COMMODITY PRICE SHOCKS AND ECONOMIC ACTIVITY IN PAKISTAN: AN EMPIRICAL ANALYSIS

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Declaration of Authorship

I, **Humera Iram** D/O **Khadim Hussain,** Registration No, 164-FE/PHD/F16, student of Ph.D. Economics at the School of Economics, IIIE, do hereby solemnly declare that the thesis entitled "**Commodity Price Shocks and Economic Activity in Pakistan: An Empirical analysis",** submitted by me in partial fulfillment for the award of Ph.D. degree in Economics, is my original work, except where otherwise acknowledged in the text. I have carried it individually under the supervision and guidance of my supervisors. I further declare that this work has not been submitted to any institution for the award of a certificate, diploma or degree. It is done in partial fulfillment for the Doctor of Philosophy in Economics of the International Islamic University, Islamabad.

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بسم الله الرحمن الرحيم

Dedicated to

My Father-in-law(late)

Sufi Muhammad Iqbal

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In the name of Allah, the most merciful the most beneficial there is nothing in this world that can happen without Allah's will.

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Humera Iram

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ABBREVIATIONS

APTMA	All Pakistan Textile Mills Association
ARDL	Auto Regressive Distributed Lag
ADF	Augmented Dickey-Fuller
CA	Comparative Advantage
CPI	Consumer price index
CEC	Cotton Export Corporation
FED	Federal Excise Duty
LSMI	Large Scale Manufacturing Industries
OLS	Ordinary Least Square
PIDC	Pakistan Industrial Development Commission
PPI	Producer Price Index
QTM	Quantity Theory of Money
RCA	Revealed Comparative Analysis
SIC	Schwarz Info Criterion
SBP	State Bank of Pakistan
SD	Standard Deviation
SVAR	Structural Vector Auto Regressive

ABSTRACT

This thesis is comprised of three objectives that jointly examine the role of commodity price shocks on economic activities in Pakistan. It will contribute to existing literature significantly and investigate the impact of commodity price shocks by disaggregating commodity price indices into seven different groups namely food, clothing and footwear, housing, energy, transport, education, health, and others. We used monthly data from July 2008 to June 2020 and employ SVAR model for our analysis.

The first objective of the study examines the impact of commodity price shocks at the macro level for Pakistan. The results of our study provide the 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. Energy price shocks have dominant positive impact on the interest rate, food price shocks on inflation and health price shocks on the exchange rate. Whereas education price shocks have a dominant negative impact on output. The finding of our study can help policymakers to control the prices of commodities that are more harmful to the macro economy of Pakistan and allow the one that generates a positive impact.

The second objective delves even further into the impact of commodity price shocks on Pakistan's economy and provides a comprehensive analysis of the impact of these shocks on thirteen large-scale manufacturing industries of Pakistan. It investigates the differential impact of commodity price shocks on demand and supply of these industries. The result of our study shows that different commodity price shocks have a differential impact on industries. The pattern of the response of industries to energy and health price shocks has a positive and dominating impact on the supply side of industries. Whereas the food, transportation and housing price shocks have a dominating impact on industries through the demand side. Further, the education and clothing and footwear price shocks show mixed impacts on the demand and supply side. The results of our analysis provide a clear view that which type of commodity price shocks can lead to a boom and which to busts to these industries. It provides useful information to a policymaker that will help them to achieve their goals more effectively.

In the third objective, we extend the analysis confiscated in the second objective, here we focus on the dynamic transmission effects of commodity price shocks on the exports of the textile industrial chain of Pakistan. The finding of our study provides the insight that downstream industries are the most affected industries with the commodity price shocks. However, the impact of these shocks is positive. Whereas midstream industries are adversely affected by food and education price shocks. These results provide guidance to policymakers to provide subsidies to only those industries that are adversely affected by commodity price shocks. Further, the study also revealed the fact that not all commodity price shocks are bad for the export of the textile industries chain as it increases the export of some industries significantly.

Chapter 1

INTRODUCTION

Commodity price fluctuations have always been of great significance to developing economies (Abbasi et al., 2021). These economies are commonly exposed to substantial international commodity price shocks that have significant effects on macroeconomic policy and stability (Makin, 2013). However, most of the previous work on commodity prices centers on the analysis of energy price shocks, where crude oil prices gained prominent attention. There is a vast literature that investigates different aspects through with oil prices may affect an economy (Hamilton, 1983; Bernanke et al., 1997; Papapetrou, 2001; Lee and Ni, 2002; Taghizadeh-Hesary et al., 2016; McLeod, 2018; Tiwari et al.2020).

Pakistan's economy has been facing many problems since its creation. The trade balance of the country mostly remains in deficit due to higher dependency on imports. Further, the deficit in trade balance adversely affects the foreign exchange reserves of the country and Pakistan's currency continued to devaluate due to these problems. However, the worst of all problems is the increasing public debt that reached 106% of GDP in fiscal year 2020. Macroeconomic stability is a much-needed factor for Pakistan's economy. However, empirical literature shows that commodity price movements cause major turns in business cycles (Laybs et al., 2000; Davidson et al., 1997; Moore, 1988). Moreover, international commodity prices can suppress or depress economic growth (Walter, 2003; Raddatz, 2007; Bruckner and Ciccone 2010). Pakistan's economy suffers from commodity price shocks as food prices, energy, transportation, education, health, clothing and footwear, increase sharply due to many internal and external factors.

The shocks in food prices have a direct impact on the stability of food prices (Timmer, 2000). Moreover, according to the World Bank (2016) annual report, the sharp increase in food prices since 2008 has become a matter of daily unrest, struggle, and even sacrifice for more than 2 billion people. Studies have found that for Pakistan economy, food prices shocks are most significant commodity price shocks after oil price shocks (Kiani,2011; Ahmed,2011). Furthermore, economies whose total export earnings depend on a small set of commodities are more vulnerable to commodity price shocks. For example, in Pakistan, textiles account for 60% of total export earnings, so fluctuations in textile prices have a significant impact on foreign earnings, national income and terms of trade of Pakistan. On the other hand, some commodities like energy, transportation, education and health of labor are key inputs in the production process. Any shock in the prices of these basic inputs has a significant impact on the industrial production of an economy.

A comprehensive analysis of different commodity price groups is very important for the macroeconomic stability and industrial development of Pakistan's economy. It is a ray of hope that can bring Pakistan's economy out of this predicament. It is believed that industrialization can help to utilize natural resources optimally and increase the quantity and quality of production. Further, stability of the industrial sector is the best way to bring stability to the economy and reduce dependence on imports. Moreover, industrial expansion can help to expand exports and improve the foreign exchange reserves situation. There are several other benefits of macroeconomic stability, industrialization, and higher export-like increase in employment, development in other sectors, increase in investment, reduction in pressure on land, efficient use of natural resources, improvement in foreign reserves and foreign debt situation.

1.1. THEORETICAL BACKGROUND

There are different transmission channels through which different commodities prices affect an economy. The transmission channels of oil prices are the most debated channels among all commodities. Numbers of studies postulate six possible channels through which oil prices may impact an economy (Tang et al. 2009; Khan and Ahmed, 2011; Alom et al. 2014). Supply side channels work through high inflation caused by positive oil price shocks; it leads to short run reduction in output, unemployment and reduction in national output. Wealth transfer channel shows that Purchasing Power (PP) of oil exporting countries increases with increase in oil prices and PP of oil importing countries decreases. The inflation channel is the most direct channel of oil price shocks, which reflects that increases in oil price shocks increase PPI and CPI. The real balance channel postulates that as CPI increases, cost of living increases, the real balance of currency decreases, money demand increases, interest rate increases, and investment and output decrease in the short run (Tang, et al. 2010. Khan and Ahmed, 2010). Further, oil price shocks lead to sectoral readjustment, where production of oil-intensive sectors contracts with increases in oil prices and expands in other sectors. The uncertainty about oil prices shocks and its impact creates uncertainty in the economy.

Previous studies also show that food prices are responsible for slowing down economic activities through net exports and supply side channels (Alom, 2011; Khan and Ahmed, 2014). As an increase in international food prices reduces demand for food products and increases the imports bills, which in general reduces net exports. Further, when food prices increase demand for money increases and this leads to adverse effects on interest rates, investment and national output (Jongwanich and Park, 2011). Housing prices on the other hand, affect an economy through wealth and income redistribution channels (Pettinger, 2013). An increase in the prices of houses has a positive impact on aggregate demand, which is due to psychological effects, equity withdrawal effect, and increased income effect. Moreover, high house prices increase the wealth of house owners and reduce wealth and living standards for those who don't have a house (Mishkin, 2007). Further, the fall in house prices adversely affects spending and growth of an economy.

There are several studies that suggest that education and health of the population of an economy have a positive impact on economic development (Patrinos&Psacharopoulos, 2011; Bloom, et al. 2004). Therefore, high prices of education and health adversely affect the labour productivity, human development and economic growth. Moreover, transportation is a major tool for the development and globalization of an economy. There are six potential channels through which transportation affects economic development. (Helling, 1997). Transportation price shocks affect productivity and innovations of private firms, living standards, labuor and entrepreneurs supply and range of goods supply.

Commodity price shocks have been considered as wearisome for developing countries mainly due to their effects on foreign exchange earnings and the stability of these countries. However, recently the role of commodity prices in inducing inflation and transmitting macroeconomic and financial adjustments that range from changes in output and employment to changes in interest rates, money supply and exchange rates has gained a lot of attention. There are several ways in which commodity price shocks affect macroeconomic adjustments in an economy. These impacts are also considered in terms of the various theories and several related hypotheses.

The direct price hypothesis states that commodity price fluctuations affect and predicts the movements in consumer price levels (Bosworth & Lawrence, 1982;

Beckerman & Jenkinson, 1986). The indirect price hypothesis suggests that commodity prices have impacted on general price level with lag, by entering as the costs in output prices. Kaldor (1976) has postulated that industrial costs and prices have positively affected by any significant increase in commodity prices. The increase in the prices of basic inputs like raw materials and energy will be transferred through the industries value addition chains with a multiplier effect. The increase in the industrial prices initially (in short run) causes a growth of the profits in manufacturing. However, this rise in profits grounds stress for wage increases; this is what Hicks (1963) called "real wage resistance" a probable price-induced rise in wages.

On the other hand, the Kaldor-effect hypothesis states that in addition to wage and indirect price effects, the significantly large shock in commodity prices will possibly have an ability to shrink industrial activities. Commodity price inflation itself can reduce effective demand for industrial goods and have a deflationary effect in real terms for the manufacturing of industrial goods. This reduction is partly because the increase in profits may not be complemented with the increase in expenditure for producers of the primary sector. Moreover, it is partly because the governments of most economies respond through monetary and fiscal measures to control domestic inflation, which limits industrial investment and reduces consumer demand. Therefore, an increase in commodity prices, for the industrial sector can cause a spiral-type of inflation, which in consequence slows the industrial activities.

A fall in commodity prices during the recessionary phase of the business cycle may not result in a reduction in industrial activities. However, studies suggest that declines in the cost of raw materials used in the manufacturing industry tend to be offset, by and large, with real wage increases (Finger & De Rosa, 1978; Brown,1985; Beckerman & Jenkinson 1986). Consequently, there is a "ratchet effect", where commodity price increase induces inflation and reduces real output; the decline in commodity price would likely have no significant effect in the opposite direction. Essential of this hypothesis is the idea that any increase in commodity price has passed through into final product prices, but when commodity prices decline, no symmetric deflation occurs.

One aspect of analyzing the commodity prices is that different price impacts might take place, conditional on the physical nature or production source of the commodities traded. Commodity price behavior is generally disaggregated into different commodity groups, most commonly in food, agricultural raw materials, metals and minerals, and energy. Generous evidence exists for the conviction that the prices of these commodity groups have different impacts on the economic activities of countries (Laby&Maizels, 1993; Knop &Vespignan, 2014; McLeod, 2018). The shocks in food prices affect consumer prices and so the value of consumer's budgets. The increase in cost of living may consequently lead to pressure for wages increase and, where engendered, these in turn restrict the profitability of enterprises, and lead to domestic cost-push inflation. On the other hand, significant rise in consumer prices lead to more preventive inflation policies, so the result of these policies could be in form of reduced employment and output. The same consequences can follow from other groups of commodities prices. However, the fact is noted by many studies that the impact of energy prices, predominantly for oil price shocks on economic activities of an economy is much severe than any other shock of commodity prices (Darby,1982; Burbridge& Harrison, 1984; Baumeister et al. 2010; Cunado et al. 2015 &Taghizadeh-Hesary et al.2016).

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Lawrence, 1982; Beckerman and Jenkinson, 1986). The indirect price hypothesis suggests that commodity prices have an impact on a general price level with lag, by entering costs into output prices. Kaldor (1976) has postulated that industrial costs and prices have been positively affected by any significant increase in commodity prices. The increase in the prices of basic inputs like raw materials and energy will be transferred through the industry's value addition chains with a multiplier effect. The increase in industrial prices initially (in the short run) causes a growth in profits in manufacturing. However, this rise in profits grounds stress for wage increases; this is what Hicks (1963) called "real wage resistance" a probable price-induced rise in wages.

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1.2. SIGNIFICANCE OF THE STUDY

Most of the previous studies tend to assume that all commodity price shocks are the same and advocate a "one size fits all" policy response (Paulo, 2015). 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 focused on oil price shocks and postulate the possible ways through which oil prices may impact the macroeconomy (Tang et al., 2009; Khan and Ahmed, 2011; Alom et al., 2013). Whereas the impact of other commodity prices is ignored in the studies. It is important to incorporate the impact of different commodity price shocks on the macroeconomy as each commodity price shock effects differently through the different mechanisms. Several studies are available on the impact of oil prices on the macroeconomy of Pakistan (Kiani, 2011; Nazir and Qayyam, 2014; Malik, 2008; Chughtai and Kazmi, 2014; Ahmed et al, 2017; Ahad and Anwer, 2020; Khan et al.2021). However, there are limited studies that focus on the impact of different commodity prices.

Oil prices are observed as one of the major factors that affect industrial activities (Humiltion, 1983, Lee and Ni, 2002. Kumar, 2005). The initial work of Lee and Ni (2002) that investigates the impact of oil price shocks on demand and supply of fourteen major industries of US, calls for a number of researches to work on the impact of oil price shocks on industrial output (Fukunaga et al., 2011; Jimenez-Rodriguez, 2008; Schmidt and Zimmermann, 2007; Rotemberg and Woodford, 1996; Goodwin and Gisser, 1986). Several studies are available on the impact of oil prices on the overall economy and industries of Pakistan (Kiani, 2011; Nazir and Qayyam, 2014; Malik, 2008; Chughtai and Kazmi, 2014, Ahmed et al., 2017; Sarwar et al., 2020). However, to the best of our awareness, there is no valuable work that has examined the impact of different groups of commodity prices on industrial variables, especially for Pakistan.

The undeniable importance of the textile industry in the economy of Pakistan attracts researchers. There are several studies that work on the textile industry of Pakistan through different aspects. On the stream of literature focused on the comparative analysis theory for cotton and cloth production in Pakistan (Jawed et al., 2006; Ahmed and Kalim,2014 and Irshad and Xin 2017). Whereas another stream focused on the determinants of textile export (Subhani and Habib, 2008 and Sidiquie et al.,2012). The existing research also highlighted the impact of commodity prices on the textile industry (Hussain et al., 2020). However, what has been lacking in the literature is the analysis of the differences in the impacts of commodity price shocks on industrial chains and transmission mechanisms. Commodity price shocks have industrial differences and price shock is transmitted along with industries chain from upstream industries to downstream industries. To the best of our knowledge, there is no well-known study that has been conducted to examine the commodity price transmission mechanism for the exports of the textile industry chain of Pakistan.

1.3. RESEARCH OBJECTIVES

On the foundation of our above discussion, we sketch our research objectives as follows:

1. To investigate whether all commodity shocks are identical for the macro-economy of Pakistan; by disaggregating commodity price indices into seven different groups, namely food, clothing and footwear, housing, energy, transport, education, health and others.

2. To investigate the impact of commodity price shocks for the demand and supply of major thirteen large scale manufacturing industries of Pakistan.

3. To quantify the dynamic transmission effects of commodity price shocks on the exports of textile industrial chain of Pakistan.

1.4. RESEARCH QUESTIONS

Our research analysis will help to answer the following questions.

Q1. What is the impact of commodity price shocks on macroeconomic variables of the Pakistan economy?

Q2. Do all commodity price shocks have the same impact on the macroeconomic variables of Pakistan?

Q3. How to identify industrial demand and supply?

Q4. What is the impact of commodity price shocks on identified industrial demand and supply?

Q5. Whether all commodity price shocks have the same or differential impact on industries?

Q6. Are the exports of upstream Industries (USI), midstream industries (MSI), and downstream textile industries (DSI) of Pakistan affected equally by commodity price shocks?

Q7. Which commodity price shock has the most dominant impact on the export of the textile industrial chain?

It is important to incorporate the impact of different commodity price shocks on the macroeconomy as each commodity price shock affects differently through different mechanisms. However, there are limited studies that focus on the impact of different commodity prices. 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).

Furthermore, to the best of our knowledge, there is no study that addresses the impact of the above-mentioned seven groups' commodity prices on sub-sectors or industries of Pakistan. Industries are the energy of an economy; the development and stability of industries promotes the development of other sectors such as agriculture, communication and transport of an economy (Seth et al., 2016). It also allows the economy to produce a range of consumer goods at low costs and in large quantities. Therefore, by considering the importance of industries in the economy of Pakistan, this study aims to examine the impact of commodity price shocks on fourteen major industries of Pakistan. These industries include textile, food and beverages, and tobacco, coke and petroleum products; iron and steel, automobiles, fertilizer, paper and board, electronics, chemicals, leather products, engineering products, rubber products, non-metallic mineral products, and pharmaceuticals. The share of these industries in manufacturing is around 80% whereas their share in GDP is approximately 10.7%.

Lastly, the existing research mainly highlights the impact of commodity prices on macro-economy without analyzing the differences in the impacts of price shocks on industrial chains and transmission mechanisms of these industries. In Pakistan, the textile industry gives employment to 40% of the industrial labor force and adds about one-fourth of industrial value-added. Moreover, textiles have the largest share of about 60% of the total exports of Pakistan (Annual Report on Performance of Textile Industry, 2017-18). The textile industry is the most significant production industry and has the longest manufacturing chain, with the intrinsic nature of value addition at each stage of production, from cotton collection to ginning; from spinning to fabric dyeing and finishing to garments and other made-up. Therefore, commodity prices shock is transmitted into textile industry chains differently. To the best of our knowledge, there is no well-known study that incorporates the impact of commodity price shocks on the exports of the textile industry chain in Pakistan. Therefore, the main contribution of this study, in this area is that it examines the impact of commodity price shocks on the exports of the textile industry chain.

This study expects some interesting guidelines for policymakers and governments. The structure of the study suggests that commodity price shocks play an important role in affecting economic activities in Pakistan. Moreover, a comprehensive analysis of different commodity price groups is very important for the macro economy, industrial growth, and improvement in exports. Furthermore, the results of the study are expected to help policy makers to bring stability as they can make policies to control prices of those commodities which have a significant and large impact on the economy.

1.5. STRUCTURE OF THE STUDY

This study proceeds in the following way. Chapter two displays the appropriate literature review for all objectives that rationalizes the theoretical foundation of our study. Chapter three examines the impact of commodity price shocks on macroeconomic variables of the Pakistan economy. Chapter four presents the analysis of commodity price shocks and industrial demand and supply. Whereas, chapter five examines the transmission mechanism of commodity price shocks on the export of textile industrial chains. The last chapter of the study presents the conclusion and policy implications.

Chapter 2

LITERATURE REVIEW

Commodity price shocks is one of the top concerns in consumers' and businesses' decision making, as it indicates profit or loss conditional on whether they are linked with these commodities as a consumer or producer (McLeod, 2018). Commodity price trends also impact the lives of people, the profitability of a business, and affect macroeconomic policies. Garton (2008) describes that the fluctuations in the relative prices hint to the reallocation of resources among sectors and have a significant impact on real income and aggregate demand in an economy.

This chapter provides the summary of literature for the topic under consideration; it is organized in the following way: The first section of the chapter briefly describes the invention of money and different relevant theories of money, along with its relationship with prices. The understanding of the historical revolution of money helps us to understand the function of prices in an economy. The second section of the chapter discusses commodities and their different groups, along with the role of commodity prices in the economy. The third section of the chapter highlights the relationship between commodity prices and the major macroeconomic determinants. Whereas, section four describes the relationship between commodity prices and industries in light of past research. The last section of the chapter highlights the impact of commodity prices on the export of textile industry chains.

2.1. MONEY AND PRICES

Money and its value determination remain the most debatable topic in history. However, theories of the value of money do not clarify "what money is" instead, they focus more on "what money can do" (Durani and Qureshi, 2016). Classical economists like Adam Smith, J.B, Says, D. Ricardo, T. Malthus, and J.S. Mill built the first modern school of economic thought. The core theory of value by classical economists highlighted that the prices or costs of goods should be interpreted by the wages of the labor that produced those goods (Smith, 1776). Accordingly, for classical economists, the primary function of money was as a medium of exchange; due to the stability of their prices; precious metals are considered as better money materials. Smith (1776) in his book, *Wealth and Nations* describes the theory of value of money as "*the value of slandered money varies directly with the number of exchanges to be made and the frequency with which they are affected and inversely with the whole quantity of money in use and the capacity of circulation.*"

Say's law has a special place in classical economic thought; this famous law is named after the economist Jean Baptiste Say. According to Say's law, the production process of goods generates income and this income is used to create demand (Say's, 1834). The relationship between prices and money is thoroughly discussed by classical economist Ricardo. In his view, money is neutral and any changes in money affect only nominal variables like prices, wages, and exchange rates, and it does not have any long-term impact on employment and output (Ricardo, 1956). J.S. Mill contributes to classical economics thoughts with his simple and clear monetary theories. According to Mill, the value of money is determined by its demand and supply in the short run, and in the long term, it's determined by production costs (Mill, 1871).

The relationship between money and prices was first developed in a mathematical equation by Fisher and it is known as the Quantity Theory of Money (QTM). According to QTM, an increase in the money supply has a direct proportionate impact on price levels (Fisher, 1922). The QTM equation is written as

$$MV = PT$$

Where M is the money supply, V is the velocity of money, P is prices, and T is the total number of transactions in an economy during a specific period. The QTM assumed that V and T are stable and constant, so any changes in the money supply would have a direct positive and proportionate impact on prices. QTM further believed that money supply is exogenous and it is determined independently to PT and money affects only nominal income and this relationship does not exist in other ways around. However, Mises (1953) explains QTM differently because, according to him, money is never neutral. So, a change in the money supply in the Fisher equation changes all the variables, including velocity and the total number of transactions (that are assumed to be constant in the Fisher equation). Thus, the relationship between money and prices is still direct and positive, but hardly proportional.

Keynes, the prominent economist of the neo-classical school of thought, sharply criticized the description of QTM by Fisher and refused the Fisher view that money supply has no impact on the economy in the long run and it only increases prices. Keynes argued that the classical dichotomy that isolates real and nominal variables of the economy is not valid in its real spirit, and nominal variables like money and prices have an impact on real variables (Keynes, 1936). According to Keynesian economics, equilibrium in an economy cannot even exist at a full-employment level. As long as the economy is not at its full-employment level, any increase in the money supply increases output proportionality and there will be no change in prices. But once the full equilibrium level is achieved, then any increase in the money supply will not affect output and will have a direct and proportionate impact on prices.

Milton Friedman generates the modern form of QTM with the inclusion of money demand and other assets like equity, bonds, and goods. According to Friedman, both money demand and the velocity of money are quite stable. His description was inconsistent with Keynes, who argued that money demand and velocity are highly volatile. Thus, Frideman's (1956) view of QTM supports monetary policy as a useful tool for stabilization of the economy, whereas Keynes's view of QTM supports fiscal policy. The subjective theory of value and marginalism in price theory was introduced by the economists of the Austrian school of monetary economics, mainly by Carl Menger, Ludwig Von Mises, Friedrich von Wieser, and Leon Warlas. According to them, the process of pricing commodities in the market is subjected to the price of producer goods that are used to produce them, and the value of any commodity is linked with its utility at the margins.

In the barter economy with no money, the concept of price is understood by the willingness of two parties to trade off commodities on a specific ratio. For example, if two parties want to exchange or make a transaction for a certain quantity of apples (x_1) and bananas (x_2), then the ratio $\frac{x_1}{x_2}$ shows the price paid for bananas in terms of apples. However, the need for markets, its discipline, and its forces lead to the creation of money. This natural evolution of money is later on regulated by governments that serve the role of creators and issuers of money (Durani and Qurashi, 2016).

After the creation of money, price theory addresses the issues of production and transfer of value of goods and services when two parties want to make transactions. The main concern of price theory is why some products are so cheap and why some goods are so expensive? The famous Diamond- Water Paradox. Adam Smith (1776) explains that the value of any good is derived from its scarcity and the use of labor in its production. The monetary value of a commodity, in Adam Smith's view, is related to the value of money used in transactions. He solved the Diamond-Water Paradox by noting that diamond extraction is more labor-intensive, so it is more expensive.

Carl Menger, Walras, and W. Stanley provide a different resolution of the Diamond-Water Paradox based on marginal utility linked to a commodity. Menger (1871) explains that the marginal utility of water decreases gradually with the consumption of each extra glass of water, but not the utility of diamonds. Stanley (1881) further suggests that it is the employment of labor and supply of certain commodities that indicates the eagerness of people's need for that commodity and this eagerness of demand decides the price of that commodity. Moreover, Walras (1874) explains that in an exchange economy, the price of any commodity is linked to the value of that commodity. As long as there exists excess demand for any commodity, its market price tends to increase. The excess supply of any commodity decreases the value and price of that commodity. This process of adjustment is known as Walras Tatonnement. Due to his mathematical presentation, clarity, and precision of his subject, Walras is recognized as the father of general equilibrium theory.

In the market, economic prices play a central role in the allocation of resources. Prices give signals for shortage and surplus in markets. If there is a shortage, prices of commodities tend to increase and as a result, demand decreases, and high prices give incentive to reduced supply. At the same time, surplus decreases prices and supply and increases demand (Nicholas, 2011). Prices act as the invisible hand in the market economy and allocate the resources where they're needed (Weber, 2012). There is no doubt that prices have a special role to play in an economy. However, there are some limitations. In the case of externalities, prices do not present the true value of commodities and could over or underestimate it (Richard and Sandler, 1986). Moreover, prices may lead to unfair distribution of resources. For example, in the case of drought, the price of water could increase and make it difficult for some people to have enough of it. Likewise, in the presence of monopolies, high prices reflect monopoly power, not the shortage of supply, and thus lead to allocative inefficiency (Sickles and Zelenyuk, 2019).

2.2. COMMODITIES AND PRICES

Commodities are basic economic goods or services that are fungible, hard assets, and are interchangeable with the same type (Karl Marx, 1997). The history of commodities contains the history of man's civilization. The existence of human life on earth, the survival of societies, the prosperity of nations, and the development of civilization depend on the human capacity to control commodities. The ability to control basic commodities is necessary for the survival of nations and those who couldn't vanish. The stages of man mastery over basic commodities are still linked with the history of man civilization "*The Stone Age*, "*The Braze Age*", "*The Iron Age*" (Chaudary and Chaudary, 1985). History also witnessed that most of the battles were fought for basic commodities, like gold, water, oil, and other precious metals. When Franciso Pizarro first discovered the gold mountain in South Africa in 1524, his conquerors destroyed the whole Incan civilization that came their way (Rowe, 2006).

In the 19th century, the eagerness to control commodities like precious minerals and metals led to the first deadly Anglo-Boer war (Nasson, 2010). The 20th century of the "*Hydrocarbon Age*" became a turning point of man's control and his ability to use natural resources. Further, the 21st century of the "*Nuclear Age*" also was ready to see the hunger of international players for the possession of commodities. Thus, analysis of history suggests that commodities always had an important role to play in developing the wealth, and fate of nations, and commodities will continue to play this role in the future.

According to their nature and specific characteristics, commodities are divided into two broad groups' primary and secondary commodities (Spraos, 1980). Primary commodities are those commodities that are extracted from natural resources directly and not processed and do not have a specific standard; their quality depends on the originated area and its environment (Redetzki, 1990). On the other hand, secondary commodities are those commodities that are processed and in processing, they use primary commodities (Collier, 2003). For example, cotton is a primary commodity and cloth made through it is a secondary commodity. Furthermore, services are also commodities that are traded in the market with value addition and differentiation (Bailey et al, 2000). However, services can't be priced uniformly across the world as the prices of primary and secondary commodities.

Primary commodities are further divided into three subgroups; non-fuel commodities, industrial inputs, and energy (IMF, 2019). Non-fuel commodities are further divided into three categories, namely edibles, food, and beverages. Whereas industrial inputs are divided into agriculture, raw materials, and metals. Energy is divided into petroleum and other products. According to the National Bureau of Economic Research (1938) secondary commodities are divided into sixteen sub-groups namely food and kindred products, paper and paper products, forest products, printing, publishing and allied industries, chemical and allied products, products of chemical and coal, rubber products, leather and its manufacturing, stove, clay and glass products, iron and steel products, non-ferrous metal and their products, machinery not including transportation equipment, transportation equipment, air, land, water and railway repair shops and miscellaneous industries[1]. The sixteen groups of secondary commodities were also allocated to five broad categories by Kuznet (1938). These categories include finished products, construction materials, servicing, unfinished products, and products that belong to more than one category. Some of the services are added to secondary commodities. Whereas, the Bureau of Labor Statistics (1980) divides services into household services, transportation services, medical care, residential services, and others.

In the market economy, the price of commodities is determined by their demand and supply. Alfred Marshall (1980) first developed the theory of demand and supply. Where demand is based on consumer preferences, supply is determined by the cost of production. The movement of prices, in fact, leads to equilibrium in the market (Paul Samuelson, 1966). If there is excess demand, prices tend to increase, which encourages producers to increase supply and thus, gradually, this price movement adjusts supply and demand to equilibrium.

There is a vast amount of literature in economics that addresses commodity prices from different aspects. The study of commodity prices starts with the work of Singner (1950) and Prebisch (1950). Prebisch-Singner hypothesis states that in the long run, primary commodity prices decline relative to secondary commodity prices and thus deteriorate the terms of trade and economic growth of primary commodity importing countries (Harvey et al., 2010). This hypothesis earned the prime attention of researchers during the 1950s to 1970s. However, later on, substantial amounts of research on commodity prices focused on properties and major determinants of commodity prices (Borensztein and Reinhart, 1994; Grilli and Yang, 1988; and Kim et al., 2003). Studies have found that real interest rates, total factor productivity, unconditional demand of

[1]This classification of secondary commodities was based on the census of manufacturing 1929.

commodities, traded supply of commodities, and monetary policy are the major determinants of commodity prices (Arango et al., 2011; Baffes and Etienne, 2016; Frankel and Rose, 2009). The recent literature on commodity prices focused more on the cycle of commodity prices (Alquist and Coibion, 2014; Reinhart, 2016; Drehmann et al., 2012, and Gruss, 2014). The main objective of the research of the cycles of commodity prices, booms and busts is to understand their duration and magnitude as a solid understanding of these cycles helps to bring stability to the economy (Neil et al., 2018).

The review of the literature suggests that commodity prices have remained a prominent topic for researchers throughout history. However, what has been lacking is the analysis of the "different groups" of commodity prices. All commodity prices are not alike; according to the nature and use of commodities; each commodity price has a different level of impact on the economy. There is limited literature that analyzes the impact of different groups of commodity prices. Moreover, these studies were mostly focused on oil prices. There is much literature that investigates different aspects through which oil prices may affect an economy (Hamilton, 1983; Bernanke et al., 1997; Papapetrou, 2001; Lee and Ni, 2002; Taghizadeh-Hesary et al., 2016; McLeod, 2018). However, some studies investigate the impact of oil and food prices on the economy (Heady and Fan, 2008; Alom, 2011; Abott et al., 2009; Jongwanich and Prak, 2011; Khan and Ahmed, 2011). Moreover, there are studies on the impact of housing prices on investment and economic growth (Miller et al., 2011; Compbell&Cocco, 2007; Buiter, 2008). However, the comprehensive study of different groups on commodity prices remain neglected. So, this study aims to fill this gap and takes into account seven different groups of commodity prices, namely, food, clothing and footwear, housing, energy, education, transportation and health and others, and study their impact on the economic activities of Pakistan.

2.3. COMMODITY PRICES AND MACRO ECONOMY

Fluctuations in commodity prices imply significant challenges for the macro-economy of nations. Shocks in commodity prices are frequently related to macroeconomic volatility (Céspedes and Velasco, 2012). By using a real business cycle model for a small open economy, Mendoza (1995) shows that approximately one-half of the variation 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.

Macroeconomic variables are the main signals of the health and trends of an economy. The stability of macroeconomic variables is very critical for consumers, producers and governments (Wang and Le, 2018). Governments analyze, study and understand macro variables to better macro-manage an economy as these variables indicate the sources of economic growth, inflation and recession (Mügge, 2016). Moreover, macroeconomic variables help firms and investors to make their decisions efficiently. There is a variety of literature that investigates the impact of macro-economic variables on a firm's stock returns (Naik, 2013; Jamil and Ullah, 2013; Adarmola, 2012). Furthermore, macro variables like prices, interest rates, unemployment and income affect consumer demand (Weber, 1975). So, in short, the sustainable economic development and growth of an economy rely heavily on the stability of macroeconomic variables.

There are huge empirical and theoretical studies that show the impact of commodity prices on macroeconomic activities. However, among all commodities, oil has no doubt received the most attention. Since the pioneering work of Hamilton (1983), a number of studies shows that oil prices affect macroeconomic variables through the channels of demand and supply (Burbidge and Harrison, 1984; Mork, 1989; Bernanke et al., 1997; Papapetrou, 2001; Killian, 2006; Peersman and Robays, 2009 & 2012; Baumeister et al., 2010; Cunado et al., 2015; Taghizadeh-Hesary et al., 2016).

Studies on the impact of oil price shocks can further be divided into three categories (Tang et al., 2010). The first category contains studies that have examined the impact of high oil prices on output and inflation (Gisser and Goodwin, 1986; Lee et al., 1995; Hooker, 1996; Pappetrou, 2001). These studies give a common view that any significant increase in oil prices leads to a reduction in aggregate output and also accelerates inflation. The second category contains studies from the 1970s to the 1990s that have investigated the nature of the relationship between commodity price shocks and macroeconomic variables. However, most of these studies were focused on developed countries and tried to explore whether the relationship among oil price shock and macro-economic activities are symmetric or non-symmetric, linear or non-linear (Mory, 1989; Lee et al., 2001; Lee and Ni, 2002; Lardic and Mignon, 2008). The third category of study has focused on the role of macroeconomic policies in response to commodity price shocks (Leduc and Sill, 2004; Haung et al., 2005; Cologni and Manera, 2008). These studies suggest that the relationship between commodity prices and macro variables may be weakened due to the active role of monetary and fiscal policy. Moreover, some of the studies also found that oil price shocks (mainly positive) badly affect the terms of trade of oil-importing countries, their exchange rate, real money balances and its demand, interest rate, and real GDP growth (Huset et al., 2008 and Mork, 1994).

Among all macroeconomic variables, the relationship of inflation with commodity prices earns the prominent attention of researchers. There are several channels through which commodity prices are linked with inflation (Chenng, 2009). Firstly, the increase in commodity price reflects the increase in the demand for commodities, and thus promotes inflation. Secondly, most of the commodities are used as inputs in the production process. If the increase in commodity prices is sufficiently large and persistent, then it affects inflation, as producers pass the high cost of inputs to final goods price. Thirdly, as most of the commodities are storable, the demand for inventories is influenced by the expected future price of commodities. Lastly, if commodities are treated as financial assets, then the price of commodities becomes the main indicator for determining inflation as their rate of return incorporates expected inflation (Tkacz, 2007; Chenng, 2009).

Most of the studies on commodity prices and their link with inflation were done during the late 80s and 90s (Cody and Mills, 1991; Boughton and Branson, 1991; Blomber and Harris, 1995). These studies differentiate between the direct and indirect impact of commodity prices on inflation. The direct impact works through commodity prices that are part of CPI like food and energy; any change in the prices of these commodities directly affects inflation. The indirect effect works through inflationary expectations that are mainly formed due to changes in the prices of core commodities (Gilbert, 1990). Furthermore, the literature showed that the strength of the relationship between commodity prices and inflation depends on the nature of the shock in commodity prices and the response of monetary policy. Moreover, some of the studies have found that the link between commodity prices and inflation has weakened over time (Furlong and Ingenito, 1996; Blomber and Harris, 1995; Morre, 1992). There are several reasons for this relationship to be weakened like changes in monetary policy, inflation targeting, shifts in production to low commodity-intensive products, and real wage rigidities (Blanchard and Gali, 2008).

International trade extended the impact of commodity prices on all trading countries. The history of the link of domestic inflation to international commodity prices is as old as the history of international trade itself. Studies have found that there are different channels through which international commodity prices affect domestic inflation.

Firstly, domestic prices of final commodities are affected by imported input prices. Secondly, the demand for imported goods from domestic consumers. Thirdly, change in demand behavior and income of exporters. Lastly, by the availability of exporTables domestically (Kravis and Lipsey, 1977; Mussa et al., 2000; Jongwainch and Park, 2011: Hanif et al., 2017). Furthermore, the impact of commodity prices on inflation is found to be different for commodity-exporting and commodity-importing countries. An increase in commodity prices leads to deterioration of terms of trade of commodities-importing countries and hampers their economic growth. Whereas, for commodity-exporting countries increase in commodity prices is a signal for economic growth, and improvement of terms of trade (Vespignan, 2014; Aponte, 2016; Mcleod, 2018).

A number of studies on the impact of commodity prices on macro-economic variables are devoted to co-integration analysis (Labys and Maizels, 1993; Hua, 1998; Awokuse and Yang, 2003; Cheung and Morin, 2007; Hamori, 2007). Further, some of the studies are focused on the impact of uncertainty associated with commodity prices, especially with energy prices (Jo, 2012, Basher et al., 2013, Huang et al., 2005). However, some studies are focused more on commodity prices rather than uncertainty. Charnavoki and Dolado (2014) using the VAR model for quarterly data over the period 1958Q2 to 2008Q3, examine how commodity price shock affects the trade balance and exchange rate for commodity-exporting countries. They find that commodity price shocks positively and significantly affect the trade balance and appreciate the exchange rate. This relationship between commodity prices terms of trade and exchange rate is recognized as "commodity currency effect". Vasishtha and Maier (2013) examine the impact of different international shocks, including commodity prices, on macro-economic variables of Canada. The findings of their study suggest that the Canadian economy is exposed to commodity price shocks and positive commodity shocks that are beneficial for the economy. However, these benefits are limited by the reduction in global economic activity (due to high commodity prices) tempering demand for Canadian exports. Silva (2011) examines the relationship between commodity price shocks and real GDP, domestic inflation and interest rate. The study used SVAR methodology for monthly data over the period Jan 2001 to Jan 2011 for the subset of Latin American countries and found that a positive price shock increases real GDP, domestic inflation and interest rate in the short run. Whereas, McLeod (2018) examines the aggregate level impact of commodity prices on the Canadian economy using SVAR methodology for the period Feb 1997- March 2016. The results of the study suggest that an increase in commodity prices increases inflation, interest rate and exchange rate significantly.

There are quite a few studies that have investigated the impact of commodity prices on the macroeconomy of developing countries. Farzanegan and Markwardt (2009) analyze the impact of oil price shocks on major macroeconomic variables for Iran. Using the VAR approach, their study finds that inflation and production (mainly industrial) are significantly affected by oil prices. In contradiction, Iwayemi and Fowowe (2011) find that oil price shocks don't affect any macroeconomic variable of Nigeria. The results of their study were consistent with the study of Olomola and Adjumo (2006). However, Kuwait studies provide evidence of a strong impact of oil prices on macro-economic variables, especially on government spending (Al-Awadi, 2001). Furthermore, Raguindin and Reyes (2005) show that a positive oil shock reduces the domestic growth of the Philippines's economy; moreover, the impact of negative oil price shocks seems to be larger than the impact of a positive one. Tang et al. (2012) found evidence that positive oil price shocks negatively affect investment and output in China. However, it has a positive impact on interest rates and inflation, and the real effects of oil price shocks are more persistent than the nominal effects for China.

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 payments, the government's budget and cause inflation (Malik, 20018). 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 prices depends on the share of oil prices in GDP, the ability to fulfill the requirements of oil imports, domestic production of oil, and investment of the private and public sectors in oil production. The findings of Nazir and Qayyam (2014) are consistent with Chughtai& Kazmi (2014). Using Cobb-Douglas production function for annual data for the period 1972 to 2011, their study provides evidence of a long-run relationship between oil prices and economic growth.

Fawad Ahmed (2013) shows the link between oil prices and the unemployment rate for Pakistan. This study suggests that an increase in oil prices significantly increases the input cost and total production cost and consequently increases the unemployment rate. Using monthly data over the period Jan 1991 to Dec 2010, a study found that oil prices have a significant impact on unemployment and concludes that oil prices can be used for forecasting the unemployment rate. Moreover, Kiani (2011) finds that an increase in oil prices 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. 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. (2007) 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. Further, international commodities were grouped into three categories, namely oil inflation (petroleum crude oil); food inflation (contains seven food items), and metal and cotton inflation. The study also examines the impact of global prices on overall inflation as well as on core inflation, food inflation, non-food inflation, and administrative prices in Pakistan[2]. The study's findings show that global inflation has a strong positive impact on domestic inflation in Pakistan for all commodities except for meat. Further, the overall inflation response is more towards petroleum products compared to metal and cotton prices and food prices. There is a direct causality that runs from international food inflation to food inflation in Pakistan and from global oil prices to core inflation. Moreover, a 1% increase in international oil prices increases administrative price inflation by about 2% points in one year.

The impact of international food and oil prices on major macroeconomic variables of Pakistan is examined by Khan and Ahmed (2011). Using SVAR methodology, their study suggests that international prices of food and oil have a significant impact on inflation, output, interest rates and the real effective exchange rate of Pakistan. 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 of the study provide evidence of the impact of international food prices on domestic food inflation of Pakistan and among the food group, manufactured food commodities exhibited inflation persistence.

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[2]About one eight of CPI basket commodities prices are administered by the government.

The reviewed literature shows that there are several studies for developed and developing countries that examine the impact of commodity prices on macroeconomic 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 four major macroeconomic variables, namely output, CPI, interest rate and exchange rate for Pakistan.

2.4. COMMODITY PRICES AND INDUSTRIES

The industrial revolution that began in Great Britain in the 18th century transformed the rural agriculture economies of Europe and America into urban industrialized economies (De Vries, 1994). The very old "cottage textile industry" of Great Britain transformed into new textile factories with the innovation of power looms, spinning jenny, water frame, and flying shuttle. This industrial revolution spread to the rest of the world in the 1830s and 1840s. This spread witnessed a massive increase in industrial demand, mainly due to an increase in income, a fall in the prices of industrial goods, an increase in population, and a change in taste (Mokyr, 1977). Further, the increase in industrial demand led to the demand-induced expansion in the supply of industrial goods, which was accomplished with the help of technological improvements, accumulation of capital, and improvement in quality of organization and institutions (Fine and Leopold, 1990).

The recognition of industrial development as a major source of economic development opens up new aspects for research of determinants and sources of industrial development. Industrial developments depend on many macroeconomic factors like the availability of efficient inputs, aggregate output, the role of government, aggregate money supply, and the role of monetary policy (Rodrik, 2006). The adequate and efficient supply of industrial production depends on the availability of efficient labor, technology and capital. Artur Lewis's model of economic development believes in an unlimited supply of labor. According to Lewis, there is an inverse relationship between the cost of labor and industrial production. However, studies have found that this relationship also depends on the rate at which the agriculture sector withdraws labor (Mellor, 1995; Poonyth et al., 2001; Byerlee, 2009; McMillan et al., 2017).

Capital is also an important factor in industrial production. According to Solow's growth model savings are an important component of growth and capital accumulation. Studies have found that there is a positive relationship between saving, capital accumulation and industrial production (Bustos et al., 2020; Khan,2017; Narula and Dunning, 2000; Balassa, 1980). Moreover, the government plays an important role in the determination of industrial development. Since the government is the central body that controls crucial macroeconomic variables like gross domestic product, inflation, exchange rate, and interest rate. All these variables determine the path of industrial production. Studies have found that government policies play a significant role in the production and development of the industrial sector (Lall, 1994; Sanjaya, 2004; Rodrik, 2006; Gabriele, 2010; Cheah and Ho, 2020). Another stream of literature examines the impact of monetary policy on industries. Monetary policy is responsible for the control of money supply, interest rate, and exchange rate. It indirectly controls and affects aggregate demand, production and employment. Studies have found that monetary policy has significantly impacted production in industries (Hammed, 2020; Ketabfoorush et al., 2020; Kutu et al., 2016; Ubi et al., 2012; Borio, 1997).

