IBT Journal of Business Studies (IBT-JBS)
E-ISSN: 2409-6520; P-ISSN: 2414-8393
Volume 17.2, 134-156 (2021)

# Not All Commodity Price Shocks are Alike for the Macro Economy of Pakistan

Humera Iram[1*] | Abdul Jabbar[2] | Arshad Ali Bhatti[3]

**Abstract**

*This study examines the impact of commodity price shocks on the macroeconomic variables of the Pakistan economy by disaggregating commodity price indices into seven different groups, namely food, clothing and footwear, housing, energy, transport, education, health, and others. It uses monthly data from July 2008 to June 2020 and employs the SVAR model for data analysis. The results of our study provide insight that all commodity price shocks are not alike for the macroeconomy of Pakistan, and different commodity price groups affect the economy differently with different magnitude. We note that energy price shock has a dominant positive impact on the interest rate, food price shock on inflation, and health price shock on the exchange rate. Whereas education price shock has a dominant-negative impact on output. The findings of our study may help policymakers control the prices of commodities that are more harmful to the macroeconomy of Pakistan and allow the one that generates a positive impact.*

**Keywords:** *:Commodity Price shocks; Inflation; Output; Exchange rate; Interest rate*

**Author's Affiliation:**
Institution: International Islamic University, Islamabad[1-2-3]
Country: Pakistan
Corresponding Author's Email: *Ciram88@gmail.com

## INTRODUCTION

Shocks in commodity prices are frequently related to macroeconomic volatility (Tule et al. (2019). Macroeconomic variables are the main signals of the health and trends of an economy. The stability and cost related to the volatility of macroeconomic variables are critical for consumers, producers, and governments (Wang & Le, 2018). It is generally recognized that fluctuations in macroeconomic variables result in reduced investment and output growth and increase the cost of living, unemployment, and poverty. By using a real business cycle model for a small open economy, Mendoza (1995) shows that approximately one-half of the variations in aggregate output in a sample of the 23 developing economies and G7 countries can be attributed to commodity price shocks. Moreover, Kose and Ayhan (2002) find that commodity price shocks can explain roughly all of the variance in the output of small open developing economies.

Most previous studies assume that all commodity price shocks are the same and advocate a "one size fits all" policy response (Jo el al.2019). In fact, not all commodity price shocks are alike. There is a vast range of commodities traded in an economy, and each commodity price has a different level of impact. Most of the studies only focus on oil price shocks and postulate the possible ways through which oil prices may impact the macroeconomy (Akhmedov, 2019; Alom et al., 2013; Khan and Ahmed, 2011; Tang et al., 2009;) while, the impact of other commodity prices has been ignored.

It is important to incorporate the impact of different commodity price shocks on the macroeconomy as each commodity price shock affects differently through diffident mechanisms. In this context, a few studies are available on the Pakistan economy, however, there are limited studies that focus on the impact of different commodity prices. (Ahad and Anwer, 2020; Nazir and Qayyam, 2014; Chughtai and Kazmi, 2014; Kiani, 2011; Malik, 2008). Pakistan economy is facing a lot of economic problems, including the fiscal deficit, ever-increasing external debt, low savings, and poor tax to GDP ratio, among others; hence, macroeconomic stability is much-needed. This study fills in this gap and examines the impact of seven groups of commodities on the macro-economy of Pakistan. These groups are food (including food and non-alcoholic beverages, alcoholic beverages and tobacco, restaurant and hotels), clothing and footwear, housing, water, electricity, gas, and other fuels, transport, education, health, and others (including communication, recreation, and culture and miscellaneous).

## LITERATURE REVIEW

There is a huge empirical and theoretical literature that shows the impact of commodity prices on macroeconomic activities. However, among all the commodities, oil has no doubt received the most attention. Since the pioneering work of Hamilton (1983) several studies show that oil prices affect macroeconomic variables through the channels of demand and supply (Raduzzi and Ribba, 2020; Akhmedov, 2019; Taghizadeh-Hesary et al., 2016; Peersman and Robays, 2012; Kilian, 2009; Papapetrou, 2001). The literature is also growing on the impact of oil

price shocks on the macroeconomic conditions of developing countries. Pakistan's economy is heavily dependent on the import of oil; thus, international oil price shocks adversely affect terms of trade, the balance of payment, government's budget and cause inflation (Khan et al. 2021).
Ahmed et al. (2019) examine the impact of oil price shocks on selected SARC countries including Pakistan. Using annual data over the period 1982 to 2014 study employed the SVAR model and Johansen cointegration method. The finding of the study suggests that oil price shocks significantly affect the macroeconomy of these countries. However, the magnitude of this effect is different for each country depending on the structural, institutional, and policies differences. Zeshan et al. (2019) using the SVAR model for annual data of 1993-2015 find that positive oil price shocks contract the output growth of Pakistan. Malik et al. (2017) study suggest that oil price shocks adversely affect the domestic output and exchange rate of Pakistan's economy. Moreover, the shocks in oil prices also increase inflation and interest rate. Malik (2016) finds a positive relationship between oil price shocks and inflation for quarterly data of different periods for the Pakistan economy. The study employed the Johansen cointegration method to check the long-run relationship among variables.

Chughtai and Kazmi (2014) find that oil price shocks significantly affect the economic growth of Pakistan. Their study also suggests that the strength of the impact of oil price depends on the share of oil price in GDP, the ability to fulfill the oil import requirements, domestic production of oil, and investment of private and public sectors in oil production. The findings of Nazir and Qayyam (2014) are consistent with Chughtai and Kazmi (2014). Using Cobb-Douglas production function for annual data for the period 1972- 2011, their study provides evidence of a long-run relationship between oil price and economic growth. Moreover, Hanif (2012) examines the impact of international food prices on the domestic food prices of Pakistan and the persistence of food inflation. The results provide evidence of the impact of international food prices on domestic food inflation of Pakistan, and in the food group, manufactured food commodities exhibit inflation persistence.

Kiani (2011) finds that an increase in oil price leads to budget deficits, inflation, and deterioration of the exchange rate of Pakistan's economy. Further, a rise in oil prices badly affects the consumption patterns of consumers. The impact of international food and oil price on major macroeconomic variables of Pakistan is examined by Khan and Ahmed (2011). Using SVAR methodology, their study suggests that the international prices of food and oil have a significant impact on inflation, output, interest rate, and the real effective exchange rate of Pakistan. Malik (2008) examines the impact of oil prices on the macroeconomy of Pakistan. Using the augmented Phillips curve and IS model, the study finds a strong link between oil prices and output. Moreover, the relationship is found to be non-linear and becomes negative after a specific level.

There are also few studies on Pakistan that have examined the impact of international commodity prices on domestic inflation. Hanif et al. (2008) examine the impact of ten internationally traded commodities (rice, sugar, fish, beef, tea, petroleum crude oil, palm oil, metal, wheat, and cotton) on the domestic inflation of Pakistan.

