	5.51	2.75	Yes
INF_CH	11	0.00	10	0.00	I(0)	4.85	2.75	Yes
MIR_CH	0	0.16	0	0.00	I(1)	3.23	2.75	Yes
LRER_CH	0	0.32	0	0.00	I(1)	3.63	2.75	Yes
Pakistan								
AD_P	13	0.58	0	0.01	I(1)	5.32	2.75	Yes
LGDP_P	15	0.83	14	0.00	I(1)	5.28	2.75	Yes
INFL_P	2	0.00	10	0.00	I(0)	2.13	2.75	No
MMR_P	10	0.61	12	0.00	I(1)	2.16	2.75	No
LRER_P	2	0.57	1	0.00	I(1)	1.74	2.75	No

Table 6 Standard Deviation (Shock Size) of the Global SVAR

United States		China		Pakistan	
LWCP	**0.0165**			AD_P	**0.0002**
LGDP_US	**0.0024**	LGDP_CH	**0.0024**	LGDP_P	**0.0593**
INF_US	**0.0868**	INF_CH	**0.2023**	INF_P	**0.2650**
FFR_US	**0.1134**	MIR_CH	**0.1927**	MMR_P	**1.7390**
		LRER_CH	**0.0065**	LRER_p	**0.0070**

Table 4 reveals that both the variables, the world oil price (LWOP) and world commodity price index (LWCP), are integrated of order one which means that they are not stationary at level but stationary at first difference. Moreover, both the variables confirm the existence of seasonal roots. In the second block GDP of the United States (LGDP_US) and federal fund rate (FFR_US) are not stationary at level but stationary at first difference and both suffer from seasonality issues. On the other hand, the inflation rate in the US (INF_US) is stationary at level so integrated of order zero. Furthermore, inflation in the US is free of seasonality issues as the LM statistic value is less than the LM critical value. In China block, all the variables including GDP of China (LGDP_CH), discount rate (MIR_CH) and exchange rate of China (LRER_CH) are integrated of order one because these variables are not stationary at level but stationary at first difference and all these variables also confirm the presence of seasonality. However, the inflation rate in China (INF_CH) is stationary at level so it is integrated in order and possesses the issue of seasonality. In the case of Pakistan, aggregate demand (AD_P), GDP (LGDP_P), money market rate (MMR_P) and exchange rate (LRER_P) are not stationary at level but stationary at first difference. Inflation in Pakistan (INF_P) is, however, stationary at level. So, all the variables, except inflation, in Pakistan are integrated of order one. The seasonality test reveals that only AD_P and LGDP_P suffer from seasonality issues. The seasonality issue in these variables has been resolved by seasonal adjustment applying (Sax, 2018) Census X-13 method. The seasonally adjusted graphs of these variables for Model_II (SVAR model) are reported in Appendix G.

The SVAR model has been estimated by the maximum likelihood method and the structural coefficients are reported in Appendix K. These coefficients quantify the immediate effects between variables under the SVAR model. The lag effect is analyzed through the impulse response function

generated from the estimated SVAR model. The likelihood ratio test (LR test) reveals that the null hypothesis cannot be rejected at 5% level of significance (As p-value=0.10) which confirms that the SVAR model is over-identified and the restrictions are valid (Khan & Ahmed, 2011).

To analyze the dynamic relationship between variables, the key impulse response functions are obtained by shocking the structural Vector autoregression model. The size of shocks is reported in table 4.5, which is calculated by taking the standard deviation of the errors generated from the structural vector autoregression model discussed earlier. The selection of the impulse function is made based on the objective of the study.

To assess the effect of international shocks more accurately on Pakistan, it is mandatory to identify the dynamics of the internal subsystem of the economy of Pakistan. The local shocks to the economy of Pakistan are reported in figure 4.2.

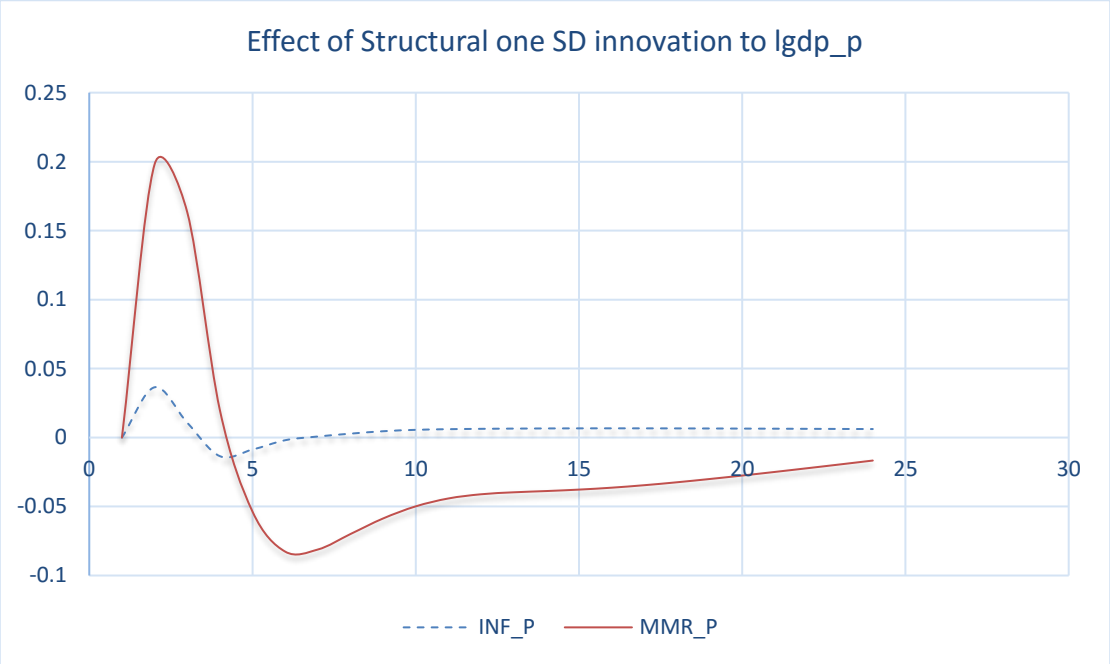


Figure 1: Responses of Pakistan's inflation and the interest rate to shocks in output in Pakistan:

Figure 1 reports the responses of inflation and policy rate to a positive shock to the output level. The responses of the interest rate and inflation are expansionary, as anticipated. A positive shock to the output level increases both the policy rate (money market rate) and inflation for a period of three months and starts falling thereafter. Contrarily, the response of the output and inflation to the policy rate shock is reported in figure 1.