Reviewing the literature on oil price shocks revealed that researchers differentiate between different types of oil price shocks like oil supply shock, oil demand shock, and shocks due to change in aggregate demand (Kilian,2009; Chen, 2019). Oil is always treated as an important factor in production; therefore, an increase in the price of oil resulting from oil supply shock increases the marginal cost of production for industries (Zhong et al., 2019). Moreover, to maximize their profits, producers of these industries offset the effect of this high production cost by increasing the price of their final products, resulting in cost-driven inflation in an economy (Qian et al., 2014). Thus, the more the industry is oil intensive, the more its Producer Price Index (PPI) is affected by oil price shocks (Tasi, 2015).

The oil price shock resulting from shocks in aggregate demand increases the PPI simultaneously across industries. However, trade openness and dependence on exports are vital factors causing the differential impact of oil price shocks on industries (Chen, 2009; Tang, 2014). Further, shocks in oil prices that are dominated by shocks in aggregate demand also increase the cost of industrial production and increase PPI. Moreover, industries that are more oil-intensive are more vulnerable to these shocks. However, some industries that are located closer to the supply chain of the oil industry are more active in oil market derivatives and can be in a better position to adjust their inventories in advance. So, their PPI would be less affected by the increase in oil price shocks (Tan et al., 2015).

After the seminal examination of Hamiltion (1983), a large number of studies were conducted to investigate the impact of oil prices on the economy through different aspects. However, the VAR model stands out in this context and is used extensively by researchers. Burbidge and Harrison (1984) first employed the VAR model to analyze the impact of oil prices on the macroeconomy of America. The study found that oil prices affect Gross

National Product (GNP) and employment level significantly. Mork (1989) examined the impact of oil prices on the macroeconomy of seven OECD countries using VAR. Later on, Papepetrou (2001) showed the significant impact of oil prices on Greece's industrial returns and employment. Kumar (2005) used the VAR model to examine the impact of oil price shocks on Indian industries for quarterly data over the period 1971-Q1 to 2004-Q3. The study found that there is an inverse relationship between oil price shocks and industrial growth. Thus, a 100% increase in oil prices decreases industrial growth by 1%. Moreover, the variance decomposition results show that oil price shocks combined with monetary shocks account for the largest variation in industrial production.

Kilian and Vigfusson (2009) introduced the VAR model to examine the impact of oil price shocks on the USA economy by employing regression models that provided consistent and efficient estimators indifferently for the degree of asymmetry of oil price shocks. Using annual data over the period 1973 to 2007 study found that oil prices have a differential impact on overall industrial production. The study also showed that the commonly used asymmetric VAR model for oil price shocks was misspecified and led to inconsistent and biased results. Fukunaga et al. (2010) decomposed the oil price shocks into demand and supply-side shocks for Japan and the USA. The study used the VAR model over the period 1973 to 2008 and examined the impact of oil shocks that were caused by a disturbance in supply from the oil market and by a change in global demand for oil. The results of the study showed that shocks in oil prices from the supply side impacted as negative supply shocks for oil-intensive industries of Japan and the USA. Whereas, for less oil-intensive industries this shock impacted a negative demand shock. For the USA, the demand shock of oil impacted as a negative supply shock, whereas, for most of the industries of Japan it impacted as a positive demand shock. Whereas, Scholtens and Yurtsever (2012) examined the impact of oil price shocks on industries of the Euro region over the period 1983 to 2007. Using dynamic VAR study found that asymmetric oil price shocks had a differential impact on industries. Moreover, Chen et al. (2019) investigated the relationship between oil price shocks and industrial growth in China using VAR and Granger Causality tested for monthly data over the period 2000 to 2017. The study found that different types of oil shocks affected the Chinese economy differently. Whereas, the impact of negative shocks was largest and more significant.

The introduction of the structural VAR model by Lee and Ni (2002) for examining the impact of oil demand and supply shocks on industrial demand and supply shifted the interest of researchers from VAR to SVAR models. After Lee and Ni (2002) the work of Kilian (2006) on the SVAR model and its employment for the analysis of oil demand and supply shocks on global economic activities became the benchmark for the use of SVAR models. Hereafter, a large stream of literature employed SVAR models to investigate the impact of oil price shocks on macroeconomy and industries.

Lee and Ni's (2002) study is among one of the most prominent studies that investigated the impact of oil price shocks on fourteen large-scale industries of the USA using the SVAR model. These industries are petroleum industry, chemical industry, paper, rubber and plastic products, nonferrous metal, apparel industry, household appliances, electronics industry, construction machinery, office and computing machinery, automobile, household furniture, lumber products, iron and steel and metals industries. The study used different data set from 1959 to 1997, the results of the study showed that for oil-intensive industries like petroleum and chemical industries oil price acts as a negative supply shock. Oil price shocks did not significantly affect the supply of the petroleum industry however, its PPI did significantly increase. The results also showed that the demand of the petroleum industry was price inelastic in the short run. Moreover, the supply of the chemical industry decreased, and its PPI increased significantly with positive oil price shocks. Whereas, the study observed the largest response of oil price shocks for the automobile industry as the demand curve of this industry shifted inwards substantially. However, the demand for large-size cars decreased more drastically than the demand for small-size cars. The results of impulse response function are also consistent with these findings.

Lippi and Nobili (2008) employed the SVAR model to examine the impact of oil price shocks on USA industries for annual data over the period 1973 to 2007. This study provided an interesting explanation for the reduction in the strength of oil price shocks that affected USA industries. According to the study oil price shocks still decreased the industrial production in the USA however, the shocks in oil prices originated from the demand side acted as the positive demand shocks for USA industries and increased the overall demand for industrial commodities. Thus, the negative impact of oil supply shocks had been offset by positive demand shock. Jeo et al. (2012) used the SVAR model to investigate the impact of oil price shocks on five major industries of China. These industries were the petroleum industry, natural gas extraction industry, chemical industry, non-metallic minerals products and petroleum processing industry. Using the annual data over the period 1973 to 2007 study showed that positive oil price shocks had a positive impact on the profits and investment of petroleum and gas extraction industries. Whereas, positive oil price shocks negatively affected the profits and investment of petroleum processing industries. However, the study found that chemical and non-metallic minerals industries had not been affected by oil price shocks.

Jayakumar et al. (2018) disaggregated the oil price shocks into oil demand, oil supply and oil-specific demand shocks. The study used quarterly data over the period 1996-Q1 to 2014-Q4, using SVAR model study found that oil supply shocks negatively affect the industrial production of India. Whereas, oil demand shocks had a significant and larger impact on the Indian economy as compared to oil supply and oil specific demand shocks. Jo et al. (2019) re-examined the study of Lee and Ni (2002) using the two new data sets one from Jan 1972 to Sep 1997 and the other from Feb 1972 to Feb 2017. The results of Jo et al. (2019) were quite consistent with the results of Lee and Ni (2002). However, the strength of the impact of oil price shocks on USA industrial demand and supply decreased over time for several reasons. Firstly, the input cost share of oil in USA industries decreased over time. Secondly, the share of imported oil in total consumption oil consumption reduced the impact of international oil price shocks on USA industries. Thirdly, change in technology and innovations of new sources of energy. Fourthly, the change in response of monetary policy towards oil price shocks. Finally, the nature and structure of USA industries changed significantly over time.

Chen and Zhu (2019) based on the SVAR model examined the impact of oil price shocks on the PPI of Chines industries for monthly data over the period Oct-1996 to June 2017. The study showed that positive oil supply shocks negatively affected the PPI Chines industries. Whereas, the positive oil demand shocks positively affected the PPI and industrial demand. According to the study oil intensity and export dependence were the major determinants for the impact of oil price shocks on Chines industries. Further, the variance decomposition analysis suggested that oil demand shocks had a larger impact on PPI.

Along with VAR and SVAR models, studies also used some other methodologies to investigate the impact of oil price shocks on industries. Wang and Zhang (2014) examined the impact of international oil price shocks on Chines industries using the ARJI-GARCH model. The four fundamental industries were the oil fats industry, grain industry, metal industry and petrochemical industry. The study disaggregated the international oil price shocks into positive and negative shocks and jump shocks. Results of the study showed that different types of oil price shocks had different impacts on Chinese industries. However, the negative oil price shocks had the largest impact on all industries. Whereas the petrochemical industry was found to be most sensitive to oil price shocks and the grain industry was least sensitive. Further, the petrochemical and oil price industry responded sharply to oil price jumps. Zhang and Chen (2014) using ARMA and GARCH model explored the relationship between oil price shocks and Chinese industries. The study disaggregated oil shocks into expected, negatively expected and unexpected oil price shocks. The results of the study showed that unexpected oil price shocks turned out to be more complex after 2007. Seth et al. (2016) examined the impact of oil price shocks on production, raw material cost and sales turnover of selected Indian industries using the Ordinary Least Square (OLS) technique for annual data over the period 2005 to 2014. Oil price shocks significantly affected the "production" of coke, petroleum and chemical industry and "raw material cost" of the food processing industry and fertilizer industry.

Unfolding all the previous studies for Pakistan on the topic under discussion, it is safe to say that there is no well-known study that examined the impact of commodity price shocks on the industrial level in Pakistan. However, like other developed and underdeveloped countries, studies have been directed to examine the impact of energy prices on industries through different expects. Ahmed et al. (2017) study is among one the prominent studies on the impact of oil price shocks on industrial production of six major large-scale industries of Pakistan. The Paper and Board industry are among the important industries that contribute significantly to the GDP growth of Pakistan. The engineering industry is the key to development and efficiency, the stability of this industry is crucial for the economy of Pakistan. The iron and steel industry links directly to the better and improved infrastructure. Whereas the textile industry is the backbone of Pakistan's economy and is a major commodity export industry. The petroleum industry is the frontline industry of Pakistan and it depends heavily on the international oil price as Pakistan is a net oil importer of oil. The study also incorporated the automobile industry as only oil is used as the fuel for automobiles and there is no substitute for oil. Using the monthly data over the period July 2000 to June 2015 study employed the VAR model and found that the paper and board industry, petroleum industry and textile industry were efficient and not affected by oil price shocks. Whereas, automobile industrial production and iron and steel production was found to be quite sensitive to the change in oil prices.

Ahmed et al. (2018) examined the impact of gas prices on the industrial production of Pakistan. The study used selected industries namely cotton cloth, yarn, glass, cement, cotton cloth, nitrogen fertilizer, phosphorus fertilizer, sheet iron and synthetic fiber and paper and board industry. Using VAR model over the monthly data over Jan 2010to Sep 2017. The study revealed that gas prices impacted industrial production only in the short run. In the long run, there was no significant impact of gas prices on Pakistan's industries. The reason behind this result was that gas prices are more stable and less volatile as compared to oil prices. Further, most of the natural gas is produced in Pakistan. So, global fluctuation in gas prices does not affect Pakistan's domestic gas price. Moreover, the government takes control of the regularity of gas prices so it does not experience unexpected jumps, unlike oil prices.

There is very limited literature on the impact of oil price shocks on the industries of Pakistan. However, one stream of literature examines the impact of oil prices on industries stock returns. Siddiqui (2004) examined the impact of oil price shock on the industrial returns of Pakistan. Using the ARDL model for annual data over the period 1970 to 2003 study found a positive relationship between oil price shocks and industrial stock returns. Arshad and Bashir (2015) examined the impact of oil and gas prices on the stock returns of textile, fertilizer and chemical industries of Pakistan. The study used monthly data from Jan 2009 to Dec 2013 and employed panel regression methodology and multifactor model and found that oil price shocks negatively affected the stock returns of textile and chemical industries. Whereas, gas price shocks only affected textile industry stock returns. The study also found that macroeconomic variables like exchange rate and inflation also affected industries stock returns in Pakistan. Waheed et al. (2017) investigated the impact of oil price shocks on a firm's level returns in Pakistan. The study used panel data estimation over the period 1998 to 2014 and found that level oil price change negatively affected the stock returns of chemical, textile and miscellaneous industries. Whereas, the lagged oil price affected the stock returns of all industries except jute, tobacco and vanaspati industries. According to the study, the oil price is an important indicator that investors should keep in mind while taking the investment decision in Pakistan industries stocks.

The review of the above literature suggests that oil price shocks are treated as the major and sole commodity shocks that affect the industry's demand and supply. Oil is no doubt the main source of energy that plays an important role in industrial production and economic growth, and thus, the fluctuation in oil prices significantly affects economies. However, the strength of the impact of oil price shocks depends on many factors like oil intensity in production, the share of oil imports in total domestic consumption, monetary policy, government support, and efficiency of industries. Moreover, there are some other factors that directly or indirectly contribute towards industrial production and are ignored by researchers. Transportation prices directly affect the supply and demand decisions of industries and must be incorporated into industrial analysis. Moreover, education and health price shocks also indirectly affect industries through the channel of investment in the most important factor of industrial production, "human capital". Likewise, entrepreneurs' and consumers' decisions about industries' supply and demand, respectively, also take into account the impact of overall food, clothing and shelter prices. The shocks in these different groups of commodity prices have influenced the production and consumption decisions of industries and are ignored by the researcher by limiting them to oil price shocks. Thus, this study is aimed to fulfill this gap by taking into account the impact of seven groups of commodity prices on the demand and supply of fourteen large-scale industries of Pakistan.

2.5. COMMODITY PRICES AND TEXTILE INDUSTRY OF PAKISTAN

Many of the scholars studied the commodity price shock transmission mechanism from the perspective of macroeconomy (Lee and Ni, 2002; Jimenes- Rodriguez, 2008; Liu and Jiang, 2010; Qian et al., 2014; Tsai, 2015 and Su, 2015). However, commodity price shocks have industrial differences and price shocks are transmitted along industry chains from upstream industries to downstream industries.

Gao et al. (2018) developed a new perspective of the industry chain to examine the internal relationship among the metal industry chain for China. Their study analyzes the direct and indirect impact of international metal prices on the output of metal industry chains. The results of the study show that metal price shocks have a significant impact on midstream and upstream industries, whereas the downstream industry is not directly affected. Moreover, international metal price shocks have spillover effects and their strength weakens, as transmitted on industries prices, along the industry chain from upstream to downstream industries.

To the best of our knowledge, there isn't any well-known study that is conducted to examine the commodity price transmission mechanism for the exports of the textile industry chain of Pakistan. The textile industry is the major contributor to the export of Pakistan (Javed, 2019). The year 2018-19 witness improvement in the export of textile with ready-made garments and hosiery accounting for Rs. 544 billion of total trade. Whereas, nylons, socks and other off-the shelf clothes contribute 24% of total revenue from exports. Other major contributors are bed sheets and pillow covers with a revenue share of 18%; cotton clothes with a revenue share of 9% and cotton thread with a revenue share of 5% (Gallup, Survey Statistics, 2019).

The literature on the export of the textile industry of Pakistan is mainly focused on the determination of textile export. Subhani and Habib (2008) examine the determinants of the textile export performance of Pakistan. The study finds that an increase in export intensity, export market development, past export performance satisfaction, pricing strategy adaptation, export intensity and firms' commitment to exporting have a significant impact on expected short run textile export performance. Sidiquie et al. (2012) used co-integration analysis to find out the major determinants of the export demand of the textile sector of Pakistan. Results of the study suggest that income and trade openness are the major determinants of Pakistan. A further significant positive relationship has been found between the exchange rate and textile export and between CPI and textile export.

Hussain et al. (2020) investigate the supply-side factors that can affect the export performance of Pakistan. The study used annual data over the period 1971 to 2014 with ARDL model to find out short and long run impacts. Results revealed that relative prices and cost of production have a significant and larger impact on the export of value-added manufacturing like textiles. Moreover, domestic demand and production capacity are the prominent determinants in LR, whereas, the cost of production and production capacity and relative prices have a significant impact in the short run.

One stream of literature focused on comparative advantage (CA) and revealed comparative analysis (RCA) for the textile industry of Pakistan. Hanif and Jafri (2008) used RCA for annual data over the period 1974-2004 to examine the export performance of the Pakistan textile industry. The results of their findings provide evidence that external finance affects the competitiveness of industry both in the long run and in the short run. Ahmed and Kalim (2014) used annual data from 1980 to 2011 and employed the RCA method for overall textile export and clothing export of Pakistan. It noted that Pakistan has a high comparative advantage in textile exports and a low comparative advantage in clothing exports. The study also found that the Pakistan textile industry did not get the benefits of the elimination of the quota regime. Irshad and Xin (2017) employed CA analysis and found that although Pakistan's exports do not play much significant role in world trade. It had CA in the export of clothing and overall textile export. Maqboll et al. (2020) examine the competitiveness of textile export of Pakistan. It employs different measures of RCA and found that Pakistan has a comparative advantage in textile export and also in textile import.

Domestic and foreign shocks can affect the export performance of any industry. Afzal (2012) examines the impact of electricity shocks and positive interest rate shocks on the performance of the textile industry of Pakistan. The study found that interest rate shocks had a dominant impact as compared to electricity shortage shocks. Iqbal et al. (2017) aimed to highlight the impact of the energy crisis on the Pakistan textile industry. It uses annual data over the period 2000 to 2015 and employed OLS method. The study found that the energy crisis leads to a negative impact on the return on assets and return on equity of the textile industry of Pakistan. Abdul (2017) examines the impact of domestic and foreign shocks on textile exports of Pakistan. Domestic shocks include interest rate, output and inflation and exchange rate shocks. Foreign shocks include oil supply, financial, and income shocks in the international market. The study employs the SVAR model for monthly data over the period 2003-2016. It found that a positive shock in international output positively affects textile exports. Whereas, negative financial and oil supply shocks negatively affect the export of the textile industry of Pakistan. In the case of domestic shocks, inflation and output response positively, whereas, interest rate and exchange rate caused a negative response.

Overall, a review of the literature advocates that oil price shocks have gained dominant attention in the examination of the relationship between commodity prices and economic performance at every level. Moreover, there is a majority of literature available on the impact of oil prices on macro-economic variables and industrial performance. However, most of this literature is focused on commodity-exporting countries. There is no well-known study that has incorporated the impact of a different group of commodity prices. Likewise, the analysis of the impact of commodity prices on the industrial chain and transmission mechanism needs to be explored. Therefore, given these gaps, this study will incorporate seven groups of commodity prices and will examine their impact at the macro and industrial levels. Moreover, this study will contribute to the existing literature and investigate the effect of commodity price shocks on the exports of the textile industry chain of Pakistan.

Chapter 3

COMMODITY PRICES AND MACRO ECONOMIC VARIABLES OF PAKISTAN

3.1.INTRODUCTION

Shocks in commodity prices are frequently related to macroeconomic volatility (Céspedes and Velasco, 2012). Macroeconomic variables are the main signals of the health and trends of an economy. The stability and the cost related to the volatility of macroeconomic variables is very critical for consumers, producers and governments (Wang & Le, 2018). It is generally recognized that fluctuations in macroeconomic variables result in reduction of investment and output growth and increases 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 variation 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.

Commodity price shocks have been considered as wearisome for developing countries mainly due to their effects on foreign exchange earnings and the stability of these countries. However, recently the role of commodity prices in inducing inflation and transmitting macroeconomic and financial adjustments that range from changes in output and employment to changes in interest rates, money supply and exchange rates has gained a lot of attention. There are a number of ways in which commodity price shocks affect macroeconomic adjustments in an economy. Most of the studies only focused on oil price shocks and postulate the possible ways through which oil prices may impact the macro economy (Tang et al. 2009; Khan and Ahmed, 2011; Alom et al. 2014). Whereas, the impact of other commodity prices is ignored in the studies.

Food prices play an important role in an economy and are responsible for slowing down economic activities through net exports and supply side channels (Alom, 2011; Khan and Ahmed, 2014). Housing prices on the other hand, affect an economy through wealth and income redistribution channels (Pettinger, 2013). An increase in the prices of houses has a positive impact on aggregate demand, which is due to psychological effects, equity withdrawal effect, and increased income effect. Moreover, high house prices increase the wealth of house owners and reduce wealth and living standards for those who don't have a house (Mishkin, 2007). Further, the fall in house prices adversely affect aggregate spending and growth of an economy. Moreover, education and health of the population of an economy have a positive impact on economic development (Patrinos&Psacharopoulos, 2011; Khattak and Khan, 2012; Bloom, et al., 2004). Therefore, high prices of education and health adversely affect the labour productivity, human development and economic growth. Moreover, transportation is a major tool for the development and globalization of an economy. Transportation price shocks affect productivity and innovations of private firms, living standers, labor and entrepreneurs supply and range of goods supply (Helling, 1997).

It is important to incorporate the impact of different commodity price shocks on macro economies as each commodity price shock effects differently through different mechanisms. 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).

On the foundation of our above discussion, we sketch our research objectives as follows:

1. To investigate whether all commodity shocks are identical for the macro-economy of Pakistan; by disaggregating commodity price indices into seven different groups.

This study aims to address the following research questions;

Q1. How commodity price shocks affect macroeconomic variables of Pakistan economy?

Q2. Do all commodity price shocks have the same impact on the macroeconomic variables of Pakistan?

This study proceeds in the following way. Section two explains data and methodology. Section three presents the results of the estimation, their interpretation, and significance. Section four concludes the study.

3.2.DATA AND METHODOLOGY

This study will use monthly data over the period July 2008 to June 2020. This study aims to employ the Structural VAR model in order to examine the relationship between commodity prices and macro-economic activities in Pakistan.

3.2.1.DATA

This study will use data from seven groups of commodity prices namely clothing and footwear (cpcf), energy(cpe), education (cpedu), food (cpf), health (cphel), housing(cph), transport (cpt) price. The macroeconomic variables we want to include in the study are

Gross Domestic Product (y), Consumer Price Index (cpi), Interest rate (rate) and Exchange rate (er).

3.2.1.1.FOOD PRICES

Food group includes the prices of three sub-groups, namely food and non- alcoholic beverages[3]; alcoholic beverages and tobacco[4], restaurants and hotels[5]. The weight of Food group in Consumer Price Index (CPI) is 37.48% which shows the importance of this group. Moreover, for lower middle-income countries like Pakistan food prices are a matter of great concern as Pakistan spends a large portion of her income on food items. Further, food prices play an important role in any economy; an increase in food prices tends to increase imports that in result decrease net exports and lead domestic output to fall. Moreover, the increase in international food prices leads to a reduction in demand for exports, net export earnings, and national income (Alom, 2011). Furthermore, high food prices lead to increase in money demand and can raise interest rates that in result creates a hostile effect on investment and exchange rates (Khan and Ahmad, 2011).

3.2.1.2.CLOTHING AND FOOTWEAR PRICE

This group includes the price of clothes and footwear. The role of clothing and footwear commodities has shifted far away from a basic human need. For Pakistan, expenditure share on clothing and footwear is more than 10% (HIES, 2015-2016). Whereas, the clothing industry adds more than 60 percent of the export earnings of the country. Therefore, an increase in the price of textile increases the net earnings of the economy and improves the balance of payment situation.

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[3]Food and non- Alcoholic beverages include the price of 39 basic food commodities.
[4]Include the price of cigarettes and betel leaves and nuts.
[5]Include price of ready-made food.

3.2.1.3.HOUSING PRICE

Housing includes the price of two sub-groups, namely the price of housing[6] and furnished household equipment, and maintains[7]. In recent years, housing prices have played a fueling role in economic activity. Rising house prices generally encourage consumer spending through the wealth effect and lead to higher economic growth. However, a cycle of falling house prices is expected to discourage investment and construction of new houses, consequently slowing down economic activities (Miller et al., 2011).

3.2.1.4.ENERGY PRICE

Energy group includes the price of water, electricity, gas and other fuels[8]. Energy prices are very closely examined by policy makers and economic units. Energy is one of the most important inputs for firms. It is also a substantial item for households' transportation and heating expenditures. Theoretical literature has pointed out six channels through which oil price shocks affects the macroeconomic variables (Jones et al., 2004; Tang, et al., 2010; Khan and Ahmed, 2011). These channels contain the inflation effect, sector adjustment effect, supply-side effect, wealth transfer effect, real balance effect and the psychological effect.

3.2.1.5.EDUCATION PRICE

Education group includes price of education. The price of education has been on an increasing trend since the 1980s. According to the *"National Center for Education Statistics"* the average cost of the 2017-2018 academic year for a private university was

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[6]Includes house Rent, construction input item price and Construction Wage Rate.
[7]Includes price of Furniture, Household Textile, Household Equipment, Utensils, Plastic Products, Washing Soap & Detergent, Sewing Needle, Dry Cell, Household Servant, Marriage Hall Charges.
[8]Include price of Water, Elect, Gas and other Fuels, Kerosene Oil, Fire Wood Whole.

roughly doubled from the average cost of the 2015-2016 academic year for a public university. Psacharopoulos and Patrinos (2011) estimate that, on average, welfare losses in terms of per capita GDP due to one-year deficiency in schooling range from 7 to 10 percent of per capita GDP. Moreover, education has a strong link to the economy; it improves human capital and labour productivity, future earnings and growth of the economy (Barro, 1991; Patrinos and Psacharopoulos, 2011).

3.2.1.6.TRANSPORTATION PRICE

It includes the price of transportation[9]. Transportation on average has 15% of the total expenditures share of the household. Moreover, transportation has accounts for about 4% of the total costs of production of each unit of output (Faridi et al., 2011). Furthermore, the price of transportation has major impact on every field of human life like production, trade, education, research, entertainment, defense, and culture.

3.2.1.7.HEALTH AND OTHERS PRICE

This group includes price of four sub-groups, namely health[10], communication[11], recreation and culture[12] and miscellaneous[13]. Healthcare has always been considered as an economic activity; societies invest their time and resources in it, and they have trade for it (van Velden, 2005). Therefore, healthcare prices have important consequences for the economy. Several studies like McNamara et al. (2010); Tompa (2002) and Bloom and Canning (2000) show that the child health has a positive impact on human capital and economic development. Moreover, in the area of technology communication price also have

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[9]Include price of Motor Vehicle, Motor Vehicle Accessories, Motor Fuel, Mechanical Service, Motor Vehicle Tax and Transport Services.
[10]Includes price of Drug Medicine, Medical Equipment, Doctor (MBBS) Clinic Fee and Medical Test.
[11]Postal Services and Communication & Apparatus.
[12]Includes price of Recreation & Culture, Text Books, News Papers and Stationery.
[13]Price of Personal Care Cosmetics, Blades and Personal Equipment.

significant impact on economic activities. Furthermore, expenditure on recreation and culture are part of daily life; shocks in their prices affect the household expenditure behavior, aggregate demand, and thus GDP (Loomis and Walsh, 1997).

3.2.1.8.MACRO ECONOMIC VARIABLES

Following the work of McLeod (2008), the macroeconomic variables we want to include in the study are Gross Domestic Product (y), Consumer Price Index (CPI), Interest rate (rate) and Exchange rate (er). GDP suggests the size and health of the economy; economists use GDP as a main indicator to determine whether an economy is experiencing a recession or boom and how fast an economy is growing (Hobijn, 2009). However, monthly data of GDP is not available for Pakistan's economy; therefore, following the work of Khan and Ahmed (2011) and Alom et al. (2013) we will use monthly industrial production as a proxy for GDP. Monthly published Quantum Index of Manufacturing data by State Bank of Pakistan (SBP) has been used for this purpose. Inflation is another important macroeconomic variable; there are different theories that describe how inflation affects an economy. Quantity Theory of Money (QTM), suggests that inflation has no role to play with real variables in the economy. However, the Keynesians opposed this view, and advocated inflation effectiveness on aggregate demand, investment, employment and output through the channel of interest rates. Moreover, Neo-Keynesians take a Keynesian view in the short-run and a classical view in the long-run. Interest rate is the price of money at which goods or money today may be traded off for goods or money tomorrow. It is an important policy instrument and has an important influence on inflation (Sensier, 2002). Further, in the long run, interest rates determine capital accumulation and potential economic growth (Turner, 2014). Similarly, the exchange rate is also considered as important variable for an economy. The exchange rate affects trade and financial flows and the rate of inflation in many direct and indirect ways (Hamilton, 2018). Exchange rate also affects an economy's GDP; an exchange rate appreciation leads to sluggish GDP growth and depreciation accelerates it (Rodrik, 2008).

3.2.2: DESCRIPTIVE STATISTICS

In order to get a better understanding of the data, we have performed its descriptive analysis. Table 3.1 below shows the descriptive statistics of commodity prices and macro-economic variables of Pakistan.

Table 3. 1:Descriptive statistics of macro-economic variables

Variable	Mean	Median	Max	Mini	SD	Skewness	Kurtosis	Obs
Cpcf	196.13	208.24	298.90	107.37	55.36	-0.10	1.80	144
Cpe	170.90	170.58	251.68	106.96	38.70	0.26	2.18	144
Cpedu	194.35	191.12	304.61	103.85	65.07	0.33	1.78	144
Cpf	204.92	217.04	289.35	117.76	44.33	-0.34	2.32	144
Cph	193.49	204.26	283.97	108.45	49.53	-0.12	1.93	144
Cphel	169.34	174.17	236.92	105.44	35.48	-0.02	2.15	144
Cpt	176.39	177.39	239.97	119.93	29.67	-0.08	2.59	144
Y	123.78	123.69	175.16	83.23	19.68	0.44	2.81	144
Cpi	187.93	194.94	271.17	112.35	42.48	-0.03	2.20	144
Rate	11.25	11.19	15.54	7.60	2.26	-0.20	1.73	144
Er	104.23	101.74	165.10	70.59	22.08	1.26	3.92	144

Note:This Table shows the descriptive statistics of commodity price of clothing and footwear (cpcf), commodity price of energy(cpe), commodity price of education (cpedu), commodity price of food (cpf), commodity price of health (cphel), commodity price of housing(cph), commodity price of transport (cpt), output (y), consumer price index (cpi), interest rate (rate) and exchange rate (er).

Table 3.1 shows that the average of all commodity price indices is positive. The food price index witnessed the highest average, of 204.94. Whereas, the average output (y) is about 123.78. The interest rate mean value is 11.25% and the average monthly exchange rate mean is 104.23. The "max" and columns of Table 3.1 show that the education price index has the highest value of 304.61 and it was recorded in March 2020. The main causes of this increase in education prices were a reduction in the fiscal budget for education; an increase in private school fees; an increase in government college and government engineering university fees, and double digit increase in government medical college fees. The SD column shows that among all groups of commodity prices education price shows highest variation, whereas, transportation prices show least variation for the period of our analysis.

3.2.3.GRAPHICAL ANALYSIS

The graphical analysis of the food price index has been presented in Figure 3.1 below. Food prices in Pakistan show an upward trend for the period of our analysis. However, food prices increased sharply after July 2019, mainly due to supply side disturbance resulting from covid-19 situation, hoarding and high transportation cost. Further, the climate change and shifts in weather patterns badly affect minor crops. Figure 3.2 shows that energy prices also follow a smooth upward trend. However, from July 2018 to November 2019 this upward trend is sharper and afterwards it becomes stable and witnesses slight reduction. Oil prices reduced to 60% in international oil market during first six months of year 2020 due to covid-19 situation that caused a massive closure of industries, services, and tourism worldwide. However, the share of oil sector in total energy consumption of Pakistan is decreasing with time and the share of renewable, hydro and nuclear energy has increased significantly in year 2019 and 2020. Moreover, the increase in electricity consumption by households causes upward pressure on electricity and overall energy prices. Therefore, even after the sharp fall in oil prices, overall energy prices did not reduce with the same magnitude in Pakistan.

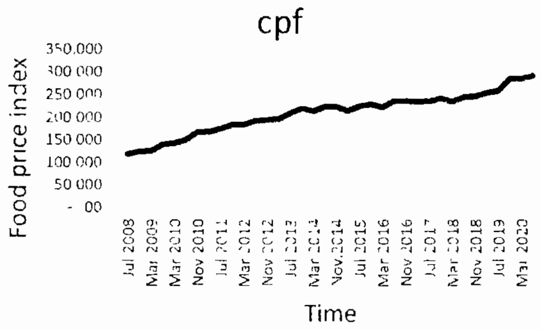

Figure 3.1: Food price index

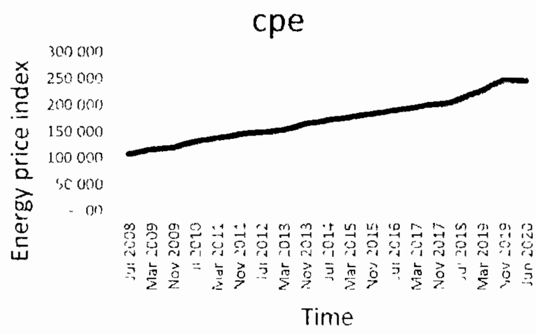

Figure 3.2: Energy price index

Figure 3.3 below shows that the education price index follows an upward trend for the period of our analysis; especially after July 2017, there was a sharp upward movement. This increase was mainly attributing to inadequate education financing, inefficient policies, lack of enforcement of rules and regulations, failure of equitable implementation of policies, increase in

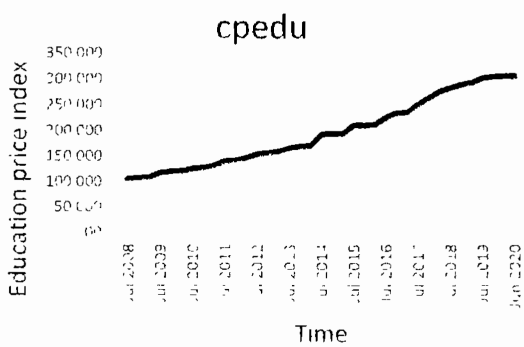

Figure 3.3: Education price index

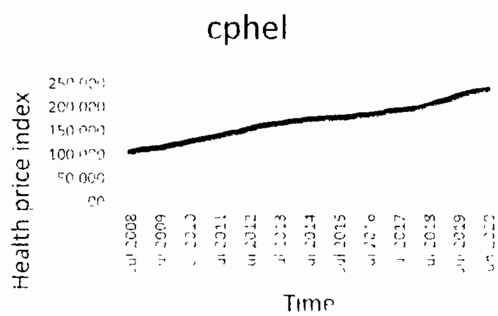

Figure 3.4: Health price index

administration costs, and increase in cost of living. Figure 3.4 shows that health prices also have an upward trend that is caused by supply gaps and high demands; depreciation of the rupee that makes imports of basic inputs for medicines and other health care more expensive and increase in cost of domestic raw materials.

Figure 3.5 below shows that housing prices in Pakistan are increasing over time. There are several possible reasons for that, like low investment from government in housing, complex method of side development, monopolies of small group of property developer, high immigration from Afghanistan and overpopulation. Figure 3.6 shows the graphical analysis of transportation price index and it shows that there was a sharp increase in transportation after march 2019 due to covid 19 situation that leads to smart lock down in Pakistan and off and on closures of public transport creates uncertainty and increase in demand when business is open for work. However, transportation prices start to decrease after March 2020.

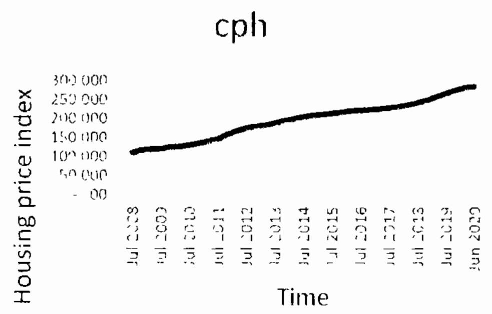

Figure 3.5: Housing price index

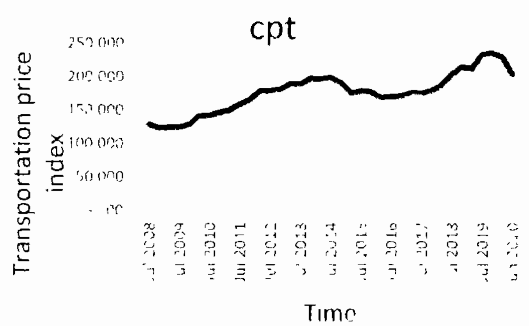

Figure 3.6: Transportation price index

Figure 3.7 shows that clothing and footwear prices have a smooth upward trend. Whereas, Figure 3.8 shows that interest rate in Pakistan follows a downward trend after November 2008 until June 2018. However, interest rate starts to increase after July 2018 due to increase in policy rate by State Bank of Pakistan (SBP) and conditions of liquidity in the interbank market. Further, in response to a reduction in policy rates in March 2020, interest rates also started to reduce.

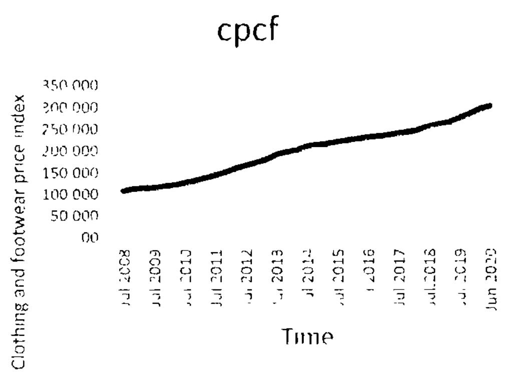

Figure 3.7: Clothing and Footwear price

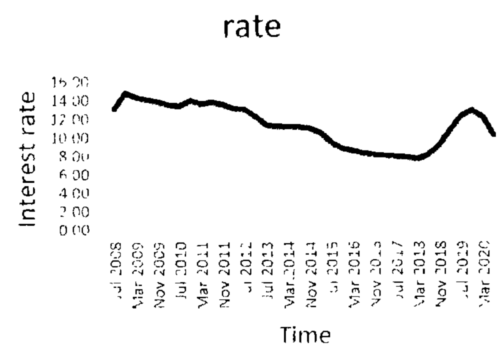

Figure 3. 8: Interest rate

Figure 3.9 below shows that aggregate prices like other groups of commodity prices, follow an upward trend for the period of our analysis. Figure 3.10 shows the graphical analysis of the exchange rate of Pakistan. It can be observed from figure 10 that after March 2018 interest rate of Pakistan starts to increase. There are many factors that lead to this increment like high domestic inflation rate, balance of payment deficit, increase in government debt, instability of policies and performance, increase in primary deficit and covid-19 situation.

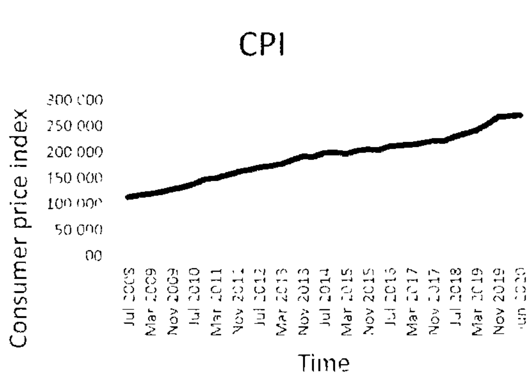

Figure 3.9: Aggregate prices

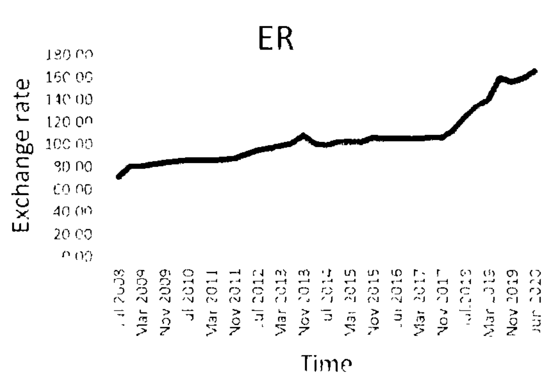

Figure 3.10: Exchange rate

Figure 3.11 below shows the graphical representation of monthly Quantum Index of Manufacturing data represents as output. It can be observed from the figure below that output follows a seasonal pattern, and it falls around September to November each year and reached its peak around March each year. This fall in production was mainly due to the harvesting season of cotton crop as cotton and textile are the major industries of Pakistan during its harvesting season industrial production reduces and after that it starts to increase. Further, output experienced a decline after April 2019 due to the covid-19 pandemic.

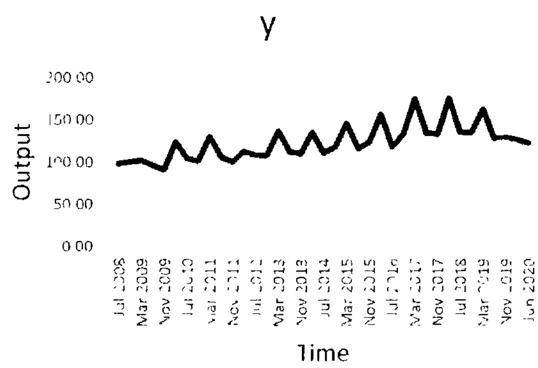

Figure 3.11: Output

The graphical analysis of commodity prices and macro-economic variables shows that the covid-19 situation adversely affects almost all the industries. So, in order to account for the impact of covid-19 shocks, we will add the dummy of covid from April 2019. Further, in order to capture the impact of seasonality, we added the seasonal dummy for the two months of November and March.

3.2.4.METHODOLOGY

This study aims to employ the Structural VAR model in order to examine the relationship between commodity prices and economic activities in Pakistan. Sims (2002) defines the SVAR model in econometrics as *"it allows us to predict the effect of 'interventions' deliberate policy actions, or changes in the economy or in nature of known types"*. The SVAR models developed by Sims &Zha (1995) have four key applications. First, they examine the mean impact of the quantified one-time structural shock on the variables of the model. Second, they can measure the average influence of a certain structural shock to the inconsistency of the data, as they permit the estimation of forecast error variance decompositions. Third, SVAR models can provide past decompositions to measure the aggregate influence of each structural shock on the progression of every variable over time. Finally, SVAR models permit the creation of forecast states restricted by the theoretical classifications of future structural shocks (Kilian, 2013).

The VAR model has been extensively used by researchers, but it has limitations such as being incompetent to designate current correlations and not considering economic theory. Centered on the prevailing economic theory, the SVAR model can build the current correlation between variables, which can efficiently recognize intrinsic structural errors. Moreover, compared with the other models, SVAR model can more precisely describe the dynamic impact of commodity price shocks and is more in line with economic reality. The simultaneous equation model is another model of the same class, but it is better suited for policy simulations (Gottschalk, 2001). Whereas, SVAR models are useful tools to analyze the dynamics of a model by subjecting it to an unexpected shock.

The SVAR model can be expressed as in equation 3.1

$$A_0Y_t = A_1Y_{t-1} + \cdots + A_pY_{t-p} + Bu_t \qquad (3.1)$$

Where y_t is a (n × 1) vector of macro economic variables and A is (n × n) matrix of coefficients of macro variables that capture the contemporaneous relationship between variables. Whereas, $u_t$is a (n × 1) vector of the structural economic shocks and p shows lag order of macro economic variables. The VAR model are really sensitive to the lag order. The lag length helps to determine the long-term impact of variables on each other. However, studies found that the greater lag length[14] creates the problem of multicollinearity and reduces degree of freedom (Arshad &Ahmed, 2011; Tang, et al.

[14]Mostly studies show greater than 11 lag shows these problems.

2010; Wooldbridge, 2006). It is further assumed that model residuals are linearly related with structural shocks where B is(n × n) matrix of coefficients showing the impact of structural shocks. The vector of the structural economic shocks has property that u_t is white noise with zero mean and variance covariance matrixΩ. Moreover,for estimation of the structural model we need to derive its reduced-form and for that we pre-multiply both sides of the SVAR model equation (1) byA_0^{-1}.

By pre-multiply both sides of the model byA_0^{-1} we get

$$Y_t = A^{-1}C\ (L)Y_{t-p} + A^{-1}B\mu_t \qquad (3.2)$$

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 lag operator.We can write equation 3.2 as

$$C(L)Y_t = A^{-1}B\mu_t \qquad (3.3)$$

And

$$A^{-1}B\mu_t = \epsilon_t \qquad (3.4)$$

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

$$A^{-1}\mu_t = \epsilon_t \qquad (3.5)$$

Or

$$A\epsilon_t = \mu_t \qquad (3.6)$$

Standard estimation methods like OLS permits us to attain consistent estimates of the reduced form parameters, the reduced form errorsε_t 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 will also use Augmented Dickey-Fuller (ADF) model for unit root test in order to check the stationarity of data. For below equation the unit root hypothesis can be written as;

$$\mu_t = A_1\mu_{t-1} + \gamma_t \quad (3.7)$$

The hypothesis is;

$H_0: A_1 = 0$ Stationary (not unit root)

$H_1: A_1 \neq 0$ Non-Stationary (unit root)

If a series had a unit root (null hypothesis cannot be accepted).