The study's findings show that global inflation has a strong positive impact on the domestic inflation of Pakistan for all commodities except for meat.

The reviewed literature shows that there are several studies for developed and developing countries that examine the impact of commodity prices on macro-economic variables. However, most of the researchers mainly focus on the impact of oil price shocks, and there are relatively limited studies for other groups of commodity prices. Specifically, in the case of Pakistan, there is no well-known study that incorporates other commodity prices except for oil. Therefore, this study is unique because it provides a comprehensive analysis of the impact of seven groups of commodity prices on five major macro-economic variables, namely real GDP, inflation, interest rate, exchange rate, and unemployment for Pakistan.

## DATA AND METHODOLOGY

This study uses monthly data from July 2008 to June 2020 and employs the Structural VAR (SVAR) model to examine the relationship between commodity prices and macroeconomic activities in Pakistan. Following the work of McLeod (2008), the selected macroeconomic variables are Gross Domestic Product (y), Inflation (inf), Interest rate (rate) and Exchange rate (er). The GDP suggests the size and health of the economy; economists use GDP as the main indicator to determine whether an economy is experiencing a recession or boom and how fast an economy is growing (Zeshan et al. 2019). However, the monthly data of GDP is not available for the Pakistan economy, therefore following the work of Khan and Ahmed (2011) and Alom et al. (2013) this study uses monthly industrial production as a proxy of GDP.

The SVAR model can be expressed as in equation 1

$$A_0 y_t = A_1 y_{t-1} + \cdots + A_p y_{t-p} + B u_t \qquad (1)$$

Where is an vector of macroeconomic variables and is matrix of coefficients of macro variables that capture the contemporaneous relationship between or among the variables. Whereas, is an vector of the structural economic shocks, and p shows the lag order of macro-economic variables. The vector of the structural economic shocks has the property that is white noise with zero mean and variance-covariance matrix. Moreover, for estimation of SVAR, we need to derive its reduced form, and for that, we pre-multiply both sides of the SVAR model, equation (1) by.

By pre-multiply both sides of the model by we get

$$y_t = A^{-1}C\ (L)y_{t-p} + A^{-1}B\mu_t \quad (2)$$

Where C (L) $= I - C_1(L) - C_2L^2 - \cdots - C_pL^p$ and $C_i$ is the coefficient matrix ($i = 1 \ldots p$), and L is the lag operator. We can write equation 2 as

$$C(L)y_t = A^{-1}B\mu_t \quad (3)$$

and

$$A^{-1}B\mu_t = \epsilon_t \quad (4)$$

When the contemporaneous relationship between variables exists, the variance-covariance matrix of residuals, B, is equal to identity thus;

$$A^{-1}\mu_t = \epsilon_t \quad (5)$$

or

$$A\epsilon_t = \mu_t \quad (6)$$

Standard estimation methods like OLS permits us to attain consistent estimates of the reduced form parameters, the reduced form errors, and their covariance matrix, Σ. Moreover, as the Σ and the structural variance-covariance matrix Ω are related, the structural shocks of any variable can be recovered by imposing appropriate identifying restrictions.

This study also uses Augmented Dickey-Fuller (ADF) model for unit root testing in order to check the stationarity of data. For equation (7) below, the unit root hypothesis can be written as;

$$y_t = A_1y_{t-1} + u_t \quad (7)$$

The hypotheses are;

non-stationary (unit root)

Stationary (not unit root )

If a series has a unit root, the null hypothesis cannot be rejected.

## IDENTIFICATION OF SVAR MODEL

Researchers have no consensus on the exact number of macroeconomic variables that can fully describe the economy. Different studies use different macroeconomic variables however, this study uses the most commonly used variables in our SVAR model. Further, SVAR model is estimated separately for each group of commodity prices. Therefore, we need to impose separate restrictions for each commodity price.

### 3.1.1) FOR OIL PRICES

The identification of restriction of our SVAR model used an information-based approach. The maximum number of parameters in A is 25 , and the maximum

number of independent movements in the covariance matrix is 15 . Thus, our model required at least 10 fully identified restrictions. In the energy price group, oil price got the highest weight, and oil price is assumed to be set exogenous to the macroeconomic variables of a small open economy like Pakistan (Jo et al., 2019; Sims and Zha, 1998). Therefore, we take energy price as exogenous in our model. In equation 2 we assumed that the goods market is independent of the movement in the money market and money is neutral. Thus, the aggregate output equation only incorporates the impact of prices of the most important input in production energy

Moreover, following the work of Lee and Ni (2002) and Sims and Zha (1998), equation 3 includes energy prices and output. While, the interest rate equation takes into account the impact of all macroeconomic variables except the exchange rate following the fact that the impact of interest rate on the exchange rate is more dominating than the impact of exchange rate on the interest rate. The exchange rate is most endogenous in our model, and it responds contemporaneously to energy, aggregate output, inflation, and interest rate shocks. The above system of equations can be expressed in matrix form as follows;

$$\begin{bmatrix} \mu cpe_t \\ \mu y_t \\ \mu inf_t \\ \mu rate_t \\ \mu_t er_t \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon cpe_t \\ \varepsilon y_t \\ \varepsilon inf_t \\ \varepsilon rate_t \\ \varepsilon er_t \end{bmatrix}$$

We have imposed 10 zero restrictions to estimate our macro-economic SVAR model. Thus, in total 15 parameters are to be estimated with 15 independent movements of the covariance matrix and our model is just identified. The restrictions for other commodity price groups have been shown in Appendix.

## RESULTS

This section represents the results of our estimations. Table 1 shows the unit root tests result of macro variables and commodity prices, where cpe is energy prices, cpf is food prices, cpedu is education prices, cphel is health prices, cph is housing prices, cpt is transportation prices, cpcf is clothing and footwear prices, inf is inflation, rate is interest rate, y is output and er is exchange rate.

***Table 1: Unit root test results***

| Variables | ADF Test at Level | | ADF Test at First Diff | | Oder of Integration |
|---|---|---|---|---|---|
| | T Statistics | P Values | T Statistics | P Values | |
| cpe | 0.11 | 0.966 | -5.15** | 0.000 | I(1) |
| cpf | -0.56 | 0.874 | -11.51** | 0.000 | I(1) |
| cpedu | -0.09 | 0.947 | -11.55** | 0.000 | I(1) |
| cphel | 0.45 | 0.984 | -10.83** | 0.000 | I(1) |
| cph | 0.36 | 0.981 | -3.65** | 0.000 | I(1) |
| cpt | -1.45 | 0.559 | -8.10** | 0.000 | I(1) |
| cpcf | 1.84 | 0.999 | -10.36** | 0.000 | I(1) |
| inf | 0.35 | 0.980 | -11.36** | 0.000 | I(1) |
| rate | -1.50 | 0.528 | -7.69** | 0.000 | I(1) |
| y | -1.68 | 0.437 | -5.45** | 0.000 | I(1) |
| er | 1.91 | 0.999 | -8.45** | 0.000 | I(1) |

CV at 5% level with intercept=-2.88 and CV at 1% level with intercept=-3.48. ** shows significance at 1% * showes significance at 5% level.