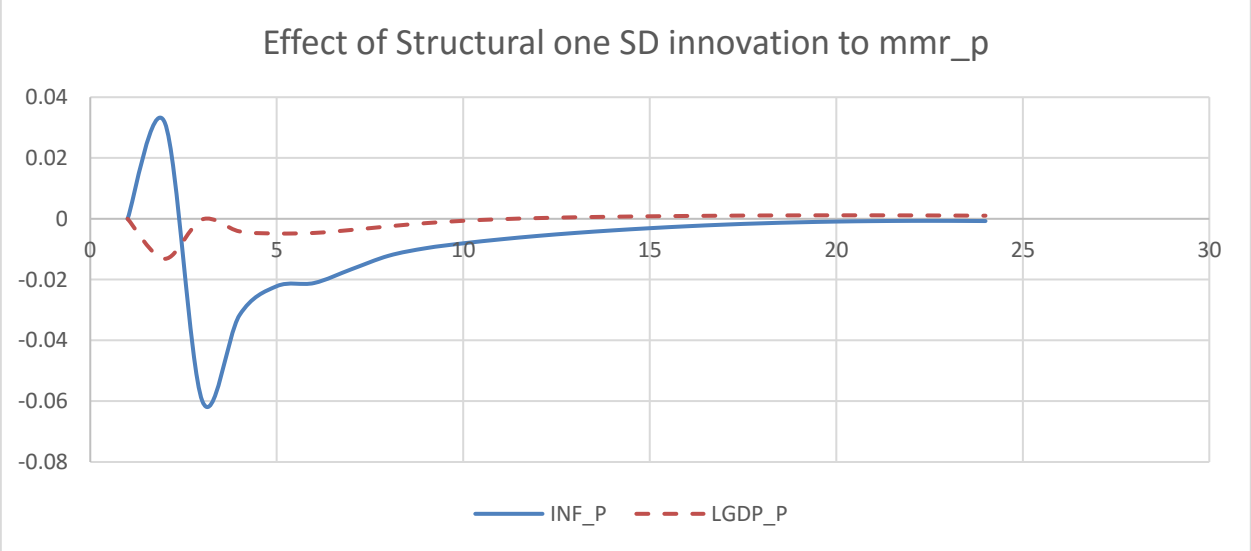


Figure 2: Response of output and inflation in Pakistan to shock in policy rate in Pakistan.

Monetary policy shock is represented by the interest rate shock. In contractionary monetary policy, the output level and inflation are expected to fall. Figure 2 reveals that output falls in response to a positive shock to policy rate, whereas the response of the prices is different. Prices initially rise for a period of three months reflecting the price puzzle and start falling sharply thereafter.

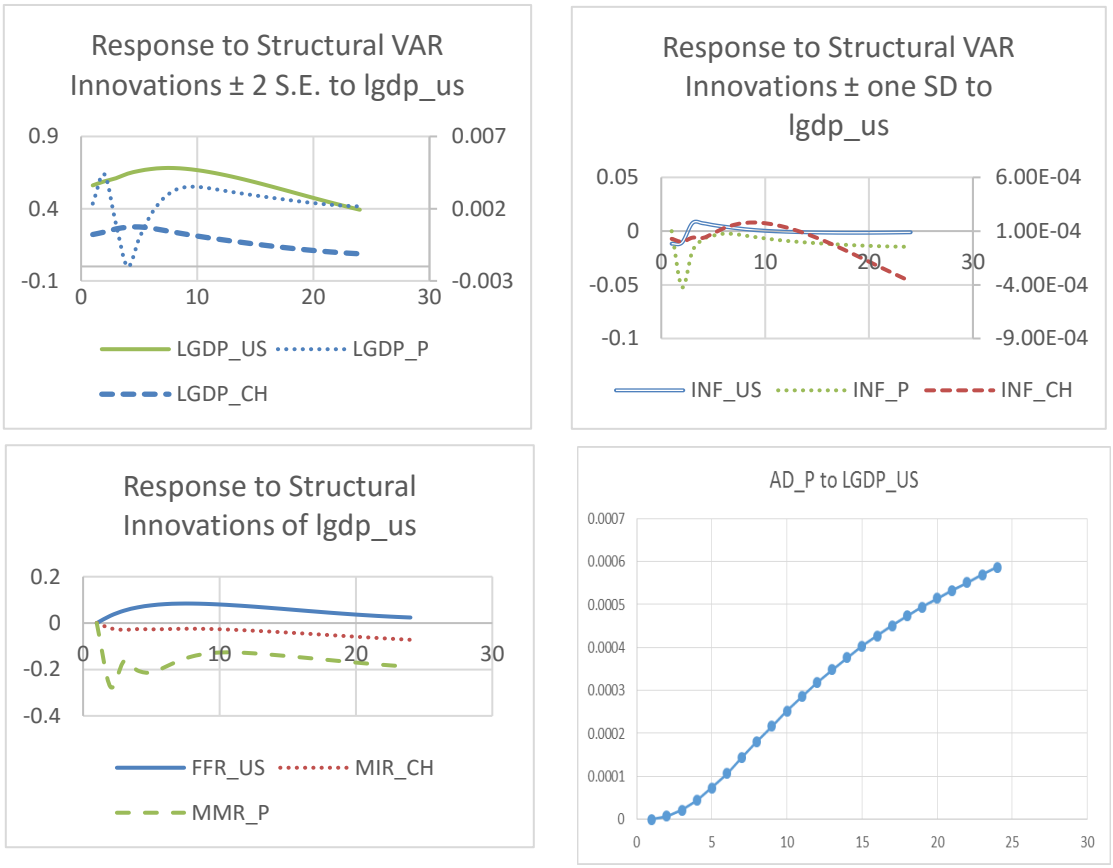
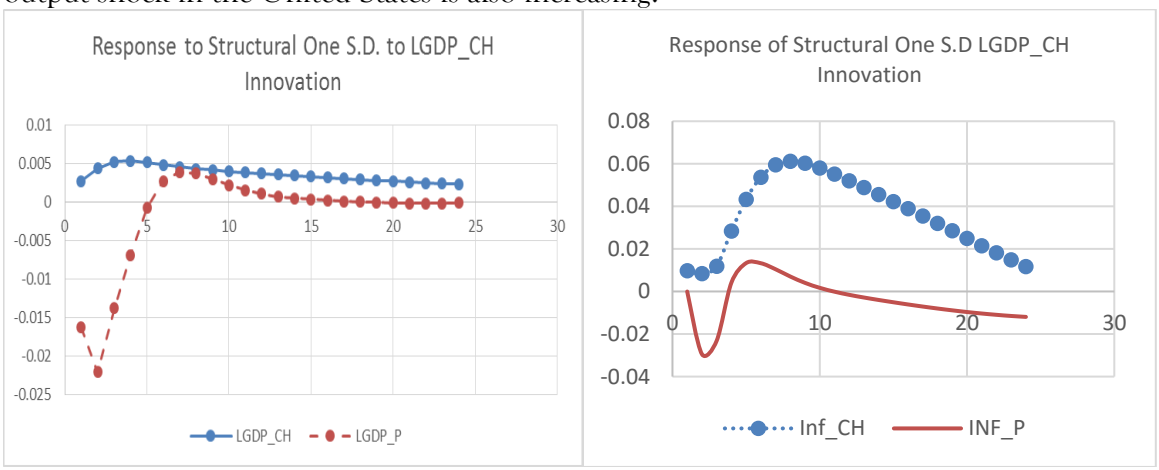