The construction of SVAR model for our macro analysis follows the work of Mecleod (2018), Aponte (2016) and Arshad and Ahmed (2011). Whereas, macro-economic variables include commodity prices (cp), GDP (y), consumer price index (inf), interest rate(rate) and exchange rate (ER). The real GDP data for Pakistan economy is not available on monthly bases therefore following Arshad and Ahmed (2011) we will use industrial production as a proxy for aggregate output.

3.2.5.IDENTIFICATION OF SVAR MODEL

There is no consensus among researchers on the exact number of macro-economic variables that can fully describe the economy. Different studies use different macro-economic variables. However, we are using the most commonly used variables in our SVAR model. Further, we will estimate our macro SVAR model separately for each group of commodity prices. Therefore, we need to impose separate restrictions for each commodity price.

3.2.5.1.FOR ENERGY PRICES

The identification of restriction of our SVAR model used information-based approach. The maximum number of parameters are 25[15] and maximum number of independent movements in the co variance matrix is 15[16]. Thus, our model required at least 10 fully identified restrictions.

Commodity Price equation

$$cpe_t = \beta_1 cpe_{t-p} + \mu_e \quad (3.8)$$

Aggregate output equation

$$y_t = \beta_2 y_{t-p} + \beta_3 cpe_{t-p} + \mu_y \quad (3.9)$$

Aggregate price setting equation

$$inf_t = \beta_4 inf_{t-p} + \beta_5 y_{t-p} + \beta_6 cpe_{t-p} + \mu_{inf} \quad (3.10)$$

Interest rate equation

$$rate_t = \beta_7 rate_{t-p} + \beta_8 cpe_{t-p} + \beta_9 inf_{t-p} + \beta_{10} y_{t-p} + \mu_{rate} \quad (3.11)$$

Exchange rate equation

$$er_t = \beta_{11} er_{t-p} + \beta_{12} cpe_{t-p} + \beta_{13} y_{t-p} + \beta_{14} inf_{t-p} + \beta_{15} rate_{t-p} + \mu_{er} \quad (3.12)$$

In the energy price group oil prices got the highest weight and oil prices are assumed to be set exogenous to the macro-economic variables of small open economy like Pakistan (Jo et al. 2019; Sims and Zha, 1998). Therefore, by keeping in view this fact, we are taking energy prices as exogenous in our model. In the equation of aggregate output, we assumed that the goods market is independent of movement in the money market and that money is

[15] : N^2=25

[16] $N(N+1)/2$

neutral. Thus, 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) aggregate price equation includes energy prices and output. Whereas, the interest rate equation takes into account the impact of all macro-economic variables except exchange rate following the fact that the impact of interest rate on exchange rate is more dominating than the impact of exchange rate on interest rate (Arshad and Ahmed, 2011). The exchange rate is most endogenous in our model and it responds contemporaneously to energy, aggregate output, cpi and interest rate shocks. The above system of equation can be express 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 total 10 zero restrictions to estimate our macro-economic SVAR model. Thus, total 15 parameters will be estimated with 15 independent movements of covariance matrix and our model is just identified.

3.2.5.2.FOR FOOD PRICES

Commodity Price equation

$$cpf_t = \beta_1 cpf_{t-p} + \mu_f \tag{3.13}$$

Aggregate output equation

$$y_t = \beta_2 y_{t-p} + \mu_y \tag{3.14}$$

Aggregate price setting equation

$$inf_t = \beta_3 inf_{t-p} + \beta_4 y_{t-p} + \beta_5 cpf_{t-p} + \mu_{inf} \tag{3.15}$$

Interest rate equation

$$rate_t = \beta_6 rate_{t-p} + \beta_7 cpf_{t-p} + \beta_8 inf_{t-p} + \beta_9 y_{t-p} + \mu_{rate} \quad (3.16)$$

Exchange rate equation

$$er_t = \beta_{10} er_{t-p} + \beta_{11} cpf_{t-p} + \beta_{12} y_{t-p} + \beta_{13} inf_{t-p} + \beta_{14} rate_{t-p} + \mu_{er} \quad (3.17)$$

The above system of equations is similar to energy price with one change that our aggregate output equation does not include food price as it is not directly related with production. The above system of equation can be written in matrix form as follows;

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

We have imposed total 11 zero restrictions to estimate our macro-economic SVAR model. Thus, total 14 parameters will be estimated with 15 independent movements of covariance matrix and our model has on over identified restriction.

3.2.5.3.FOR HOUSING PRICES

Commodity Price equation

$$cph_t = \beta_1 cph_{t-p} + \beta_2 y_{t-p} + \beta_3 rate_{t-p} + \mu_h \quad (3.18)$$

Aggregate output equation

$$y_t = \beta_4 y_{t-p} + \mu_y \quad (3.19)$$

Aggregate price setting equation

$$inf_t = \beta_5 inf_{t-p} + \beta_6 y_{t-p} + \beta_7 cph_{t-p} + \mu_{inf} \quad (3.20)$$

Interest rate equation

$$rate_t = \beta_8 rate_{t-p} + \beta_9 cph_{t-p} + \beta_{10} inf_{t-p} + \beta_{11} y_{t-p} + \mu_{rate} \quad (3.21)$$

Exchange rate equation

$$er_t = \beta_{12} er_{t-p} + \beta_{13} y_{t-p} + \beta_{14} inf_{t-p} + \beta_{15} rate_{t-p} + \mu_{er} \quad (3.22)$$

The housing assets are forward looking, so their prices react instantly to macroeconomic situation of an economy. Studies found that housing prices reacted immediately to production activities (Woodford, 2002). Further interest rate also has significant impact on housing price (Su et al., 2019). Therefore, equation 1.18 includes the impact of aggregate output and interest rate. However, the exchange rate equation does not include the housing prices as we did not find any evidence of impact of housing prices on exchange rate. The rest of the restrictions are similar to oil price model.

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

Thus, total 15 parameters will be estimated with 15 independent movements of covariance matrix We impose total 10 zero restrictions to estimate our macro-economic variables matrix for housing prices. So, our model is perfectly identified.

3.2.5.4.FOR TRANSPORTATION PRICES

Commodity Price equation

$$cpt_t = \beta_1 cpt_{t-p} + \mu_t \tag{3.23}$$

Aggregate output equation

$$y_t = \beta_2 y_{t-p} + \beta_3 cpt_{t-p} + \mu_y \tag{3.24}$$

Aggregate price setting equation

$$inf_t = \beta_4 inf_{t-p} + \beta_5 y_{t-p} + \beta_6 cpt_{t-p} + \mu_{inf} \tag{3.25}$$

Interest rate equation

$$rate_t = \beta_7 rate_{t-p} + \beta_8 cpt_{t-p} + \beta_9 inf_{t-p} + \beta_{10} y_{t-p} + \mu_{rate} \tag{3.26}$$

Exchange rate equation

$$er_t = \beta_{11} er_{t-p} + \beta_{12} cpt_{t-p} + \beta_{13} y_{t-p} + \beta_{14} inf_{t-p} + \beta_{15} rate_{t-p} + \mu_{er} \tag{3.27}$$

The transportation price is assumed to be exogenous in our model ad it determines by the demand and supply of transportation and depends on many other factors like fuel price, capital, operational cost, depreciation cost, maintains cost and lubricants (Shain et al., 2009). The aggregate output equation considers transportation cost as most of the industrial activities involve the movements of labor, raw materials and finished products from one place to other (Redding and turner, 2015; Paulley et al., 2006). The rest of restrictions are similar to energy prices.

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

We have imposed total 10 zero restrictions to estimate our macro-economic SVAR model. Thus, total 15 parameters will be estimated with 15 independent movements of covariance matrix and our model is perfectly identified.

3.2.5.5.FOR EDUCATION PRICE

Commodity Price equation

$$cpedu_t = \beta_1 cpedu_{t-p} + \mu_{edu} \tag{3.28}$$

Aggregate output equation

$$y_t = \beta_2 y_{t-p} + \beta_3 cpedu_{t-p} + \mu_y \tag{3.29}$$

Aggregate price setting equation

$$inf_t = \beta_4 inf_{t-p} + \beta_5 y_{t-p} + \beta_6 cpedu_{t-p} + \mu_{inf} \tag{3.30}$$

Interest rate equation

$$rate_t = \beta_7 rate_{t-p} + \beta_8 cpedu_{t-p} + \beta_9 inf_{t-p} + \beta_{10} y_{t-p} + \mu_{rate} \tag{3.31}$$

Exchange rate equation

$$er_t = \beta_{11} er_{t-p} + \beta_{12} cpedu_{t-p} + \beta_{13} y_{t-p} + \beta_{14} inf_{t-p} + \beta_{15} rate_{t-p} + \mu_{er} \quad (3.32)$$

The education price is taken as exogenous in our model. However, the aggregate output production equation incorporates the impact of education prices as the positive relationship between education, economic growth and productivity is well known in literature (Barro, 1991; Patrinosand Psacharopoulos, 2011; Otalu and Anderu,2015).

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

We have imposed total 10 zero restrictions to estimate our macro-economic SVAR model. Thus, total 15 parameters will be estimated with 15 independent movements of covariance matrix and our model is perfectly identified.

3.2.5.6.FOR HEALTH PRICE

Commodity Price equation

$$cphel_t = \beta_1 cphel_{t-p} + \mu_f \quad (3.33)$$

Aggregate output equation

$$y_t = \beta_2 y_{t-p} + \mu_y \quad (3.34)$$

Aggregate price setting equation

$$inf_t = \beta_3 inf_{t-p} + \beta_4 y_{t-p} + \beta_5 cphel_{t-p} + \mu_{inf} \quad (3.35)$$

Interest rate equation

$$rate_t = \beta_6 rate_{t-p} + \beta_7 cphel_{t-p} + \beta_8 inf_{t-p} + \beta_9 y_{t-p} + \mu_{rate} \quad (3.36)$$

Exchange rate equation

$$er_t = \beta_{10} er_{t-p} + \beta_{11} cphel_{t-p} + \beta_{12} y_{t-p} + \beta_{13} inf_{t-p} + \beta_{14} rate_{t-p} + \mu_{er} \quad (3.37)$$

Our SVAR model with health price does not include health price in aggregate output equation as it is not directly related with production. The above system of equation can be written in matrix form as follows;

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

We have imposed total 11 zero restrictions to estimate our macro-economic SVAR model. Thus, total 14 parameters will be estimated with 15 independent movements of covariance matrix and our model has on over identified restriction.

3.2.5.7.CLOTHING AND FOOTWEAR PRICE

Commodity Price equation

$$cpcf_t = \beta_1 cpcf_{t-p} + \mu_{cf} \quad (3.38)$$

Aggregate output equation

$$y_t = \beta_2 y_{t-p} + \mu_y \quad (3.39)$$

Aggregate price setting equation

$$inf_t = \beta_3 inf_{t-p} + \beta_4 y_{t-p} + \beta_5 cpcf_{t-p} + \mu_{inf} \quad (3.40)$$

Interest rate equation

$$rate_t = \beta_6 rate_{t-p} + \beta_7 cpcf_{t-p} + \beta_8 inf_{t-p} + \beta_9 y_{t-p} + \mu_{rate} \quad (3.41)$$

Exchange rate equation

$$er_t = \beta_{10} er_{t-p} + \beta_{11} cpcf_{t-p} + \beta_{12} y_{t-p} + \beta_{13} inf_{t-p} + \beta_{14} rate_{t-p} + \mu_{er} \quad (3.42)$$

We treat clothing and footwear price as exogenous. Further, we don't add clothing and footwear prices in aggregate output as it doesn't have direct impact on production. The above system of equation can be written in matrix form as follows;

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

We have imposed total 11 zero restrictions to estimate our macro-economic SVAR model. Thus, total 14 parameters will be estimated with 15 independent movements of covariance matrix and our model has on over identified restriction.

3.3.RESULTS

This section represents the results of our estimations. Table 3.2 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, cpi is consumer price index, rate is interest rate, y is output and er is exchange rate.

Table 3.2: Unit root test results

Variables	ADF Test at Level		ADF Test at First Diff		Oder of Integration
	τ statistics	P values	τ 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)
Cpi	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)

Note: 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 3.2 above shows that all the variables are stationary at first difference.[17] The review of the literature shows that SVAR model is estimated in two different ways. First,

[17] Study will use inf (inflation) in place of dcpi hereafter.

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 1.

Figure 3.12 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 findings of Rasheed (2019). Further, Punaukar and Singh (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. Bernanke (2006) also supports this view of Hamilton.

In response to food price shocks, output decreases significantly in the first month. As households spend a large portion of their budget on food items, an 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 findings 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 reduced 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.

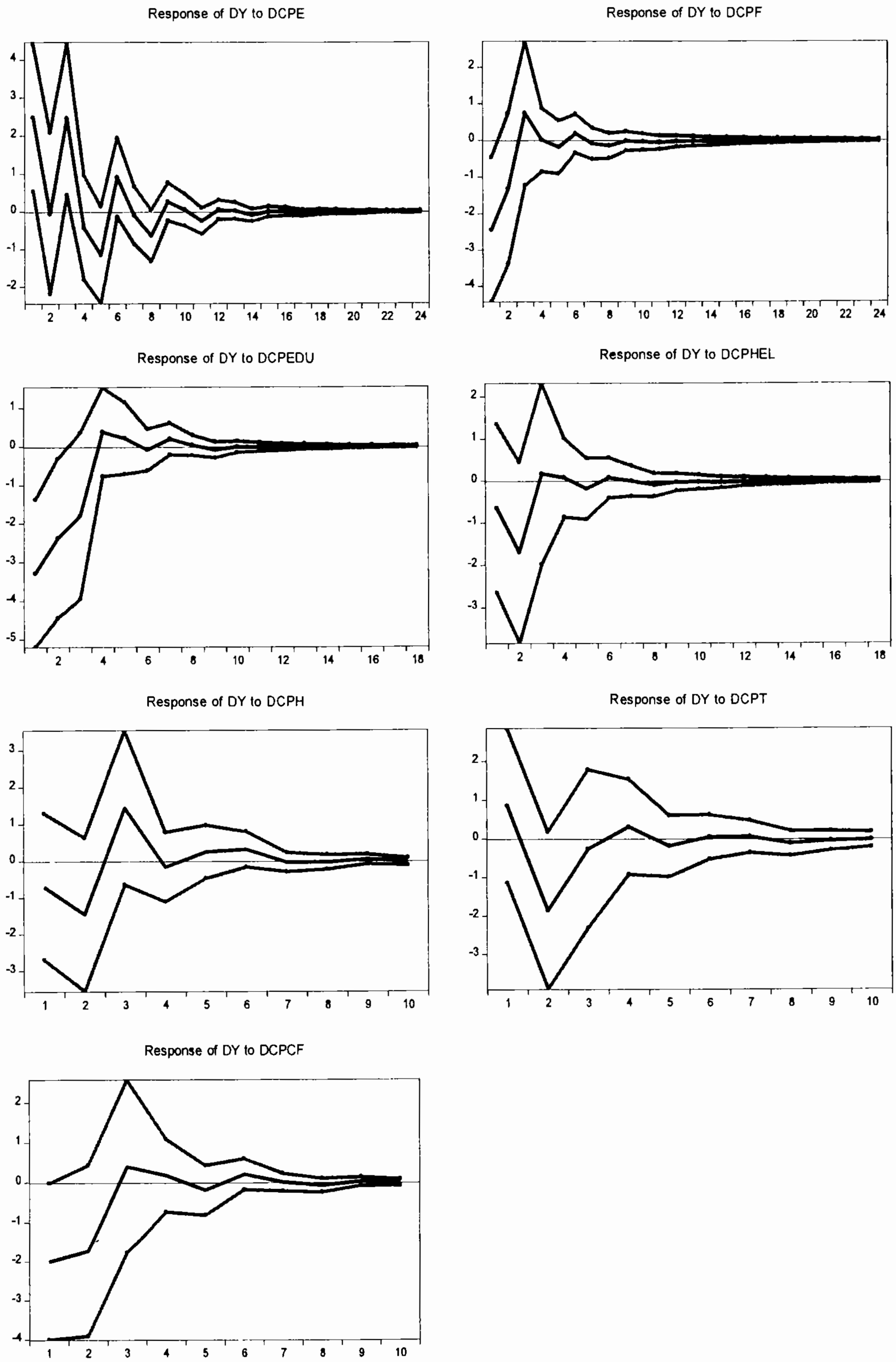

Figure 3.12: Impact of commodity prices on output

Figure 3.13 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 prices 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) and Ibid (2010).

Education and health price shocks increased 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 show 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.

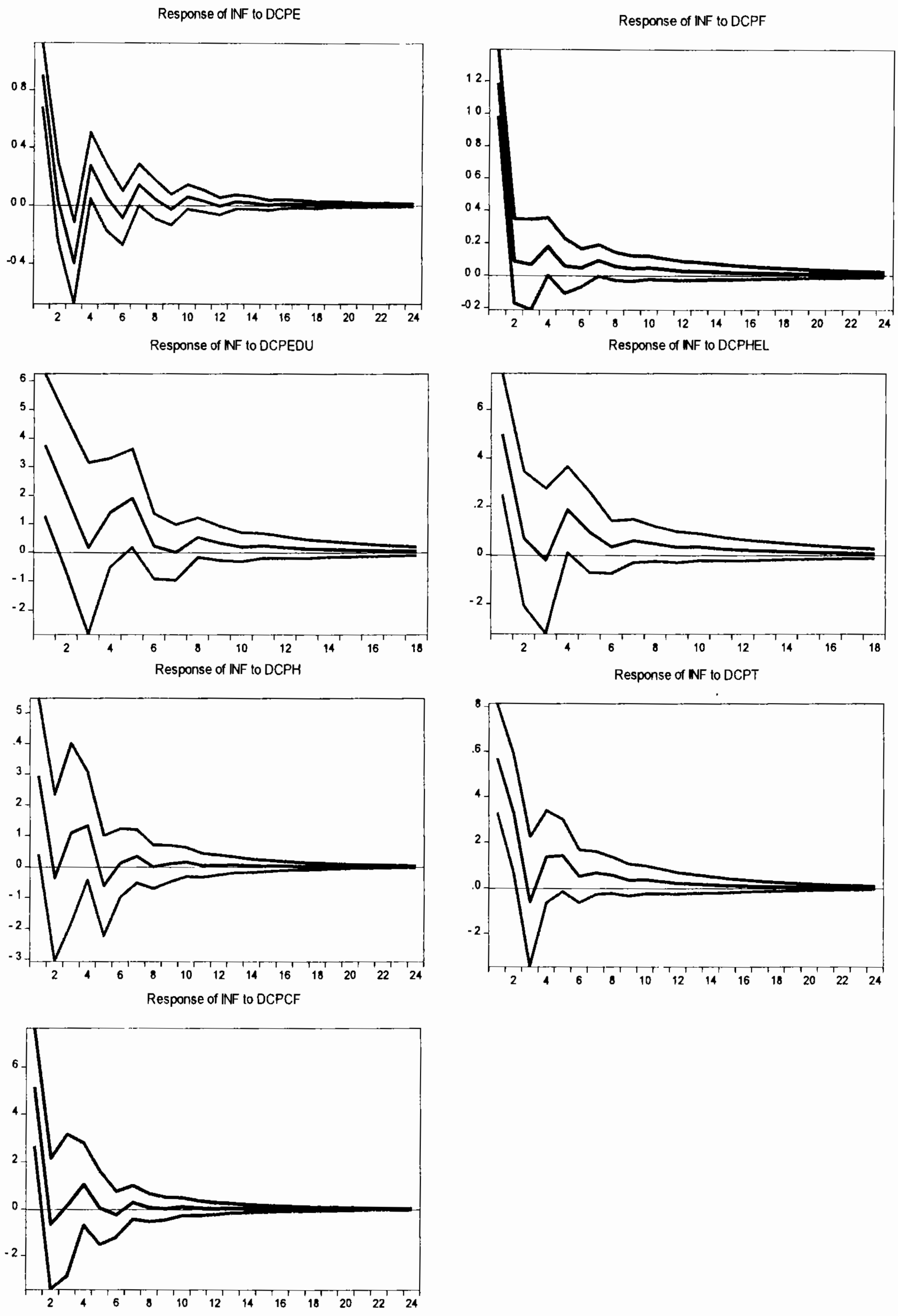

Figure 3.13: Impact of commodity prices on inflation

Figure 3.14 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 increase the demand for money and thus leads to an increase in interest rate (Khan & Ahmed, 2011).

Education price shocks increased the interest rate in the third month. Whereas health price shocks increased interest rate 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 rates. Housing, clothing, and footwear price shocks have no significant impact on the interest rates of the Pakistan economy. However, transportation price shocks have a significant positive impact on interest rate for the third and sixth month of the shock, which dies out in the long run.

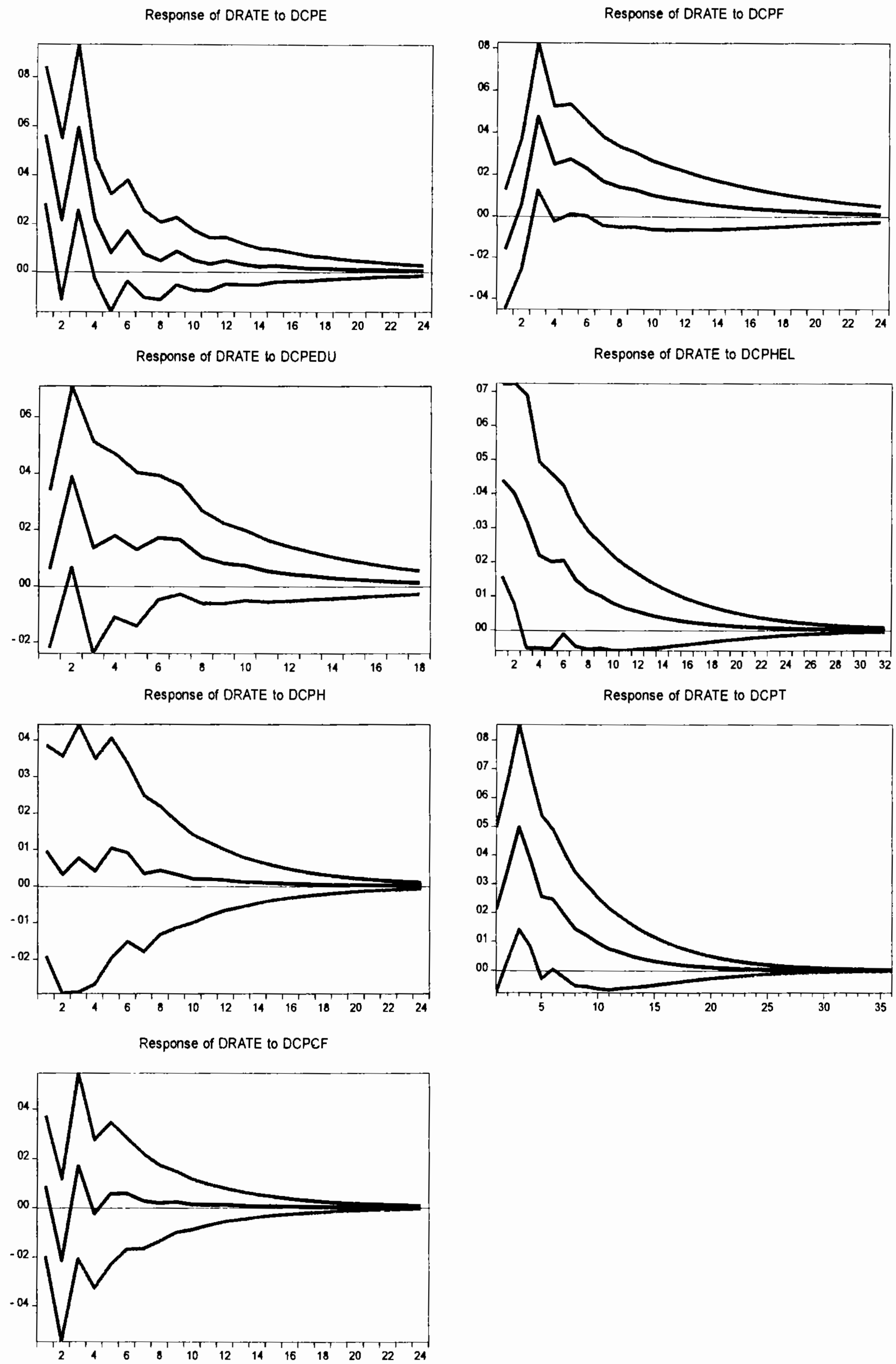

Figure 3.14: Impact of commodity prices on interest rate

Figure 3.15 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 with 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 show 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.

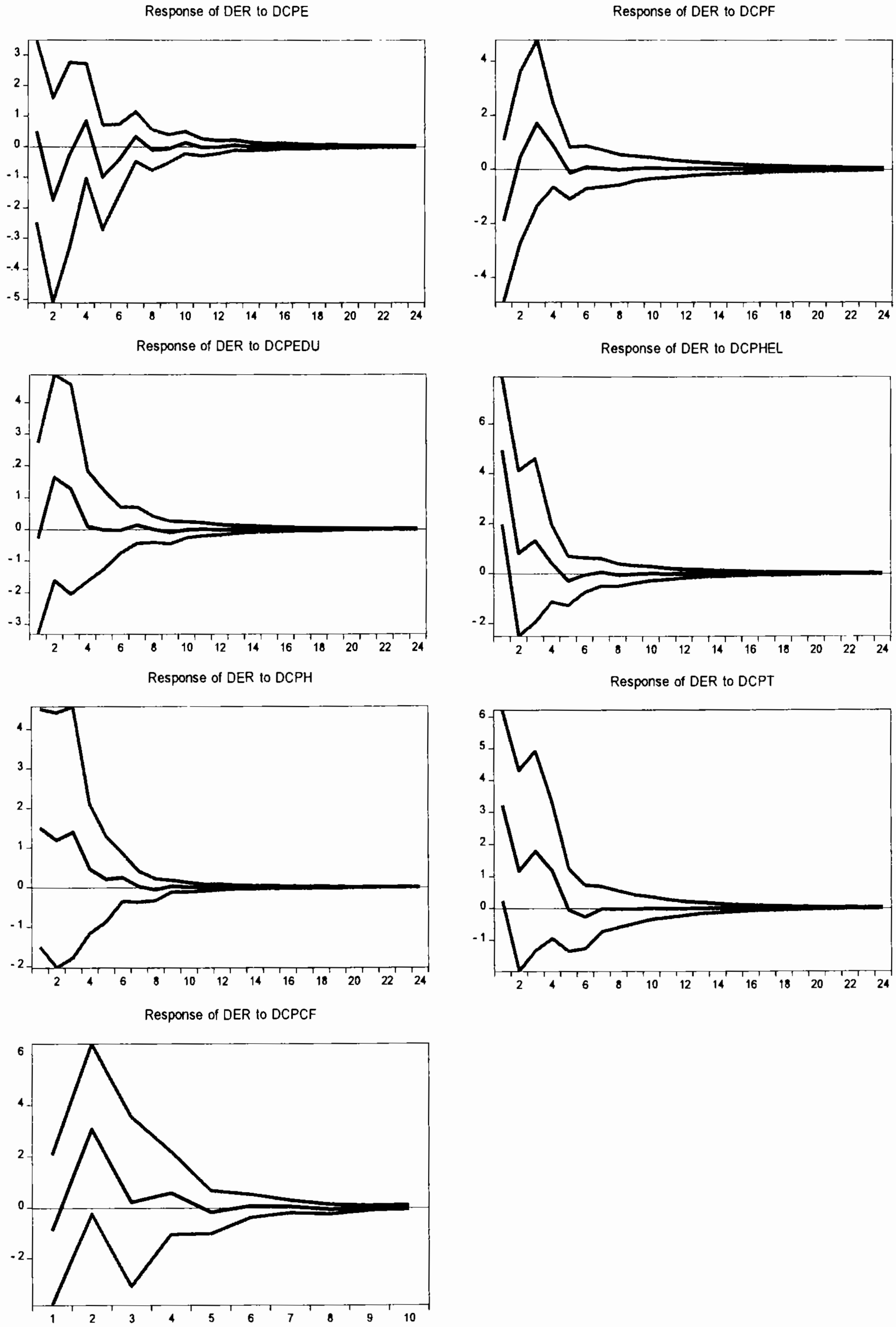

Figure 3.15: Impact of commodity prices on exchange rate

Table 3.3 below summarizes the most dominant and weakest significant responses of macroeconomic variables of Pakistan to commodity price shocks.

Table 3.3: Summarized results of macro analysis

Macro-economic variables	Dominant impact	Weakest impact
Output	Education price shocks -0.33%	Health and Housing price shocks -0.17% and -0.16%
Inflation	Food price shocks +1.2%	Housing price shocks +0.29%
Interest rate	Energy price shocks +0.64%	Education price shocks +0.39%
Exchange rate	Health price shocks +0.5%	Transportation price shocks +0.32%

3.4.CONCLUSION

This 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 employs 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 magnitudes. Energy price shocks have dominant positive impact on interest rate, food price shocks on inflation and health price shocks on exchange rates. Whereas, education price shocks have dominant negative impact on output. The finding of our study can help policymaker to control the prices of commodities that are more harmful for macro economy of Pakistan and allow the one that generates positive impact.

Chapter 4

INDUSTRIAL IMPACT OF COMMODITY PRICE SHOCKS ON THE PAKISTAN ECONOMY

4.1.INTRODUCTION

Since the industrial revolution, the impact of industrialization on the economy has been widely analyzed. Studies found that an increase in industrial production leads to an increase in employment and it also increased the wealth and living standard in an economy (Szirmai, 2012; Pacheco-lopez and Thirlwall,2013; Ndiaya and Lv, 2018; Opoku and Yan,2019). The relationship between industrial production and economic growth is also known as "*Kaldor first growth law*" referred to Nicholas Kaldor (1996). According to this law, industrial growth is an engine for economic growth as industrial production has an increasing return to scale. Therefore, the expansion of the industrial sector draws and employs labor from the agriculture sector. So, the marginal product of labor that was below average product in the agriculture sector increases and this process helps to accelerate the overall production and economic growth (Pacheco-lopez and Thirlwall,2013; Kaldor, 1976).

Industrial performance is one of the main indicators of countries' domestic product and development; it allows the economy to produce a vast range of consumer goods at low costs and in large quantities (Lee & Ni, 2002). To the best of our knowledge, there are very limited studies that examine the impact of commodity prices on industrial variables. However, vast literature is available that examines the impact of oil price shocks on industrial output (Goodwin and Gisser, 1986; Rotemberg& Woodford, 1996; Schmidt & Zimmermann, 2007; Jimenez-Rodriguez, 2008; Fukunaga et al., 2011). The shocks in different groups of commodity prices somehow and other impact industries and are ignored in research by limiting it to oil price shocks. This study is aimed to fills-in this gap and examines the impact of seven groups of commodities. These groups are food (including food and non-alcoholic beverages, alcoholic beverages and tobacco, restaurant and hotels), clothing and footwear, housing, oil, transport, education, health and Others (including communication, recreation and culture and miscellaneous).

Furthermore, to the best of our knowledge, there is no well-known study that addresses the impact of above mentioned seven groups' commodity prices on sub-sectors or industries of Pakistan. Therefore, by taking into account the importance of industries in the economy of Pakistan, this study aims to examine the impact of commodity price shocks on thirteen large scale manufacturing industries (LSMI) of Pakistan. These industries include textile, food and beverages, and tobacco, coke and petroleum products; iron and steel, automobiles, fertilizer, paper and board, electronics, chemicals, leather products, engineering products, rubber products, non-metallic mineral products, and pharmaceuticals. The share of these large-scale industries in manufacturing is around 65%[18] whereas their share in GDP is approximately 9 %.

On the foundation of our above discussion, we sketch our research objectives as follows;

1. To investigate whether all commodity shocks are identical for the demand and supply of major thirteen industries of Pakistan.

[18] The share of total Large scale industries in manufacturing is around 70 percent (source:Pakistan Bureau of Statistics).

2. How these commodity price shocks affect the demand and supply of the selected industries.

Our research analysis will help to answer the following questions.

Q1. How to identify industrial demand and supply?

Q2. What is the impact of commodity price shocks on identified industrial demand and supply?

Q3. Whether all commodity price shocks have same or differential impact?

Our research work is organized in the following way. Section two explains data and methodology. Section three presents the results of estimation, their interpretation and significance. Section four concludes the study.

4.2.DATA AND METHODOLOGY

This study will use monthly data used over the period July 2008 to June 2020. It aims to employ the Structural VAR model in order to examine the relationship between commodity prices and industrial activities in Pakistan.

4.2.1.DATA

This study will use data from seven groups of commodity price, namely clothing and footwear (cpcf), energy(cpoil), education (cpedu), food (cpf), health (cphel), housing(cph), transport (cpt) price. The macroeconomic variables we want to include in the study are money stock measure (m), long term interest rate interest rate (lb),3-month T bill rate (ir), consumer price index (inf), and overall industrial production (ip).The industries specific output and price variables are output of automobile (Y_ato), chemical (Y_chem), electronics (Y_electro), engineering(Y_engin), food(Y_f), fertilizer(Y_ferti), leather(Y_lther), non-metallic-minerals (Y_NMM), paper and board(Y_PB), petroleum(Y_petro), pharmaceutical(Y_pharma), Rubber(Y_rub) and output of textile industry(Y_tex). Price of automobile (P_ato), chemical (P_chem), electronics (P_electro), engineering(P_engin), food(P_f), fertilizer(P_ferti), leather(P_lther), non-metallic-minerals (P_NMM), paper and board(P_PB), petroleum(P_petro), pharmaceutical(P_pharma), Rubber(P_rub) and price of textile industry(P_tex).

4.2.1.1.INDUSTRIAL VARIABLES

Following the work of Lee and Ni (2002), this study takes two main industrial variables, namely industry-specific output (y) and producer price index (PPI). The industrial output data is collected from the Quantum Index of Manufacturing (QIM) published by Pakistan Bureau of Statistics (PBS). QIM exhibits the change in the production of Pakistan's Large Scale Manufacturing Industries (LSMI) on monthly basis. The weights in the estimation of QIM have been assigned in two stages by PBS. Firstly, weight for different industries has been assigned according to their contribution in terms of gross value added in total LSMI at some basic prices level. Furthermore, the total gross value added for LSMI is assumed as 100 and the percentage contribution of each industry is considered as its weight. The following formula has been used by PBS in computing percentage change in production in one month;

$$\frac{\text{Production of ith industry in June 2020}}{\text{Production of ith industry in June 2019}} * 100 - 100$$

Secondly, the weights of sub-industries of each industry have been assigned on the following lines;

If there was only one sub-industry in an industry, the total weight of that industry would have been given to that sub-industry.

If there were more than one sub-industries in an industry, then weights of the sub-industries have been assigned according to their relative percentage contribution in that industry.

In order to compare and make interpretation meaningful, the PPI and all other variables data have been converted using the method of QIM. The QIM data has an advantage as it is one type of seasonally adjusted data[19]. Moreover, due to the limitation of data and following Tiwari and Shahbaz (2013), wholesale price index (WPI) will be used in place of PPI in the selected industries. WPI was used to be a general price index to measure producer prices before the establishment of PPI dating back to the 19th century. Moreover, WPI is the most accurate proxy for the coverage of PPI (IMF, 2004); as it measures the prices of domestically produced goods (included in PPI) and prices of imported goods (excluded in PPI), while it excludes the prices of exported goods included in PPI. Therefore, WPI becomes a more relevant variable for our analysis.

4.2.2: DESCRIPTIVE STATISTICS

For the sake of a better understanding of the data of industrial variables, we have performed its descriptive and graphical analysis. Table 4.1 below shows the descriptive statistics of output data of thirteen major large-scale industries of Pakistan.

[19] $\frac{\text{PPI of ith industry in June 2020}}{\text{PPI of ith industry in June 2019}} * 100 - 100$

is seasonally adjusted as we compare June 2020 PPI with June 2019 PPI.

Table 4. 1:Descriptive statistics of industrial output

Variables	Mean	Median	Max	Min	SD	Skewness	Kurtosis	Obs
Y_Ato	11.82	12.63	113.08	-93.86	32.12	0.08	3.82	132.00
Y_Chem	1.92	0.86	24.31	-19.44	8.22	0.39	3.39	132.00
Y_Electro	15.14	6.46	411.24	-83.66	47.00	4.75	39.99	132.00
Y_Engin	0.09	-3.03	120.98	-77.74	26.64	1.24	7.80	132.00
Y_F	13.59	4.72	314.04	-16.66	42.10	4.72	28.00	132.00
Y_Ferti	7.06	3.63	220.30	-41.14	28.57	4.43	30.66	132.00
Y_Lther	4.47	1.68	77.44	-71.61	21.27	0.79	5.87	132.00
Y_NMM	6.11	1.37	129.90	-55.46	26.32	1.90	8.44	132.00
Y_PB	6.67	3.97	57.79	-45.12	17.57	0.71	4.04	132.00
Y_PETRO	12.08	2.81	862.28	-53.23	80.61	9.16	95.65	132.00
Y_PHARMA	5.32	4.99	36.05	-22.44	10.83	0.02	3.11	132.00
Y_RUB	4.83	4.98	54.38	-32.83	10.88	0.65	7.82	132.00
Y_TEX	15.57	-1.20	583.91	-51.61	65.82	5.70	45.27	132.00

Note:This Table shows the descriptive statistics of output of automobile (Y_ato), chemical (Y_chem), electronics (Y_electro), engineering(Y_engin), food(Y_f), fertilizer(Y_ferti), leather(Y_lther), non-metallic-minerals (Y_NMM), paper and board(Y_PB), petroleum(Y_petro), pharmaceutical(Y_pharma), Rubber(Y_rub) and textile industry(Y_tex).

Table 4.1 shows that the average percentage change of automobiles output is positive and 11.81% for the period of our analysis. Likewise, the average percentage change of all other industries is positive and shows that Pakistan's industries are growing. The "max" column of Table 4.1 shows that the maximum percentage change in output for the petrolatum industry is highest among all and it is about 862.27%. This massive percentage increase was observed in May-2013 (comparing May-2013 production with May-2012). This change was mainly contributed by the huge increase in production of Diesel oil and high-speed Diesel. The "min" column of Table 4.1 shows that the automobiles industry experienced the minimum percentage change among all industries of -93.858. This decline was observed in April 2020. The major contributors to this decline were the covid situation, depreciation of rupee, hikes of policy rate, increase in Federal Excise Duty (FED) to 7.5 from 2.5 for different types of vehicles and increment of additional customs duty. Moreover, the chemical industry shows the least variations among all industries for the period under analysis. Whereas, petrolatum industry shows most variations. Table 4.2 below shows the descriptive statistics of price data of thirteen major large-scale industries of Pakistan.

Table 4.2:Descriptive analysis of industrial price data

Variables	Mean	Median	Max	Min	SD	Skewness	Kurtosis	Obs
P_ATO	6.47	3.98	23.36	-2.25	6.89	0.67	2.27	132.00
P_CHEM	9.64	8.20	34.10	-9.48	10.16	0.60	2.51	132.00
P_ELECTRO	4.76	3.56	16.49	-0.93	4.21	1.41	4.15	132.00
P_ENGIN	6.43	5.35	16.92	-1.28	4.52	0.53	2.39	132.00
P_F	7.73	6.97	23.24	-4.15	6.53	0.34	2.51	132.00
P_FERTI	5.27	1.34	58.15	-16.17	16.50	1.45	4.98	132.00
P_LTHER	14.51	4.18	74.72	-14.68	23.52	1.38	3.51	132.00
P_NMM	8.69	8.58	18.84	-1.86	5.73	0.02	1.91	132.00
P_PB	10.75	3.08	64.62	-31.66	21.27	0.28	2.74	132.00
P_PETRO	9.25	9.96	54.71	-32.04	19.51	-0.26	2.73	132.00
P_PHARMA	9.00	6.53	40.82	-1.99	10.87	1.80	5.57	132.00
P_RUB	5.31	3.82	22.00	-8.89	8.09	0.55	2.54	132.00
P_TEX	10.47	10.01	24.86	2.05	4.49	0.87	3.91	132.00

Note:This Table shows the descriptive statistics of price of automobile (P_ato), chemical (P_chem), electronics (P_electro), engineering(P_engin), food(P_f), fertilizer(P_ferti), leather(P_lther), non-metallic-minerals (P_NMM), paper and board(P_PB), petroleum(P_petro), pharmaceutical(P_pharma), Rubber(P_rub) and textile industry(P_tex).

Table 4.2 shows that the average percentage change of the automobile industry's PPI is 6.47% and the food industry's PPI has an average of 7.73% over the period of analysis. Likewise, the average percentage change of all the industries' PPI is positive. The "max" Column of Table 4.2 shows the maximum percentage change of PPI of selected industries. Leather industry PPI recorded the highest percentage change among all industries. This 74.72% change was observed in April 2019 and it is attributed to the massive depreciation of the rupee, domestic increase of energy prices, the negative impact of monetization of public debts and supply side bottlenecks. The "min" column of Table 4.2 shows the minimum percentage change of PPI over the period of our analysis. The

Paper and board and petroleum industries experienced the lowest percentage change of their PPI. The petroleum industry's drop of 32.04% was recorded in October 2015 on account of a reduction in global oil prices. Further, the easy imports increase the supply of inputs which improved local production. The "SD" column shows that the leather industry PPI shows the most variation whereas, the electronics PPI shows the least variation.

4.2.3.GRAPHICAL ANALYSIS

The graphical analysis of the textile industry of Pakistan has the largest share of 20.91% in total LSMI. The food industry is the second largest industry of LSMI with a weight of 12.37%. Figure 4.1 shows two major declines in the production of the food industry. First, in June 2015, when overall food production decreased due to a slump in sugar production

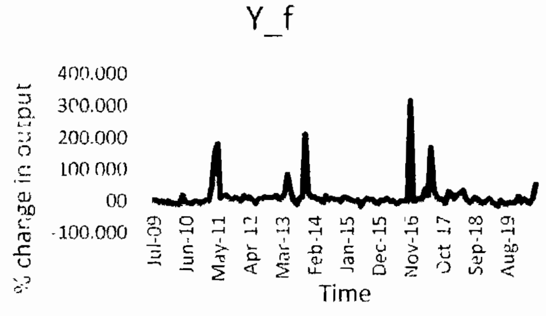

Figure 4.1: Food industry output

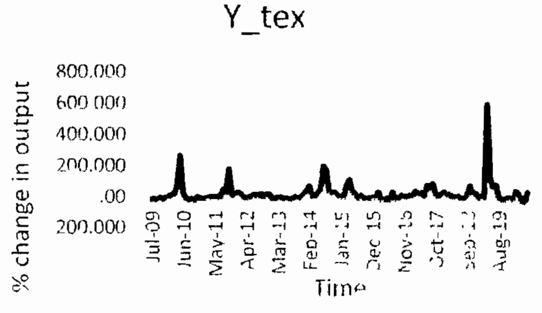

Figure 4.2: Textile industry output

on account of late crushing of sugarcane due to dead-lock between sugar mills owners and sugarcane growers over the supportive price of cane. Moreover, the ghee production also declined in June 2015 compared to June 2014. Second, food production again fell massively in May 2019 due to a decline in production of sugar and cigarettes where cigarettes production falls due to a significant increase in FED. The food industry production increases significantly in November 2016 on account of major increase in production of sugar almost 30% due to better production of sugarcane. Further, the production of soft drinks, juices, tea and vegetable ghee also increases significantly.

Figure 4.2 above shows that textile industry reached at highest level of production in June 2019. However, it experienced a decline after April 2019 due to the covid-19 pandemic.