Table 1 above shows that all the variables are stationary at first difference. The review of the literature shows that SVAR model is estimated in two different ways. First, at level regardless of stationarity of data second, with stationary data. The argumentation about which method is more appropriate is old and dated back to the original work of Sims (1976). Working with the level data regardless of stationarity gives consistent estimates that are asymptotically normally distributed. However, the standard textbooks support stationary data as it helps to meet the normality condition, and inference can be drawn. Therefore, we prefer to use stationary data and use SIC for the selection of lag length as it is best fitted for small samples. To get a better understanding of results, we represent the response of individual macro variables to each commodity price in one place. The reactions of other macro variables are presented in Appendix.

Figure 1 below shows the impulse response of output to different groups of commodity prices. In response to energy price shocks, output increases significantly in the first month and then in the 3rd month. This may be because the decline in production of energy-intensive industries is offset by the higher production in non-energy-intensive industries. However, output reduces in the 8th month when the impact of high energy prices shifts to overall inflation and aggregate production decreases. These results are consistent with the finding of Rasheed (2019). Further, Malik et al. (2017) find that energy prices have a significant long-run relationship with macroeconomic variables of the Indian economy. Moreover, Killain (2007) finds that increased energy prices significantly slow down production in the economy. Hamilton (2005) argues that an increase in energy prices affects production by disturbing the pattern of consumer spending on commodities other than energy.

In response to food price shocks, output decreases significantly in the first month. As householdss spend a large portion of their budget on food items, increase in its price reduces the purchasing power of consumers and slows down economic activities. However, this decline is for a short period, and it shows no impact in the long run. These results are somehow consistent with the finding of Khan and Ahmed (2011). However, the results are not consistent with the finding of Alom (2011) that finds no impact of food prices on industrial output. Clothing and footwear price shocks also have a significant negative impact on output in the short run. This decline may be because the textile industry is the largest manufacturing industry, and reduction in this industry production significantly reduces aggregate industrial output.

Output declines in response to health price shocks in the short run until 2nd month then it starts to rise again. However, this response is statistically insignificant and dies out in the long run. Shocks in education prices significantly reduce industrial output for the initial two months. After the 3rd month, this decline is almost diminishing. In response to transportation price shocks, industrial output falls for the first two months and then starts to recover. However, this response is insignificant. In response to housing price shocks, the industrial output shows a mixed response; it falls in the first two periods and then increases in the third month, but this response is insignificant.

**Figure 1: Impact of commodity prices on output**

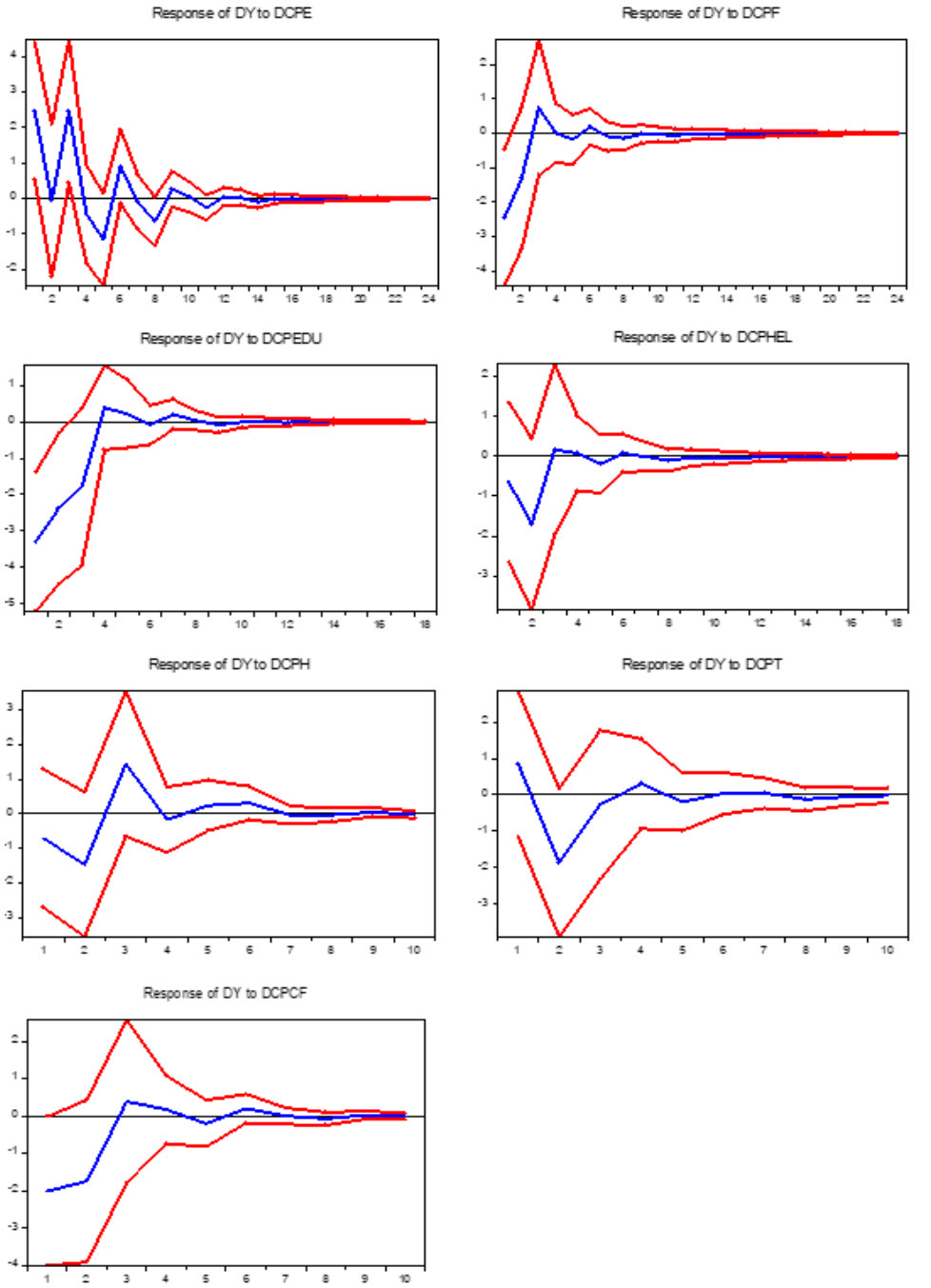


Figure 2 below shows that energy prices have a mixed type of impact on aggregate inflation. In response to positive shocks in energy prices, inflation rises for the first two months and then it decreases in the third month and then increases again in the fourth and seventh months. These results are significant and consistent with the finding of Tang et al. (2010) and Galesi and Lombandi (2009); that an increase in energy prices causes an immediate rise in aggregate inflation. Shocks in food price also increase inflation significantly as food items are the major components of the consumer basket and have the highest weight. Therefore, any change in food prices causes a significant impact on aggregate inflation. These results are consistent with the finding of Alom (2011).