Figure 3 reports the responses of the inflation, output and interest rate in the United States, China, and Pakistan in response to output shock in the United States. A positive output shock to the output in the United States leads to expanded output in the United States, China, and Pakistan. The expansion of output in Pakistan, in response to a positive shock in output in the United States, remains for a period of 2 months and falls thereafter. The response of prices in the United States and China is inflationary and in Pakistan, inflation also rises after a fall in prices for two months. The response of interest rate to the output shock in the United States is expansionary. However, the response of interest rates in China and Pakistan is contractionary. The response of the aggregate demand in Pakistan to output shock in the United States is also increasing.



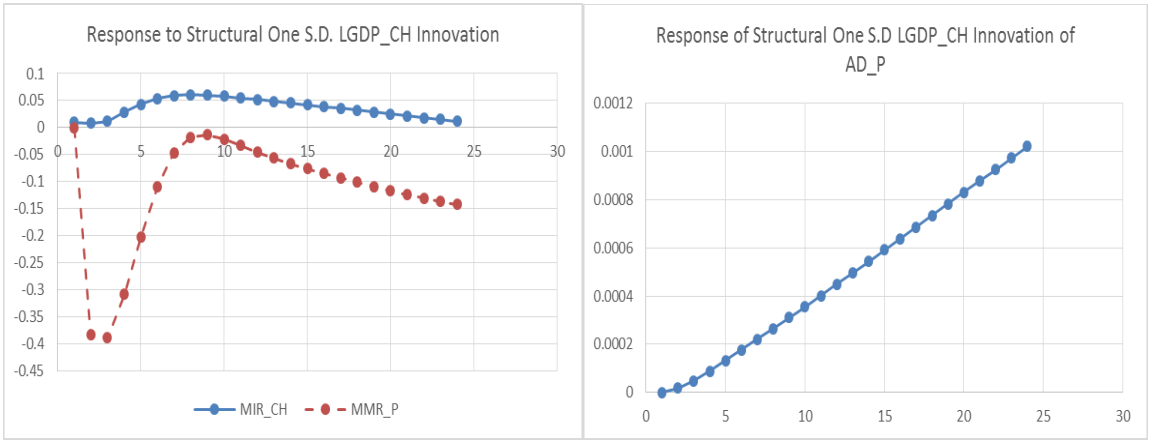
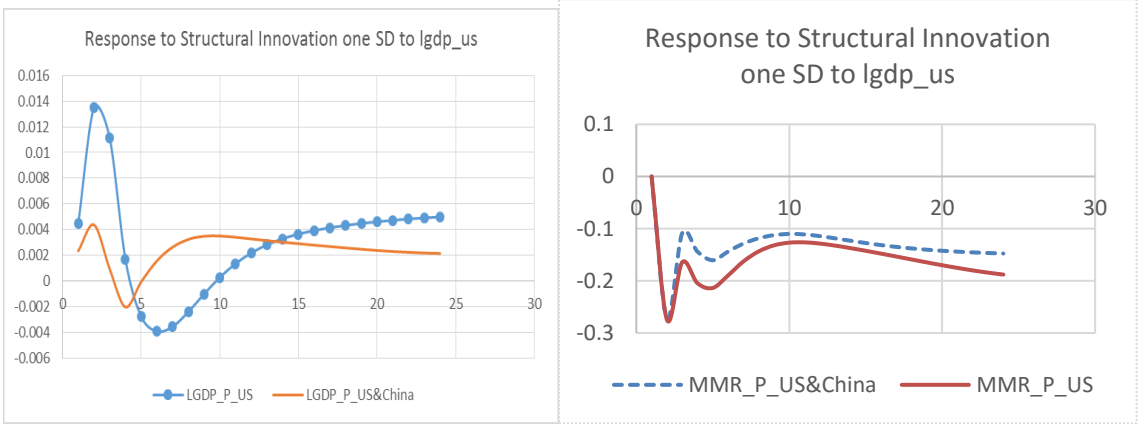


Figure 4: Responses of Pakistan and China Variables to Chinese Output Shock

Figure 4 reports the responses of the Pakistan and Chinese economies to Chinese output shock. Output in China increases in response to a confident output shock to Chinese output. The GDP of Pakistan also increases after a fall for 2 months to Chinese output shock. Inflation in both the economies increases in response to output shock in China. And in Pakistan, too, inflation increased after a fall of 2 months. Interest rate in China increases in response to positive shock in output. However, the interest rate in Pakistan falls drastically for a period of 3 months and starts rising thereafter. Aggregate demand in Pakistan increases in response to a positive to Chinese output for a long period.