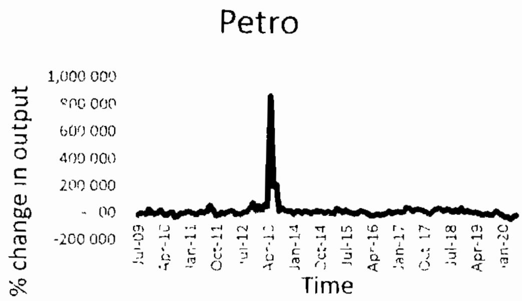

Figure 4.3: Petroleum industry output

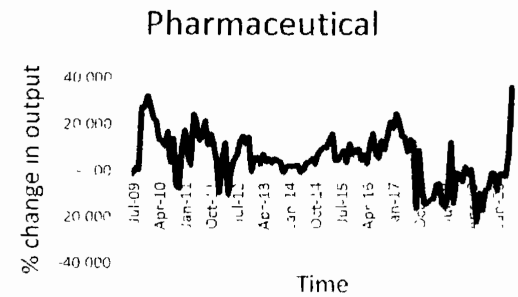

Figure 4.4: Pharmaceutical industry output

The petroleum industry has a 5.514% share of LSMI. Figure 4.3 shows that the percentage change of petroleum has two peak points. One positive peak in May 2013 that is mainly due to increase in margins of oil refineries, the establishment of partial solution of financial debts that encourages firms to import more oil and utilizes their excess capacity. Further, the petroleum industry experiences a sharp decline in its production in April 2020 compared to April 2019 as can be shown by its negative peak. This decline was caused by both demand and supply-side shocks of oil prices.

The pharmaceutical industry share in LSMI is about 3.62%. The production of the pharmaceutical industry witnesses a massive decline on mid of year 2019 as can be seen in Figure 4.4. This sharp slump was attributed towards the significant lag of adjustment in regularity prices and exchange rate appreciation that adds to the problems of a highly import-dependent industry. However, the situation of Covid increases the demand for medicines and increases the prices that boost production after June 2019.

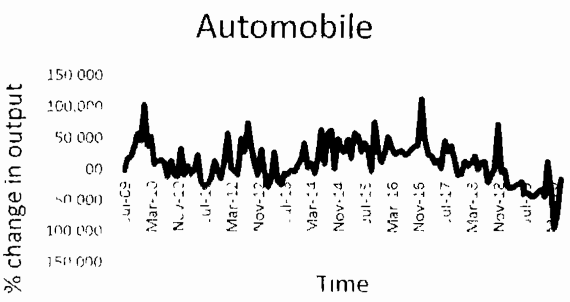

Figure 4.5: Automobile industry output

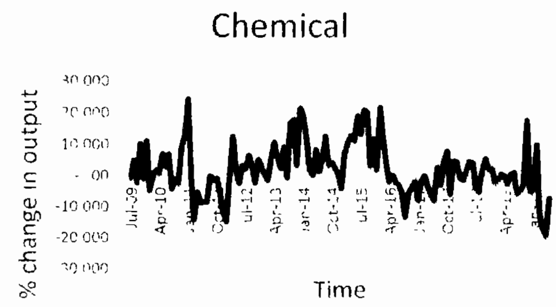

Figure 4.6: Chemical industry output

The automobile is another important industry with a share of 4.613% in LSMI. The chemical industry weights of 1.71 in LMSI. Both of these industries experienced a reduction in their production due to the slowdown of economic activities in the context of covid-19.

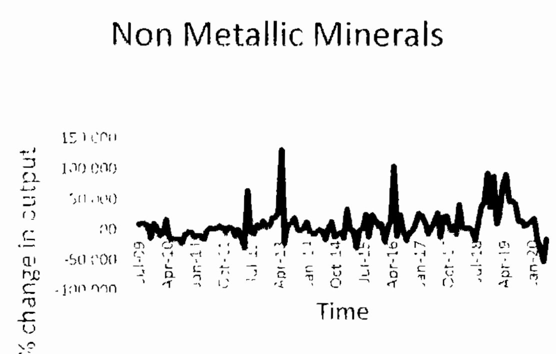

Figure 4.7: Non-Metallic Minerals industry output

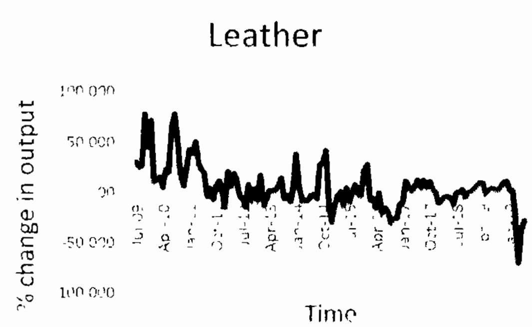

Figure 4.8: Leather industry output

Figure 4.7 shows that the percentage change of production of Non-Metallic Minerals (NMM) declines after Feb 2020 till May 2020 and in June 2020 it witnesses increase mainly due to an increase in the production of cement. Whereas, Figure 4.8 shows that leather production also decreases significantly after March 2020. This decline was attributed to the complete lockdown situation in the USA and EU that are the major exporter of Pakistan leather.

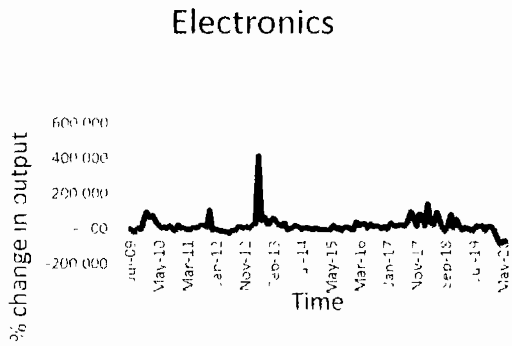

Figure 4.9: Electronics industry output

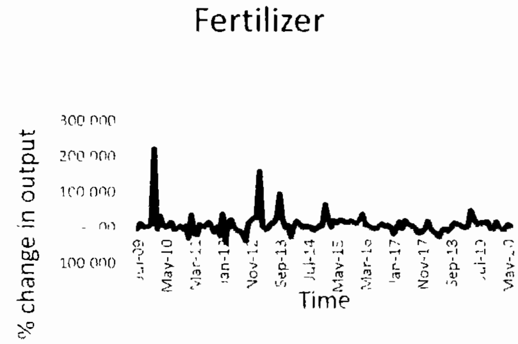

Figure 4.10: Fertilizer industry output

The electronics industry share in LSMI is approximately 2%. Figure 4.9 shows that the electronics industry undergoes a massive dip with the start of the year 2020. Electric motor that has the highest weight in electronics industry is mainly responsible for this slump as electric motor production decreases around 13.42% during this period. This massive decline was caused by a reduction in demand, depreciation of the rupee, high electricity tariffs, increasing cost of borrowing that adds in the reduction in consumer demand for durable electronics goods. Figure 4.10 shows that the production of the fertilizer industry remains much stable as compared to other LSMI.

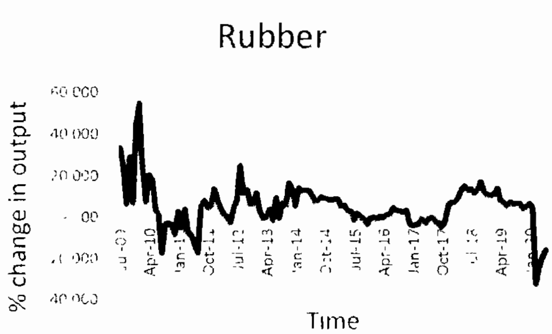

Figure 4.11: Rubber industry output

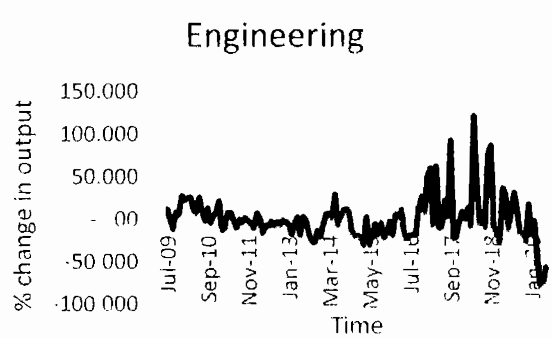

Figure 4.12: Engineering industry output

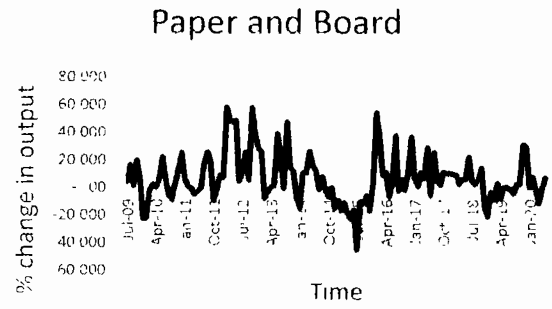

Figure 4.13: Paper and Board industry output

Figure 4.11 and 4.12 shows the graphical representation of the rubber and engineering industries production. Both industries output decreases with the start of year 2020. However, the paper and Board industry show much stable performance in covid 19 situation as can be seen in Figure 4.13. However, its production fell down significantly in July 2011 as compared to July 2010. The main factor that hindered its production was the shortage of power supply and unavailability of desired inputs.

The graphical analysis of industrial PPI has been performed for better understanding of the data.

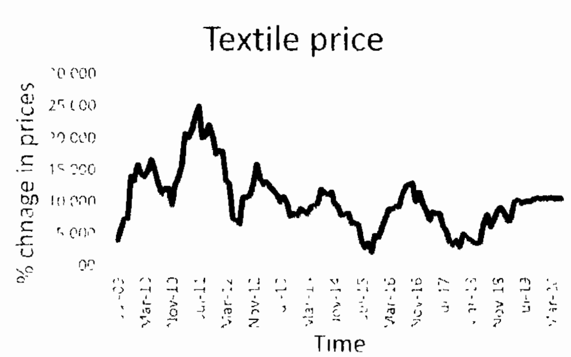

Figure 4.14: Textile industry PPI

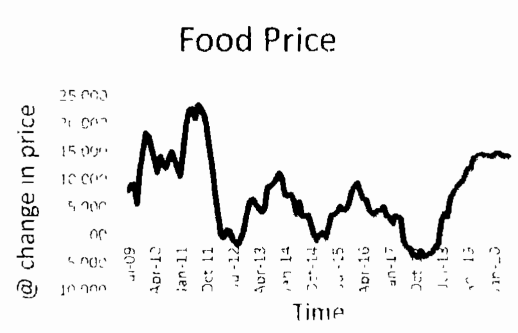

Figure 4.15: Food industry PPI

Figure 4.14 shows that textile PPI increases after Jan 2011 on account of high cotton and yarn prices, domestic floods that badly affect cotton crops, increase in international demand of textile and increase in international cotton price. Further, a massive decline in textile PPI has been observed in September 2015 as compared to September 2014. This decline was mainly due to a decline in fuel prices and a reduction in international commodity prices. The outbreak of covid-19 reduces demand and puts downward pressure on the PPI of all most all industries however, the supply side disruption generates upward pressure. As both downward and upward pressure cancel out each other textile industry PPI remains quite stable after August 2019. Figure 4.15 shows that the percentage change of the food industry PPI reached at the highest point of 1.43% in July 2011. This increase was mainly due to flood that damaged most of the crops. On the other hand, October 2017 witness massive decline in food industry PPI due to improved wheat crop, good monitoring of food prices and improved measurement for smooth supply.

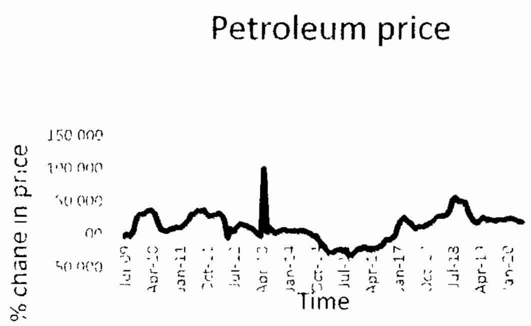

Figure 4.16: Petroleum industry PPI

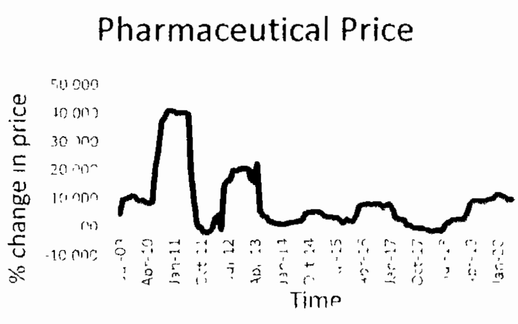

Figure 4.17: Pharma industry PPI

Figure 4.16 shows that petroleum industry PPI declines significantly in September 2015 on account of the decline in international fuel prices and decline in inflation in the international market that fed into the domestic petroleum industry through easy imports and an increase in domestic supply. Figure 4.17 shows that the pharmaceutical industry PPI drops down sharply in November 2011 as compared to November 2010 mainly due to the strictness of the government on the regularity of pharmaceutical industry prices.

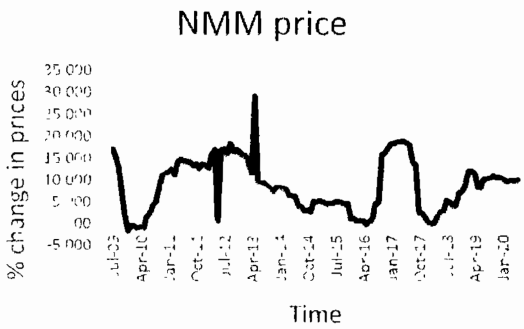

Figure 4.18: NMM industry PPI

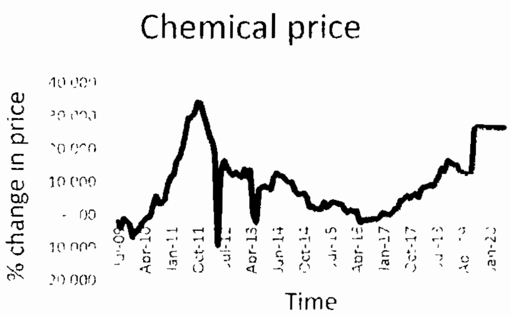

Figure 4.19: Chemical industry PPI

Figure 4.18 shows that Non-Metallic Minerals PPI declines sharply in February 2010 this decline was mainly caused by the reduction in cement price. Figure 19 shows that chemical industry prices remain stable and shows up-word trend during the period of our analysis.

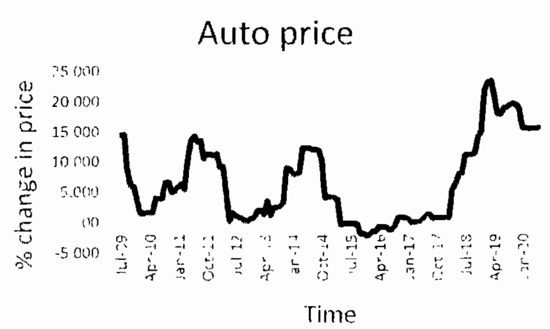

Figure 4.20: Automobile industry PPI

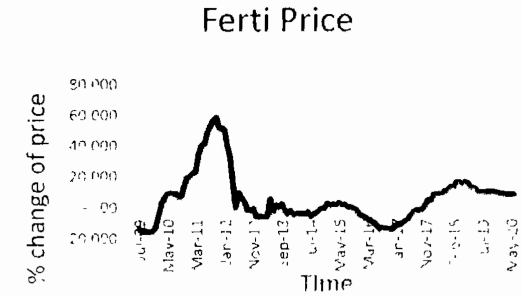

Figure 4.21: Fertilizer industry PPI

Figure 4.20 shows that the automobiles industry PPI experienced a dip in December 2015 due to the stable exchange rate and the impact of Apna Rozgar Scheme launched by Punjab government. The fertilizer industry shows a smooth trend after a sharp decline in October 2009 and the increase in fertilizer prices in year 2011.

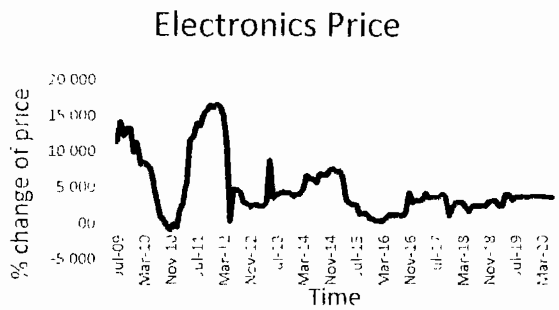

Figure 4.22: Electronics industry PPI

Figure 4.23: Leather industry PPI

Figure 4.22 shows that percentage change in PPI of the electronics industry was declined to -1.15% in November 2010. This decline is mainly attributed to a sharp reduction in domestic demand of durable. Moreover, the electronic industry PPI depends heavily on the prices of imported raw materials like steel and copper that makes this industry PPI highly vulnerable to international commodity price movements. Figure 4.23 displays that the leather industry PPI remains almost stable over the period of our analysis expect the decline in February 2015 compared to February 2014 due to a decline in leather prices internationally.

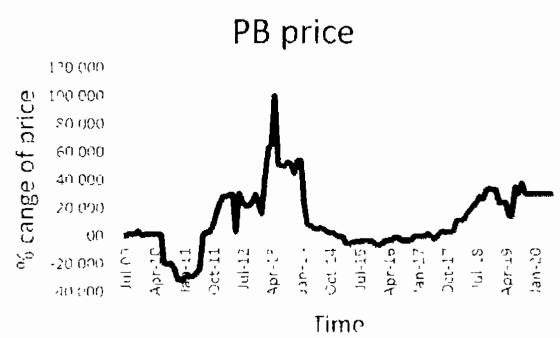

Figure 4.24: Paper and Board industry PPI

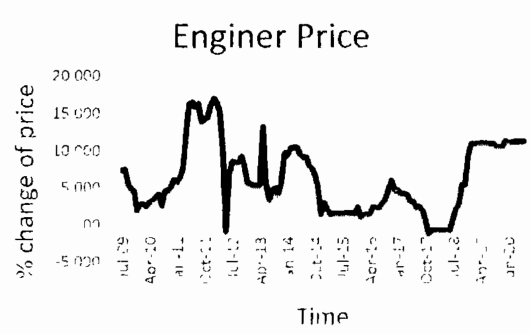

Figure 4.25: Engineering industry PPI

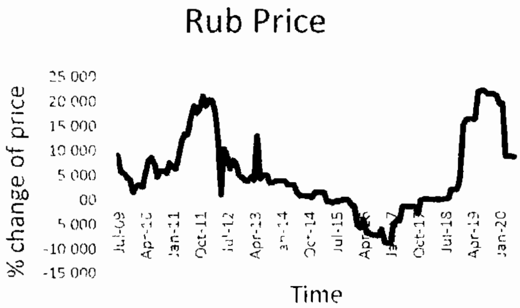

Figure 4.26: Rubber industry PPI

Paper and Board industry and rubber industry PPI also witness a smooth trend expect one sharp down peak for both industries as can be seen through Figure 4.24 and Figure 4.26. The engineering industry PPI on the other hand experienced more fluctuations with a sharp decline in November 2017 mainly due to reduction in domestic demand. The graphical analysis of industrial output and price data shows that the covid 19 situation adversely affects almost all the industries. So, in order to account for the impact of covid 19 shocks, we will add the dummy of covid from April 2019.

4.2.4.METHODOLOGY

This study aims to employ the Structural VAR model in order to examine the relationship between commodity prices and industrial activities in Pakistan. In order to get the accurate impact of commodity price shocks on industrial output and prices, it is important to isolate them from the impact of macroeconomic shocks and specific industrial shocks. Moreover, this study is using data of large number of industries and groups of commodity prices so, it is not feasible to add all industries and commodity prices groups in one model. Thus, this study will use separate model for each industry and each group of commodity prices. The SVAR model for our industrial analysis can be written as:

$$\begin{pmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{pmatrix} \begin{pmatrix} Y_{1t} \\ Y_{2t} \end{pmatrix} = \begin{pmatrix} C_{11} & C_{12} \\ C_{21} & C_{22} \end{pmatrix} \begin{pmatrix} z_{1t} \\ z_{2t} \end{pmatrix} + \begin{pmatrix} B_{11} & B_{12} \\ B_{21} & B_{22} \end{pmatrix} \begin{pmatrix} \mu_{Y1t} \\ \mu_{Y2t} \end{pmatrix} \tag{4.1}$$

The A_{11}element in matrix A describes the relationship between macroeconomic themselves. Whereas, the A_{12}shows the relationship between macro-economic variables and industrial variables. The elements in A_{21}describes the contemporaneous relationship between industrial variables and macro-economic variables. Whereas, A_{22}shows the relationship between industrial variables themselves.

Firstly, following the work of Jo et al. (2019) and Lee and Ni (2002) we impose the restriction on matrix A and assume that industrial variables have no impact on macroeconomic variables and thus $A_{12} = 0$. So, our SVAR model can be written as:

$$\begin{pmatrix} A_{11} & 0 \\ A_{21} & A_{22} \end{pmatrix} \begin{pmatrix} Y_{1t} \\ Y_{2t} \end{pmatrix} = \begin{pmatrix} C_{11} & 0 \\ C_{21} & C_{22} \end{pmatrix} \begin{pmatrix} z_{1t} \\ z_{2t} \end{pmatrix} + \begin{pmatrix} B_{11} & 0 \\ B_{21} & B_{22} \end{pmatrix} \begin{pmatrix} \mu_{Y1t} \\ \mu_{Y2t} \end{pmatrix} \quad (4.2)$$

By pre-multiply both sides of the model byA_0^{-1} we get

$$Y_t = A^{-1}C\ (L)Y_{t-p} + A^{-1}B\mu_t \quad (4.3)$$

We can write equation 1.9 as

$$\mathrm{C}(L)y_t = A^{-1}B\mu_t \quad (4.4)$$

And

$$\mathrm{A}^{-1}\mathrm{B}\mu_t = \epsilon_t \quad (4.5)$$

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

$$A^{-1}\mu_t = \epsilon_t \quad (4.6)$$

Or

$$A\epsilon_t = \mu_t \quad (4.7)$$

The elements of A matrix is estimated through maximum likelihood function for a given covariance matrix (obtained from the residuals of macroeconomic block). For identification of restrictions, we borrow heavily from Jo and Reza (2019); Lee and Ni (2002): Sims and Zha (1998) and Gordon and Leeper (1994). We will estimate our macro base-line SVAR model separately for each group of commodity price. Therefore, we need to impose separate restrictions for each commodity price.

4.2.5.IDENTIFICATION OF BASE-LINE SVAR MODEL

4.2.5.1.FOR ENERGY PRICES

Commodity Price equation

$$cpoil_t = \beta_1 cpoil_{t-p} + \mu_{oil} \quad (4.8)$$

Aggregate industrial output

$$ip_t = \beta_2 ip_{t-p} + \beta_3 cpoil_{t-p} + \mu_{ip} \quad (4.9)$$

Aggregate price setting equation

$$inf_t = \beta_4 inf_{t-p} + \beta_5 ip_{t-p} + \beta_6 cpoil_{t-p} + \mu_{inf} \quad (4.10)$$

Money demand equation

$$m_t = \beta_7 m_{t-p} + \beta_8 r_{t-p} + \beta_9 inf_{t-p} + \beta_{10} ip_{t-p} + \mu_m \quad (4.11)$$

Money supply equation

$$r_t = \beta_{11} r_{t-p} + \beta_{12} m_{t-p} + \beta_{13} lb_{t-p} + \beta_{14} cpoil_{t-p} + \mu_r \quad (4.12)$$

Long bond yield

$$lb_t = \beta_{15} lb_{t-p} + \beta_{16} m_{t-p} + \beta_{17} r_{t-p} + \beta_{18} cpoil_{t-p} + \beta_{19} inf_{t-p} + \beta_{20} ip_{t-p} + \mu_{lb} \quad (4.13)$$

The identification restriction used information-based approach. The maximum number of parameters in A are N^2[20] that is 36 and maximum number of independent movements in the covariance matrix is $N(N+1)/2$[21]. Thus, our SVAR model requires at least $N(N-1)/2$[22] full identified restrictions. Where oil price is assumed to be set

[20] N=6

[21] $N(N+1)/2 = 21$

[22] $N(N-1)/2 = 15$

independently from macro-economic situation of Pakistan. Studies showed that oil price shocks are mainly caused by supply shocks in oil markets and by international crises that affect the demand for oil (Bansky and Kilia,2000; Hamilton, 1985). Thus, the oil price is treated as exogenous in our model. We also make an assumption that goods market does not respond to the movement in money markets. Whereas, our money demand equation incorporates the cost of holding money (r), aggregate inflation level which reflects the purchasing cost for the goods consumer buys and aggregate output. Following the work of Sims and Zha (1998) we impose exclusion restrictions on our derived demand equation of money, and it does not include long term interest rate and single commodity price. The money supply equation is assumed to not respond with aggregate industrial output and aggregate inflation due to lag of publication of data of these variables. The restriction on money supply depends on the timing at which information is available to state bank. The state bank monitor variety of variables but within a month it can observe and respond to current financial and money market variables not the good market variables that becomes available with one month lag. The commodity prices, r and lb seem like an economic instrument for state bank mainly because these are available once (Gordon and Leeper, 1994). Moreover, our model implicitly assumes that financial market quickly reacted to the shocks in both goods and money markets. Thus, the long-term deposits interest rate is reflected by bond yields that observed any new information quickly. Thus, the matrix A_{11} with the help of equation 4.8 to 4.13 can be written as;

$$\begin{bmatrix} \mu cpoil_t \\ \mu ip_t \\ \mu inf_t \\ \mu m_t \\ \mu r_t \\ \mu lb_t \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 \\ 0 & a_{42} & a_{43} & 1 & a_{45} & 0 \\ a_{51} & 0 & 0 & a_{54} & 1 & a_{56} \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon cpoil_t \\ \varepsilon ip_t \\ \varepsilon inf_t \\ \varepsilon m_t \\ \varepsilon r_t \\ \varepsilon lb_t \end{bmatrix}$$

We impose total 16 zero restrictions to estimate our macro-economic variables matrix A_{11}. Thus, total 20 parameters will be estimated with 21 independent movements of covariance matrix (that will be obtained through the residuals of macroblocks). Our model has one over identified restriction.

4.2.5.2.FOR FOOD PRICES

Commodity Price equation

$$cpf_t = \beta_1 cpf_{t-p} + \mu_f \tag{4.14}$$

Aggregate industrial output

$$ip_t = \beta_2 ip_{t-p} + \mu_{ip} \tag{4.15}$$

Aggregate price setting equation

$$inf_t = \beta_3 inf_{t-p} + \beta_4 ip_{t-p} + \beta_5 cpf_{t-p} + \mu_{inf} \tag{4.16}$$

Money demand equation

$$m_t = \beta_6 m_{t-p} + \beta_7 r_{t-p} + \beta_8 inf_{t-p} + \beta_9 cpf_{t-p} + \beta_{10} ip_{t-p} + \mu_m \tag{4.17}$$

Money supply equation

$$r_t = \beta_{11} r_{t-p} + \beta_{12} m_{t-p} + \beta_{13} lb_{t-p} + \beta_{14} cpoil_{t-p} + \mu_r \tag{4.18}$$

Long bond yield

$$lb_t = \beta_{15} lb_{t-p} + \beta_{16} m_{t-p} + \beta_{17} r_{t-p} + \beta_{18} cpf_{t-p} + \beta_{19} inf_{t-p} + \beta_{20} ip_{t-p} + \mu_{lb} \tag{4.19}$$

The above system of equations is similar to energy price with few changes and can be written in matrix form as follows;

$$\begin{bmatrix} \mu cpf_t \\ \mu ip_t \\ \mu inf_t \\ \mu m_t \\ \mu r_t \\ \mu lb_t \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & a_{45} & 0 \\ a_{51} & 0 & 0 & a_{54} & 1 & a_{56} \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon cpf_t \\ \varepsilon ip_t \\ \varepsilon inf_t \\ \varepsilon m_t \\ \varepsilon r_t \\ \varepsilon lb_t \end{bmatrix}$$

The aggregate output equation does not include food price as it is not directly related with industrial production. On the other hand, money demand is directly affected by food prices (Khan and Ahmed, 2004). Thus, the money demand equation also includes food prices. We impose total 16 zero restrictions to estimate our macro-economic variables matrix A_{11}. Thus, total 20 parameters will be estimated with 21 independent movements of covariance matrix. Our model has one over identified restriction.

4.2.5.3.FOR HOUSING PRICES

Commodity Price equation

$$cph_t = \beta_1 cph_{t-p} + \beta_2 ip_{t-p} + \beta_3 m_{t-p} + \beta_4 lb_{t-p} + \mu_h \quad (4.20)$$

Aggregate industrial output

$$ip_t = \beta_5 ip_{t-p} + \mu_{ip} \quad (4.21)$$

Aggregate price setting equation

$$inf_t = \beta_6 inf_{t-p} + \beta_7 ip_{t-p} + \beta_8 cph_{t-p} + \mu_{inf} \quad (4.22)$$

Money demand equation

$$m_t = \beta_9 m_{t-p} + \beta_{10} r_{t-p} + \beta_{11} inf_{t-p} + \beta_{12} ip_{t-p} + \mu_m \quad (4.23)$$

Money supply equation

$$r_t = \beta_{13} r_{t-p} + \beta_{14} m_{t-p} + \beta_{15} lb_{t-p} + \mu_r \quad (4.24)$$

Long bond yield

$$lb_t = \beta_{16} lb_{t-p} + \beta_{17} m_{t-p} + \beta_{18} r_{t-p} + \beta_{19} cph_{t-p} + \beta_{20} inf_{t-p} + \beta_{21} ip_{t-p} + \mu_{lb} \quad (4.25)$$

Housing prices reacted immediately to production activities (Woodford, 2002; Goldberg and Knetter, 1997; The Edge, 2016). The housing assets are forward looking, so they react instantly to macroeconomic situation of an economy. Further, money supply has positive impact on house prices (Su et al., 2019). Moreover, housing prices are not included in the money supply equation as these prices like output and inflation can't be observed within a month. The above system of equations can be written in matrix form as follow;

$$\begin{bmatrix} \mu cph_t \\ \mu ip_t \\ \mu inf_t \\ \mu m_t \\ \mu r_t \\ \mu lb_t \end{bmatrix} = \begin{bmatrix} 1 & a_{12} & 0 & a_{14} & 0 & a_{16} \\ 0 & 1 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 \\ 0 & a_{42} a_{43} & 1 & a_{45} & 0 & \\ 0 & 0 & 0 & a_{54} & 1 & a_{56} \\ & a_{61} a_{62} a_{63} a_{64} a_{65} & 1 & & & \end{bmatrix} \begin{bmatrix} \varepsilon cph_t \\ \varepsilon ip_t \\ \varepsilon inf_t \\ \varepsilon m_t \\ \varepsilon r_t \\ \varepsilon lb_t \end{bmatrix}$$

Thus, total 21 parameters will be estimated with 21 independent movements of covariance matrix We impose total 15 zero restrictions to estimate our macro-economic variables matrix for housing prices. So, our model is perfectly identified.

4.2.5.4.FOR TRANSPORTATION PRICES

Commodity Price equation

$$cpt_t = \beta_1 cpt_{t-p} + \mu_t \quad (4.26)$$

Aggregate industrial output

$$ip_t = \beta_2 ip_{t-p} + \beta_3 cpt_{t-p} + \mu_{ip} \quad (4.27)$$

Aggregate price setting equation

$$inf_t = \beta_4 inf_{t-p} + \beta_5 ip_{t-p} + \beta_6 cpt_{t-p} + \mu_{inf} \quad (4.28)$$

Money demand equation

$$m_t = \beta_7 m_{t-p} + \beta_8 r_{t-p} + \beta_9 inf_{t-p} + \beta_{10} ip_{t-p} + \mu_m \quad (4.29)$$

Money supply equation

$$r_t = \beta_{11} r_{t-p} + \beta_{12} m_{t-p} + \beta_{13} lb_{t-p} + \beta_{14} cpt_{t-p} + \mu_r \quad (4.30)$$

Long bond yield

$$lb_t = \beta_{15} lb_{t-p} + \beta_{16} m_{t-p} + \beta_{17} r_{t-p} + \beta_{18} cpt_{t-p} + \beta_{19} inf_{t-p} + \beta_{20} ip_{t-p} + \mu_{lb} \quad (4.31)$$

The transportation price is taken as exogenous in our model ad it determines by the demand and supply of transportation and depends on many other factors like fuel price, capital, operational cost, depreciation cost, maintains cost and lubricants (Shain et al., 2009). The aggregate industrial input equation takes into account transportation cost as most of the industrial activities involve the movements of labor, raw materials and finished products from one place to other (Redding and turner, 2015; Paulley et al., 2006). The rest of restrictions are similar to oil prices.

$$\begin{bmatrix} \mu cpt_t \\ \mu ip_t \\ \mu inf_t \\ \mu m_t \\ \mu r_t \\ \mu lb_t \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 \\ 0 & a_{42} & a_{43} & 1 & a_{45} & 0 \\ a_{51} & 0 & 0 & a_{54} & 1 & a_{56} \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon cpt_t \\ \varepsilon ip_t \\ \varepsilon inf_t \\ \varepsilon m_t \\ \varepsilon r_t \\ \varepsilon lb_t \end{bmatrix}$$

We impose total 16 zero restrictions to estimate our macro-economic variables matrix A_{11} with transportation prices. Thus, total 20 parameters will be estimated with 21 independent movements of covariance matrix (that will be obtained through the residuals of macroblocks). Our model has one over identified restriction.

4.2.5.5.FOR EDUCATION PRICE

Commodity Price equation

$$cpedu_t = \beta_1 cpedu_{t-p} + \mu_{edu} \tag{4.32}$$

Aggregate industrial output

$$ip_t = \beta_2 ip_{t-p} + \beta_3 cpedu_{t-p} + \mu_{ip} \tag{4.33}$$

Aggregate price setting equation

$$inf_t = \beta_4 inf_{t-p} + \beta_5 ip_{t-p} + \beta_6 cpedu_{t-p} + \mu_{inf} \tag{4.34}$$

Money demand equation

$$m_t = \beta_7 m_{t-p} + \beta_8 r_{t-p} + \beta_9 inf_{t-p} + \beta_{10} ip_{t-p} + \mu_m \tag{4.35}$$

Money supply equation

$$r_t = \beta_{11} r_{t-p} + \beta_{12} m_{t-p} + \beta_{13} lb_{t-p} + \beta_{14} cpedu_{t-p} + \mu_r \tag{4.36}$$

Long bond yield

$$lb_t = \beta_{15}lb_{t-p} + \beta_{16}m_{t-p} + \beta_{17}r_{t-p} + \beta_{18}cpedu_{t-p} + \beta_{19}inf_{t-p} + \beta_{20}ip_{t-p} + \mu_{lb} \quad (4.37)$$

We treat education price as exogenous from our macro-economic variables. However, the aggregate industrial production equation incorporates the impact of education prices as the positive relationship between education, economic growth and productivity is well known in literature (Ram, 1980; Lau et al., 1991; Barro, 1991; Patrinosand Psacharopoulos, 2011; Otalu and Anderu,2015). Thus, the matrix $A_{11}$with the help of equation 4.32 to 4.37 can be written as;

$$\begin{bmatrix} \mu cpedu_t \\ \mu ip_t \\ \mu inf_t \\ \mu m_t \\ \mu r_t \\ \mu lb_t \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 \\ 0 & a_{42} & a_{43} & 1 & a_{45} & 0 \\ a_{51} & 0 & 0 & a_{54} & 1 & a_{56} \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon cpedu_t \\ \varepsilon ip_t \\ \varepsilon inf_t \\ \varepsilon m_t \\ \varepsilon r_t \\ \varepsilon lb_t \end{bmatrix}$$

We impose total 16 zero restrictions on matrix A_{11} and our model has one over-identified restriction.

4.2.5.6.FOR HEALTH PRICES

Commodity Price equation

$$cphel_t = \beta_1 cphel_{t-p} + \mu_{hel} \quad (4.38)$$

Aggregate industrial output

$$ip_t = \beta_2 ip_{t-p} + \mu_{ip} \quad (4.39)$$

Aggregate price setting equation

$$inf_t = \beta_3 inf_{t-p} + \beta_4 ip_{t-p} + \beta_5 cphel_{t-p} + \mu_{inf} \quad (4.40)$$

Money demand equation

$$m_t = \beta_6 m_{t-p} + \beta_7 r_{t-p} + \beta_8 inf_{t-p} + \beta_9 cphel_{t-p} + \beta_{10} ip_{t-p} + \mu_m \quad (4.41)$$

Money supply equation

$$r_t = \beta_{11} r_{t-p} + \beta_{12} m_{t-p} + \beta_{13} lb_{t-p} + \beta_{14} cphel_{t-p} + \mu_r \quad (4.42)$$

Long bond yield

$$lb_t = \beta_{15} lb_{t-p} + \beta_{16} m_{t-p} + \beta_{17} r_{t-p} + \beta_{18} cphel_{t-p} + \beta_{19} inf_{t-p} + \beta_{20} ip_{t-p} + \mu_{lb} \quad (4.43)$$

We treat health price as exogenous to our macro-economic variables. The above system of equations is similar to oil price with few changes the aggregate output equation does not include health price as it is not directly related to industrial production. However, the demand for money equation adds health prices as an increase in health prices increases the demand for many for precautionary motives (Frenkel and Jovanovic, 1980). Thus, the above system of equation can be written in matrix form as follows;

$$\begin{bmatrix} \mu cphel_t \\ \mu ip_t \\ \mu inf_t \\ \mu m_t \\ \mu r_t \\ \mu lb_t \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & a_{45} & 0 \\ a_{51} & 0 & 0 & a_{54} & 1 & a_{56} \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon cphel_t \\ \varepsilon ip_t \\ \varepsilon inf_t \\ \varepsilon m_t \\ \varepsilon r_t \\ \varepsilon lb_t \end{bmatrix}$$

We impose total 16 zero restrictions to estimate our macro-economic variables matrix A_{11} with health prices. Thus, total 20 parameters will be estimated with 21 independent movements of covariance matrix (that will be obtained through the residuals of macroblocks). Our model has one over identified restriction.

4.2.5.7.CLOTHING AND FOOTWEAR PRICES

Commodity Price equation

$$cpcf_t = \beta_1 cpcf_{t-p} + \mu_{cf} \quad (4.44)$$

Aggregate industrial output

$$ip_t = \beta_2 ip_{t-p} + \mu_{ip} \tag{4.45}$$

Aggregate price setting equation

$$inf_t = \beta_3 inf_{t-p} + \beta_4 ip_{t-p} + \beta_5 cpcf_{t-p} + \mu_{inf} \tag{4.46}$$

Money demand equation

$$m_t = \beta_6 m_{t-p} + \beta_7 r_{t-p} + \beta_8 inf_{t-p} + \beta_9 ip_{t-p} + \mu_m \tag{4.47}$$

Money supply equation

$$r_t = \beta_{10} r_{t-p} + \beta_{11} m_{t-p} + \beta_{12} lb_{t-p} + \beta_{13} cpcf_{t-p} + \mu_r \tag{4.48}$$

Long bond yield

$$lb_t = \beta_{14} lb_{t-p} + \beta_{15} m_{t-p} + \beta_{16} r_{t-p} + \beta_{17} cpcf_{t-p} + \beta_{18} inf_{t-p} + \beta_{19} ip_{t-p} + \mu_{lb} \tag{4.49}$$

We treat clothing and footwear price as exogenous. Further, we don't add clothing and footwear prices in aggregate industrial output as it doesn't have direct impact on industrial production. The above system of equation can be written in matrix form as follows;

$$\begin{bmatrix} \mu cpcf_t \\ \mu ip_t \\ \mu inf_t \\ \mu m_t \\ \mu r_t \\ \mu lb_t \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 \\ 0 & a_{42} & a_{43} & 1 & a_{45} & 0 \\ a_{51} & 0 & 0 & a_{54} & 1 & a_{56} \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon cpcf_t \\ \varepsilon ip_t \\ \varepsilon inf_t \\ \varepsilon m_t \\ \varepsilon r_t \\ \varepsilon lb_t \end{bmatrix}$$

We impose total 17 zero restrictions to estimate our macro-economic variables matrix A_{11} with health prices. Thus, total 19 parameters will be estimated with 21 independent movements of covariance matrix (that will be obtained through the residuals of macroblocks). Our model has two over identified restrictions.

4.2.6.IDENTIFICATION OF INDUSTRIAL SVAR MODEL

Industrial variables are present in last row of matrix A (A_{21} *and* A_{22}). The elements in A_{21} shows the contemporaneous relationship between industrial variables and macro-economic variables. Whereas, A_{22} shows the relationship between industrial variables themselves. As mentioned earlier in order to get the accurate impact of commodity price shocks on industrial output and prices, it is important to isolate them from the impact of macroeconomic shocks, so we treat the macro-economic shocks as exogenous. So, the industrial price and output equation can be written as;

Industrial price equation

$$P_{it} = \beta_1 P_{it-p} + \beta_2 lb_{t-p} + \beta_3 m_{t-p} + \beta_{24} r_{t-p} + \beta_5 cpoil_{t-p} + \beta_6 inf_{t-p} + \beta_7 ip_{t-p} + \beta_8 y_{it-p} + \mu_p \quad (4.50)$$

Industrial output equation

$$Y_{it} = \beta_9 Y_{it-p} + \beta_{10} lb_{t-p} + \beta_{11} m_{t-p} + \beta_{12} r_{t-p} + \beta_{13} cpoil_{t-p} + \beta_{14} inf_{t-p} + \beta_{15} ip_{t-p} + \beta_{16} P_{it-p} + \mu_y \quad (4.51)$$

Whereas for the element of matrix A_{22} the above equation can be written as

$$Y_{it} = \beta_1 Y_{it-p} + \beta_2 P_{it-p} + \mu_{yt} \quad (4.52)$$

$$P_{it} = \beta_3 P_{it-p} + \beta_4 y_{it-p} + \mu_{pt} \quad (4.53)$$

The maximum number of parameters in A_{22} are N^2= 4 and maximum number of independent movements in covariance matrix is $N(N+1)/2$=3. Thus, in order to make our SVAR model fully identified we must have to impose at least one restriction. Following the work of Lee and Ni (2002) and Jo et al. (2019) we impose restriction in our industrial price equation for this purpose we first estimate the reduced form VAR model for above equations. We scaled our industrial output and industrial price data by dividing it with their respective standard deviations. The procedure of scaling makes the parameter β_1 and $\beta_3$approximately equal to unity. We then estimate the SVAR model for above system of equations with scale data and assume that $\beta_2 = -\theta\beta_4$. Further, following the work of Jo et al. (2019) the value of $\theta$is fixed to 2 for all industries. The classification of industrial demand and supply equation will depend on the signs of estimated coefficients $\hat{\beta_2}$ and $\hat{\beta_4}$as the sign of $\hat{\beta_1}$ and $\hat{\beta_3}$are positive by construction. Thus if $\hat{\beta_4}$ is negative then 4.53 is our industrial supply equation while 4.52 describes our industrial demand and if $\hat{\beta_4}$is positive the 4.53 is industrial demand and 4.52 is industrial supply.

Thus, the matrix A_{22} with restriction can be written as;

$$\begin{pmatrix} \mu y_{it} \\ \mu p_{it} \end{pmatrix} = \begin{pmatrix} a_{11} & -\theta * a_{21} \\ a_{21} & a_{22} \end{pmatrix} \begin{pmatrix} \epsilon y_{it} \\ \varepsilon p_{it} \end{pmatrix}$$

Thus, we will estimate the above matrix for each industry separately. And the estimation of matrix A_{22} help us to identify our relevant industrial demand and industrial supply. After identifying industrial demand and supply equations we incorporate the element matrix A_{21}that shows the contemporaneous relationship between industrial variables and macro-economic variables in our analysis. As our main aim is to examine the impact of commodity price shocks on industrial demand and supply so we take all other macroeconomic variables except commodity price as exogenous. Thus, we will identify matrix A_{21} with three endogenous variables N=3. The maximum number of parameters in A_{21} are N^2= 9 and maximum number of independent movements in covariance matrix is 6[23] . Thus, in order to make our SVAR model fully identified we must have to impose at

[23] $N(N+1)/2$=6

least 3[24] restrictions. Thus, we identify the restrictions with the help of following equations for oil price;

$$CPoil_t = \beta_1 CPoil_{t-p} + \mu_{oilt} \tag{4.54}$$

$$y_{it} = \beta_2 y_{it-p} + \beta_3 CPoil_{t-p} - \theta\beta_4 P_{it-p} + \mu_{yt} \tag{4.55}$$

$$P_{it} = \beta_5 P_{it-p} + \beta_6 CPoil_{t-p} + \beta_7 y_{it-p} + \mu_{pt} \tag{4.56}$$

Where oil price is assumed to be set independently from macro-economic situation of Pakistan as mentioned earlier. Further we add same restriction in equation 1.61 as we imposed on equation 1.58. Thus, the matrix A_{21}can be written as;

$$\begin{bmatrix} \mu cpoil_t \\ \mu y_{it} \\ \mu p_{it} \end{bmatrix} = \begin{bmatrix} a_{11} & 0 & 0 \\ a_{21} & a_{22} & -\theta a_{32} \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \begin{bmatrix} \varepsilon cpoil_t \\ \varepsilon y_{it} \\ \varepsilon p_{it} \end{bmatrix}$$

So, we impose three restriction and our model is just identified. The same model will be estimated for each commodity price and each industry separately. The restrictions for each group of commodity price remain same (following the restriction of matrix A_{12}=0 industrial variables have no impact on commodity prices).