Education and health price shocks increase inflation in the first and fifth and first and fourth months, respectively. However, these impacts are for the short run and die out in the long run. The shocks in housing prices also increase inflation in the short run. These results are consistent with Guo et al. (2015) that shows an increase in housing prices increases inflation through the channel of bank credit. Further, the shocks in transportation prices increase inflation for the first two months.

**Figure 2: Impact of commodity price shocks on aggregate inflation**

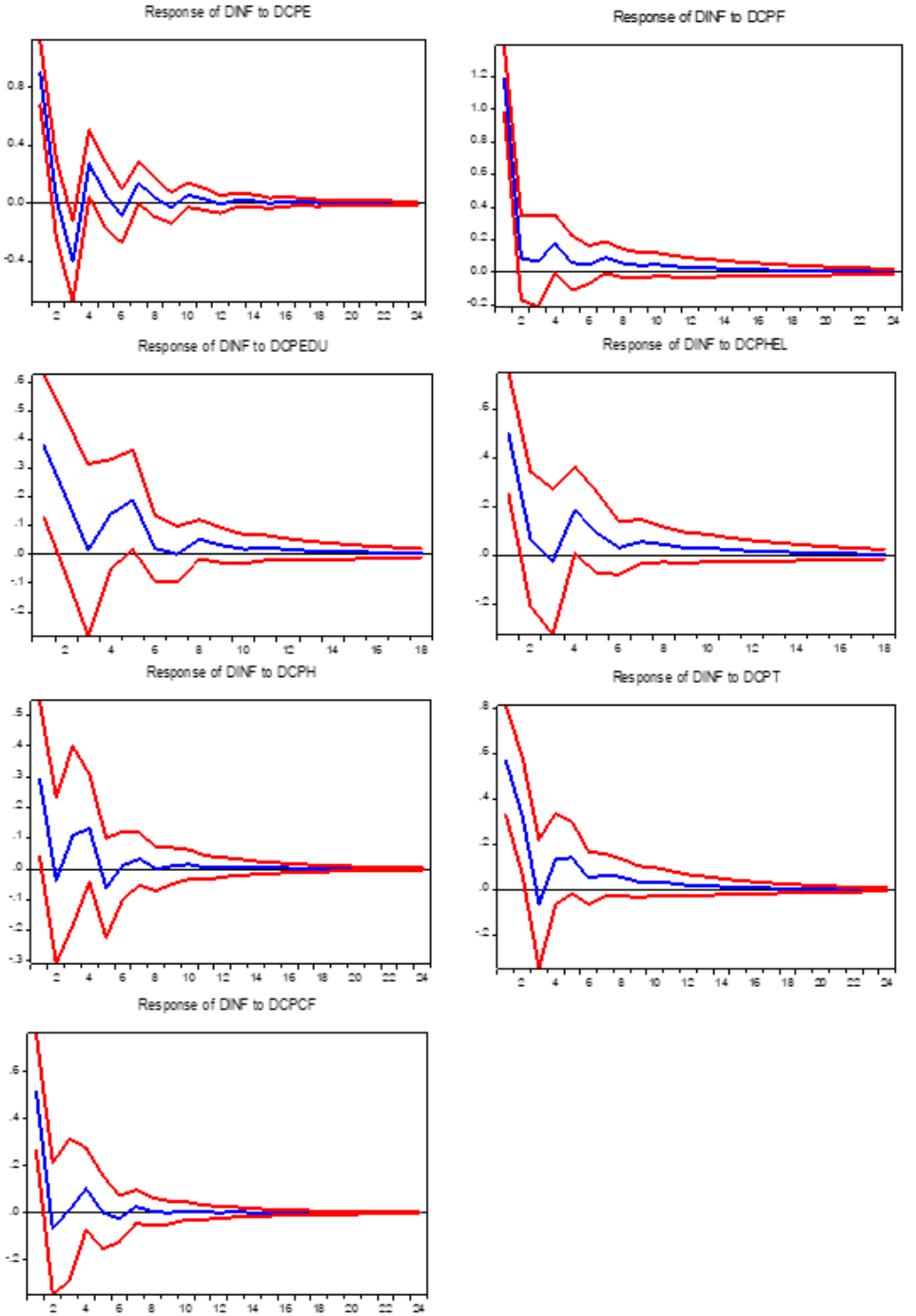


Figure 2: Impact of commodity price shocks on aggregate inflation

Figure 3 below shows that in response to oil price shocks, interest rate increases significantly in the short run. These results are consistent with the findings of Khan and Ahmed (2011) that shows an increase in oil prices increase inflation and cost of living and reduces production; thus, real money balances of currency reduce demand for money, and this leads to a rise in interest rate in the short run. Further, contractionary monetary policy in response to inflation caused by oil price shock also leads to an increase in interest rate (Tang et al., 2010). Food price shocks significantly increase the interest rate in the short run, and this impact dies out in the long run. An increase in food prices increases the demand for money and thus leads to an increase in interest rate (Khan & Ahmed, 2011).

Education price shocks increase the interest rate in the third month. Whereas health price shocks increase the interest rates in the first two months. It may be because an increase in health prices increases the money demand for precautionary motives and leads to an increment in interest rate. Housing, clothing, and footwear price shocks have no significant impact on the interest rate of the Pakistan economy. However, transportation price shocks have a significant positive impact on the interest rate for the third and sixth months of the shock, which dies out in the long run.