To determine the significance of China in the external sector of Pakistan, it is mandatory to make a comparison between two models: the model with and without China in the external sector of Pakistan. To make a comparison of the responses of the economy of Pakistan in both cases, two countries and three countries structural vector autoregression models have been estimated. By comparing the amplitude of the responses on the macroeconomic variables of Pakistan to the US shock both in the presence and absence of the economy of China, the following conclusion is drawn: if the amplitude of the responses of the macroeconomic variables of Pakistan are influenced by inclusion of China, then the inclusion of China, besides the US, would make sense and the specification of the SVAR model could further be improved to enhance the effectiveness of monetary policy for Pakistan. Such comparison of the responses of the macroeconomic variables of Pakistan to US shock is reported in table 5 below.



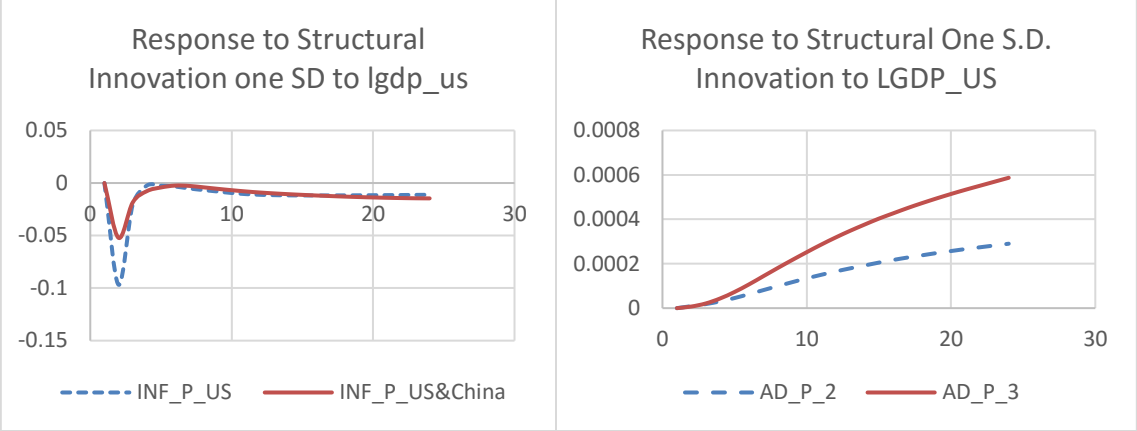


Figure 5: Comparison of the responses of Pakistan's Economy to US output both in two countries and Multi-Countries Models

Figure 5 reports the direct and indirect influence of the United States' shocks on the economy of Pakistan. It is clear from the figure that the inclusion of China in the external sector of Pakistan reduces the amplitude of the responses of the macroeconomic variables, namely output, inflation, interest rate and aggregate demand. This evidence reveals that by merely including the US in the external sector, the foreign shocks overstate the macro economy of Pakistan. The inclusion of China in the external sector of Pakistan helps to measure the pressure of the foreign shocks more accurately to the economy of Pakistan. To compare the relative importance of the Chinese economy in the economy of Pakistan, a comparison is made between the responses of inflation to a one standard deviation shock to both the output level of Pakistan and China. The evidence has been reported in figure 5. It is clear that a positive shock to output in Pakistan raises inflation for a period of two months and starts declining thereafter leaving a long-lasting expansionary effect on price level. The response of inflation to the output shock of China in Pakistan is different from that of output shock in Pakistan. The response of inflation to the output shock of China is contractionary for a period of three months and starts rising thereafter, raising prices till the fifth month and begins declining thereafter, leaving a long-lasting contractionary impact on price level in Pakistan. It is concluded that the output shock of China and Pakistan to inflation is almost the same and in the opposite direction to each other.