4.3.RESULTS

This section represents the results of our estimations. Table 4.3 to 4.5 shows the unit root tests results. In order to use the correct specification of the model we perform ADF test with intercept and with intercept and trend. However, both the model shows same results. Therefore, to avoid repetition we have quoted results with intercept only. Further the lags numbers have been selected on basis of Schwarz Info Criterion (SIC).

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[24] $N(N-1)/2 = 3$

Table 4.3: Results of unit root test for industrial output variables

Variables	ADF Test at Level		ADF Test at First Diff		Oder of Integration
	τ statistics	P values	τ statistics	P values	
y_auto	-2.89*	0.04	-	-	I (0)
y_chem	-6.51**	0.000	-	-	I (0)
y_elect	-8.21**	0.000	-	-	I (0)
y_engin	-7.47**	0.000	-		I (0)
y_f	-9.41**	0.000	-	-	I (0)
y_ ferti	-10.31**	0.000	-	-	I (0)
y_lether	-4.90**	0.000	-	-	I (0)
y_nmm	-4.91**	0.000	-	-	I (0)
y_pb	-6.71**	0.000	-	-	I (0)
y_petrol	-5.36**	0.000	-	-	I (0)
y_pharm	-2.77	0.065	-10.80**	0.000	I (1)
y_rub	-5.05**	0.000	-	-	I (0)
y-tex	-8.90**	0.000	-	-	I (0)

Note:CV at 5% level with intercept=-2.88 and CV at 1% level with intercept=-3 48

Table 4.4: Results of unit root test for industrial price variables

Variables	ADF Test at Level		ADF Test at First Diff		Oder of Integration
	τ statistics	P values	τ statistics	P values	
p_auto	-1.43	0. 561	-9.23**	0.000	I (1)
p_chem	-2.04	0.267	-9.93**	0.000	I (1)
p_elect	-1.76	0.39	-7.35**	0.000	I (1)
p_engin	-2.32	0.164	-11.54**	0.000	I (1)
p_f	-2.10	0.242	-8.07**	0.000	I (1)
p_ferti	-2.89	0.048	-4.12**	0.000	I (1)
p_lether	-0.97	0.751	-8.46**	0.000	I (1)
p_nmm	-2.78	0.062	-15.78**	0.000	I (1)
p_pb	-2.24	0.192	-13.11**	0.000	I (1)
p_petrol	-2.54	0.107	-17.68	0.000	I (1)
p_pharm	-2.92*	0.041	-	-	I (0)
p_rub	-1.90	0.332	-12.72**	0.000	I (1)
lp_tex	-2.34	0.061	-11.11**	0.000	I (1)

Note:CV at 5% level with intercept=-2.88 and CV at 1% level with intercept=-3.48

Table 4.5: Results of unit root test for macro variables

Variables	ADF Test at Level		ADF Test at First Diff		Oder of Integration
	τ statistics	P values	τ statistics	P values	
cpoil	-2.61	0.09	-11.27**	0.000	I (1)
cpf	-1.83	0.36	-3.53**	0.000	I (1)
cpedu	-2.45	0.12	-12.15**	0.000	I (1)
cphel	-1.68	0.43	-10.93**	0.000	I (1)
cph	-2.15	0.45	-4.32**	0.000	I (1)
cpt	-2.47	0.12	-7.86**	0.000	I (1)
cpcf	-1.88	0.34	-6.89**	0.000	I (1)
ip	-3.27*	0.01	-	-	I (0)
inf	-1.62	0.40	-10.02**	0.000	I (1)
M	-3.27*	0.001	-	-	I (0)
ir	-2.15	0.22	-4.45**	0.000	I (1)
lb	-2.40	0.14	-3.96**	0.000	I (1)

Note:CV at 5% level with intercept=-2.88 and CV at 1% level with intercept=-3.48

The review of 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 level data regardless of stationarity is found to give consistent estimators which are asymptotically normally distributed. However, the standard textbooks support is with stationary data as it helps to meet the normality condition and inference can be done. Therefore, we have preferred to go with stationary data.

4.3.1.RESULTS OF BASE-LINE MODEL

The aim of this baseline model is to estimate the A_{11} matrix of the macro economic variables. We used monthly data over July 2008 to June 2020. We have estimated our macro model with original data without conversion in percentage[25]. The lag length criteria for each commodity price are given in Tables 2 to 7 in Appendix 2. We have use SIC for selection of lag length as it is best fitted for small samples. In order to get a better understanding of results we represent the response of individual macro variables to each commodity price in one place.

Figure 4.27 below shows the impulse response of industrial output to different groups of commodity prices. Industrial output falls initially in response to oil price shocks until it reached a minimum point in second month. Thereafter, it starts to rise and the impact of oil price shocks dies out in 3rd month. The decline in IP is may be due to reduction in production of oil intensive industries. This decline is offset by the higher production in non-oil intensive industries. However, this response is insignificant.

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[25]We have converted data of all variables in to monthly year-to-year adjusted percentage change in order to make it comparable with individual industry output data.

In response to food price shocks industrial output decreases significantly in first month. As household spend 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 short period and it shows no impact in long run. Clothing and footwear price shocks also have significant negative impact on industrial output in short run. This decline is may be due to the fact that the textile industry is the largest manufacturing industry and reduction in this industry production significantly reduce aggregate industrial output.

Industrial output declines in response to health price shocks in short run until 2nd month and then it starts to raise again. However, this response is statistically insignificant and dies out in long run. Shocks in education prices significantly reduce industrial output for initial two months. After 3rd month this decline is almost diminish. This response in industrial output in 1st and 2nd months is may be due to the nature of our data as we have used monthly year-to year adjusted data so response of all commodity price shocks is observed in initial months.

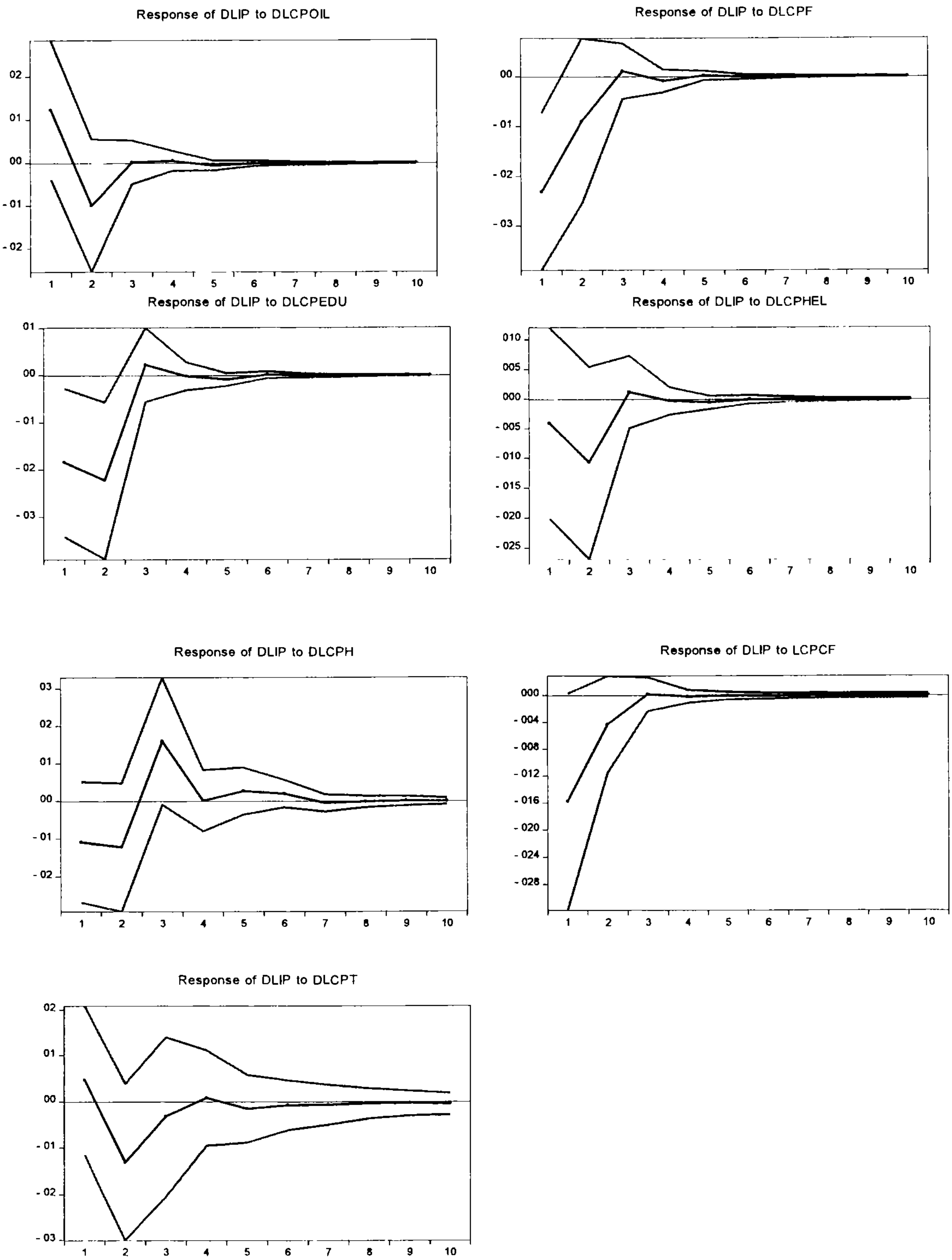

Figure 4.27: Impulse responses of industrial output

In response to transportation price shocks, industrial output decreases for the first two months and then it starts to recover. However, this response is insignificant. In response to housing price shocks, industrial output shows significant positive impact in 3rd month. This positive impact on industrial output is may be due to increase in aggregate demand resulting from wealth effect.

Figures 4.28 to 4.34 below show the response of industrial output to aggregate inflation in different commodity price macro models. The response is negative in all models except the transportation price model that had a significant positive impact in the 3rd month. Moreover, the negative response is significant for food and clothing and footwear models only. In the long run the impact of inflation on industrial output is zero that supports the classical economists view that nominal variables do not affect real variables in the long run.

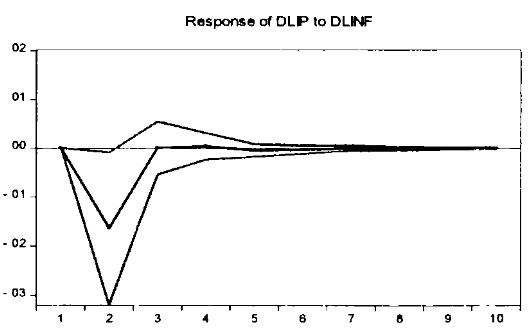

Figure 4.28: IR with clothing and footwear model

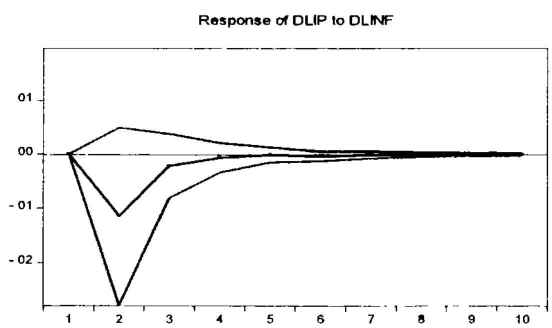

Figure 4.29: IR with oil price model

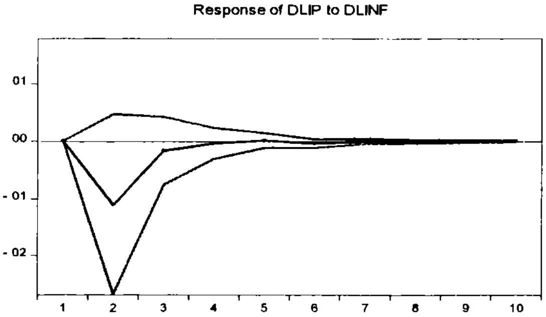

Figure 4.30: IR with education price model

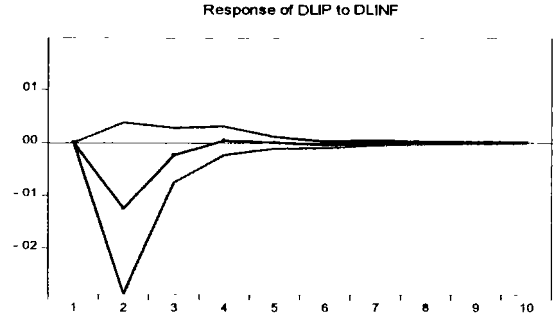

Figure 4.31:IR with health price model

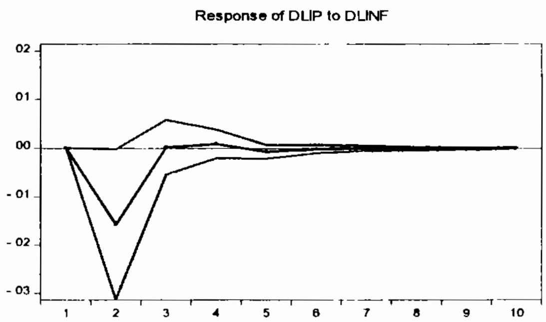

Figure 4.32: IR with food price model

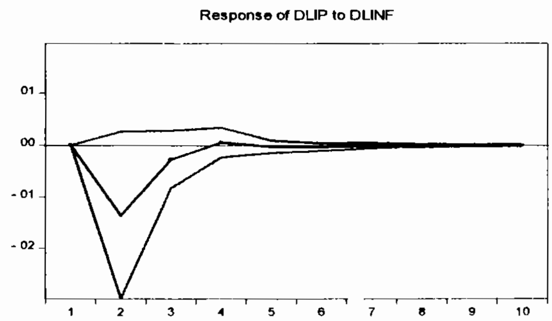

Figure 4.33:IR with housing price model

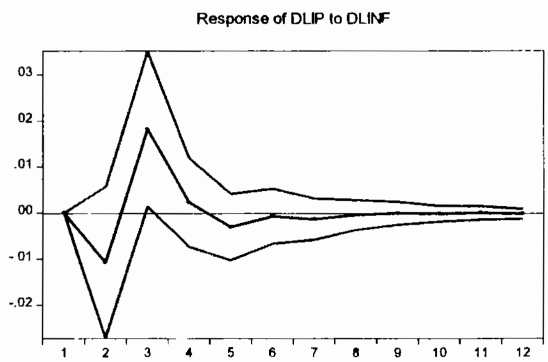

Figure 4.34: IR with transportation price

Figure 4.35 below shows the impact of contractionary monetary policy on industrial output for the oil price model. The detailed responses are given in Appendix 2 we are quoting only oil price response here because all other responses are almost same except for transportation price model that shows no significant impact of contractionary monetary policy on IP.

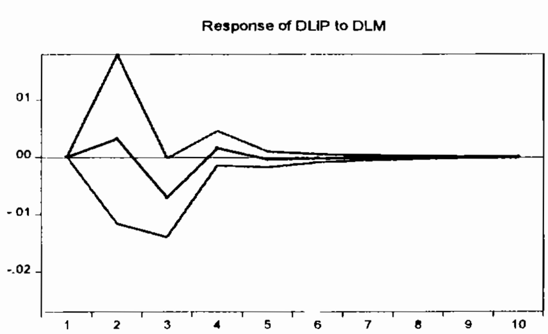

Figure 4.35: IR with oil price model

The response of short term and long-term interest rates on industrial variables is not significant for all groups of commodity prices and is given in Appendix 2 along with the impulse response of all other variables.

4.3.2.RESULTS OF INDUSTRIAL MODEL

The estimates of equations 4.52 and 4.53 show the elements of matrix A_{22} that are used to identify industrial demand and supply. Further, estimates of equations 4.54 to 4.56 show the elements of matrix A_{21} that are used to check the impulse responses of different groups of commodity prices on already identified industrial demand and supply. We have estimated separate SVAR models for each industry and for each commodity price. Therefore, for one industry total 28 SVAR models have been estimated and for 13 industries total of 364 SVAR models. In order to a get better understanding we have described results of each industry individually however; the conclusion section provides the comparative analysis of all industries.

4.3.2.1. AUTOMOBILE INDUSTRY

In order to identify industrial demand and supply equation,we have first estimated the reduced form VAR model for equations 4.52 and 4.53 for each group of commodity prices. We scaled our industrial output and industrial price data by dividing it by their respective standard deviations that we got from our estimated reduce from VAR model. Table 9 in Appendix 2 provides the details of these estimated VAR models. We then re-estimate the SVAR model for equations 4.52 and 4.53 with scale data and assume that $\beta_2 = -\theta\beta_4$. Thus, with the estimates of scale model, we have identified our demand and supply equation as described earlier. Table 4.6 below shows the results of scaled SVAR models.

Table 4.6: Identification of automobiles industry demand and supply

Commodity price	Value of $\hat{\beta}_4$ of equation 4.53	Identification of Demand and Supply
Oil	-0.024 (1 2)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Food	-0.023 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Education	-0.021 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Health	-0.017 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Housing	-0.028 (1 1)	Eq 4.52 (y) Demand Eq 4.53 (P) Supply
Transportation	-0.041 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Clothing and footwear	-0.022 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply

Note: The lag length of each scaled SVAR model has been mentioned in brackets of column 2.

The results of Table 4.6 above show that $\hat{\beta}_4$ is negative for all commodity prices; thus 4.53 is our industrial supply equation while 4.52 describes our industrial demand. The next step of our analysis is to check the impulse response of commodity prices on demand and supply of the automobiles industry. Figure 4.36 below shows the impulse response for automobile industry.

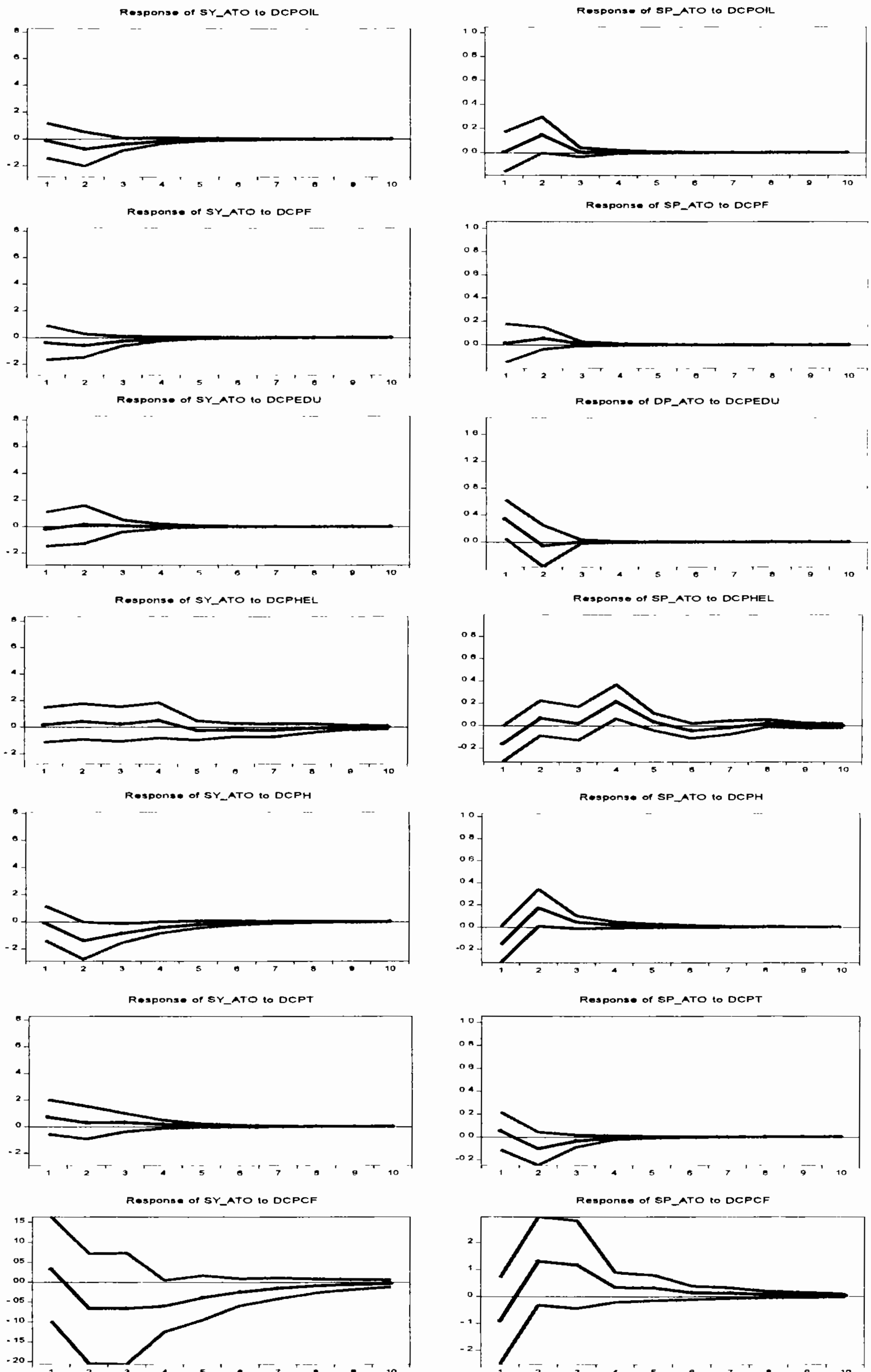

Figure 4.36: Impulse responses of automobile industry demand and supply

Table 4.7: Commodity price shocks effects on automobile industrial demand and supply

Commodity Price (CP)	CP coefficient $\hat{\beta}_3$ (p-value) in equation 4.55	CP coefficient $\hat{\beta}_6$ (p-value) in equation 4.56	Peak effect on output	Peak effect on price	Commodity price shocks effects
Oil	-0.154(0.000)	0.159 (0.000)	-*	+*	Increase in supply
Food	-0.146(0.00)	0.078(0.00)	-*	Insignificant	Reduction in demand
Education	0.065(0.23)	0.243(0.00)	0	+*	Increase in supply
Health	0.031(0.00)	0.128(0.00)	0	Mixed*	Uncertain impact on supply
Housing	-0.323(0.00)	0.091(0.00)	-*	+*	Increase in supply
Transportation	0.158(0.00)	-0.099(0.00)	Insignificant	-*	Reduction in supply
Clothing and footwear	-0.265(0.63)	0.265(0.25)	-*	Insignificant	Reduction in demand

Note: The * is used if the peak responses are significant at 5% level based on two standard error confidence intervals for at least one time period of the study "+" and "-" is for positive and negative responses respectively Mixed shows that both+ and - responses are of same magnitude.

Figure 4.36 shows the pattern of impulse responses of industrial demand and supply to commodity price shocks. Table 4.7 describes the peak responses to each commodity price shocks along with the contemporaneous structural coefficients. The effect of commodity price shocks is determined as if, industrial output and prices move in same direction, then the dominant impact is on demand side, and if they move in opposite direction then the dominant impact is on supply side. Further, supply or demand side impact is positive or negative is based on the pattern of their respective impulse responses.

The shocks in oil prices decrease demand for automobiles significantly in the third month. In the short run, consumers postpone the purchases of new cars keeping in view the additional operating cost. Further, uncertainty about future oil prices also affects the consumers decision of which car is to buy. The increase in the prices of automobiles further intensifies the reduction on demand. Moreover, the supply of automobiles is less elastic in the short run. Therefore, in Pakistan an oil price shock reduces automobiles industry demand and increases its prices whereas, dominant impact is on supply side that increases in short run.

Food is a basic necessity of life and consumers spend large portions of their income on consumption of food items. Thus, a positive shock in food prices reduces the purchasing power of consumers and they decrease the demand for durable like automobiles. Education price shocks have no significant impact on the output of the automobile industry; however, it increases the PPI of automobiles that causes excess supply in the short run. The shocks in health prices also have no impact on automobiles output however, it decreases the automobile prices in first month and then increases in fourth month therefore, its impact on supply is uncertain.

The shocks in housing prices work differently for the economy as compared to other commodity price shocks. As houses are treated as assets and increase in their prices, increase the wealth of house owners and of course increase the living costs of renters. A positive shock in housing prices reduced demand of automobiles due to the fact that consumers found its more beneficial to invest in housing and postponed their demand for automobiles. On the other hand, renter decisions to purchase new cars also affect negatively by this increase. Therefore, an increase in automobile prices along with reduced demand causes excess supply in short run. Transportation price shocks have an insignificant impact on automobiles output; however, it reduces its price significantly in the short run. The reduction in prices of automobiles encourages demand and, on another side, the high prices of transportation increase the profits of public transporters and they feel optimistic about new purchases of buses and cars. As supply of automobiles is less elastic in short run, the reduction in prices of automobiles and chances of profits boosts up demand and causes reduction in supply in short run. The shocks in clothing and footwear prices reduce the demand for automobile significantly in fourth month. However, it has no significant impact on supply side.

The above discussion showed that impact of commodity price shocks on the automobiles industry of Pakistan is dominant on the supply side. As oil, education and housing price shocks cause excess supply of automobiles. Whereas, transportation prices reduce supply. On the demand side, food and clothing and footwear price shocks play negative role and reduce demand.

4.3.2.2: CHEMICAL INDUSTRY

Likewise, for the automobile industry two reduce form SVAR models have been estimated to get the value of standard deviation for scaling of industrial output and price data of chemical industry of Pakistan. However, it can be seen through the S.D Table 9 in Appendix 2 that its value is almost the same for all commodity prices; therefore, in order to avoid repetition, we have given the results of SD for all industries together in Table 10 in Appendix 2. The results of scaled SVAR model to identify industrial demand and supply are described in Table 4.8 below.

Table 4.8: Identification of Chemical industry demand and supply

Commodity price	Value of $\hat{\beta}_4$ of equation 4.53	Identification of Demand and Supply
Oil	0.018 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Food	0.015 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Education	0.015 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Health	0.016 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Housing	0.020 (1 1)	Eq 4.52 (y) Supply Eq 4.53 (P) Demand
Transportation	0.014 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Clothing and footwear	0.022 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand

Note: The lag length of each scaled SVAR model has been mentioned in brackets of column 2.

The results of Table 4.8 above show that $\hat{\beta}_4$ is positive for all commodity prices; thus 4.53 is our industrial demand equation while 4.52 describes our industrial supply. The next step of our analysis is to check how commodity price shocks affect demand and supply in the chemical industry. Figure 4.37 below shows the impulse response for automobile industry.

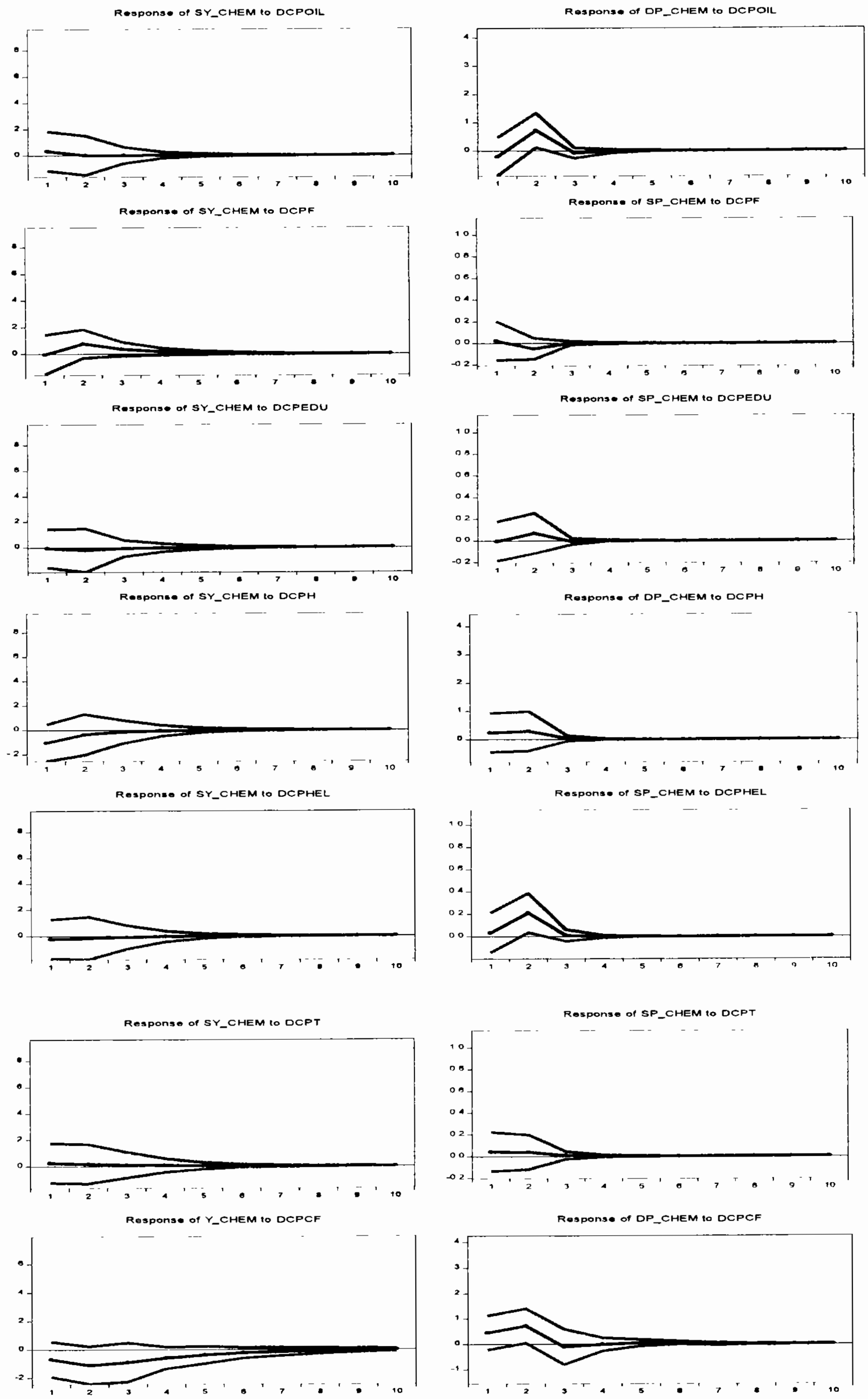

Figure 4.37: Impulse responses of chemical industry demand and supply

Table 4.9: Commodity price shocks effects on chemical industrial demand and supply

Commodity Price (CP)	CP coefficient $\hat{\beta}_3$ (p-value) in equation 4.54	CP coefficient $\hat{\beta}_6$ (p-value) in equation 4.55	Peak effect on output	Peak effect on price	Commodity price shocks effects
Oil	0.031(0.65)	0.396(0.52)	0	+*	Increase in demand
Food	0.136(0.00)	-0.033(0.00)	+*	Insignificant	Increase in supply
Education	-0.052(0.90)	0.053(0.93)	Insignificant	Insignificant	Insignificant
Health	-0.740(0.00)	1.270(0.00)	0	+*	Increase in demand
Housing	-0.176(0.14)	0.548(0.50)	Insignificant	Insignificant	Insignificant
Transportation	0.055(0.76)	0.087(0.65)	0	0	No impact
Clothing and footwear	1.132(0.00)	-0.129(0.00)	Insignificant	+*	Increase in demand

Note: The * is used if the peak responses are significant at 5% level based on two standard error confidence interval for at least one time period of the study "+" and "-" is for positive and negative responses respectively Mixed shows that both+ and - responses are of same magnitude.

Figure 4.37 shows the pattern of impulse responses of industrial demand and supply to commodity price shocks. Table 4.9 describes the peak responses to each commodity price shock along with the contemporaneous structural coefficients and their respective p values. Figure 4.37 shows that in response to oil price shocks price of the chemical industry increases significantly in the second month; however, there is no significant impact on its output. The food and clothing and footwear price shocks increase supply of chemical industries significantly; however, both have an insignificant impact on demand side. The high price of food and clothing and footwear reduces the purchasing power of consumers and increases the cost of living so it reduces aggregate demand in the short run and causes excess supply in industries. The education and housing price shocks have no significant impact on chemical industry.

The review of results of chemical industry shows that commodity price shocks have less and positive impact on chemical industry. As oil and health and others price shocks increase its demand, whereas, food and clothing and footwear price shocks increase its supply in the short run.

4.3.2.3. ELECTRONICS INDUSTRY

The results of scaled SVAR model to identify industrial demand and supply for electronics industry are described in Table 4.10 below.

Table 4.10: Identification of electronics industry demand and supply

Commodity price	Value of $\hat{\beta}_4$ of equation 4.53	Identification of Demand and Supply
Oil	-0.001 (1 2)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Food	-0.005 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Education	-0.074 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Health	-0.008 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Housing	-0.009 (1 1)	Eq 4.52 (y) Demand Eq 4.53 (P) Supply
Transportation	-0.008 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Clothing and footwear	-0.004 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply

Note: The lag length of each scaled SVAR model has been mentioned in brackets of column 2.

The results of Table 4.10 above show that $\hat{\beta}_4$ is negative for all commodity prices thus 4.53 is our industrial supply equation while 4.52 describes our industrial demand. The next step of our analysis is to check the impulse responses of commodity price shocks on demand and supply of electronic industry. Figure 4.38 below shows the impulse response for electronic industry.

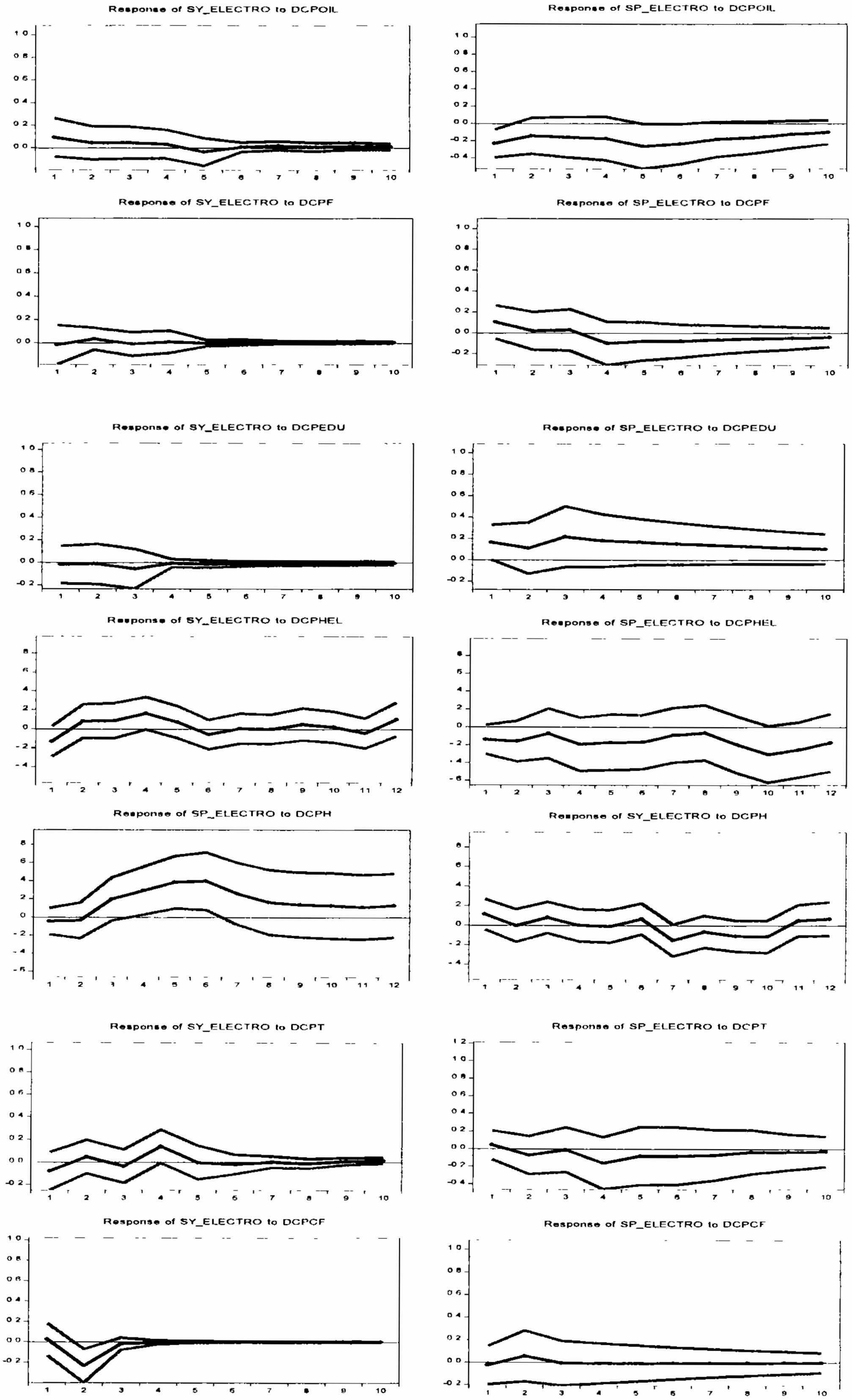

Figure 4.38: Impulse response of commodity price shocks to electronic industry

Table 4.11: Commodity price shocks effects on electronic industry demand and supply

Commodity Price (CP)	CP coefficient $\hat{\beta}_3$ (p-value) in equation 4.55	CP coefficient $\hat{\beta}_6$ (p-value) in equation 4.56	Peak effect on output	Peak effect on price	Commodity price shocks effects
Oil	0.091(0.23)	-0.234(0.00)	0	-*	Reduction in supply
Food	-0.017(0.70)	0.103(0.20)	Insignificant	0	Insignificant
Education	-0.057(0,00)	0.147(0.00)	Insignificant	+*	Increase in supply
Health	-0.134(0.00)	-0.142(0.00)	Mixed*	-*	Reduction in demand and supply
Housing	-0.177(0.00)	0.06(0.00)	-*	+*	Reduction in demand
Transportation	0.043(0.28)	-0.015(0.69)	+*	Insignificant	Increase in demand
Clothing and footwear	-0.231 (0.00)	-0.084(0.00)	-*	Insignificant	Reduction in demand

Note. The * is used if the peak responses are significant at 5% level based on two standard error confidence interval for at least one time period of the study "+" and "-" is for positive and negative responses respectively Mixed shows that both+ and - responses are of same magnitude.

Figure 4.38 shows the pattern of impulse responses of industrial demand and supply to commodity price shocks. Table 4.11 describes the peak responses to each commodity price shock along with the contemporaneous structural coefficients. Oil price shocks significantly reduce the supply of the electronics industry. A peak response of -0.27% was observed in the 5th month of the shock. The positive oil price shock increases the cost of production in the electronic industry. Further, in short run other human resources and intermediate industries also faced decline in their real wages and profit margins and they oppose this decline and put pressure on increment of unit labor cost and prices of intermediate goods that cause reduction of production of final goods.

Food price shocks have no significant impact on the electronic industry. However, education price shocks increased price of electronic industry in the first month and have no impact on output. Whereas, shocks in health and other prices create uncertainty and increase cost of living, that causes reduction in aggregate demand and in the results price of electronic products also reduces, which reduces supply. The shocks in housing and clothing and footwear prices cause a reduction in demand of electronics whereas, transportation price shocks increase the demand.

The review of the results shows that the most dominant impact on the electronic industry was from oil price shocks that reduced its production by about 3%. As the net importer of oil, the increase in oil prices deteriorates the balance of payment situation and makes imported raw material more expensive and hardens the production of the electronics industry. Further, most of the commodity price shocks in electronic industry are short lived and have no long run-in impact.

4.3.2.4: ENGINEERING INDUSTRY

The results of scaled SVAR model to identify industrial demand and supply for engineering industry are described in Table 4.12 below.

Table 4.12: Identification of engineering industry demand and supply

Commodity price	Value of $\hat{\beta}_4$ of equation 4.53	Identification of Demand and Supply
Oil	-0.008 (1 2)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Food	0.006 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Education	-0.001 (1 3)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Health	0.005 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Housing	-0.009 (1 1)	Eq 4.52 (y) Demand Eq 4.53 (P) Supply
Transportation	-0.006 (1 2)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Clothing and footwear	0.004 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand

Note: The lag length of each scaled SVAR model has been mentioned in brackets of column 2.

The results of Table 4.12 above show that $\hat{\beta}_4$ is negative for oil, education, housing and transportation prices thus 4.53 is our industrial supply equation while 4.52 describes our industrial demand. However, $\hat{\beta}_4$ is positive for food, health and clothing and footwear industries; thus, for these prices 4.53 is the industrial demand equation while 4.52 describes industrial supply. The impact of commodity price shocks on engineering industry demand and supply has been shown through impulse responses in figure 39 and Table 4.13 below.

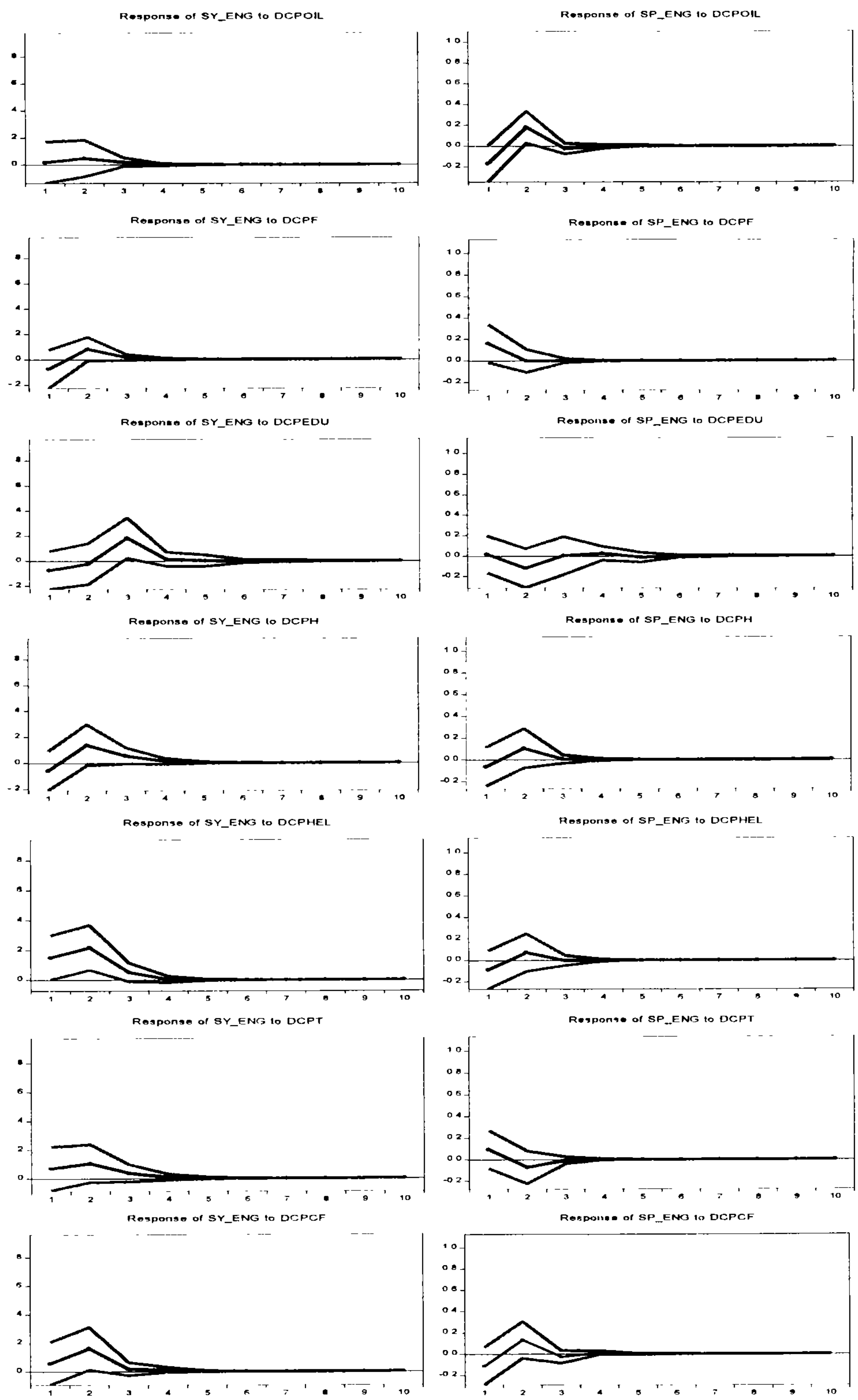

Figure 4.39: Impulse responses of engineering industry demand and supply

Table 4.13: Commodity price shocks effects on engineering industry demand and supply

Commodity Price (CP)	CP coefficient $\hat{\beta}_3$ (p-value) in equation 4.55	CP coefficient $\hat{\beta}_6$ (p-value) in equation 4.56	Peak effect on output	Peak effect on price	Commodity price shocks effects
Oil	0.077(0.87)	-0.023(0.00)	Insignificant	+*	Increase in supply
Food	0.022(0.00)	0.157(0.00)	+*	+*	Increase in demand
Education	0.099(0.32)	-0.093(0.86)	+*	Insignificant	Increase in demand
Health	0.419(0.00)	-0.021(0.30)	+*	Insignificant	Increase in supply
Housing	0.147(0.00)	0.043(0.46)	+*	Insignificant	Increase in demand
Transportation	0.213(0.37)	0.009(0.29)	Insignificant	Insignificant	Insignificant
Clothing and footwear	0.244(0.00)	-0.005(0.00)	+*	Insignificant	Increase in supply

Note: The * is used if the peak responses are significant at 5% level based on two standard error confidence intervals for at least one time period of the study. "+" and "-" is for positive and negative responses respectively. Mixed shows that both+ and - responses are of same magnitude.