**Figure 3: Impact of commodity price shocks on interest rate**

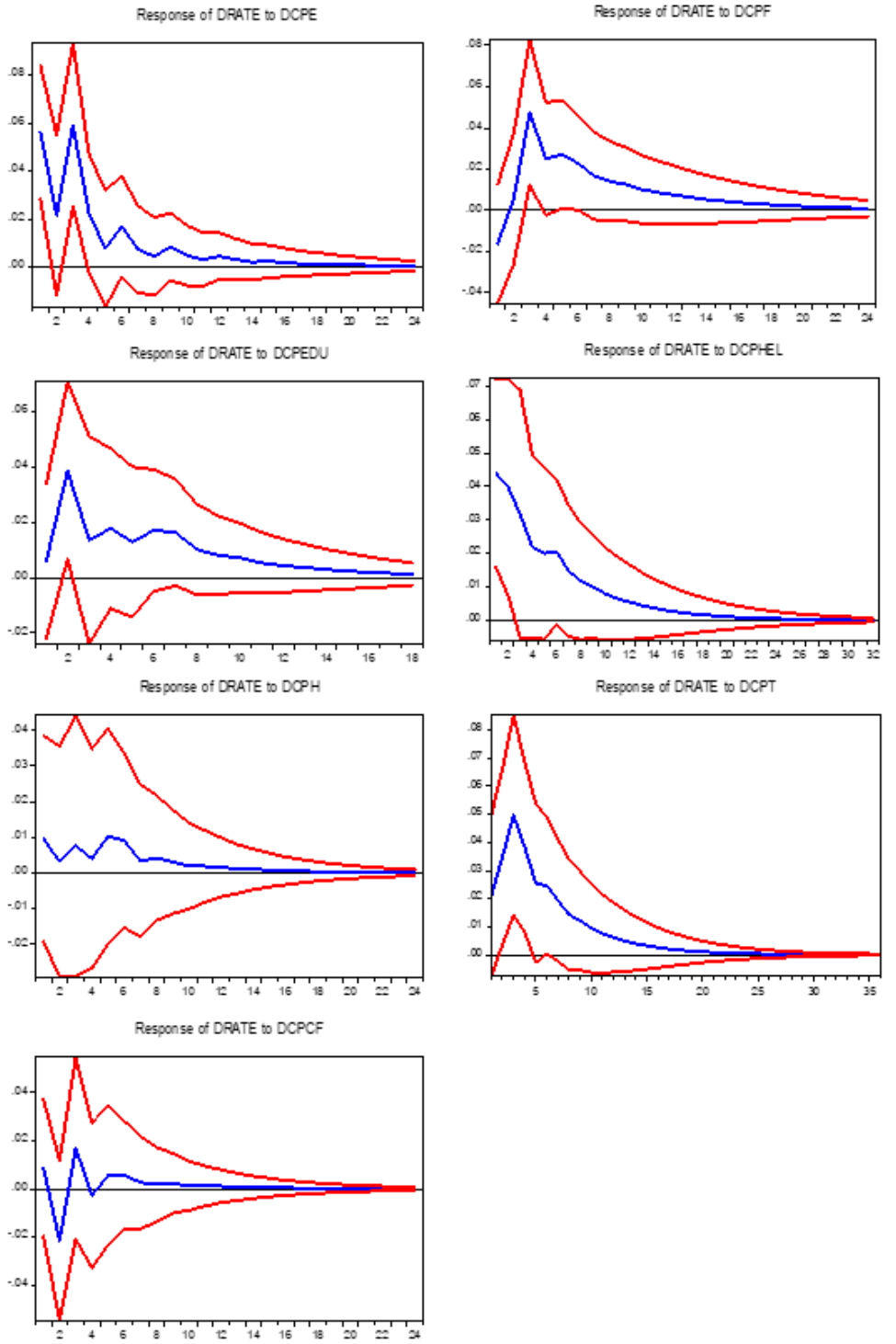
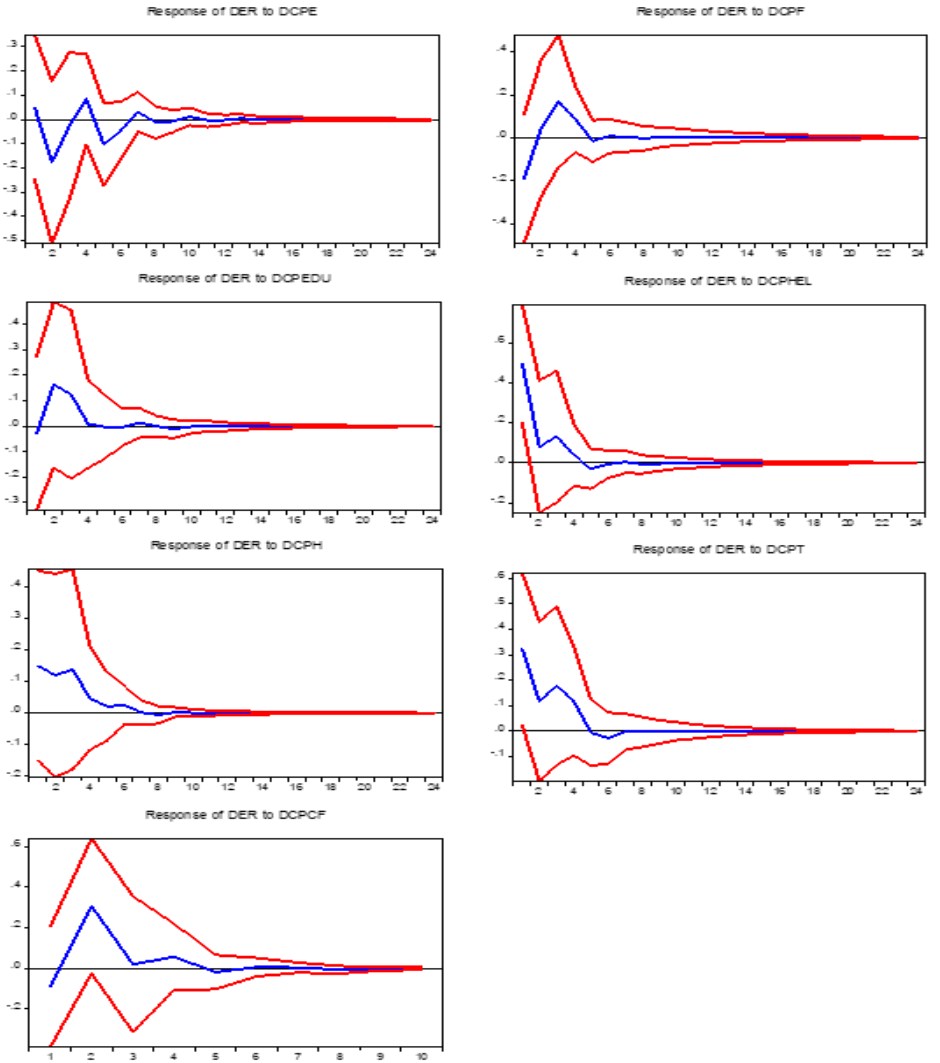


Figure 4 below shows that only health and transportation price shocks have a significant impact on the exchange rate of Pakistan. Being a small open economy that suffers severely from the balance of payment deficit due to higher imports and lower exports, domestic prices have less impact on the exchange rate. These results are not consistent with the findings of Ahmed and Khan (2011) that shows the significant impact of oil price shocks on the depreciation of the exchange rate of Pakistan. However, their study examined the impact of oil price shocks only, whereas our study incorporates the impact of all energy prices. In the presence of electricity and gas prices in total energy prices, the direct comparison of results is not possible.

**Figure 4: Impact of different groups of commodity prices on exchange rate**



## 5) CONCLUSION AND POLICY IMPLICATION

study examines the impact of commodity price shocks on macroeconomic variables of the Pakistan economy. It uses monthly data from July 2008 to June 2020 and employ the SVAR model for data analysis. The results provide an insight that all commodity price shocks are not alike for the macroeconomy of Pakistan and different commodity price groups affect the economy differently with different magnitude. The table below summarizes the most dominant and weakest significant responses of macroeconomic variables to commodity price shocks.