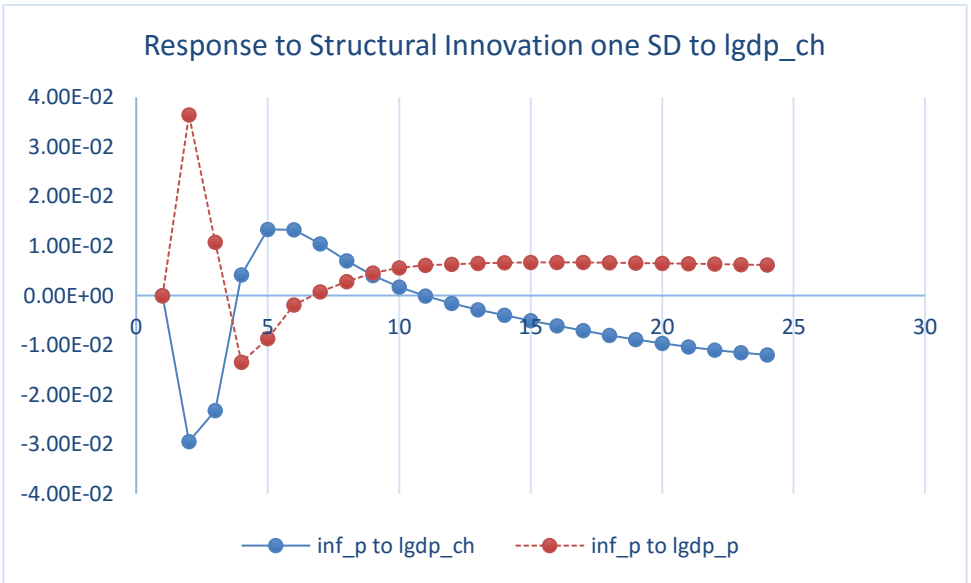


Figure 6: Response of INF_P to LGDP_CH and LGDP_P

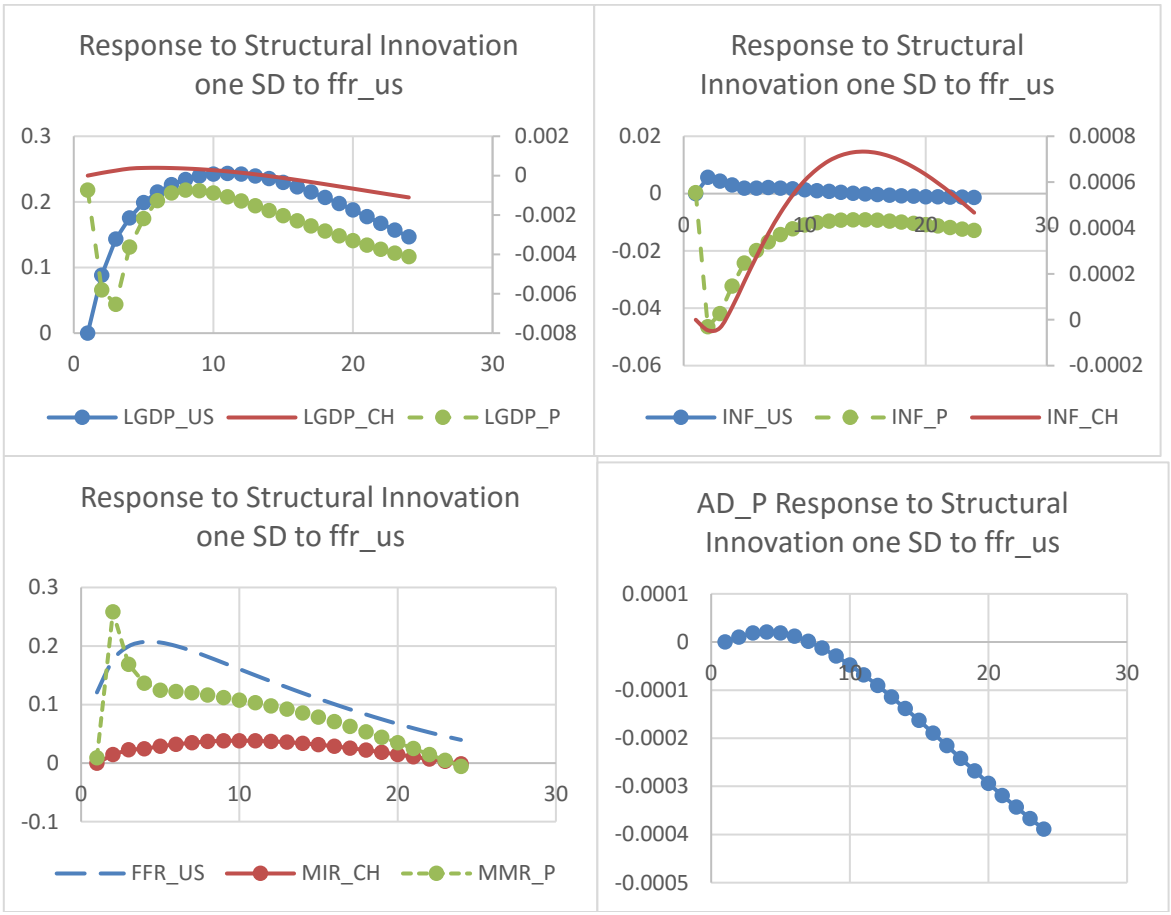


Figure 7: The Responses of the US, China, and Pakistan's economies to the US interest rate Shock

The response of the economies of China, US and Pakistan are reported in figure 7. It is evident that a contractionary monetary policy leads to decreased output in China and Pakistan. However, the output in the US increases for a period of ten months and starts falling thereafter. Fall in output in China is small and gradual; however, output in Pakistan drastically falls for a period of four months and then starts increasing sharply. Inflation in Pakistan and China falls for a period of three months and starts rising thereafter. However, there is evidence of a price puzzle in the US for the first three months and price level declines gradually after three months. Interest rates in all the three economies increase in response to a tight monetary policy shock. The interest rates almost converge to the long run equilibrium path after a period of three years. Aggregate demand in Pakistan declines in response to a positive shock to the federal fund rate in the United States.

If we analyze the response of the Pakistan and Chinese economy to the monetary policy shock in China, it will help us in comparing the response of the economy of Pakistan to that of China and the US. The response of the economies of Pakistan and China to the interest rate shock of China is shown in figure 8.

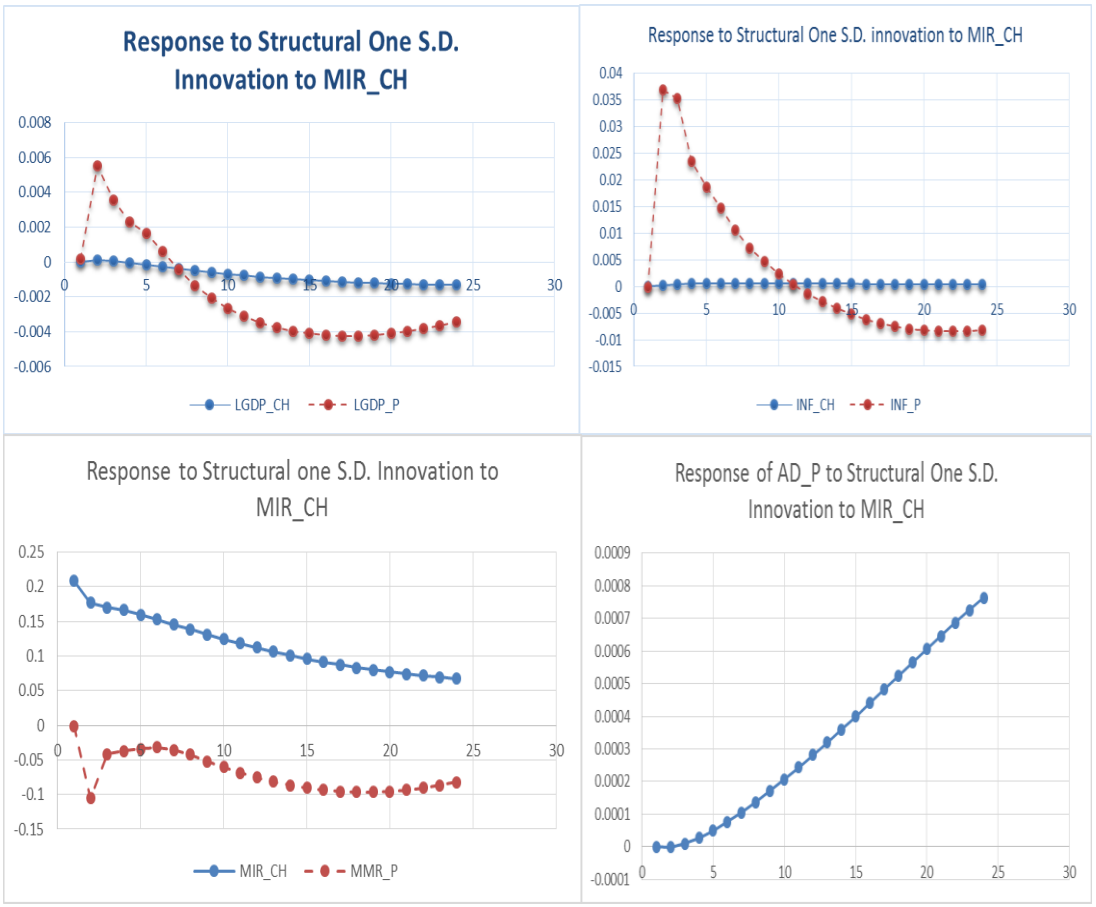
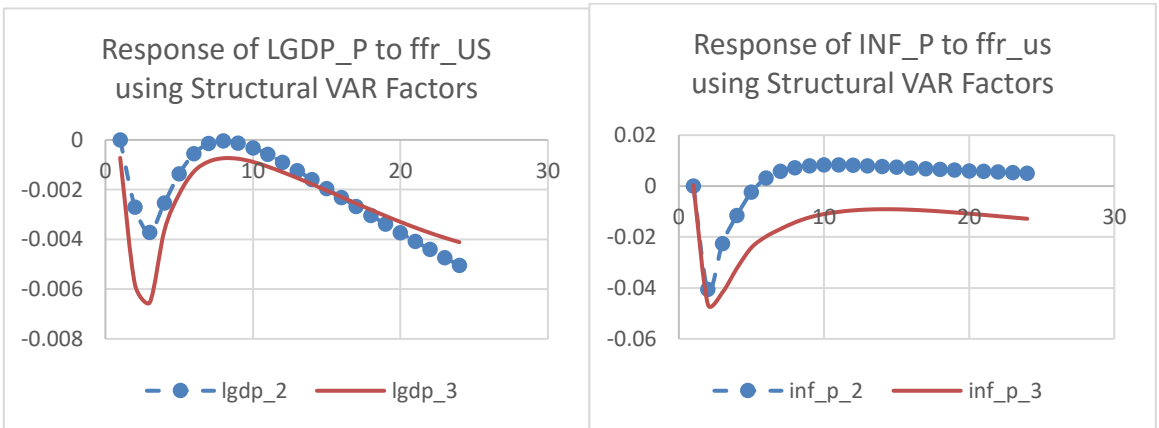