Figure 4.39 shows the pattern of impulse responses of engineering industry demand and supply to commodity price shocks. Table 4.13 describes the peak responses to each commodity price shock along with the contemporaneous structural coefficients. The engineering industry is positively effects by all commodity price shocks by increases in its demand or supply. The engineering industry of Pakistan remains neglected for longer period of time and faced many problems like energy crisis, unstable policies and political environment, brain drain and low demand for locally manufacturing goods. However, the vision 2030 of government of Pakistan is to increase share of industrial production to 30% of GDP and in order to make it possible several steps have been taken to promote engineering industry that boots up the production.

4.3.2.5. FERTILIZER INDUSTRY

The results of scaled SVAR model to identify industrial demand and supply for fertilizer industry are described in Table 4.14 below.

Table 4.14: Identification of fertilizer industry demand and supply

Commodity price	Value of $\hat{\beta}_4$ of equation 4.53	Identification of Demand and Supply
Oil	-0.022 (1 2)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Food	-0.021 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Education	-0.021 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Health	-0.020 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Housing	-0.022 (1 1)	Eq 4.52 (y) Demand Eq 4.53 (P) Supply
Transportation	-0.019 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Clothing and footwear	-0.018 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply

Note: The lag length of each scaled SVAR model has been mentioned in brackets of column 2.

The results of Table 4.14 above show that $\hat{\beta}_4$ is negative for all commodity prices thus 4.53 is our industrial supply equation while 4.52 describes our industrial demand. The impact of commodity prices shocks on fertilizer industry demand and supply have been shown through impulse responses in Figure 4.40 and Table 4.15 below.

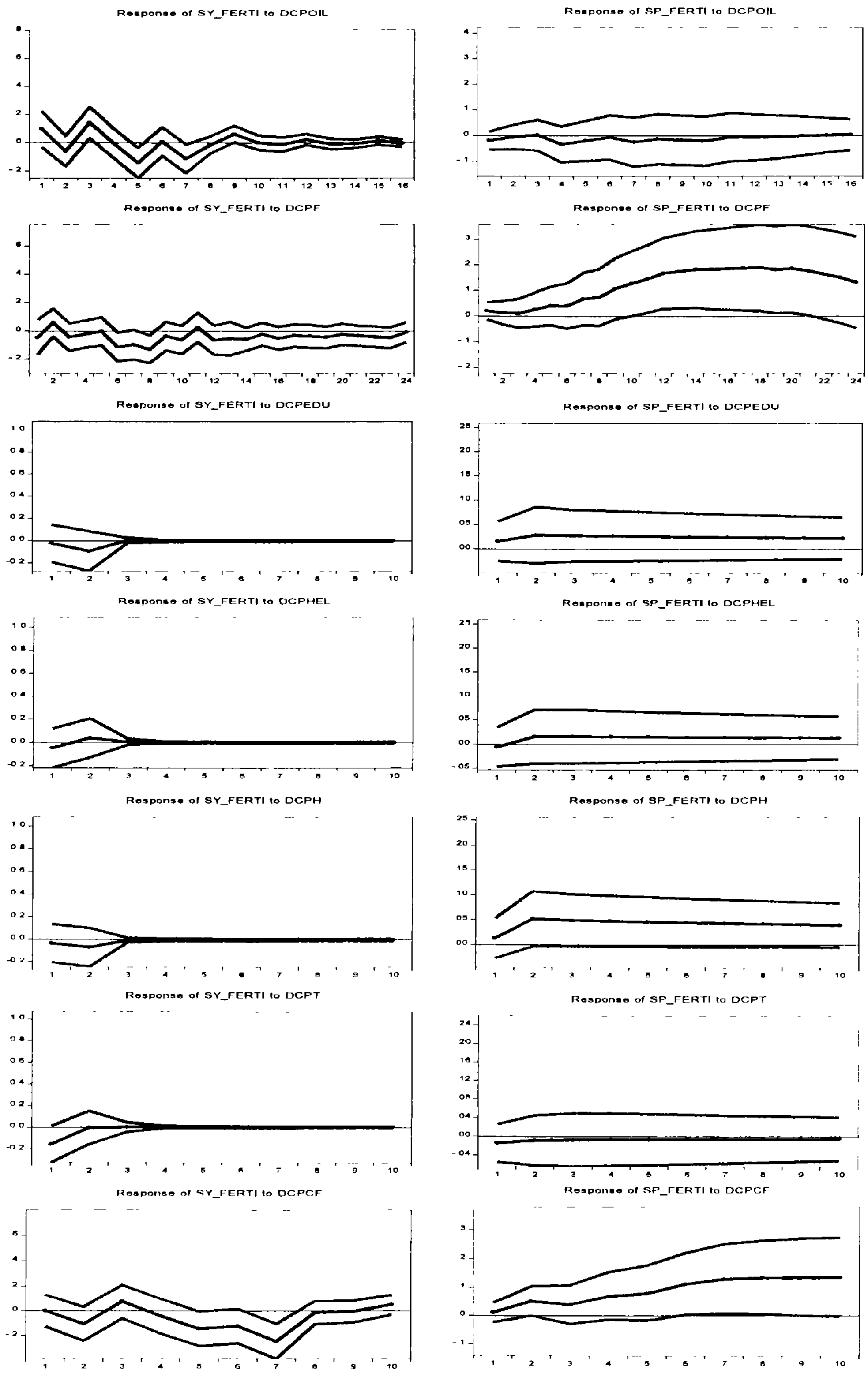

Figure 4.40: Impulse responses of fertilizer industry demand and supply

Table 4.15: Commodity price shocks effects on fertilizer industry demand and supply

Commodity Price (CP)	CP coefficient $\hat{\beta}_3$ (p-value) in equation 4.55	CP coefficient $\hat{\beta}_6$ (p-value) in equation 4.56	Peak effect on output	Peak effect on price	Commodity price shocks effects
Oil	-0.050(0.00)	-0.109(0.237)	Mixed*	Insignificant	Uncertain
Food	-0.048(0.00)	0.019(0.00)	-*	+*	Increase in supply
Education	-0.231(0.76)	0.859(0.43)	Insignificant	Insignificant	Insignificant
Health	-0.068(0.55)	0.485(0.78)	Insignificant	Insignificant	Insignificant
Housing	-0.316(0.67)	0.012(0.50)	Insignificant	+*	Increase in supply
Transportation	-0.157(0.00)	-0.262 (0.00)	-*	Insignificant	Decrease in demand
Clothing and footwear	-0.044(0.00)	1.203(0.00)	-*	+*	Increase in supply

Note: The * is used if the peak responses are significant at 5% level based on two standard error confidence interval for at least one time period of the study "+" and "-" is for positive and negative responses respectively Mixed shows that both+ and - responses are of same magnitude

Figure 4.40 shows the impulse responses of fertilizer industry demand and supply to commodity price shocks. Whereas, Table 4.15 describes the peak responses to each commodity price shock along with the contemporaneous structural coefficients. The oil price shocks have an uncertain impact on fertilizer industry due to the fact that natural gas is used as major input in production. Moreover, keeping in view the higher demand for food and major cotton crops in textile government of Pakistan provide different types of subsidies to this industry like gas subsidy, tax relaxation and distribution subsidy that boosts up the production of fertilizer industry.

However, the transportation price shocks decrease demand of fertilizer in the first month of the shock, this is due to the fact that farmers and dealers considered it as an additional cost and postponed their current decision of purchase. Education and health price shocks on the other hand, have no significant impact on the fertilizer industry's decision of demand and supply. The review of results shows that fertilizer industry is comparatively less affected by commodity price shocks and except for transportation price shocks other significant shocks positively effects fertilizer industry.

4.3.2.6.FOOD INDUSTRY

The results of scaled SVAR model to identify industrial demand and supply for food industry are described in Table 4.16 below.

Table 4.16: Identification of demand and supply for food industry

Commodity price	**Value of $\hat{\beta}_4$ of equation 4.53**	**Identification of Demand and Supply**
Oil	0.012 (1 2)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Food	0.017 (1 2)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Education	0.017 (1 2)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Health	0.014 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Housing	0.005 (1 1)	Eq 4.52 (y) Supply Eq 4.53 (P) Demand
Transportation	0.015 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Clothing and footwear	0.010 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand

Note The lag length of each scaled SVAR model has been mentioned in brackets of column 2.

The results of Table 4.16 above show that $\hat{\beta}_4$ is positive for all commodity prices thus 4.53 is our industrial demand equation while 4.52 describes our industrial supply. The response of commodity price shocks on food industry demand and supply are described through Figure and Table below.

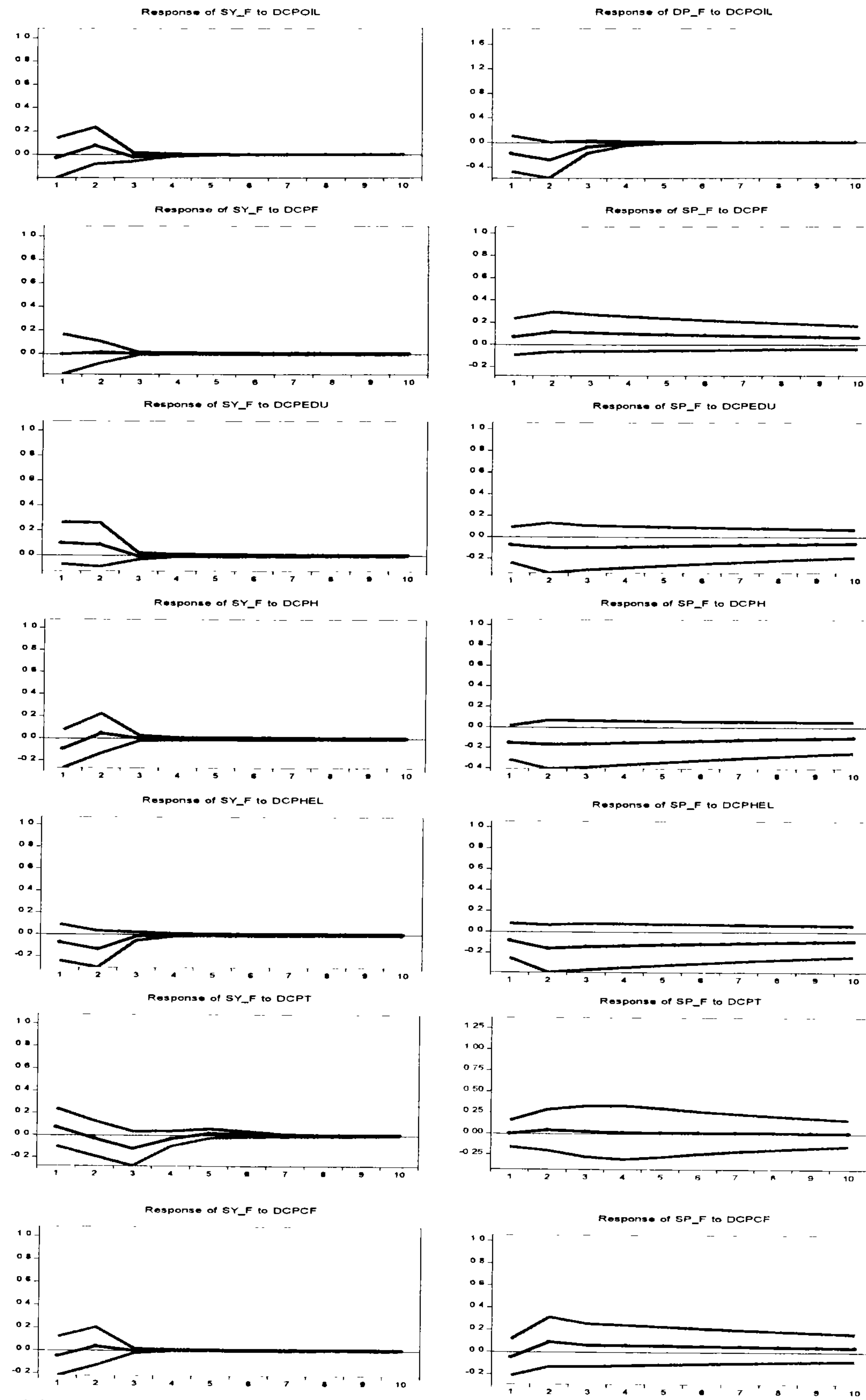

Figure 4.41: Impulse responses of food industry demand and supply

Table 4.17: Commodity price shocks effects on food industry demand and supply

Commodity Price (CP)	CP coefficient $\hat{\beta}_3$ (p-value) in equation 4.55	CP coefficient $\hat{\beta}_6$ (p-value) in equation 4.56	Peak effect on output	Peak effect on price	Commodity price shocks effects
Oil	0.019(0.00)	-0.551(0.00)	Insignificant	-*	Reduction in demand
Food	0.061(0.00)	1.700(0.00)	Insignificant	Insignificant	Insignificant
Education	0.338(0.00)	-1.148(0.00)	Insignificant	Insignificant	Insignificant
Health	-0.308(0.00)	-2.471(0.00)	Insignificant	Insignificant	Insignificant
Housing	-0.308(0.00)	-2.471(0.00)	Insignificant	Insignificant	Insignificant
Transportation	-0.086(0.00)	0.172(0.00)	Insignificant	Insignificant	Insignificant
Clothing and footwear	0.010(0.00)	0.423(0.00)	Insignificant	Insignificant	Insignificant

Note: The * is used if the peak responses are significant at 5% level based on two standard error confidence interval for at least one time period of the study "+" and "-" is for positive and negative responses respectively Mixed shows that both+ and - responses are of same magnitude.

Figure 4.41 shows the pattern of impulse responses of industrial demand and supply to commodity price shocks. Whereas, Table 4.17 describes the peak responses to each commodity price shock along with the contemporaneous structural coefficients. The results show that only oil price shocks have significant impact on the food industry as it decreases demand from second to fourth month of the shock. These results are justifiable due to the nature of the food industry as the demand and supply of food industry are very less elastic as compared to other large-scale manufacturing industries. Further, the supply of food industries depends heavily on crops yields and is fixed in short run.

4.3.2.7 LEATHER INDUSTRY

The results of scaled SVAR model to identify industrial demand and supply for fertilizer industry are described in Table 4.18 below.

Table 4.18: Identification of industrial demand and supply for leather industry

Commodity price	Value of $\hat{\beta_4}$ of equation 4.53	Identification of Demand and Supply
Oil	-0.004 (1 2)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Food	0.002 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Education	0.004 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Health	-0.007 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Housing	-0.003 (1 2)	Eq 4.52 (y) Demand Eq 4.53 (P) Supply
Transportation	0.001 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Clothing and footwear	-0.006 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply

Note: The lag length of each scaled SVAR model has been mentioned in brackets of column 2

The results of Table 4.18 above show that $\hat{\beta_4}$ is negative for oil, health, housing and clothing and footwear prices thus 4.53 is our industrial supply equation while 4.52 describes our industrial demand. However, $\hat{\beta_4}$ is positive for food, education and transportation industries thus for these prices 4.53 is industrial demand equation while 4.58 describes industrial supply. The impact of commodity prices shocks on the leather industry demand and supply has been shown through impulse responses in Figure 4.42 and Table 4.18 below.

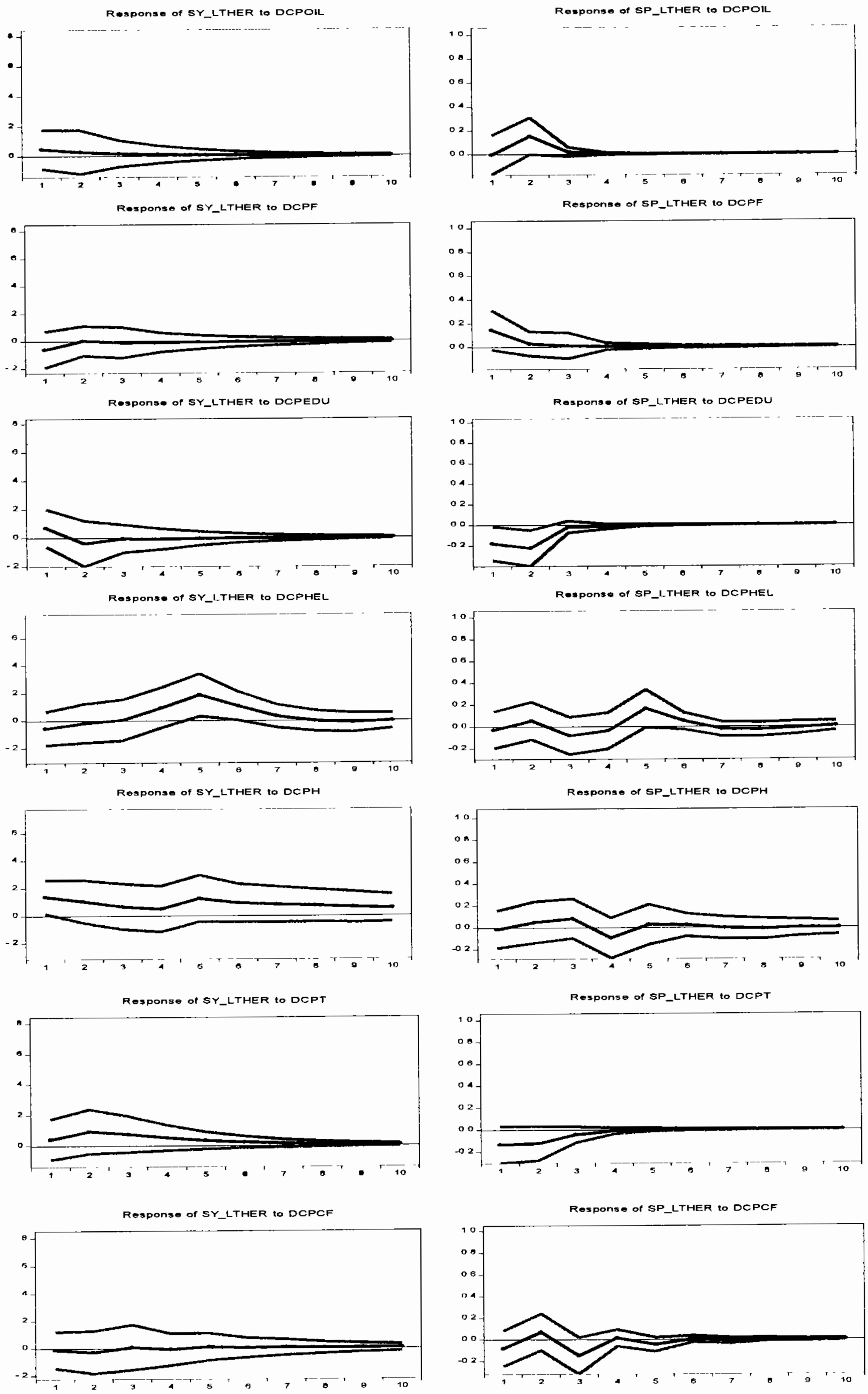

Figure 4.42: Impulse responses of leather industry demand and supply

Table 4.19: Commodity price shocks effects on leather industry demand and supply

Commodity Price (CP)	CP coefficient $\hat{\beta}_3$ (p-value) in equation 4.55	CP coefficient $\hat{\beta}_6$ (p-value) in equation 4.56	Peak effect on output	Peak effect on price	Commodity price shocks effects
Oil	0.116(0.00)	0.166(0.00)	Insignificant	+*	Increase in supply
Food	-0.084(0.00)	0.189(0.00)	Insignificant	Insignificant	Insignificant
Education	-0.010(0.00)	-0.448(0.00)	Insignificant	-*	Reduction in demand
Health	0.388(0.00)	0.043(0.00)	+*	+*	Increase in demand
Housing	1.138(0.00)	-0.018(0.00)	+*	Insignificant	Increase in demand
Transportation	0.355(0.00)	-0.310(0.00)	Insignificant	Insignificant	Insignificant
Clothing and footwear	-0.014(0.00)	-0.211(0.00)	Insignificant	-*	Reduction in supply

Note: The * is used if the peak responses are significantat 5% level based on two standard error confidence intervals for at least one time period of the study. "+" and "-" is for positive and negative responses respectively Mixed shows that both+ and - responses are of same magnitude.

Figure 4.42 shows the pattern of impulse responses of industrial demand and supply to commodity price shocks. Whereas, Table 4.19 describes the peak responses to each commodity price shock along with the contemporaneous structural coefficients. Leather is the second largest export-oriented industry in Pakistan. The shock in oil prices increases the supply of leather industry. Pakistan is a net importer of oil; an increase in its price deteriorates balance of payment situation and cause depreciation of exchange rate. Therefore, Pakistan's exports became cheaper relative to other countries and foreign demand for Pakistani leather increased resulting in domestic increase in supply. However, the shock in oil price also increases the cost of production of leather and price of leather also increases but the impact of exchange rate depreciation is stronger than price increase so supply of leather increases.

The shocks in food and transportation prices have no significant impact on leather industry prices and output. Whereas, increase in education price cause reduction in demand for first two months of shock. Health and housing price shocks on the other hand, increase the demand for leather products. Whereas, the clothing and footwear prices reduce the supply of leather products in third month due to the transfer of raw material leather to clothing and footwear industry. The review of results shows that commodity price shocks have mixed types of impacts on the leather industry. Three out of seven price shocks affect the industry positively whereas, two affect negatively and two show no significant impact.

4.3.2.8.NON-METALLIC MINERALS INDUSTRY

The results of scaled SVAR model to identify industrial demand and supply for fertilizer industry are described in Table 4.20 below.

Table 4.20: Identification of industrial demand and supply for NMM industry

Commodity price	Value of $\hat{\beta_4}$ of equation 4.53	Identification of Demand and Supply
Oil	0.209 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Food	0.207 (1 2)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Education	0.225 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Health	0.203 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Housing	0.208 (1 3)	Eq 4.52 (y) Supply Eq 4.53 (P) Demand
Transportation	0.203 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Clothing and footwear	0.202 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand

Note: The lag length of each scaled SVAR model has been mentioned in brackets of column 2.

The results of Table 4.20 above show that $\hat{\beta_4}$ is positive for all industries thus 4.53 is industrial demand equation while 4.52 describes industrial supply. The impact of commodity price shocks on NMM industry demand and supply are described below.

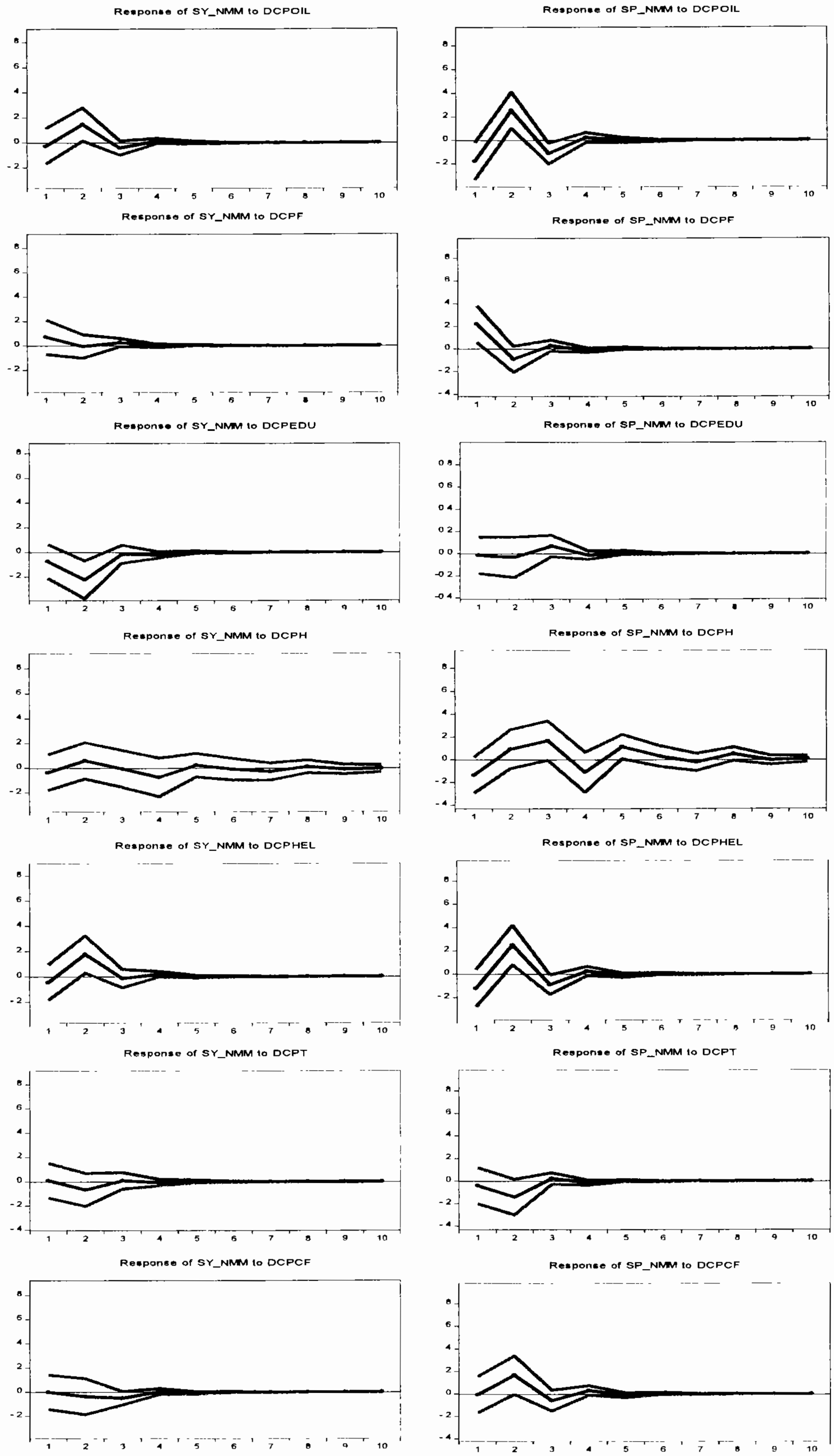

Figure 4.43: Impulse responses of NMM industry demand and supply

Table 4.21: Commodity price shock impact on NMM industry demand and supply

Commodity Price (CP)	CP coefficient $\hat{\beta}_3$ (p-value) in equation 4.55	CP coefficient $\hat{\beta}_6$ (p-value) in equation 4.56	Peak effect on output	Peak effect on price	Commodity price shocks effects
Oil	0.087(0.00)	-0.019(0.00)	+*	Mixed*	Increase in demand and supply
Food	0.088(0.00)	0.145(0.00)	Insignificant	Insignificant	Insignificant
Education	-0.342(0.00)	0.007(0.00)	-*	Insignificant	Reduction in supply
Health	0.131(0.00)	0.051(0.00)	+*	Mixed*	Increase in demand and supply
Housing	-0.097(0.00)	0.217(0.00)	Insignificant	+*	Increase in demand
Transportation	-0.062(0.00)	-0.172(0.00)	Insignificant	-*	Reduction in demand
Clothing and footwear	-0.088(0.00)	0.145(0.00)	-*	+*	Reduction in supply

Note: The * is used if the peak responses are significantat 5% level based on two standard error confidence intervals for at least one time period of the study "+" and "-" is for positive and negative responses respectively. Mixed shows that both+ and - responses are of same magnitude.

Figure 4.43 shows the pattern of impulse responses of industrial demand and supply to commodity price shocks. Whereas, Table 4.21 describes the peak responses to each commodity price shock along with the contemporaneous structural coefficients and p values that are highly significant. Impulse response of oil price shock is significant for both demand and supply of NMM industry. However, it shows positive response for supply and mixed for price. The demand for NMM industry, especially for cement industry, is less elastic as it is a basic raw material in construction activities. Therefore, despite the shock in oil price its demand and supply increase on account of many construction projects like CPEC, metro buses, orange train, housing societies and many others. Likewise, shock in housing price increase the demand of NMM industry mainly demand of cement. Whereas, shocks in transportation prices decrease demand and health price shocks increase both demand and supply, and clothing and footwear price shocks reduce supply. However, food price shocks have no significant impact on NMM industry. This is mainly due to the fact that decisions of production and price in the chemical industry are dominated by other factors like construction projects, foreign investment and other development and private projects. Thus, review of the results shows that the positive impact of commodity price shocks is dominant than negative impact.

4.3.2.9.PAPER AND BOARD INDUSTRY

The results of scaled SVAR model to identify industrial demand and supply for paper and board industry are described in Table 4.22 below.

Table 4.22: Identification of paper and board industry demand and supply

Commodity price	Value of $\hat{\beta}_4$ of equation 4.53	Identification of Demand and Supply
Oil	-0.138 (1 2)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Food	-0.137 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Education	-0.130 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Health	-0.135 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Housing	-0.136 (1 1)	Eq 4.52 (y) Demand Eq 4.53 (P) Supply
Transportation	-0.141 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Clothing and footwear	-0.147 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply

Note: The lag length of each scaled SVAR model has been mentioned in brackets of column 2.

The results of Table 4.222 above show that $\hat{\beta}_4$ is negative for all commodity prices thus 4.53 is our industrial supply equation while 4.54 describes our industrial demand. The response of industrial demand and supply to shocks in commodity prices are described below.

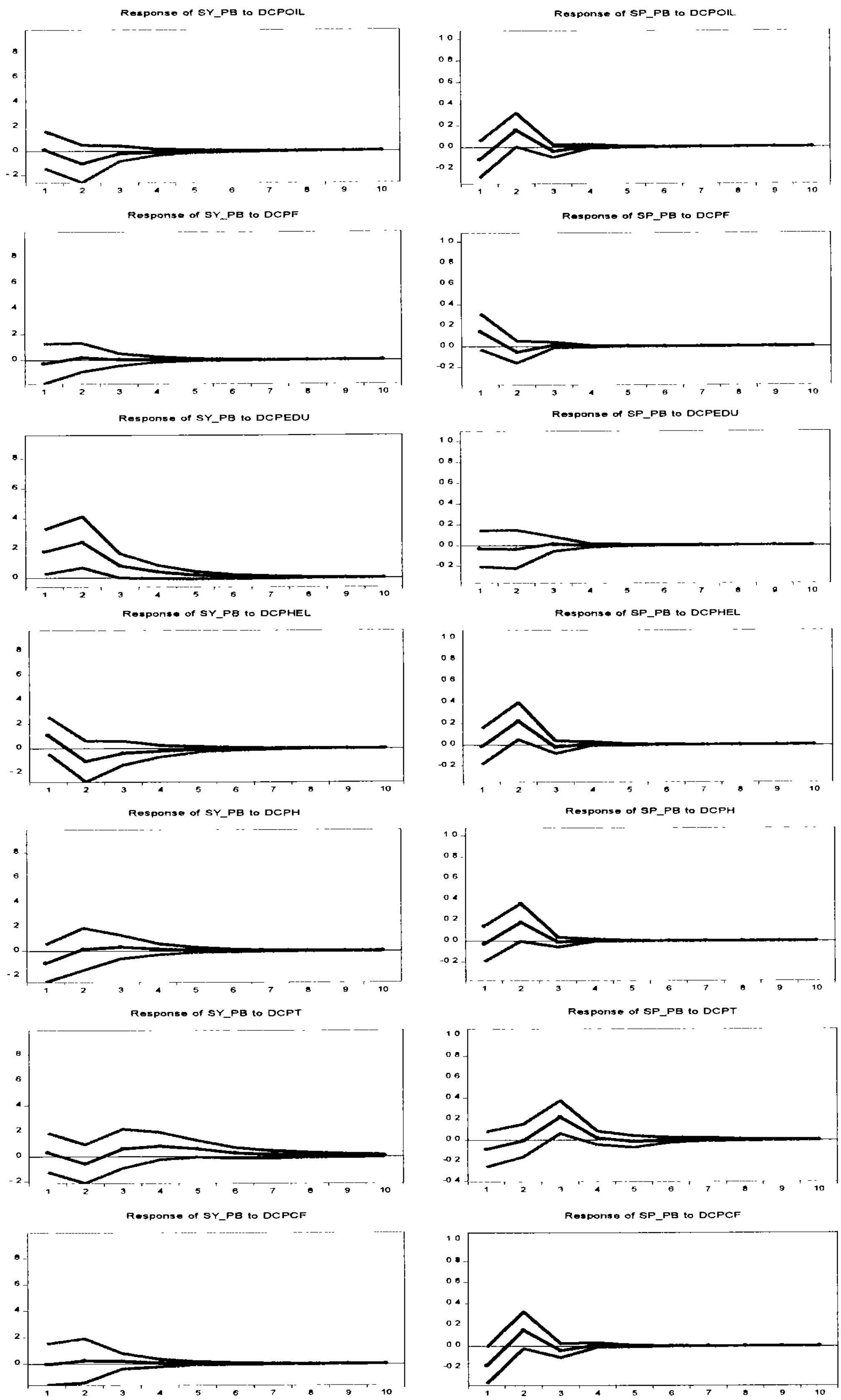

Figure 4.44: Impulse response of paper and board industry demand and supply

Table 4.23: Commodity price shock impact on paper and board industry demand and supply

Commodity Price (CP)	CP coefficient $\hat{\beta_3}$ (p-value) in equation 4.55	CP coefficient $\hat{\beta_6}$ (p-value) in equation 4.56	Peak effect on output	Peak effect on price	Commodity price shocks effects
Oil	-0.146(0.00)	0.005(0.00)	Insignificant	+*	Increase in supply
Food	-0.007(0.00)	0.093(0.00)	Insignificant	Insignificant	Insignificant
Education	0.564(0.00)	-0.064(0.00)	+*	Insignificant	Increase in demand
Health	-0.084(0.00)	0.189(0.00)	Insignificant	+*	Increase in supply
Housing	0.0847(0.00)	0.419(0.00)	Insignificant	+*	Increase in supply
Transportation	0.233(0.975)	0.127(0.281)	+*	+*	Increase in demand
Clothing and footwear	0.155(0.00)	-0.144(0.00)	Insignificant	-*	Decrease in supply

Note: The * is used if the peak responses are significant at 5% level based on two standard error confidence interval for at least one time period of the study "+" and "-" is for positive and negative responses respectively Mixed shows that both+ and - responses are of same magnitude.

Figure 4.44 shows the pattern of impulse responses of industrial demand and supply to commodity price shocks. Whereas, Table 4.23 describes the peak responses to each commodity price shock along with the contemporaneous structural coefficients and p values that are highly significant except for transportation prices. The shock in oil price increases the cost of production of paper and board industry and increases its production price index. The share of oil cost in total cost of paper and board industry is roughly 30%. However, the supply of paper and board industry is less elastic and increases in short run. This may be due to the fact that supply of paper and board industry depends on imported wood pulp and recycled paper price and domestic wheat output.

Food price shocks have no significant impact on demand and supply of paper and board industry. Whereas, education and transportation price shocks increase the demand and health and hosing price shocks increase the supply of the industry. Moreover, clothing and footwear industry price shocks decreases the supply in short run and the impact is die out in long run. The review of the results shows that paper and board industry is positively affected by commodity price shocks where most of the shocks increase its demand or supply.

4.3.2.10. PETROLEUM INDUSTRY

The results of scaled SVAR model to identify industrial demand and supply for petroleum industry are described in Table 4.24 below.

Table 4.24: Identification of industrial demand and supply for petroleum industry

Commodity price	Value of $\hat{\beta}_4$ of equation 4.53	Identification of Demand and Supply
Oil	0.944 (1 2)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Food	0.912 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Education	0.911 (1 3)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Health	0.912 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Housing	0.917 (1 1)	Eq 4.52 (y) Supply Eq 4.53 (P) Demand
Transportation	0.929 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Clothing and footwear	0.910 (1 2)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand

Note: The lag length of each scaled SVAR model has been mentioned in brackets of column 2.

The results of Table 4.24 above show that $\hat{\beta}_4$ is positive for all industries thus 4.53 is industrial demand equation while 4.52 describes industrial supply. The impact of commodity prices shocks on petroleum industry demand and supply are described below.

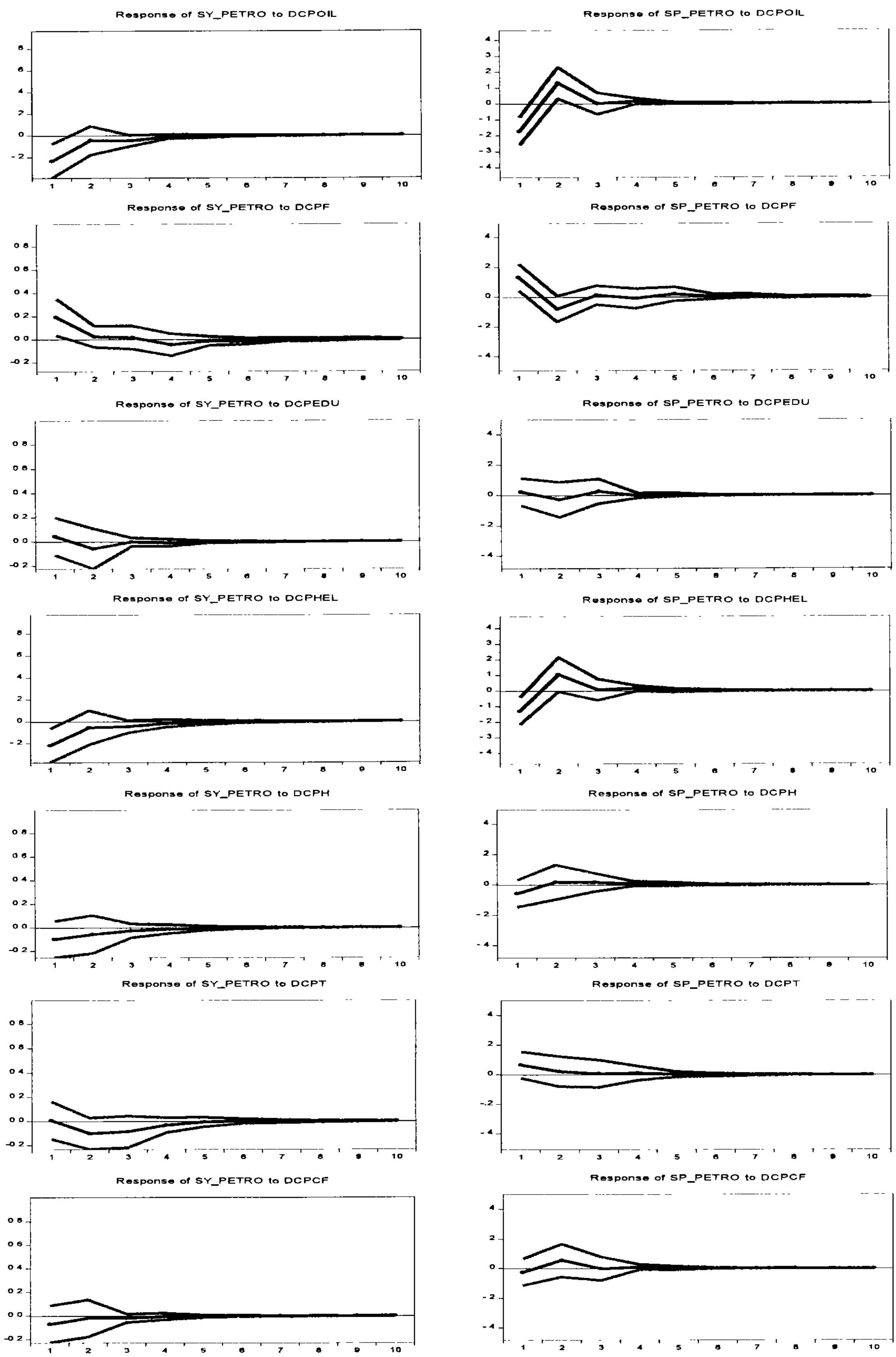

Figure 4.45: Impulse responses of petroleum industry demand and supply

Table 4.25: Commodity price shock impact on petroleum industry demand and supply

Commodity Price (CP)	CP coefficient $\hat{\beta}_3$ (p-value) in equation 4.55	CP coefficient $\hat{\beta}_6$ (p-value) in equation 4.56	Peak effect on output	Peak effect on price	Commodity price shocks effects
Oil	-0.359(0.00)	-0.020(0.00)	-*	Mixed*	Reduction in demand and supply
Food	0.151(0.245)	0.081(0.00)	+*	Mixed*	Increase in demand and supply
Education	-0.030(0.00)	0.0210.00)	Insignificant	Insignificant	Insignificant
Health	-0.360(0.00)	0.008(0.00)	-*	Mixed*	Reduction in demand and supply
Housing	-0.215(0.00)	-0.007(0.00)	Insignificant	Insignificant	Insignificant
Transportation	-0.230(0.00)	0.105(0.00)	Insignificant	Insignificant	Insignificant
Clothing and footwear	-0.404(0.00)	-0.049(0.00)	Insignificant	Insignificant	Insignificant

Note: The * is used if the peak responses are significant at 5% level based on two standard error confidence interval for at least one time period of the study "+" and "-" is for positive and negative responses respectively. Mixed shows that both+ and - responses are of same magnitude.

Figure 4.45 shows the pattern of impulse responses of industrial demand and supply to commodity price shocks. Table 4.25 describes the peak responses to each commodity price shock along with the contemporaneous structural coefficients. The petroleum industry is an oil intensive industry, therefore a shock in oil prices significantly affects its output and price. The price of the petroleum industry increases as the cost of production increases resulting from high oil prices and its supply curve also shifts leftwards.

The shocks in food prices increase the demand and supply of petroleum industry due to the reason that most of the petroleum products are used as inputs in the production of final food items. Education, housing, transportation and clothing and footwear price shocks have no significant impact on the petroleum industry. Whereas, health price shocks cause a reduction in demand and supply. The review of the above results shows that commodity price shocks have less impact on the petroleum industry compared to other industries included in our analysis. Further, as the petroleum industry is an oil intensive industry, the oil price shock effect is dominating.

4.3.2.11. PHARMACEUTICAL INDUSTRY

The results of scaled SVAR model to identify industrial demand and supply for pharmaceutical industry are described in Table 4.26 below.

Table 4.26: Identification of pharmaceutical industry demand and supply

Commodity price	Value of $\hat{\beta_4}$ of equation 4.53	Identification of Demand and Supply
Oil	-0.028 (1 2)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Food	-0.030 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Education	-0.039 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Health	-0.027 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Housing	-0.026 (1 1)	Eq 4.52 (y) Demand Eq 4.53 (P) Supply
Transportation	-0.029 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply
Clothing and footwear	-0.028 (1 1)	Eq 4.52 (Y) Demand Eq 4.53 (P) Supply

Note: The lag length of each scaled SVAR model has been mentioned in brackets of column 2.

The results of Table 4.26 above show that $\hat{\beta_4}$ is negative for all commodity prices thus 4.53 is our industrial supply equation while 4.52 describes our industrial demand. The response of industrial demand and supply to shocks in commodity prices are described below.