*Table 3: Summarized results*

| **Macroeconomic variables** | **Dominant impact** | **Weakest impact** |
|---|---|---|
| **Output** | Education price shocks<br>-0.33% | Health and Housing price shocks<br>-0.17% and -0.16% |
| **Inflation** | Food price shocks<br>+1.2% | Housing price shocks<br>+0.29% |
| **Interest rate** | Energy price shocks<br>+0.64% | Education price shocks<br>+0.39% |
| **Exchange rate** | Health price shocks<br>+0.5% | Transportation price shocks<br>+0.32% |

The study's results provide useful information to policymakers that may help them achieve their goals more effectively. For example, it may help them in bringing stability as they can make policies to control prices of those commodities which have a significant and large impact on the economy. However, due to the limitation of data, our analysis is based on a few macro variables. In the future, more macroeconomic variables like unemployment and balance of payments can be used for a more exciting go-through.

## REFERENCES

Ahad, M., & Anwer, Z. (2020). Asymmetrical relationship between oil price shocks and trade deficit: Evidence from Pakistan. The Journal of International Trade & Economic Development, 29(2), 163-180.

Ahmed, K., Bhutto, N. A., & Kalhoro, M. R. (2019). Decomposing the links between oil price shocks and macroeconomic indicators: Evidence from

SAARC region. Resources policy, 61, 423-432.

Akhmedov, E. (2019). The impact of oil price shocks on selected Kazakhstan's macroeconomic indicators. Journal of International Studies, 12(4), 258-271.

Alom, F. (2011). Economic effect of oil and food price shocks in Asia and Pacific countries; An application of SVAR model. New Zealand Agricultural and Resource Economics Society Conference, 25-26.

Chugtai, M., & Kazmi, M. H. (2014). The interaction between sharp oil prices and economic growth in Pakistan. Research Journal of Economics and Business 4(2), 26-32.

Galesi, A., & Lombardi, M. J. (2009). External shocks and international inflation linkages: A global VAR analysis.

Guo, H., Wang, D., & Ma, X. (2015). A study on the relationship between housing prices and inflation from the perspective of bank credit. Metallurgical & Mining Industry, 9, 473-477.

Hamilton, J. D. (1983). Oil and the macroeconomy since World War II. Journal of Political Economy, 91, 228-248.

Hanif, M. N. (2012). A note on food inflation in Pakistan. Pakistan Economic and Social Review, 183-206.

Jo, S., Karnizova, L., & Reza, A. (2019). Industry effects of oil price shocks: A re-examination. Energy Economics, 82, 179-190.

Khan, M. A., & Ahmed, A. (2011). Macroeconomic effects of global food and oil price shocks to the Pakistan economy: A structural vector autoregressive (SVAR) analysis. The Pakistan Development Review, 2011 Dec, 491-511.

Khan, M. I., Teng, J. Z., Khan, M. K., Jadoon, A. U., & Khan, M. F. (2021). The impact of oil prices on stock market development in Pakistan: Evidence with a novel dynamic simulated ARDL approach. Resources Policy, 70, 101899.

Kiani, A. (2011). Impact of high oil prices on Pakistan's economic growth. International Journal of Business and Social Science, 2(17).

Kilian, L. (2009). Not all oil price shocks are alike: Disentangling demand and supply shocks in the crude oil market. American Economic Review, 99(3), 1053-1069.

Kose, M., & Ayhan. (2002). Explaining business cycles in small open economies 'How much do world prices matter?. Journal of International Economics, 56, 299-327.

Lee, K., & Ni, N. (2002). On the dynamic effects of oil price shocks: A study using Industry level data. Journal of Monetary Economics, 49, 823-852.

Malik, A. (2016). The impact of oil price changes on inflation in Pakistan. International journal of energy economics and policy, 6(4), 727-737.

Malik, A. (2008). Crude oil price, monetary policy and output: The case of Pakistan. The Pakistan Development Review, 47, 425-436.

Malik, K., Ajmal, H., & Zahid, M. U. (2017). Oil price shock and its impact on the macroeconomic variables of Pakistan: A structural vector autoregressive approach. Malik, KZ, Ajmal H, Zahid M U.," International Journal of Energy Economics and Policy, 7(5), 83-92.

McLeod, S. (2018). Commodity prices, stock prices and economic activity in a small open economy. PhD Thesis

Mendoza, E. G. (1995). The terms of trade, the real exchange rate, and economic fluctuations. International Economic Review, 36 101-137.

Nazir, S., & Qayyum, A. (2015). Impact of oil price and shocks on economic growth of Pakistan: Multivariate analysis. Business and Economics Journal, 6(4), 1.

Papapetrou, E., & Stock, S. (2001). Oil price economic activity and employment in Greece". Energy Economics, No. 5, 511-532.

Peersman, G., & Van Robays, I. (2012). Cross-country differences in the effects of oil shocks. Energy Economics, 34(5) 1532-1547

Raduzzi, R., & Ribba, A. (2020). The macroeconomics outcome of oil shocks in the small Eurozone economies. The World Economy, 43(1), 191-211.

Rasheed, Q. (2019). Energy prices and the financial performance of different industries in Pakistan. Global Journal of Management and Business Research.

Sims, C. A., & Zha, T. (1998). Bayesian methods for dynamic multivariate models. International Economic Review, 949-968.

Tang, W., Wu, L., & Zhang, Z. (2010). Oil price shocks and their short and long-term e□ects on the Chinese economy. Energy Economics, 32, 3-14.

Tule, M. K., Afangideh, U. J., Adeleke, A. I., & Ujunwa, A. (2019). Macroeconomic effects of commodity price shocks on ECOWAS members. In The External Sector of Africa's Economy (pp. 163-184). Springer, Cham.

Wang, C.-N., & Le, A. L. (2018). Measuring the macroeconomic performance among developed countries and asian developing countries: Past, present, and future. Sustainability, 10(10), 3664.

Yasmeen, H., Wang, Y., Zameer, H., & Solangi, Y. A. (2019). Does oil price volatility influence real sector growth? Empirical evidence from Pakistan. Energy Reports, 5, 688-703.

Zeshan, M., Malik, W. S., & Nasir, M. (2019). Oil price shocks, systematic monetary policy and economic activity. The Pakistan Development Review, 58(1), 65-81.

Competing Interests statement
"The authors have no relevant financial or non-financial interests to disclose."