Figure 8: Responses of China and the economy of Pakistan to the Chinese interest rate shock

Figure 8 reveals that a tight monetary policy shock in China leads to a gradual and persistent fall in the output in China, whereas the output level in Pakistan increases for a period of two months and starts declining thereafter. Overall, a tight monetary policy shock has a contractionary effect on output in both the economies. The response of inflation to a tight monetary policy shock has nominal expansionary impact on the price level in China. However, prices in Pakistan increase for a period of two months and start falling long lastingly. A tight monetary policy has a gradual and contractionary impact on the interest rate in both the economies. However, the response of the aggregate demand in Pakistan to a tight monetary policy in China is expansionary.



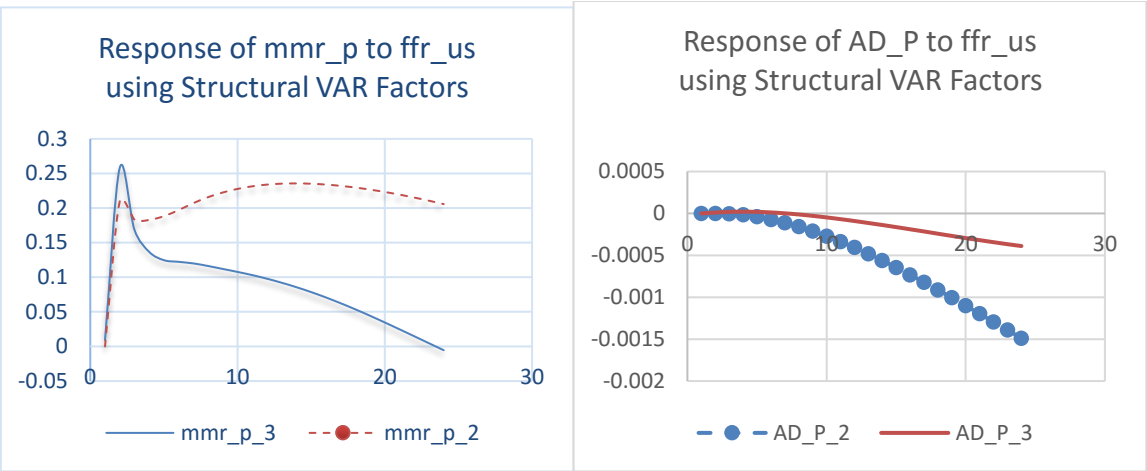
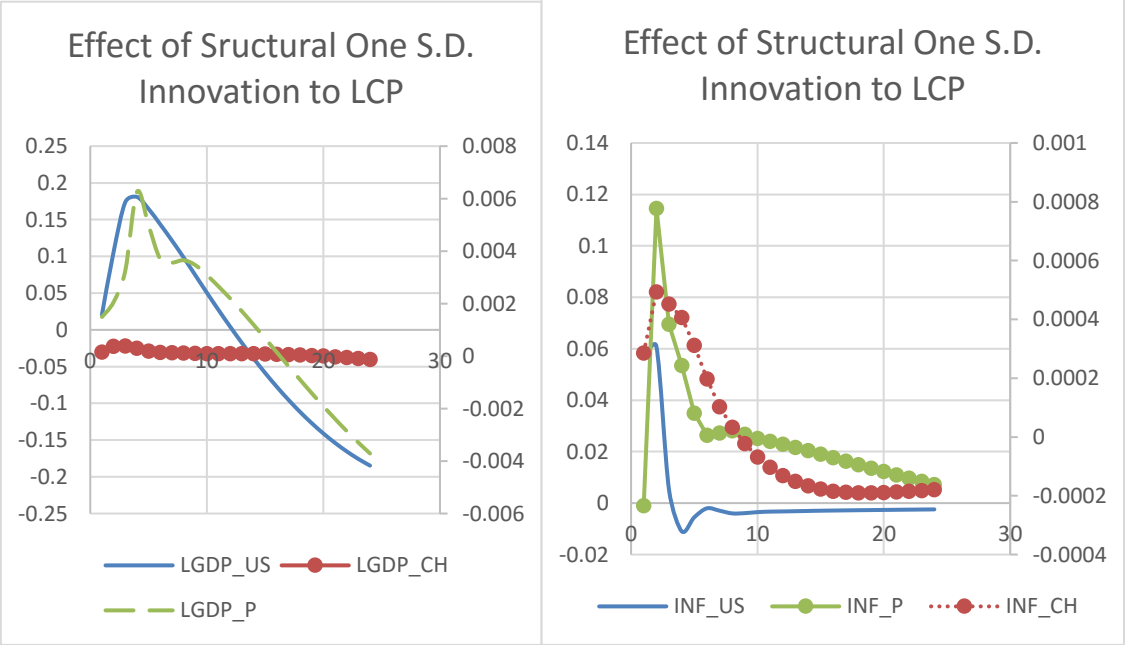