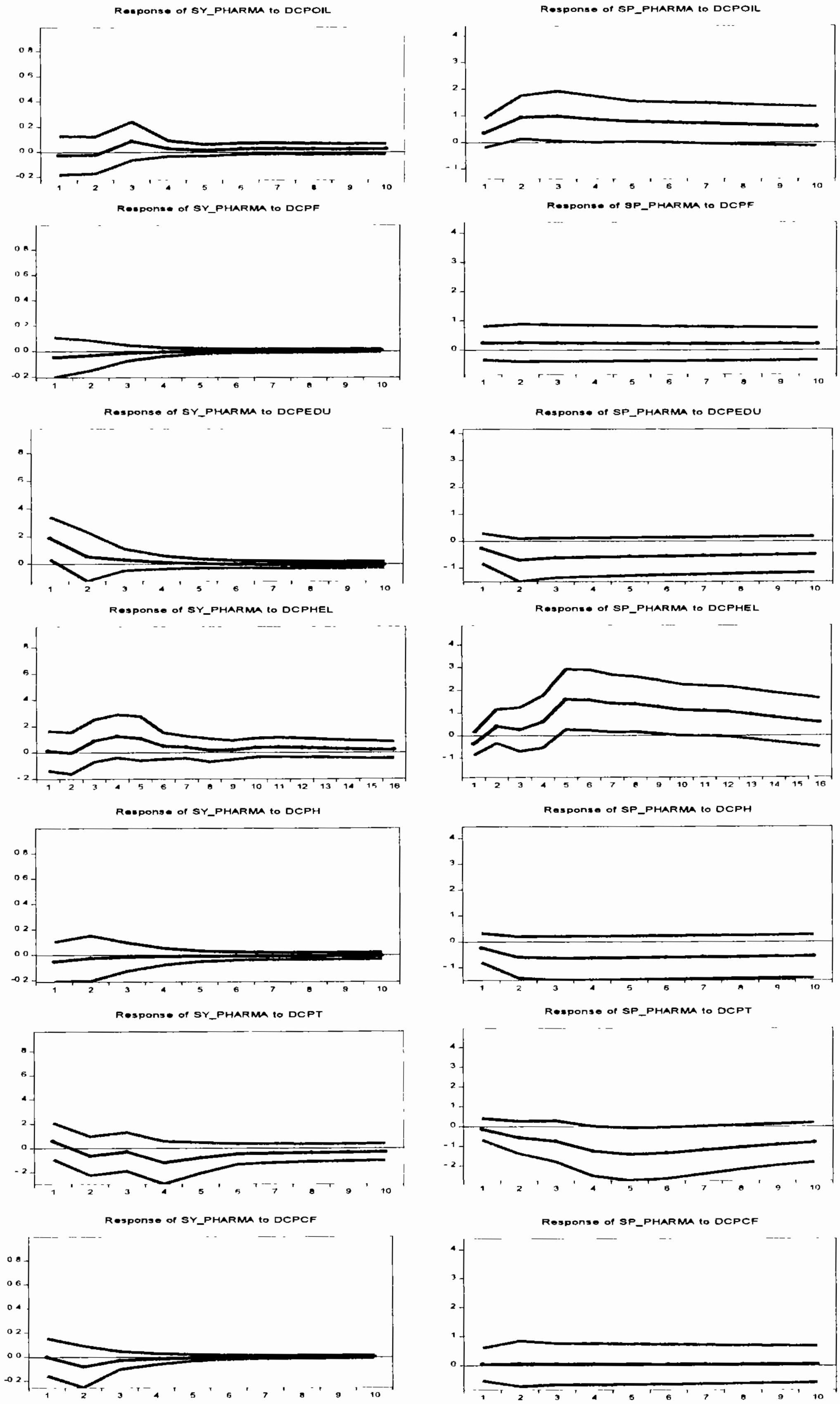

Figure 4.46: Impulse responses of pharmaceutical industry demand and supply

Table 4.27: Pattern of IR of pharmaceutical industry demand and supply

Commodity Price (CP)	CP coefficient $\hat{\beta}_3$ (p-value) in equation 4.54	CP coefficient $\hat{\beta}_6$ (p-value) in equation 4.55	Peak effect on output	Peak effect on price	Commodity price shocks effects
Oil	0.564(0.73)	1.644(0.18)	Insignificant	+*	Increase in supply
Food	-0.162(0.00)	0.248(0.00)	Insignificant	Insignificant	Insignificant
Education	-0.039(0.00)	-2.435(0.00)	Insignificant	Insignificant	Insignificant
Health	0.793(0.909)	1.670(0.12)	Insignificant	+*	Increase in supply
Housing	-0.702(0.00)	-3.788(0.00)	Insignificant	Insignificant	Insignificant
Transportation	-0.648(0.46)	-1.489(0.55)	Insignificant	-*	Reduction in supply
Clothing and footwear	-0.127(0.00)	0.181 (0.00)	Insignificant	Insignificant	Insignificant

Note: The * is used if the peak responses are significant at 5% level based on two standard error confidence interval for at least one time period of the study "+" and "-" is for positive and negative responses respectively Mixed shows that both+ and - responses are of same magnitude.

Figure 4.46 shows the pattern of impulse responses of industrial demand and supply to commodity price shocks. Table 4.27 describes the peak responses to each commodity price shock along with the contemporaneous structural coefficients. Oil price shocks causes a significant increase in the price of pharmaceutical industry as demand of pharmaceutical industry is less elastic the increase in cost of production through oil prices is completely transferred to consumer and the supply increase in the short run. The shocks in food, education, housing and clothing and footwear prices do not affect the pharmaceutical industry. However, health price shocks significantly increase the prices of the pharmaceutical industry due to the high correlation between health and pharmacy prices. Further, transportation price shocks reduce the supply of the pharmaceutical industry.

The above results show that the pharmaceutical industry is less sensitive to commodity price shocks and its effects only producer price of the industry, not the output. Moreover, only directly related price shocks oil, health, and transportation affect the PPI of pharmaceutical industry.

4.3.2.12. RUBBER INDUSTRY

The results of scaled SVAR model to identify industrial demand and supply for fertilizer industry are described in Table 4.28 below.

Table 4.28: Identification of industrial demand and supply for rubber industry

Commodity price	Value of $\hat{\beta_4}$ of equation 4.53	Identification of Demand and Supply
Oil	0.093 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Food	0.100 (1 2)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Education	0.085 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Health	0.092 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Housing	0.086 (1 3)	Eq 4.52 (y) Supply Eq 4.53 (P) Demand
Transportation	0.091 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Clothing and footwear	0.094 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand

Note: The lag length of each scaled SVAR model has been mentioned in brackets of column 2.

The results of Table 4.28 above show that $\hat{\beta_4}$ is positive for all industries thus 4.52 is industrial demand equation while 4.53 describes industrial supply. The impact of commodity price shocks on rubber industry demand and supply are described below.

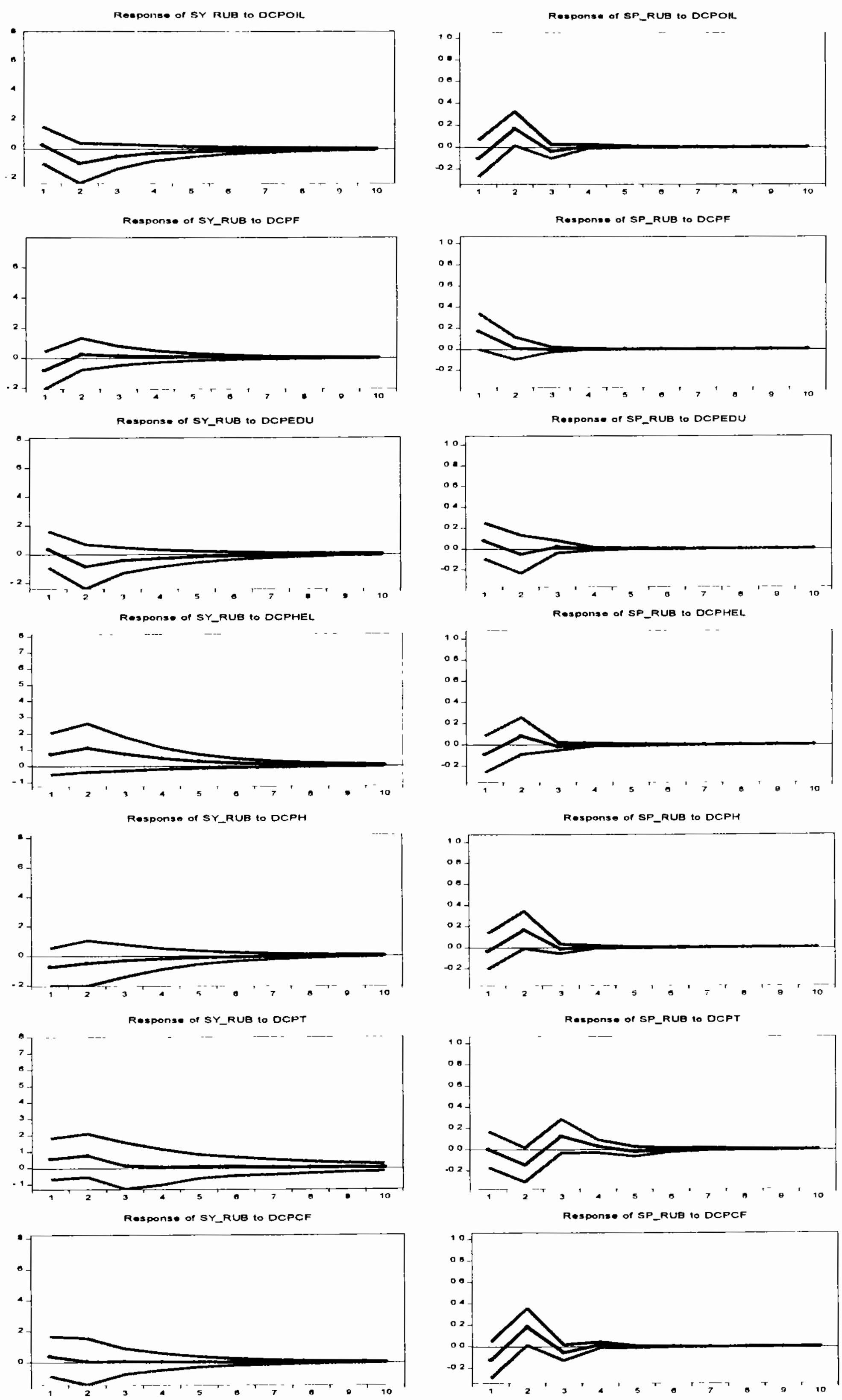

Figure 4.47: Impulse response of rubber industry demand and supply

Table 4.29: Pattern of IR of rubber industry demand and supply

Commodity Price (CP)	CP coefficient $\hat{\beta}_3$ (p-value) in equation 4.55	CP coefficient $\hat{\beta}_6$ (p-value) in equation 4.56	Peak effect on output	Peak effect on price	Commodity price shocks effects
Oil	-0.219(0.00)	0.029(0.00)	Insignificant	+*	Increase in demand
Food	-0.018(0.00)	0.1706(0.00)	Insignificant	+*	Increase in demand
Education	0.177(0.00)	0.042(0.00)	Insignificant	Insignificant	Insignificant
Health	0.381(0.00)	-0.036(0.00)	Insignificant	Insignificant	Insignificant
Housing	-0.142(0.00)	0.292(0.00)	Insignificant	+*	Increase in demand
Transportation	-0.752(0.00)	-0.159(0.00)	Insignificant	-*	Reduction in demand
Clothing and footwear	-0.604(0.00)	0.317(0.00)	Insignificant	+*	Increase in demand

Note: The * is used if the peak responses are significant at 5% level based on two standard error confidence interval for at least one time period of the study "+" and "-" is for positive and negative responses respectively. Mixed shows that both+ and - responses are of same magnitude.

Figure 4.47 shows the pattern of impulse responses of industrial demand and supply to commodity price shocks. Table 4.29 describes the peak responses to each commodity price shock along with the contemporaneous structural coefficients. The oil price shocks increased the price of the rubber industry with the lag of two months. Despite increase in the price the demand of rubber industry increases significantly on account of the fact that rubber industry demand is less elastic in the short run. Further, there is a global increase in the demand of automobiles resulting in a higher demand for the rubber tire and tubes. Likewise, the shocks of food, housing and clothing and footwear industry increases the demand forthe rubber industry. Whereas, the shocks in transportation prices reduces the demand of the rubber industry in second month and this impact is short lived and dies out in the long run.

The review of results shows that commodity price shocks affect the rubber industry price only and there is no impact on the output side. Further, most of commodity price shocks positively affect the industry by boosting up the demand.

4.3.2.13. TEXTILE INDUSTRY

The results of scaled SVAR model to identify industrial demand and supply for fertilizer industry are described in Table 4.30 below.

Table 4.30: Identification of industrial demand and supply for textile industry

Commodity price	Value of $\hat{\beta}_4$ of equation 4.53	Identification of Demand and Supply
Oil	0.166 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Food	0.155 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Education	0.085 (1 3)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Health	0.153 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Housing	0.155 (1 2)	Eq 4.52 (y) Supply Eq 4.53 (P) Demand
Transportation	0.154 (1 1)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand
Clothing and footwear	0.150 (1 2)	Eq 4.52 (Y) Supply Eq 4.53 (P) Demand

Note: The lag length of each scaled SVAR model has been mentioned in brackets of column 2

The results of Table 4.30 above show that $\hat{\beta}_4$ is positive for all industries thus 4.53 is industrial demand equation while 4.52 describes industrial supply. The impact of commodity prices shocks on rubber industry demand and supply are described below.

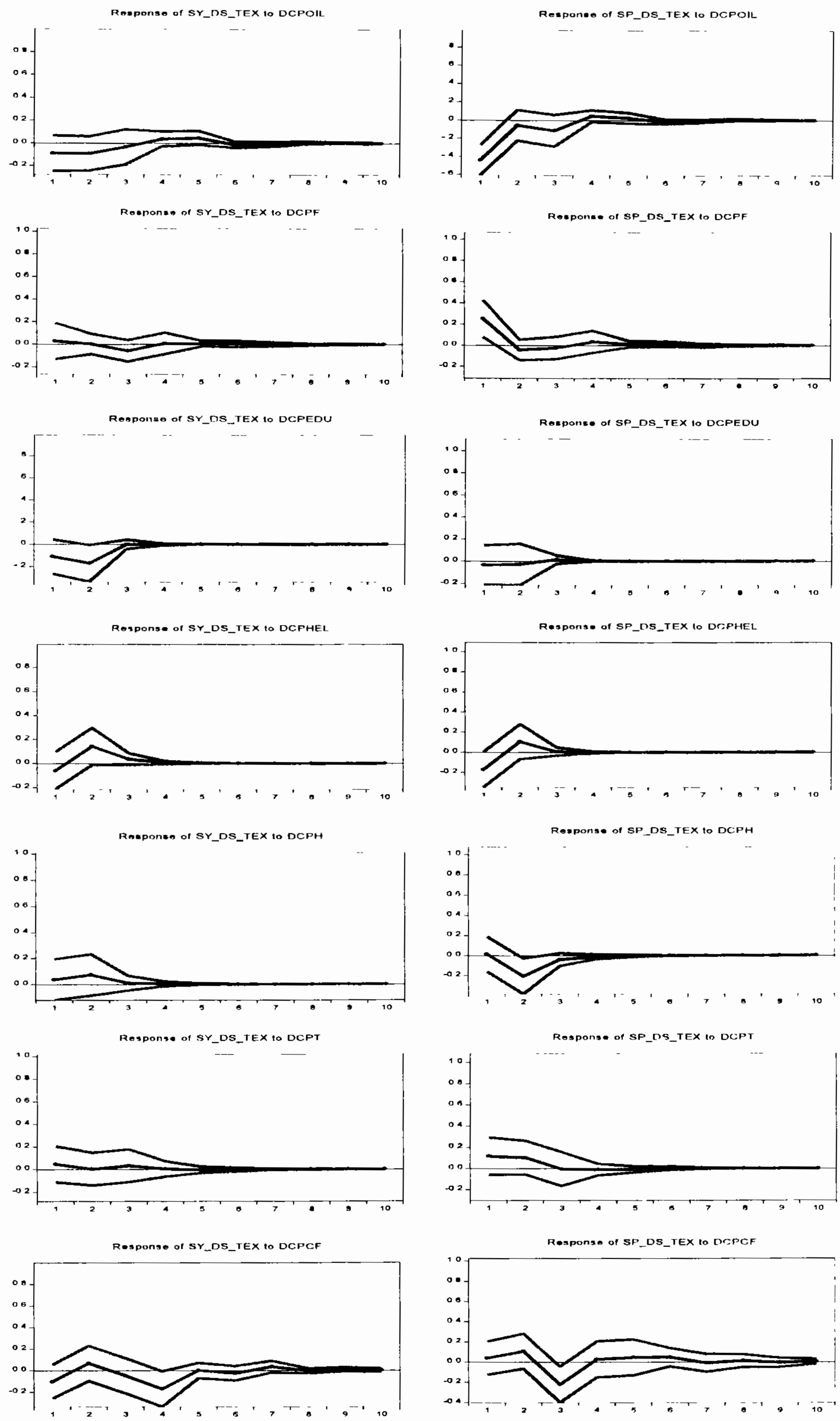

Figure 4.48: Impulse responses of textile industry demand and supply

Table 4.31: Pattern of IR of textile industry demand and supply

Commodity Price (CP)	CP coefficient $\hat{\beta}_3$ (p-value) in equation 4.55	CP coefficient $\hat{\beta}_6$ (p-value) in equation 4.56	Peak effect on output	Peak effect on price	Commodity price shocks effects
Oil	-0.156(0.42)	-0.576(0.00)	Insignificant	-*	Reduction in demand
Food	-0.013(0.44)	0.230(0.00)	Insignificant	+*	Increase in demand
Education	-0.288(0.00)	-0.052(0.00)	-*	Insignificant	Reduction in supply
Health	0.119(0.00)	-0.063(0.00)	+*	-*	Increase in supply
Housing	0.121(0.00)	-0.253(0.00)	Insignificant	-*	Reduction in demand
Transportation	0.075(0.97)	0.190(0.18)	Insignificant	Insignificant	Insignificant
Clothing and footwear	-0.152(0.10)	-0.40(0.83)	-*	-*	Reduction in demand

Note: The * is used if the peak responses are significant at 5% level based on two standard error confidence interval for at least one time period of the study "+" and "-" is for positive and negative responses respectively. Mixed shows that both+ and - responses are of same magnitude.

Figure 4.48 shows the pattern of impulse responses of industrial demand and supply to commodity price shocks. Table 4.31 describes the peak responses to each commodity price shock along with the contemporaneous structural coefficients. The shocks in oil price cause reduction in demand for the textile industry and it does not affect the supply of industry significantly. The shocks in food prices also work through demand side and it increases the PPI however, in the short run there is an increase in demand for the textile. The shocks in education prices significantly decrease production in second month with lag of one month. Moreover, the health price shocks increase the supply with positive impact on output and negative on prices. Housing price shocks lead to significant reduction in the demand of textile industry in the short run. Whereas, transportation price has no significant impact on output and price. The shocks in the clothing and footwear industry with lag of two months decreases both output and prices and in a final impact led to reduction in demand.

The above discussion shows that textile industry is negatively affected by commodity price shocks as most of the shocks lead to reduction to its demand or supply.

Further, the demand side impact is dominating then supply-side effect. The impulse responses of all other variables are displayed in Appendix 2[26].

The results of commodity price shocks on demand and supply of thirteen LSMI of Pakistan are summarized in Figure 4.49 to Figure 4.55. It was commonly believed that commodity price shocks or oil price shocks affected the supply of industries through the input cost effect, income effect and uncertainty effect. However, later on studies find out that the supply channel is not the only channel through which commodity price shocks affect the economy. Demand side channel is also important and even found to be more dominating (Lee and Ni, 2002; Jo et al., 2019). However, our results are not consistent with the finding of Lee and Ni (2002) and Jo et al. (2019) for oil price shocks, as it can be seen through Figure 4.49 that supply-side impact is more dominating. Contradictory to oil price shocks for all other commodity price shocks demand side channel is more dominating. The pattern of response of industries to oil price shocks shows that oil price shocks have positive and dominating impact on supply side these results are not consistent with Kumer (2005) that found negative impact on supply. However, our results are consistent with the results of Lippi and Nobili (2008) that show the shocks in oil price that are originated from demand side mainly cause positive impact on industrial production due to higher global demand. Moreover, the results are also consistent with Chen and Zha (2019) that showed that oil price shocks positively affect PPI and industrial production in China. Moreover, our results are consistent with the finding of Tasi (2015) that the more the industry is oil intensive the more its production effects by oil price shocks as the petroleum industry is most oil-intensive industry of Pakistan and its supply decreases immediately in response to oil price shocks. Our results are also consistent with the finding of Killian and Vigtussan

[26]The impulse response of oil price model are displayed in Appendix 2 the responses with other commodity price can be get through special request to author.

(2009) that different industries respond differently to oil price shocks and this is true for other commodity price shocks included in our analysis.

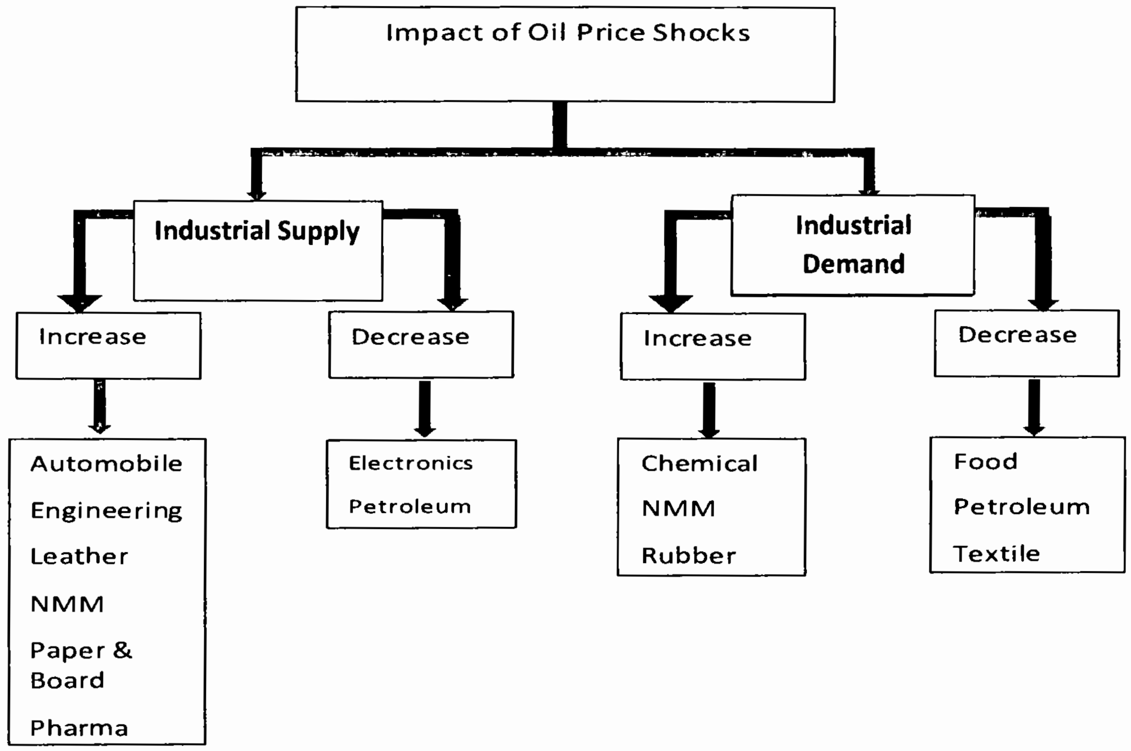

Figure 4.49: Summarized results of oil price shocks

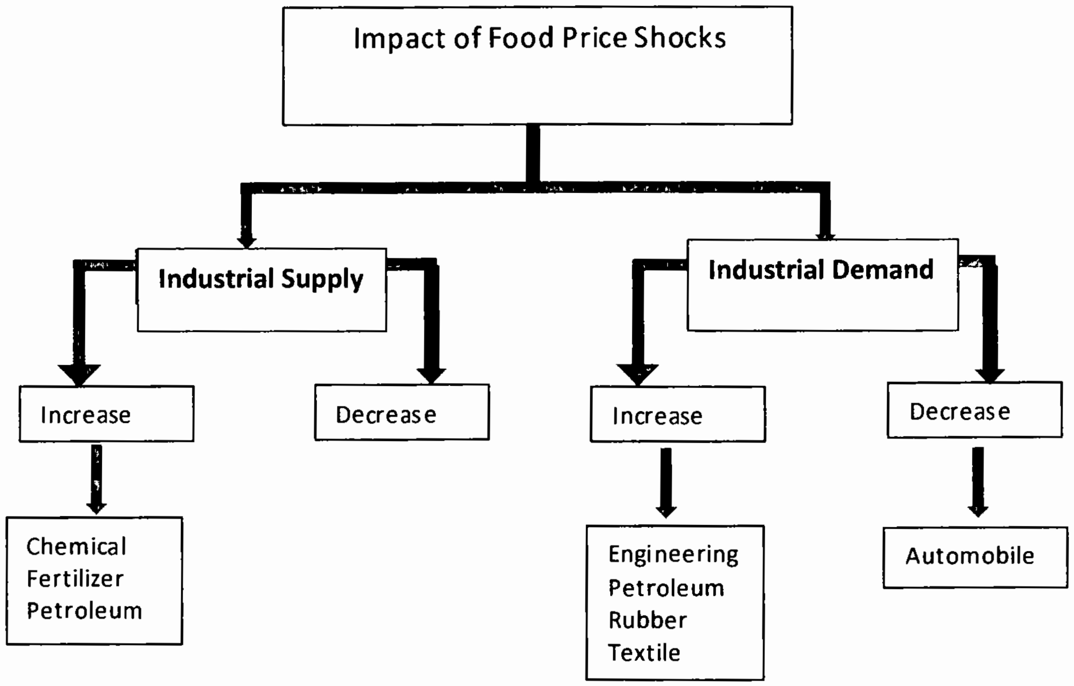

Figure4.50: Summarized results of food price shocks

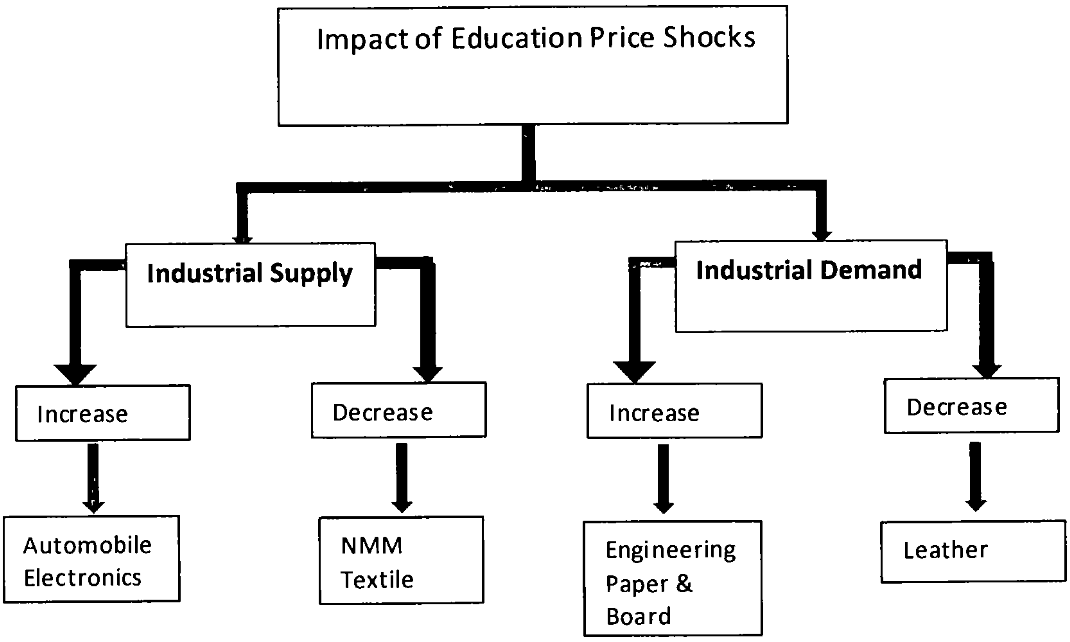

Figure 4.51: Summarized results of education price shocks

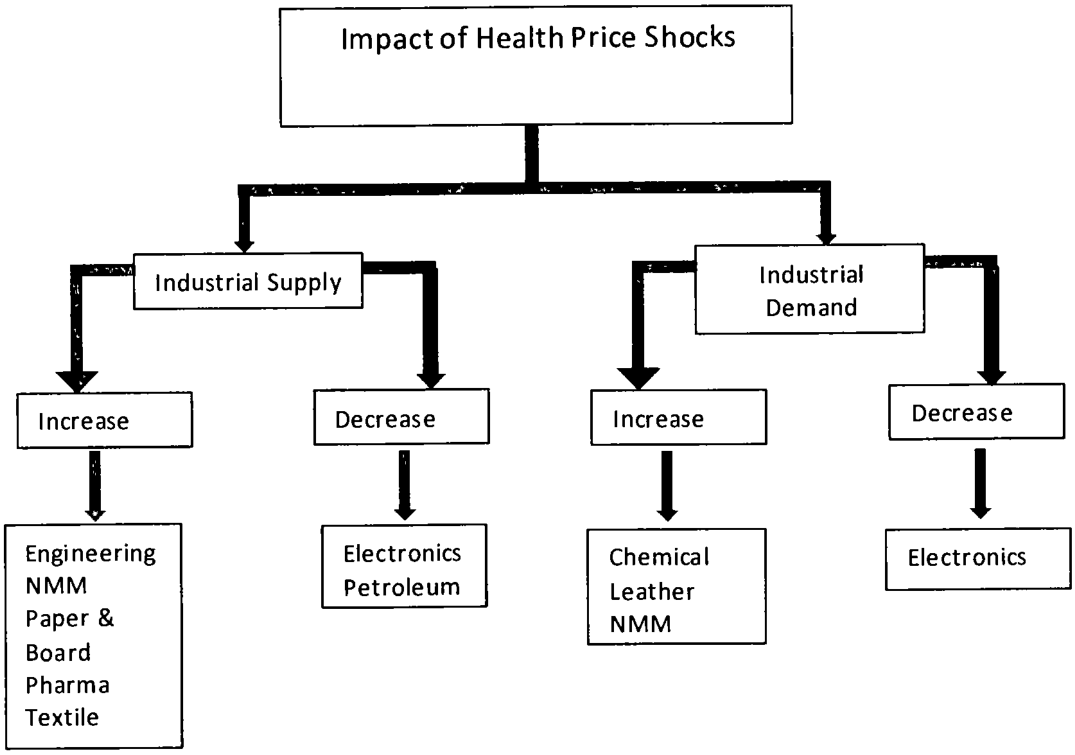

Figure 4.52: Summarized results of health price shocks

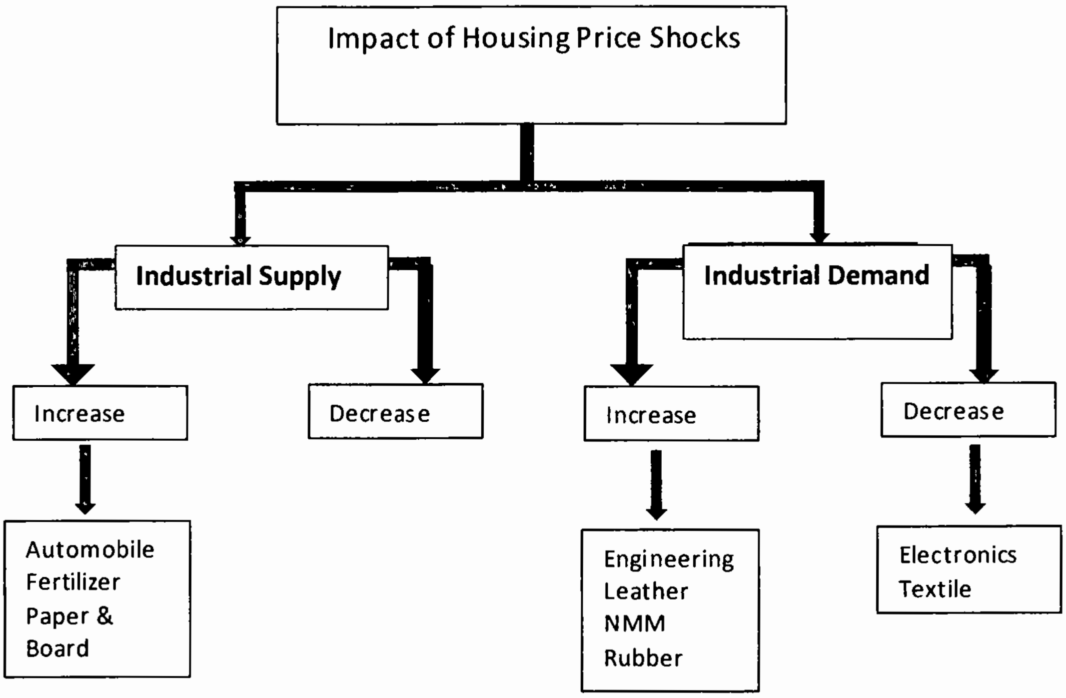

Figure 4.53: Summarized results of housing price shocks

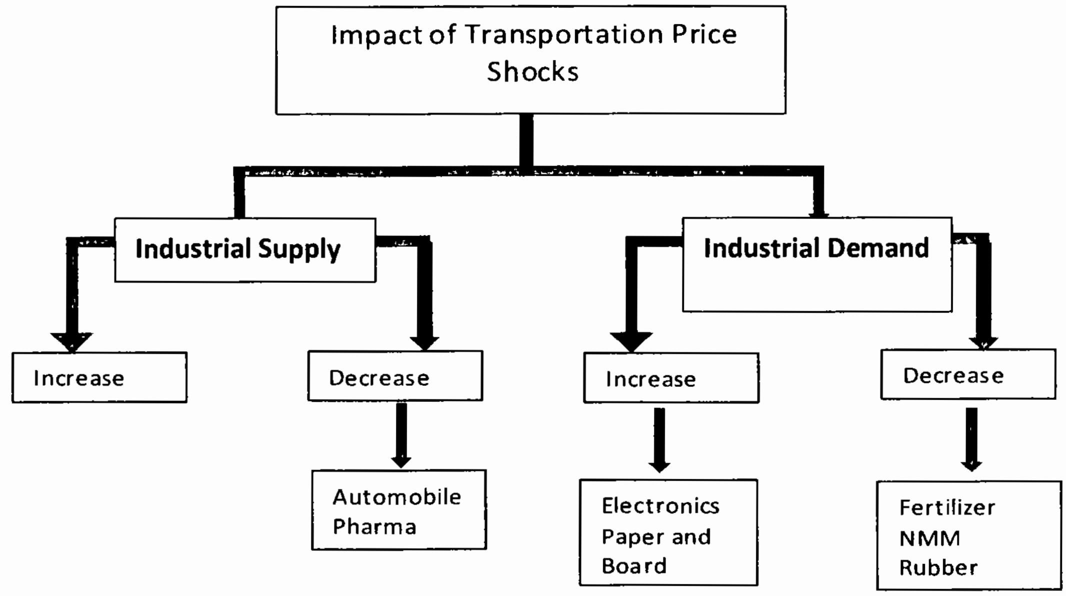

Figure 4.54: Summarized results of transportation price shocks

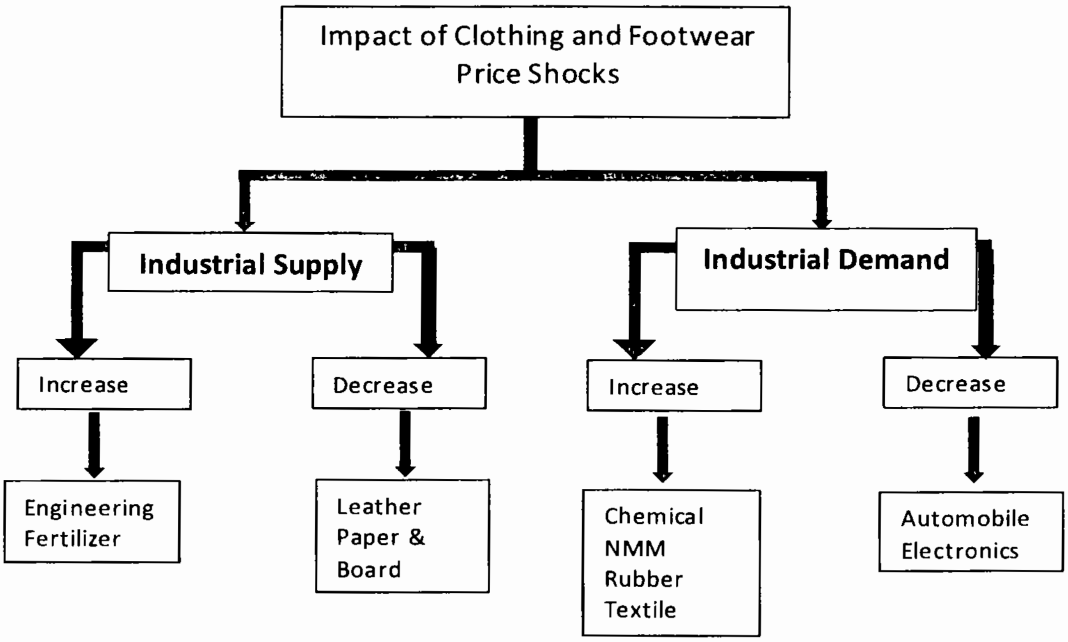

Figure 4.55: Summarized results of clothing and footwear price shocks

4.4. CONCLUSION

This study examines the industrial impact of commodity price shocks for monthly data over the period July 2008 to June 2020 and employs SVAR methodology. The results of our study show that different commodity price shocks have differential impact on industries. Commodity price shocks show a similar pattern of response for almost all industries. All the responses are short lived and occurred in initial months and recovered quickly afterward. This immediate response in industrial output and price is due to the nature of our data that captured the monthly year to year adjusted variations. Further, the pattern of response of industries to energy and health price shocks has positive and dominating impact on the supply side of industries. Whereas, the food, transportation and housing price shocks have dominating impact on industries through demand side. Further, education and clothing and footwear price shocks show mixed impact on demand and supply sides. The results of our analysis provide a clear view that which type of commodity price shocks can lead to boom and which to busts to these industries. It provides useful information to policymaker that will help them to achieve their goals more effectively.

Chapter 5

EXPORT OF TEXTILE INDUSTRIAL CHAIN OF PAKISTAN AND COMMODITY PRICE SHOCKS

5.1. INTRODUCTION

The textile industry is the mainstay of Pakistan's economy. Pakistan ranked at the fourth number in production of cotton in the world and third in its consumption. Further, textile export account for 60% of the total export of the country and have a 46% share in total manufacturing and give direct and indirect employment to 45% of the labour force. The textile industry is the oldest industry in Pakistan. After the establishment of the Pakistan Industrial Development Commission (PIDC) in 1952, the development of the textile industry starts and the inauguration of the modern Valika textile mill in Karachi in 1953 provides a major breakthrough in this development. During the mid-sixties, most of the textile units (approximately 180) were located in Karachi and Punjab. Whereas, the major investment in the textile industry has been witnessed at the end of the sixties with imported modern machines and techniques. However, it faced the problem of limited capital and a shortage of technical staff.

In 1970-1975, Pakistan textile industry faced heavy losses due to the separation of East Pakistan. Further, the nationalization of major textile units by Cotton Export Corporation (CEC) discouraged production. However, in the eighties, the textile industry flourished with the boom in the international market and investment friendly policies of the government. In the first six years of the 1990s there was a massive expansion in the spinning sector and due to duty-free import of textile machinery, domestic textile units increased to 440. The start of the year 2005 eliminates the quota regime[27] and opens up more opportunities for textile exports. However, Pakistan textile industry has not been able to get the benefits of elimination as compared to its competitors like China, Bangladesh and India.

Pakistan textile industry has an inbuilt advantage in production mainly due to the availability of high quality and quantity of raw material cotton and cheaper labour. However, as this has a large share in the total export earnings of the country, the economy of Pakistan becomes more sensitive to any shock that affects the production and export of the textile industry. In the recent past commodity price shocks becomes the most prominent shocks that affect the economies (McLeod, 2018 and Knop and Vespignans, 2014). Therefore, fluctuations in textile prices have a significant impact on foreign earnings, national income and terms of trade of Pakistan. On the other hand, some commodities like energy, transportation, education and health of labor are key inputs in the production process. Any shock in the prices of these basic inputs has a significant impact on the industrial production of an economy (Sloboda &Haliemun, 2010; Bloom et al. 2006; Bloom & Canning, 2000).

There are several studies that work on the textile industry of Pakistan through different aspects (Hussain et al., 2020; Irshad and Xin 2017; Ahmed and Kalim,2014; Sidiquie et al.,2012). However, what has been lacking in the literature is the analysis of the differences in the impacts of commodity price shocks on industrial chains and transmission mechanisms.Commodity price shocks have industrial differences and price shock are transmitted along with industries chain from upstream industries to downstream industries.

[27]The ATC(Agreement on Textile and Clothing) launched quota regime for ten year (1994-2004).

To the best of our knowledge, there is no well-known study that has been conducted to examine the commodity price transmission mechanism for the exports of the textile industry chain of Pakistan. On the foundation of our above discussion, we sketch our research objectives as follows:

1. To quantify the dynamic transmission effects of commodity price shocks on the exports of the textile industrial chain of Pakistan.

And research analysis will help us to answer the following questions.

Q1. Are the exports of upstream Industries (USI), midstream industries (MSI) and downstream textile industries (DSI) of Pakistan affected equally by commodity price shocks?

Q2. Which commodity price shock has the most dominant impact on the textile industrial chain?

5.2.TEXTILE INDUSTRIAL CHAIN OF PAKISTAN

The textile industry chain broadly consists of three major sub-sectors, the spinning sector[28], weaving sector[29] and garments manufacturing[30]. However, all the sub-sectors are strongly linked together; the end product of the first sub-sector is an input for the next sub-sector. Figure 5.1 below shows the textile industry chain of Pakistan.

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[28]Cotton spinning sector is treated as upstream industries (UPI) of textile sector.
[29] Weaving sector is treated as midstream industries (MDI) of textile sector.
[30]Garments manufacturing is treated as the downstream industries (DSI) of textile sector.

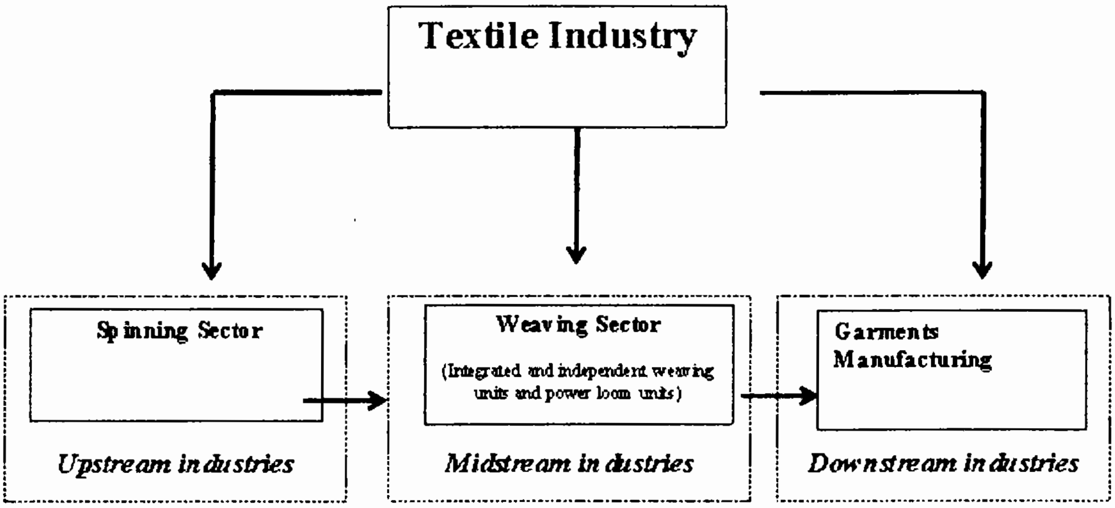

Figure 5.1: Textile Industry Chain

The textile industry chain starts from cotton spinning that adds value to cotton by renovating cotton into cotton yarn. Spinning is the base process, and all the succeeding value additions depend upon it (Memon, 2014). Therefore, any discrepancy in the quality of yarn spinning directly affects the entire textile industry chain. Moreover, most of the spinning upstream industries worked in an organized way and a total of 477 spinning units are working in Pakistan (Textile Commissioner Organization report, 2019-2020).