## Appendix

### Identification restriction

**For food prices**

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon cpf_t \\ \varepsilon y_t \\ \varepsilon inf_t \\ \varepsilon rate_t \\ \varepsilon er_t \end{bmatrix}$$

**For education prices**

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon cpedu_t \\ \varepsilon y_t \\ \varepsilon inf_t \\ \varepsilon rate_t \\ \varepsilon er_t \end{bmatrix}$$

**For health prices**

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon cphel_t \\ \varepsilon y_t \\ \varepsilon inf_t \\ \varepsilon rate_t \\ \varepsilon er_t \end{bmatrix}$$

**For Housing prices**

$$\begin{bmatrix} 1 & a_{11} & 0 & a_{14} & 0 \\ 0 & 1 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 \\ 0 & a_{52} & a_{53} & a_{54} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon cph_t \\ \varepsilon y_t \\ \varepsilon inf_t \\ \varepsilon rate_t \\ \varepsilon er_t \end{bmatrix}$$

**For Transportation prices**

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon cpt_t \\ \varepsilon y_t \\ \varepsilon inf_t \\ \varepsilon rate_t \\ \varepsilon er_t \end{bmatrix}$$

**For Clothing and footwear prices**

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon cpcf_t \\ \varepsilon y_t \\ \varepsilon inf_t \\ \varepsilon rate_t \\ \varepsilon er_t \end{bmatrix}$$