Figure 9: Comparison of the response of the economy of Pakistan to the US interest rate shock both two countries Model and Three countries Model:

To further clarify the significance of the Chinese economy in the external sector of Pakistan, the two and three countries SVAR model would further help to analyze the behavior of the economy of Pakistan to a tight monetary policy shock in the US. The response of the economy of Pakistan to a tight monetary policy shock with and without including China is reported in figure 9. Figure 9 reveals that the amplitude of the responses of the output, inflation, interest rate and aggregate demand in Pakistan is higher in two countries' models relative to three countries' models, though following the same pattern. Figure 10 shows that a positive shock to the commodity price shock has an expansionary effect on Pakistan and the US. However, the response of China is not very significant. Similarly, inflation in all the three economies increases significantly for a period of three months and starts falling thereafter. The increase in prices in the US is, however, less, and quickly recoverable. The response of the exchange rate both in China and Pakistan is like the commodity price shock. The response of the exchange rate in Pakistan is gradual and long lasting, unlike China.



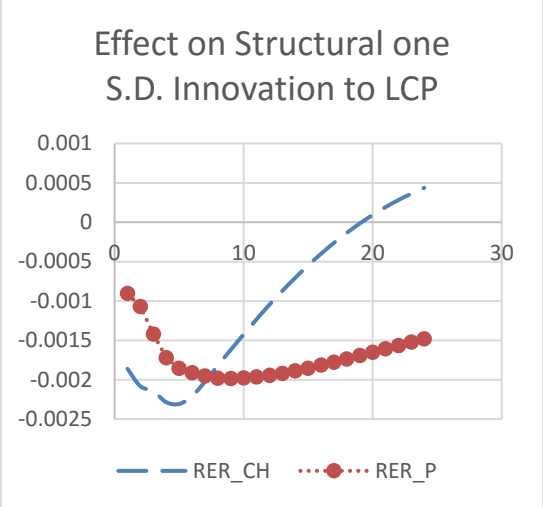
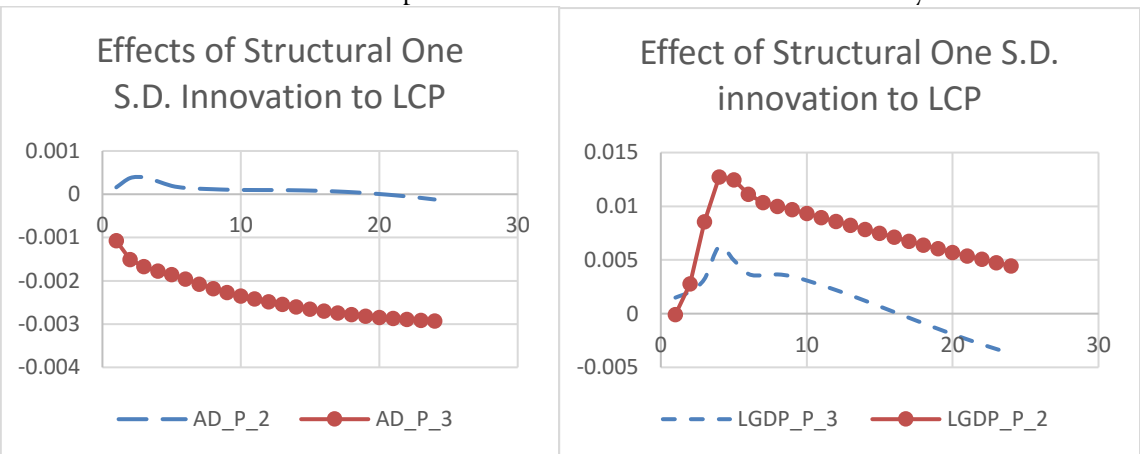


Figure 10: Responses of US, China, and Pakistan to Commodity Price Shock

To further highlight the significance of China in the external sector of Pakistan, the response of the macro economy of Pakistan is analyzed to a positive shock to the non-fuel commodity price index both in two and three countries SVAR model framework in figure 11.

The response of the aggregate demand to a positive shock to commodity prices in the two country model is different from the global SVAR model. Considering only the US in the external sector of Pakistan, the aggregate demand increases for a period of two months and converges to the steady state level after five months. However, by including China in the model, the aggregate demand declines from the very start to a positive shock to the commodity prices. Similarly, the amplitude and convergence of the response of output to a positive shock to the commodity prices decrease by including China in the external sector of Pakistan. Unlike the two countries model, the inclusion of China helps to reduce the amplitude and brings the inflation back to the steady state level, after the commodity price shock to the global SVAR model. The case of the response of the policy rate is, however, different in the case of a three country SVAR model. In the two countries SVAR model, the degree of response of the policy rate is lower than that of the response of interest rate in the three-country model.