Figure 1: Impulse responses with energy price

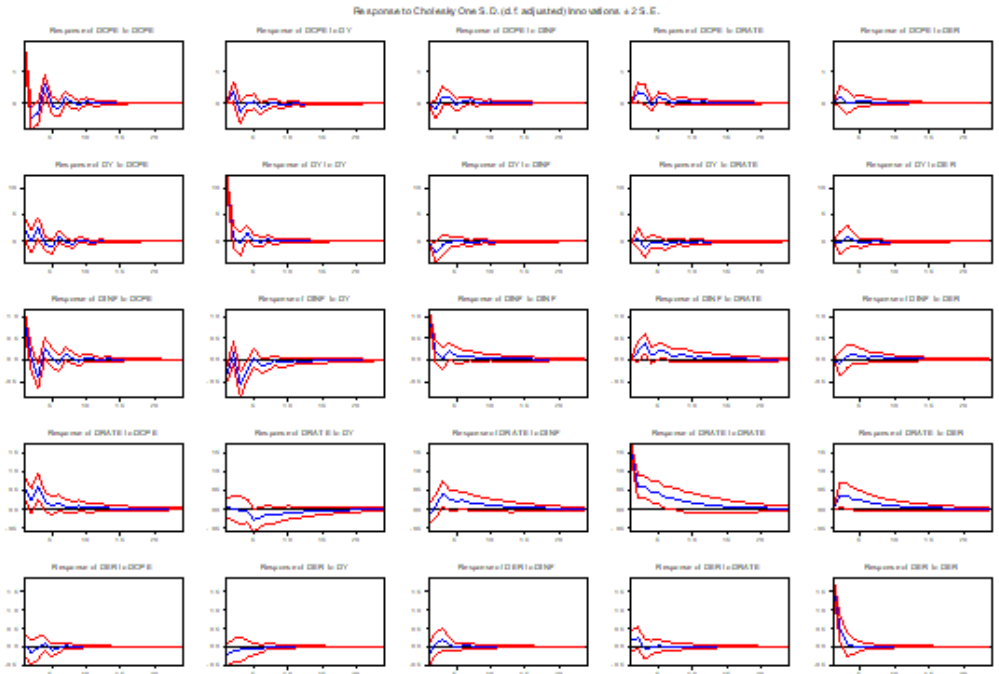


Figure 2: Impulse responses with food price

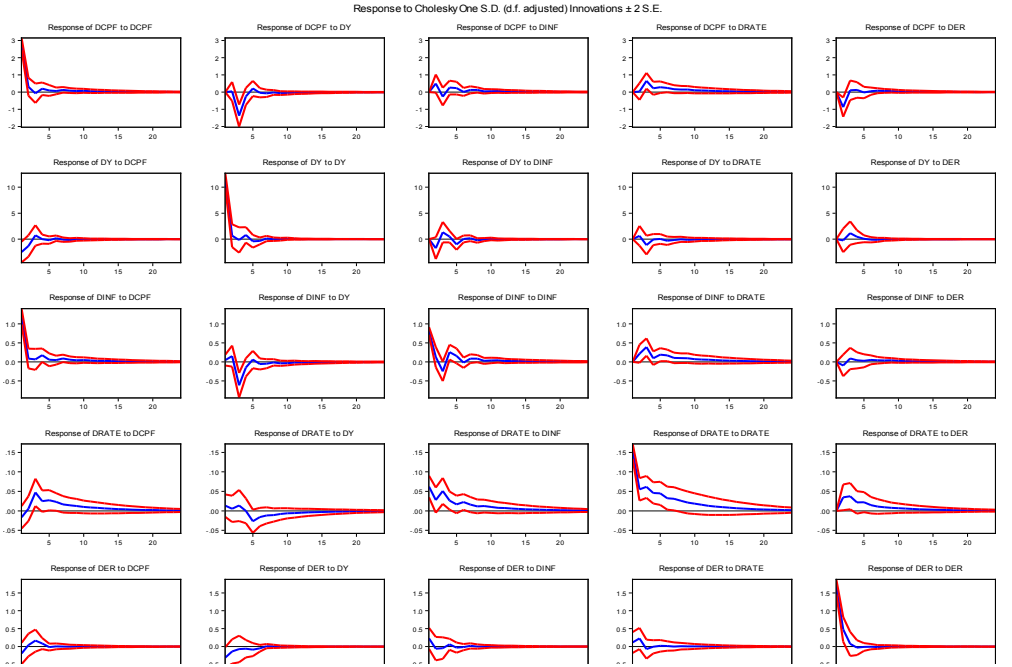



Figure 3: Impulse responses with education price

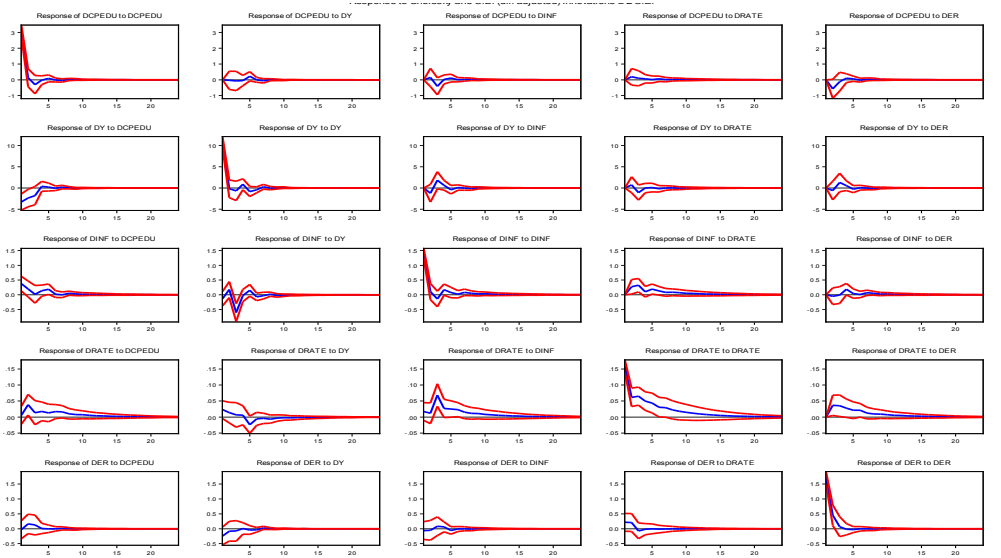


Figure 4: Impulse responses with health price

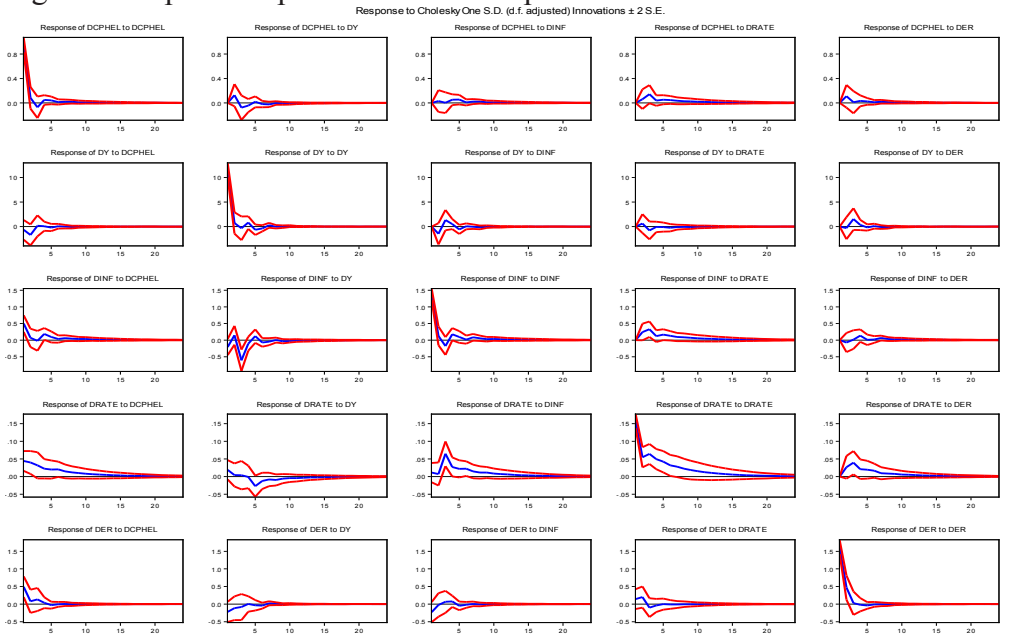



Figure 5: Impulse responses with housing price

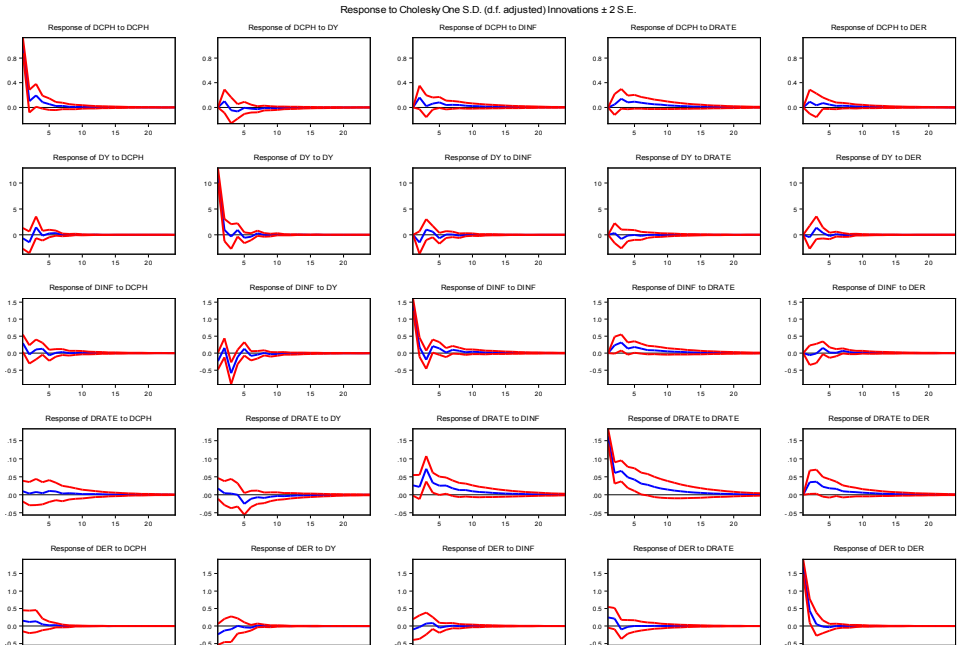


Figure 6: Impulse responses with transportation price

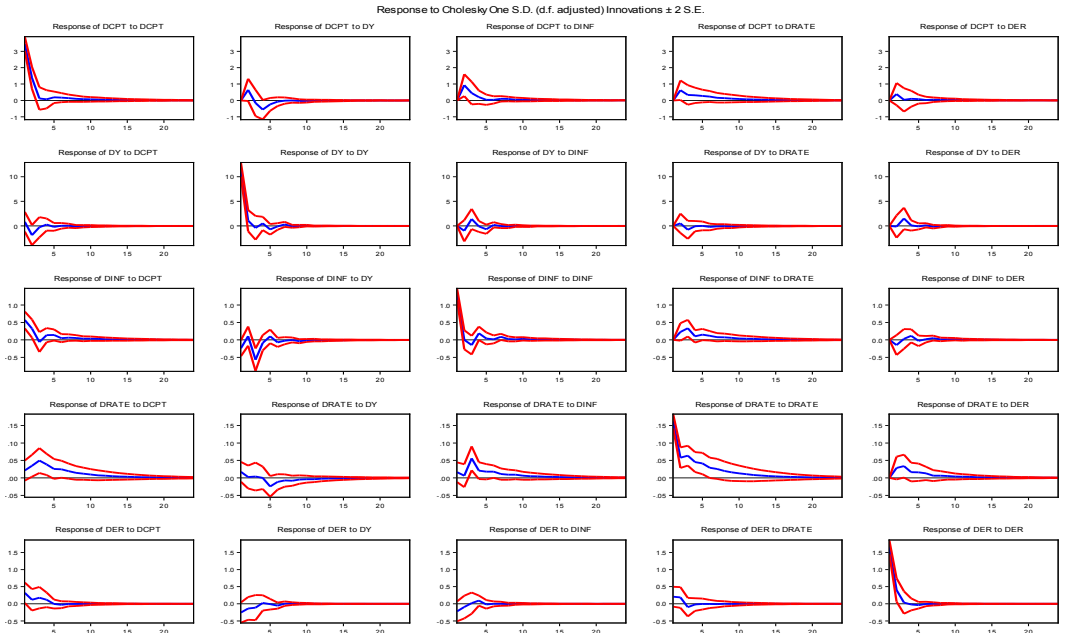



Figure 7: Impulse responses with clothing and footwear price