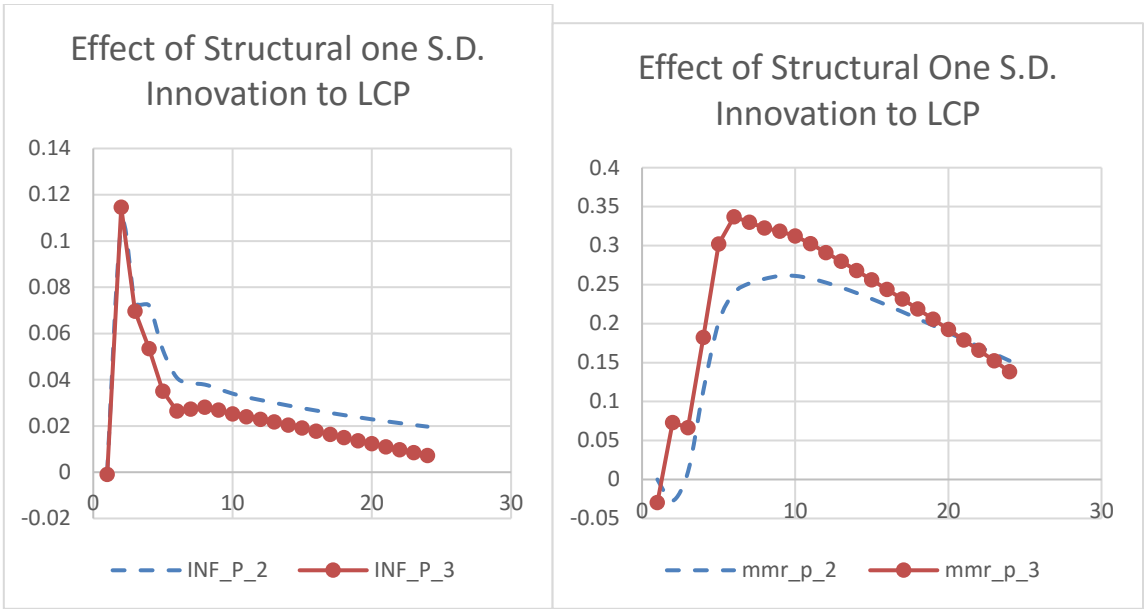


Figure 11: Comparison of Pakistan Responses to LCP in Two Countries and Multi Countries Models

5. Discussion

From empirical analysis of the global structural vector autoregression model, the impulse response function, it is observed that a positive shock to the output in Pakistan leads to a raised inflation and interest rate. Moreover, a positive shock to the interest rate reduces output level and raises inflation rate for a period of 3 months and starts falling drastically thereafter. This increase in the inflation confirms the presence of a price puzzle in the monetary policy reaction function in Pakistan. Such evidence of price puzzle is observed by (Mardi Dungey & Fry, 2003b; Munir & Javid, 2011; Primus, 2018), Nawaz et al., 2017 and (Nizamani et al., 2016a) etc. in their studies. Unlike the study of (Cochrane, 1998; McCallum, 1999), the inclusion of commodity prices and money supply variables[2] did not solve the issue of the price puzzle. The same short lived price puzzle was noted in the study of (Mardi Dungey et al., 2000) for Australia which was resolved by including the international capital market via including deflated share market prices in the SVAR model. However, the study of (Brooks & Henry, 2000) noted that the links between the equity market of the US, Japan and Australia are not causal. This approach of including the share market in the global SVAR model has not been followed because of the degree of freedom problem in estimation.

6. Conclusions

Monetary policy shock to the economy of Pakistan results in decline in output level and raises the price level for a period of three months and so the issue of price puzzle arises, which is consistent with the findings of the previous model. The inclusion of the commodity prices did not solve the problem of price puzzle for Pakistan. This result is in line with the findings of (Hanson, 2004). The responses of the macroeconomic variables of Pakistan in response to output shock in China are more likely to co move with the macroeconomic variables of China relative to the response of the economy of Pakistan to the US output shock. The US output shock overstates the macro economy of Pakistan if the external sector contains the US variable only. The inclusion of China in the external sector of Pakistan thus reduces the intensity of the US economic shocks to the economy of Pakistan. Contractionary monetary policy of the United States leads to an increase in the interest rate in Pakistan and decreases inflation and output for a period of 2 months and starts rising thereafter. The contractionary monetary policy of

[2] Selected impulse response functions have been reported in this study. The full set of responses can be shared by requesting to the author.

the United States has also a contractionary effect on the aggregate demand in Pakistan.
On the other hand, the monetary policy shock in China increases output and inflation in Pakistan for a period of 2 months and starts declining thereafter. Moreover, the monetary policy shock in China lowers the interest rate and increases the aggregate demand in Pakistan. The responses of the macroeconomic variables of Pakistan including output, inflation, aggregate demand, and interest rate to the monetary policy shock in the United States are being exaggerated in the absence of China in the model. The inclusion of China in the external sector of Pakistan reduces the intensity of the monetary policy shocks of the United States to the economy of Pakistan.
A positive shock to the commodity price increases output and inflation in the United States and Pakistan for a period of 5 months and starts decreasing thereafter. China seems less responsive to the commodity price shock in its output and inflation. The commodity price shock has a contractionary effect on the exchange rate of Pakistan; however, the exchange rate of China depreciates for a period of 5 months and then starts appreciating. Inclusion of China in the model, again, reduces the amplitude of the responses of the macro economy of Pakistan to the commodity price shock. Hence, it can be concluded that inclusion of China in the model has an important contribution to measure the intensity of foreign shocks namely US output shock, US monetary policy shock and commodity prices shock to the economy of Pakistan.

7. Recommendations

The significant influences of the United States are predicted by many empirical studies (for example see; (Mangla & Hyder, 2017; Nizamani et al., 2016b)). Despite China being the major trade partner[3], it has not been included in the external sector of Pakistan. Literature to date is based on two regions. This study is an attempt to develop a three regions model in the VAR framework that analyzes the implications of the United States in the presence of China in the external sector of Pakistan. The US represents the world economy that can influence small, open economies, but none of the economies can influence the economy of the US. China is placed in the center of the US and Pakistan, which means that US shocks translate to the Chinese economy and the Chinese economy in turn influences the economy of Pakistan. Hence, the US has both direct and indirect influences on the economy of Pakistan. The evidence has shown that China makes a significant contribution to the model and the exclusion of China leads to misspecification of the SVAR model for the policy analysis. Even though the size of shocks from China is small in magnitude, yet it has an important role in amplifying the US shocks via China to the economy of Pakistan, indirectly. The importance of China is highlighted by comparing the results of the two region model to the three regions model. Had China not been included in the model, the US shocks to the economy of Pakistan would have been overstated and the State Bank of Pakistan would overreact to the foreign shocks. It is, therefore, recommended that for an effective monetary policy, it is mandatory to accurately specify the macroeconomic model for the appropriate policy response.

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[3] China is the biggest trade partner and covers around 17% of the total trade volume of Pakistan.

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