The weaving sector consists of midstream industries and is classified into the second process of the textile industry chain in Figure 5.1. Weaving is defined as the process of transformation of cotton yarn into raw fabric and is broadly divided into two sub-sectors: the unorganized non-mill sector and the organized mill sector (Hussain et al, 2009). The unorganized non-mill sector consists of small units of production (with 50 to 100 looms), whereas the organized sector contains large textile mills. In terms of usage of technology, the weaving sector can be divided into three sub-sectors hand-looms sector, power looms and high-speed mill looms. The hand-loom sector is the oldest sector and carries a long tradition and excellence of craftsmanship. However, the power looms and high-speed mill looms sectors dominate the midstream industry in terms of investment, production and share in exports. According to the annual report of All Pakistan Textile Mills Association (APTMA, 2015) the power looms and high-speed mill loom sector is fully responsible for fulfillment of domestic needs and exports of cotton fabric. On the other hand, the hand-loom sector does not play any important role in export. However, the output of the midstream industry is mostly referred as "raw" because it does not involve any printing and dying. Therefore, the midstream industries mostly produced raw cotton fabric (80% of total production). According to Textile Commissioner's Organization report, 2019-2020, the midstream industry has 28,500 power looms and 375,000 high power mill looms.

Whereas garments manufacturing includes downstream industries, and it is the third process of the textile industry chain. Downstream industries are commonly used to make ready-made garments, bed linen, hosiery, artificial silk and synthetic fabrics, canvas, and towels. Furthermore, downstream industries have the highest-value addition in the textile industry chain of Pakistan (Hamid, 2014). The hosiery industry provides direct employment to 210,000 skilled labour and 490,000 unskilled labour. The hosiery export of Pakistan contains the export of socks, processed and knitted fabrics and knitted bed-sheets. The ready-made cloth industry of Pakistan is also one big industry for providing jobs to millions of workers. It fully met the domestic demand and has a good share in total downstream industry exports. The towel industry is an export-oriented industry and has both organized and unorganized sectors. There are 10,000 towel looms working in Pakistan both with shuttle and shuttle-less units. The canvas and tarpaulin industry have a capacity of 100 million sq. meter production. 60 percent of the total production of this industry has been exported and 40 percent has been consumed domestically. Artificial silk like polyester, nylon, synthetic fabrics, and polyolefin dominant the artificial silk and synthetic fabrics industry. There are currently five major producers of these fabrics in Pakistan with

636,00 tons annual capacity of production. Moreover, there are 9000 looms of artificial silk production in Pakistan (Economic Survey of Pakistan 2020-2021).

5.3.DATA AND METHODOLOGY

This study will use monthly data over the period July 2008 to June 2020. This study aims to employ the Structural VAR model in order to examine the relationship between commodity prices and the textile industry chain of Pakistan.

5.3.1.DATA

Following the ministry of textile industry of Pakistan, upstream industries (UI) are made up of cotton spinning industries that include the export of raw cotton, cotton yarn, cotton carded and combed and yarn other than cotton yarn. So, we will add these industries export in million US dollars for UI. Midstream industries (MI) are made up of the weaving industries and include the export of cotton fabrics in million US dollars. Whereas, the downstream industry (DI) is made up of the export of hosiery (knitwear), bed-wear, towels, canvas goods and tarpaulin, ready-made garments, artificial silk and synthetic textile and other textile made-up (excluding towels and bed-wears) in US million dollars. Whereas the other macroeconomic variables used in our study are industrial production (IP) and monthly weighted average exchange rate (ER) and monthly real interest rate (rate).

5.3.2. DESCRIPTIVE STATISTICS

In order to get a better understanding of the data we have performed its descriptive and graphical analysis. Table 5.1 below shows the descriptive statistics of export of the textile industrial chain.

Table 5.1: Descriptive statistics of textile industrial chain industries

	UI	MI	DI
Mean	145.78	188.59	678.61
Median	133.88	186.40	694.45
Maximum	310.48	282.70	929.50
Minimum	39.89	54.05	287.90
Std. Dev.	54.16	35.04	114.92
Skewness	0.78	-0.18	-0.27
Kurtosis	3.08	4.00	3.08
Jarque-Bera	14.50	6.79	1.80
Probability	0.00	0.03	0.41
Observations	144	144	144

Table 5.1 above shows the descriptive statistics of industries in the textile industry chain. The average value of downstream industries for the period of our analysis export is 678.61 million US dollars that is higher than the average value of midstream and upstream industries export value of 188.59 and 145.78 million Us dollars. It revealed the fact that downstream industries export dominates the export of other two industries of the textile industry chain. The maximum value of export of downstream industries was 929.5 million US dollars that was recorded in February 2020 due to massive increase in demand for textile manufacturing from American and European agencies as trade open up slowly after Covid-19 situation. Further, the government also contributes in this growth of export through duty drawbacks and refunds of taxes. The minimum value of export of downstream industries was recorded in April 2020 with 287.90 million US dollars. This reduction was

mainly due to delays in shipments and cancellations of orders from European Union (EU) countries. The midstream industries export reached the maximum value of 282.69 million US dollars in March 2011. This increase was mainly due to increase in raw cotton prices in international markets that leads to an increase in the price of cotton cloth and increase the export earnings. Further, international trade and demand for cotton cloths also increased significantly during this period. The minimum export of midstream industry was also recorded in April 2020 due to the same reason of shipment delay and order cancellation.

The export of upstream industries reached its maximum value for the period of our analysis in March 2011 and reached 310.48 million US dollars. As upstream industries are made up of spinning industries the increase in raw cotton prices increase the value of export. Just like midstream industries, the lowest value of export was reached 39.88 million US dollars in April 2020. The SD column shows that among all industries of textile industry chain the downstream industries export shows highest variation whereas, midstream industries export shows the least variation for the period of our analysis.

5.3.3: GRAPHICAL ANALYSIS

The graphical analysis of the export of the textile industrial chain has been presented in Figure 5.2 to 5.4 below.

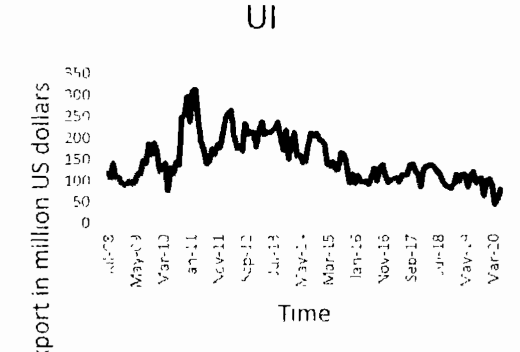

Figure 5.2: Export of upstream industries

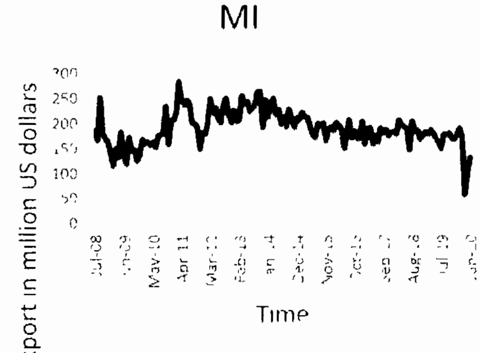

Figure 5.3: Export of midstream industries

It can be seen from Figure 5.2 that export of upstream industries experience different low and high peaks during the period of our analysis. The export of upstream industries reduced to 74.33 million US dollars in May 2010. This reduction was due to decrease in global demand and due to the domestic power shortage, that reduce the production of spinning industries and export of cotton yarn by 3 percent. However, it increases gradually after that and reached a maximum value in March 2011. It again falls to 160.06 million US dollars in October 2011. During this time Pakistan's textile industries were facing the problem of shortage of electricity and adverse law and order situation caused the closure of some industries. Further, the unannounced load shedding of electricity and high interest rate that discouraged new investment caused the closure of some upstream industries. The covid-19 situation also badly affected the export and it decreased significantly after April 2019.

Figure 5.3 above shows that the export of midstream industries shows less variation as compared to the other two industries of the textile industrial chain. The midstream industries export after reaching the maximum value in March 2011 decreases significantly and reached at a very low level of 177.82 million US dollars in January 2012. This reduction was mainly due to the shortage of power that hardened the production of power looms and high-mill power looms. Further, the export of cotton cloth also decreased and reached the lowest level in April 2020 due to the covid-19 situation.

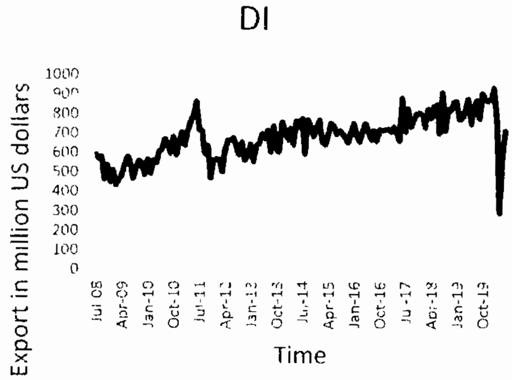

Figure 5.4: Export of downstream industries

Figure 5.4 shows the export of downstream industries that are the most dynamic industries in the textile industrial chain. In the year 2010, the global export of textile increased significantly, and China benefited significantly from this and become the leader of global textile export leaving the European Union behind. Pakistan also witnessed a massive increase in the demand for its textile manufacturing during the year 2010 and 2011. However, it reduced gradually and reached the lowest level of 501.03 million US dollars in March 2012 due to low utilization of capacity (60 percent only). However, the improvements in power supply bring positive vibes to downstream industry export. Further, the announcement of textile policy for 2014-2019 provides an incentive for new investment in the highly export oriented textile industry. Moreover, the China-America trade war shifts the American textile buyers from China to India, Vietnam and Pakistan and Pakistan share of downstream export increases. However, like other industries the covid-19 situation badly affected the export performance of downstream industries. The graphical analysis of the export of industries of textile industrial chain shows that the covid 19 situation adversely affected almost all the industries. So, in order to account for the impact of covid 19 shocks, we will add the dummy of covid from April 2019.

5.3.4: METHODOLOGY

This study aims to employ the Structural VAR model in order to examine the relationship between commodity price shocks and the export of Pakistan's textile industry chain. The SVAR model can be expressed as in equation 5.1

$$A_0 Y_t = A_1 Y_{t-1} + \cdots + A_p Y_{t-p} + u_t \tag{5.1}$$

Where Y_t is a vector of economic variables and $u_t$is a vector of the structural economic shocks. The vector of the structural economic shocks has a property that u_t is white noise with zero mean and variance covariance matrixΩ. Consistently, the model can be written more compactly as;

$$A\ (L) Y_t = u_t \tag{5.2}$$

Where A (L) = $A_0 - A_1(L) - A_2 L^2 - \cdots - A_p L^p$and $A_i$is a coefficient matrix $(i = 0 \ldots p)$ and L is lag operator. Moreover,for estimation of the structural model we need to derive its reduced-form and for that we pre-multiply both sides of the SVAR model equation (1) byA_0^{-1}.

$$A_0^{-1} A_0 y_t = A_0^{-1} A_1 y_{t-1} + \cdots + A_0^{-1} A_p y_{t-p} + A_0^{-1} u_t \tag{5.3}$$

So, the same model can be represented as;

$$y_t = B_1 y_{t-1} + \cdots + B_p y_{t-p} + \varepsilon_t \tag{5.4}$$

Where, B_i=$A_0^{-1} A_i$ and $(i = 1 \ldots p)$ and ε_t=$A_0^{-1} u_t$. Equivalently the model can be written more compactly as:

$$B(L) y_t = \varepsilon_t \tag{5.5}$$

Where B (L) = $I - B_1(L) - B_2L^2 - \cdots - B_pL^p$ and $B_i$is a coefficient matrix ($i = 1 \dots p$) and L is lag operator.Standard estimation methods like OLS permits us to attain consistent estimates of the reduced form parameters, the reduced form errorsε_t 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 will also use Augmented Dickey-Fuller (ADF) model for the unit root test in order to check the stationarity of data.

5.3.5. IDENTIFICATION OF SVAR MODEL

This study is using data from large three different industries and seven groups of commodity prices, so, it is not feasible to add all industries and commodity prices groups in one model. Thus, it will use a separate model for each industry and each group of commodity prices. Therefore, we need to impose separate restrictions for each commodity price. The identification of restriction of our SVAR model used an information-based approach. The maximum number of parameters is 25[31] and a maximum number of independent movements in the co variance matrix is 15[32]. Thus, our model required at least 10 fully identified restrictions.

5.3.5.1.FOR ENERGY PRICES

Commodity Price equation

$$cpe_t = \beta_1 cpe_{t-p} + \mu_e \quad (5.6)$$

Aggregate textile output equation

$$y\_tex_t = \beta_2 y\_tex_{t-p} + \beta_3 cpe_{t-p} + \beta_4 ui_{t-p} + \beta_5 rate_{t-p} + \mu_y \quad (5.7)$$

---

31 : N^2=25

32 $N(N+1)/2$

Upstream industries equation

$$Ui_t = \beta_6 ui_{t-p} + \beta_7 y\_tex_{t-p} + \beta_8 cpe_{t-p} + \beta_9 er_{t-p} + \mu_{inf} \quad (5.8)$$

Interest rate equation

$$rate_t = \beta_{10} rate_{t-p} + \beta_{11} cpe_{t-p} + \mu_{rate} \quad (5.9)$$

Exchange rate equation

$$er_t = \beta_{12} er_{t-p} + \beta_{13} cpe_{t-p} + \beta_{14} ui_{t-p} + \beta_{15} rate_{t-p} + \mu_{er} \quad (5.10)$$

We imposed the assumption of exogeneity on our commodity price equation as it is commonly believed that energy prices are set by the energy demand and supply forces independent of the individual industry production and export (Jo et al. 2019; Geo et al,2018). The aggregate textile equation includes energy prices as energy is the basic input in the production process (Lee and Ni, 2002). The textile industry of Pakistan is export orientated industry. Therefore, the export of the upstream industry affects the production decision of textile industry, so we add the upstream industry export in the aggregate textile production equation (Maqbool et al, 2020). Pakistan textile industry has the in-build potential for growth and performs well due to the easy and cheaper availability of raw cotton and labour. Further, the textile industry of Pakistan has massive demand domestically and internationally. Therefore, there is always a good opportunity for new investment. Thus, interest rate plays a significant role in the aggregate production of textile (Irshad and Xin, 2017). The export of upstream industry equation incorporates the impact of energy prices, aggregate textile output and exchange rate (Abdul, 2017). Whereas, studies have found that interest rate is affected by domestic aggregate output and inflation (Lee and Ni, 2002; Abdul, 2017). However, it is not assumed to be affected by a single industry like textile production. Therefore, the interest rate equation incorporates the impact of energy prices only. The exchange rate is the most endogenous variable in our model, and it responds contemporaneously to energy prices, upstream industry export and interest rate shocks. The above system of the equation can be expressed in matrix form as follows;

$$\begin{bmatrix} \mu cpe_t \\ \mu y\_tex_t \\ \mu ui_t \\ \mu rate_t \\ \mu er_t \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & a_{22} a_{23} & & 0 \\ a_{31} & a_{32} & 1 & 0 & a_{35} \\ a_{41} & 0 & 0 & 1 & 0 \\ a_{51} & 0 & a_{53} & a_{54} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon cpe_t \\ \varepsilon y\_tex_t \\ \varepsilon ui_t \\ \varepsilon rate_t \\ \varepsilon er_t \end{bmatrix}$$

We have imposed total of 10 zero restrictions to estimate our macro-economic SVAR model. Thus, total of 15 parameters will be estimated with 15 independent movements of covariance matrix and our model is just identified.

5.3.5.2.FOR FOOD PRICES

Commodity Price equation

$$cpf_t = \beta_1 cpf_{t-p} + \mu_f \tag{5.11}$$

Aggregate textile output equation

$$y\_tex_t = \beta_2 y\_tex_{t-p} + \beta_3 ui_{t-p} + \beta_4 rate_{t-p} + \mu_y \tag{5.12}$$

Upstream industries equation

$$Ui_t = \beta_5 ui_{t-p} + \beta_6 y\_tex_{t-p} + \beta_7 cpf_{t-p} + \beta_8 er_{t-p} + \mu_{inf} \tag{5.13}$$

Interest rate equation

$$rate_t = \beta_9 rate_{t-p} + \beta_{10} cpf_{t-p} + \mu_{rate} \tag{5.14}$$

Exchange rate equation

$$er_t = \beta_{11} er_{t-p} + \beta_{12} cpf_{t-p} + \beta_{13} ui_{t-p} + \beta_{14} rate_{t-p} + \mu_{er} \tag{5.15}$$

The above system of equations is similar to energy price with one change that our aggregate output equation does not include food price as it is not directly related to production. The above system of equation can be written in matrix form as follows;

$$\begin{bmatrix} \mu cpf_t \\ \mu y\_tex_t \\ \mu ui_t \\ \mu rate_t \\ \mu er_t \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & a_{22}a_{23} & 0 \\ a_{31} & a_{32} & 1 & 0 & a_{35} \\ a_{41} & 0 & 0 & 1 & 0 \\ a_{51} & 0 & a_{53} & a_{54} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon cpf_t \\ \varepsilon y\_tex_t \\ \varepsilon ui_t \\ \varepsilon rate_t \\ \varepsilon er_t \end{bmatrix}$$

We have imposed total of 11 zero restrictions to estimate our macro-economic SVAR model. Thus, total of 14 parameters will be estimated with 15 independent movements of covariance matrix and our model has an over identified restriction.

5.3.5.3.FOR HOUSING PRICES

Commodity price equation

$$cph_t = \beta_1 cph_{t-p} + \beta_2 rate_{t-p} + \mu_h \quad (5.16)$$

Aggregate textile output equation

$$y\_tex_t = \beta_3 y\_tex_{t-p} + \beta_4 ui_{t-p} + \beta_5 rate_{t-p} + \mu_y \quad (5.17)$$

Upstream industries equation

$$Ui_t = \beta_6 ui_{t-p} + \beta_7 y\_tex_{t-p} + \beta_8 cph_{t-p} + \beta_9 er_{t-p} + \mu_{inf} \quad (5.18)$$

Interest rate equation

$$rate_t = \beta_{10} rate_{t-p} + \beta_{11} cpf_{t-p} + \mu_{rate} \quad (5.19)$$

Exchange rate equation

$$er_t = \beta_{12} er_{t-p} + \beta_{13} cph_{t-p} + \beta_{14} ui_{t-p} + \beta_{15} rate_{t-p} + \mu_{er} \quad (5.20)$$

The housing assets are forward looking, so they react instantly to macroeconomic situation of an economy. Further, the interest rate has a positive impact on house prices, so we add interest rate in the equation of commodity price for housing (Su et al, 2019). The rest of the restrictions are similar to food price model. The above system of equation can be written in matrix form as follows;

$$\begin{bmatrix} \mu cph_t \\ \mu y\_tex_t \\ \mu ui_t \\ \mu rate_t \\ \mu er_t \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & a_{13} & 0 \\ 0 & 1 & a_{22} & a_{23} & 0 \\ a_{31} & a_{32} & 1 & 0 & a_{35} \\ a_{41} & 0 & 0 & 1 & 0 \\ a_{51} & 0 & a_{53} & a_{54} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon cph_t \\ \varepsilon y\_tex_t \\ \varepsilon ui_t \\ \varepsilon rate_t \\ \varepsilon er_t \end{bmatrix}$$

We have imposed total 10 zero restrictions to estimate our macro-economic SVAR model. Thus, total 15 parameters will be estimated with 15 independent movements of covariance matrix and our model is just identified.

5.3.5.4.FOR TRANSPORTATION PRICES

Commodity Price equation

$$cpt_t = \beta_1 cpt_{t-p} + \mu_t \quad (5.21)$$

Aggregate textile output equation

$$y\_tex_t = \beta_2 y\_tex_{t-p} + \beta_3 cpt_{t-p} + \beta_4 ui_{t-p} + \beta_5 rate_{t-p} + \mu_y \quad (5.22)$$

Upstream industries equation

$$Ui_t = \beta_6 ui_{t-p} + \beta_7 y\_tex_{t-p} + \beta_8 cpt_{t-p} + \beta_9 er_{t-p} + \mu_{inf} \quad (5.23)$$

Interest rate equation

$$rate_t = \beta_{10} rate_{t-p} + \beta_{11} cpt_{t-p} + \mu_{rate} \quad (5.24)$$

Exchange rate equation

$$er_t = \beta_{12} er_{t-p} + \beta_{13} cpt_{t-p} + \beta_{14} ui_{t-p} + \beta_{15} rate_{t-p} + \mu_{er} \quad (5.25)$$

The transportation price is assumed to be exogenous in our model ad it determines by the demand and supply of transportation (Shain et al., 2009). The aggregate output equation takes into account transportation cost as most of the industrial activities involve transportation (Redding and turner, 2015; Paulley et al., 2006). The rest of the restrictions are similar to energy prices. The above system of equation can be expressed in matrix form as follows;

$$\begin{bmatrix} \mu cpt_t \\ \mu y\_tex_t \\ \mu ui_t \\ \mu rate_t \\ \mu er_t \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & a_{22}a_{23} & 0 \\ a_{31} & a_{32} & 1 & 0 & a_{35} \\ a_{41} & 0 & 0 & 1 & 0 \\ a_{51} & 0 & a_{53} & a_{54} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon cpt_t \\ \varepsilon y\_tex_t \\ \varepsilon ui_t \\ \varepsilon rate_t \\ \varepsilon er_t \end{bmatrix}$$

We have imposed total 10 zero restrictions to estimate our macro-economic SVAR model. Thus, total 15 parameters will be estimated with 15 independent movements of covariance matrix and our model is just identified.

5.3.5.5.FOR EDUCATION PRICES

Commodity Price equation

$$cpedu_t = \beta_1 cpedu_{t-p} + \mu_{edu} \tag{5.26}$$

Aggregate textile output equation

$$y\_tex_t = \beta_2 y\_tex_{t-p} + \beta_3 ui_{t-p} + \beta_4 rate_{t-p} + \mu_y \tag{5.27}$$

Upstream industries equation

$$Ui_t = \beta_5 ui_{t-p} + \beta_6 y\_tex_{t-p} + \beta_7 cpedu_{t-p} + \beta_8 er_{t-p} + \mu_{inf} \tag{5.28}$$

Interest rate equation

$$rate_t = \beta_9 rate_{t-p} + \beta_{10} cpedu_{t-p} + \mu_{rate} \tag{5.29}$$

Exchange rate equation

$$er_t = \beta_{11} er_{t-p} + \beta_{12} cpedu_{t-p} + \beta_{13} ui_{t-p} + \beta_{14} rate_{t-p} + \mu_{er} \tag{5.30}$$

The above system of equations is similar to food price. Thus, our aggregate output equation does not include education price as it is not directly related to individual industry production. The above system of equation can be written in matrix form as follows;

$$\begin{bmatrix} \mu cpedu_t \\ \mu y\_tex_t \\ \mu ui_t \\ \mu rate_t \\ \mu er_t \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & a_{22}a_{23} & 0 \\ a_{31} & a_{32} & 1 & 0 & a_{35} \\ a_{41} & 0 & 0 & 1 & 0 \\ a_{51} & 0 & a_{53} & a_{54} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon cpedu_t \\ \varepsilon y\_tex_t \\ \varepsilon ui_t \\ \varepsilon rate_t \\ \varepsilon er_t \end{bmatrix}$$

We have imposed total 11 zero restrictions to estimate our macro-economic SVAR model. Thus, total 14 parameters will be estimated with 15 independent movements of covariance matrix and our model has on over identified restriction.

5.3.5.7. FOR HEALTH PRICES

Commodity Price equation

$$cphel_t = \beta_1 cphel_{t-p} + \mu_{hel} \tag{5.31}$$

Aggregate textile output equation

$$y\_tex_t = \beta_2 y\_tex_{t-p} + \beta_3 ui_{t-p} + \beta_4 rate_{t-p} + \mu_y \tag{5.32}$$

Upstream industries equation

$$Ui_t = \beta_5 ui_{t-p} + \beta_6 y\_tex_{t-p} + \beta_7 cphel_{t-p} + \beta_8 er_{t-p} + \mu_{inf} \tag{5.33}$$

Interest rate equation

$$rate_t = \beta_9 rate_{t-p} + \beta_{10} cphel_{t-p} + \mu_{rate} \tag{5.34}$$

Exchange rate equation

$$er_t = \beta_{11} er_{t-p} + \beta_{12} cphel_{t-p} + \beta_{13} ui_{t-p} + \beta_{14} rate_{t-p} + \mu_{er} \tag{5.35}$$

Our SVAR model with health price does not include health price in aggregate output equation as it is not directly related to production. The above system of equation can be written in matrix form as follows;

$$\begin{bmatrix} \mu cphel_t \\ \mu y\_tex_t \\ \mu ui_t \\ \mu rate_t \\ \mu er_t \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & a_{22} & a_{23} & 0 \\ a_{31} & a_{32} & 1 & 0 & a_{35} \\ a_{41} & 0 & 0 & 1 & 0 \\ a_{51} & 0 & a_{53} & a_{54} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon cphel_t \\ \varepsilon y\_tex_t \\ \varepsilon ui_t \\ \varepsilon rate_t \\ \varepsilon er_t \end{bmatrix}$$

We have imposed total 11 zero restrictions to estimate our macro-economic SVAR model. Thus, total 14 parameters will be estimated with 15 independent movements of covariance matrix and our model has on over identified restriction.

5.3.5.6.FOR CLOTHING AND FOOTWEAR PRICES

Commodity Price equation

$$cpcf_t = \beta_1 cpcf_{t-p} + \mu_{hel} \tag{5.36}$$

Aggregate textile output equation

$$y\_tex_t = \beta_2 y\_tex_{t-p} + \beta_3 ui_{t-p} + \beta_4 rate_{t-p} + \mu_y \tag{5.37}$$

Upstream industries equation

$$Ui_t = \beta_5 ui_{t-p} + \beta_6 y\_tex_{t-p} + \beta_7 cpcf_{t-p} + \beta_8 er_{t-p} + \mu_{inf} \tag{5.38}$$

Interest rate equation

$$rate_t = \beta_9 rate_{t-p} + \beta_{10} cpcf_{t-p} + \mu_{rate} \tag{5.39}$$

Exchange rate equation

$$er_t = \beta_{11} er_{t-p} + \beta_{12} cpcf_{t-p} + \beta_{13} ui_{t-p} + \beta_{14} rate_{t-p} + \mu_{er} \tag{5.40}$$

Our SVAR model with health price does not include health price in aggregate output equation as it is not directly related to production. The above system of equation can be written in matrix form as follows;

$$\begin{bmatrix} \mu cpcf_t \\ \mu y\_tex_t \\ \mu ui_t \\ \mu rate_t \\ \mu er_t \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & a_{22} a_{23} & & 0 \\ a_{31} & a_{32} & 1 & 0 & a_{35} \\ a_{41} & 0 & 0 & 1 & 0 \\ a_{51} & 0 & a_{53} & a_{54} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon cpcf_t \\ \varepsilon y\_tex_t \\ \varepsilon ui_t \\ \varepsilon rate_t \\ \varepsilon er_t \end{bmatrix}$$

We have imposed total 11 zero restrictions to estimate our macro-economic SVAR model. Thus, total 14 parameters will be estimated with 15 independent movements of covariance matrix and our model has on over identified restriction. Further, same restrictions will be used for midstream industries and downstream industries.

5.4: RESULTS

This section represents the results of our estimations. In order to use the correct specification of the model, we perform ADF test. Further, the lags numbers have been selected on basis of Schwarz Info Criterion (SIC). Table 5.2 below shows the results of the unit root test for commodity prices 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, rate is interest rate, y_tex is textile industry output and er is the exchange rate, ui is upstream industry export, mi is midstream industry export, di is downstream industry export.

Table 5.2: Unit root rest results

Variables	ADF Test at Level		ADF Test at First Diff		Order of Integration
	τ statistics	P values	τ 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)
Y_tex	-9.27**	0.000	-	-	I(0)
Er	1.91	0.999	-8.45**	0.000	I(1)
Rate	-1.50	0.528	-7.69**	0.000	I(1)
Ui	-3.00*	0.03	-	-	I(0)
Mi	-3.25*	0.01	-	-	I(0)
Di	-3.37*	0.01	-	-	I(0)

Note: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 5.2 above shows that most of the variables are stationary at first difference whereas, few are stationary at level. The standard textbooks support is with stationary data as it helps to meet the normality condition and inference can be done. Therefore, we have preferred to go with stationary data. This analysis aims to examine the impact of different groups of commodity prices on the textile industry chain of Pakistan. We used monthly data from July 2008 to June 2020. The lag length criteria for each commodity price are given in tables 1 to 7 in Appendix 3. We have used SIC for the selection of lag length as it is best fitted for small samples. In order to get a better understanding of results, we represent the response of one industry to each commodity price in one place. The responses of other variables of the model on industries of textile industry chain are presented in Appendix 3. Figure 5.5 below shows the impulse responses with energy price model.

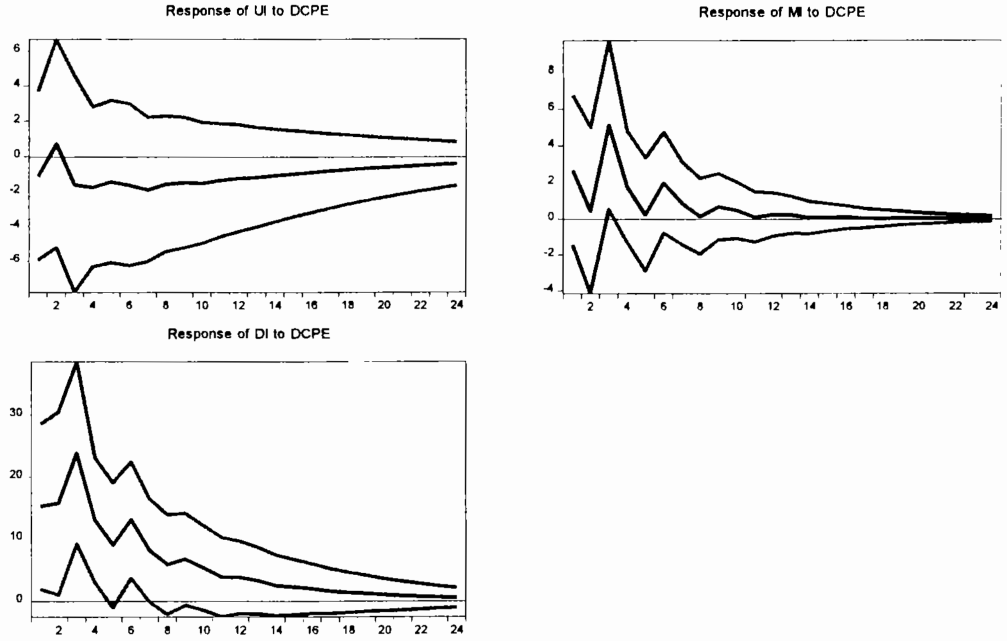

Figure 5.5: Impulse response with energy price model

In response to positive shocks in energy prices, the export of upstream industries decreases. As upstream industries consist of the spinning sector of the textile industry chain the price of cotton yarn and other products of upstream industries depend on the supply of raw cotton. Thus, the increase in energy prices does not easily transmit to these industries prices and increase in energy prices, increase cost of production and discourage production and export. However, this response is not significant for our analysis. The export of midstream industries shows positive response with energy price shocks however, it is significant for third month only. These results are consistent with the findings of Abdul (2017) that positive shocks in oil prices lead to a positive response in textile export of

Pakistan. In case of downstream industry export, the energy price shocks lead to massive expansion and this response is significant for the first seven months. The highest response is observed with a 25 percent increase in export in third month of the shock. These results provide interesting an unusual view, one possible justification for these results can be the capacity of downstream industries to increase price with increase in energy prices. It is widely believed that shocks in energy prices are transmitted to all other prices (Hanif et al, 2017; Aponte, 2016). Further, oil has dominant share in energy prices and Pakistan is net importer of oil the increase in international oil prices also affects the international textile prices and encourages export. Moreover, the downstream industries have highest value addition and also have advantage of product differentiation and subsidies from the government. Thus, if the increase in energy prices is less than the increase in international textile prices the export is expected to increase.

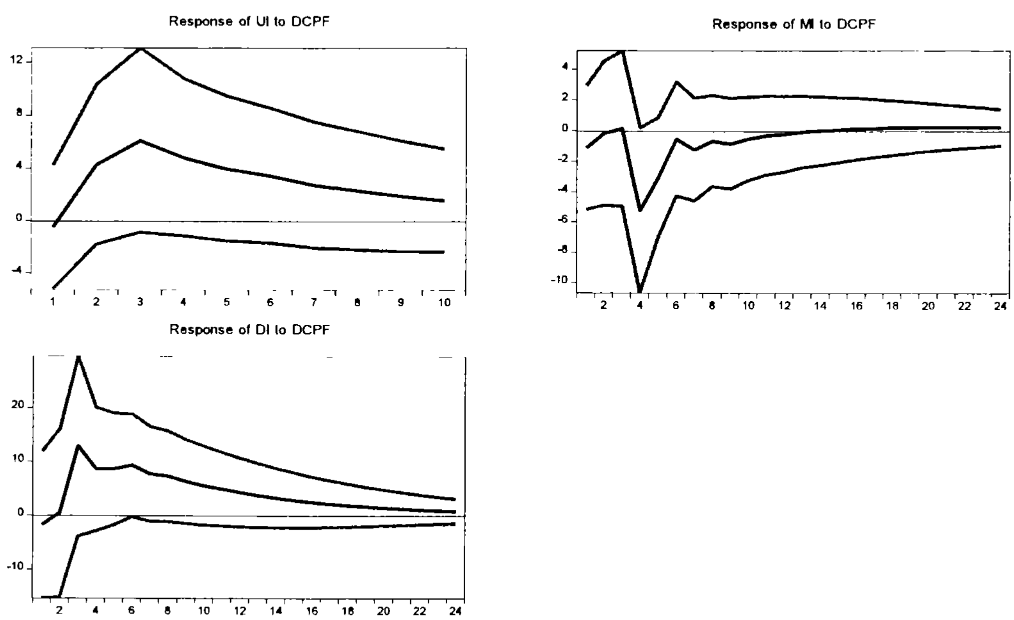

Figure 5.6: Impulse response with food price model

Figure 5.6 above shows that in response to food price shocks the export of upstream industries increases however, this response is insignificant. The export of midstream industries decreases with shocks in food prices and this response is significant in the fourth month aftershock. Food is essential of life and consumers spend an ample share of their income on consumption of food items and food prices have the highest share in consumer price index (CPI). Thus, an increase in food prices creates inflationary pressure in domestic economy. The midstream industries of Pakistan mostly export raw cotton thus its faces high competition from neighboring countries. Domestic inflation reduces the competitiveness of midstream industries export. Further, the shocks in food prices increase the export of downstream industries however this impact is significant for fifth month only.

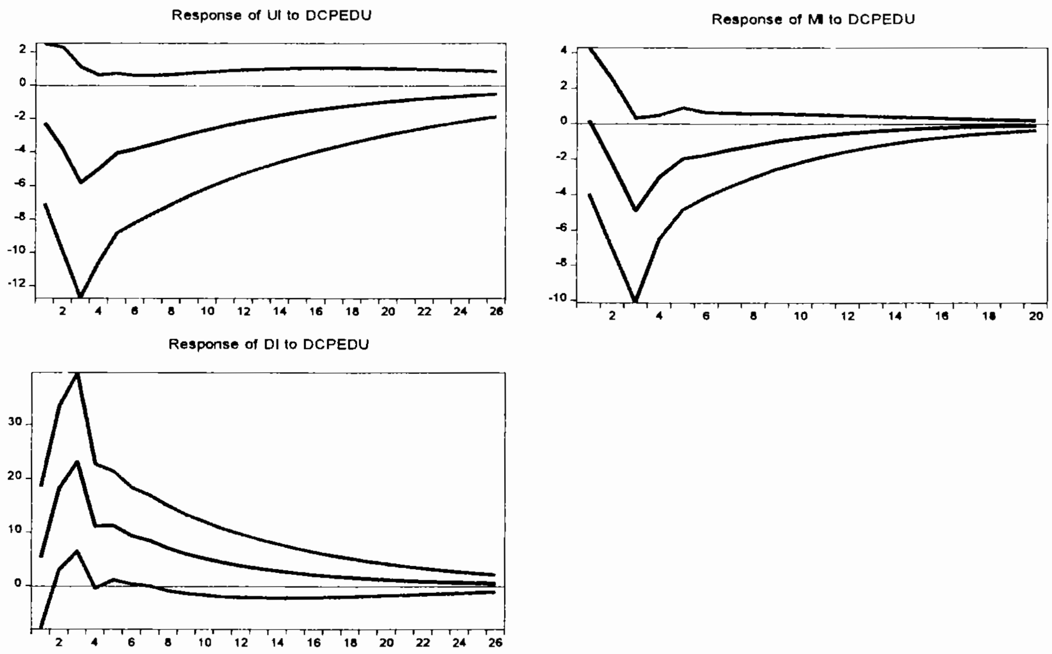

Figure 5.7: Impulse responses with education price shocks

Figure 5.7 above shows that in response to education price shock the export of upstream and midstream industries decreases. However, it is significant for midstream industries export only. Whereas the export of downstream industries increases significantly from the second to seventh month of the shock. Education is the key to investment in human capital, the increase in the price of education leads to an increase in the investment cost of human capital cost of living and production.

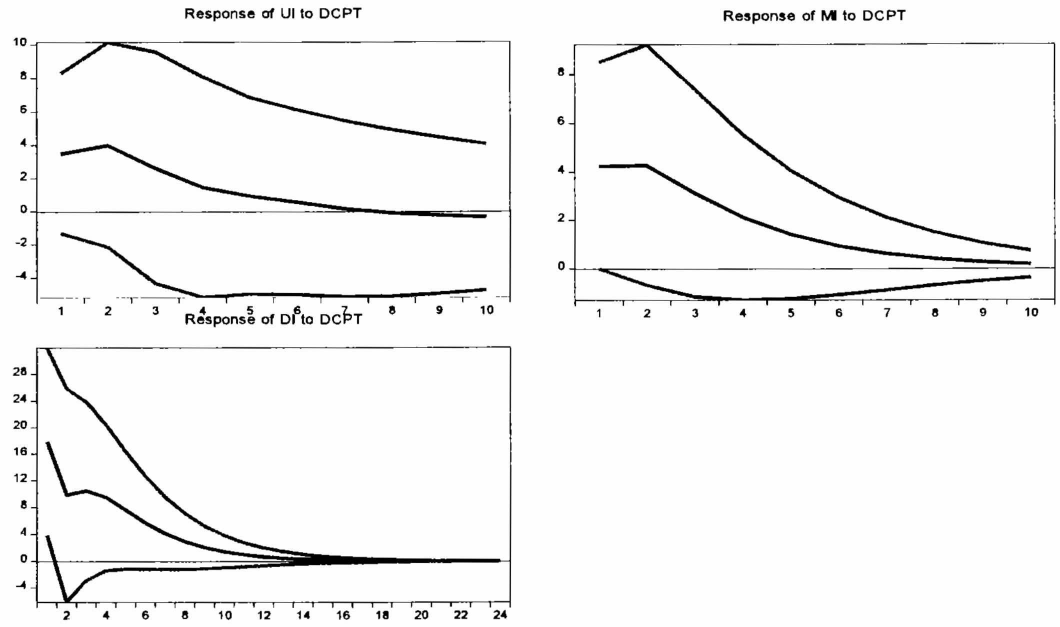

Figure 5.8: Impulse response with transportation price model

Figure 5.8 above shows that transportation price shocks increase the export of all industries. However, the response is significant for midstream and downstream industries and only for first month. Increase in transportation price increase the cost of production as most of the industrial activities involve the movements of labor, raw materials, and finished products from one place to other (Redding and turner, 2015; Paulley et al, 2006). Although, the increase in transportation price increase cost of production domestically it does not have much significant impact on export.

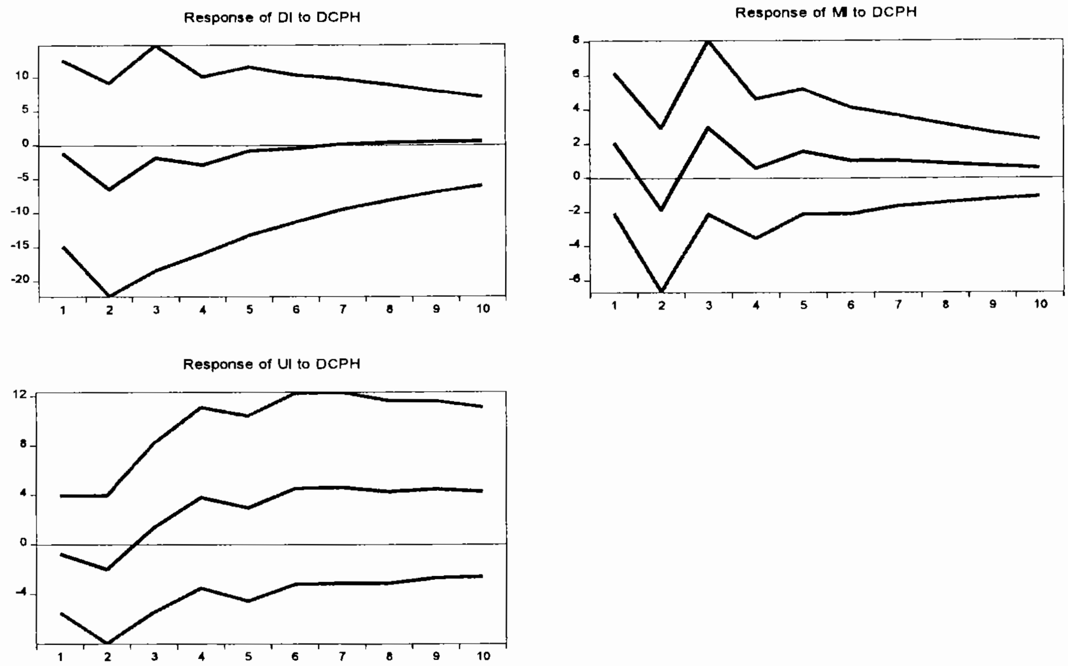

Figure 5.9: Impulse responses with housing price model

The housing assets are forward looking, so they react instantly to macroeconomic situation of an economy. The shocks in housing prices decrease the export of upstream industries. In case of midstream industries, the shocks in housing prices increase the export for first month, and then decreases for second month and thereafter it increases. In response to housing price shocks downstream industries export increases after second month. However, this response is insignificant for all industries.

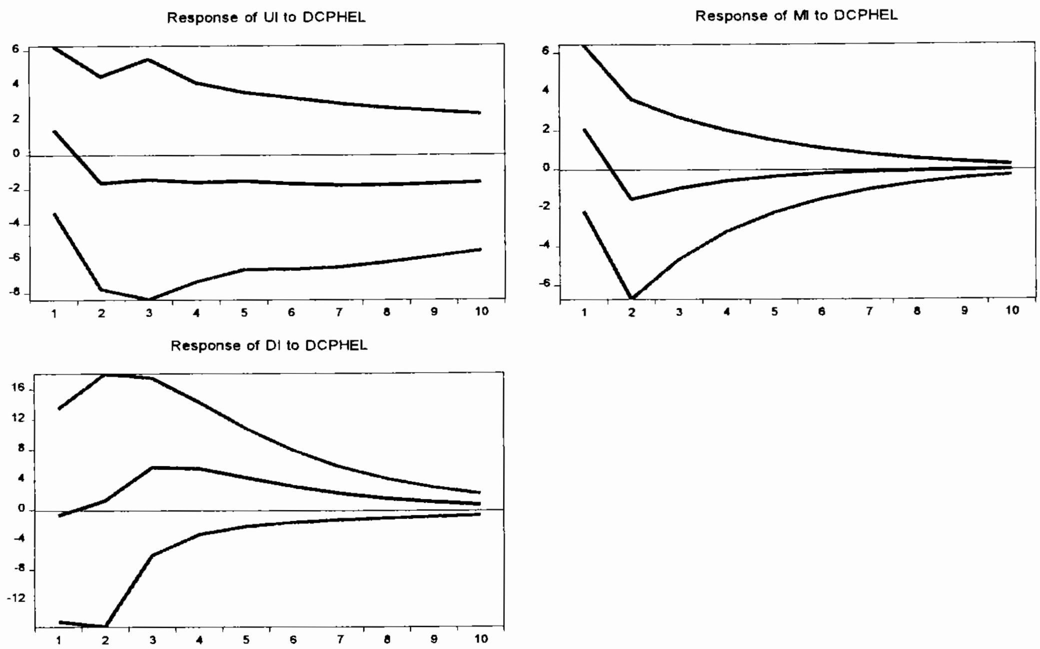

Figure 5.10: Impulse response with health price model

Figure 5.10 above shows the impulse response with health price model. Although health price shocks decrease the export for upstream and midstream industries and increases for downstream industries. Although, the results are not significant healthcare has always been considered as an economic activity, societies invest their time and resources in it, and they have traded for it (van Velden, 2005).

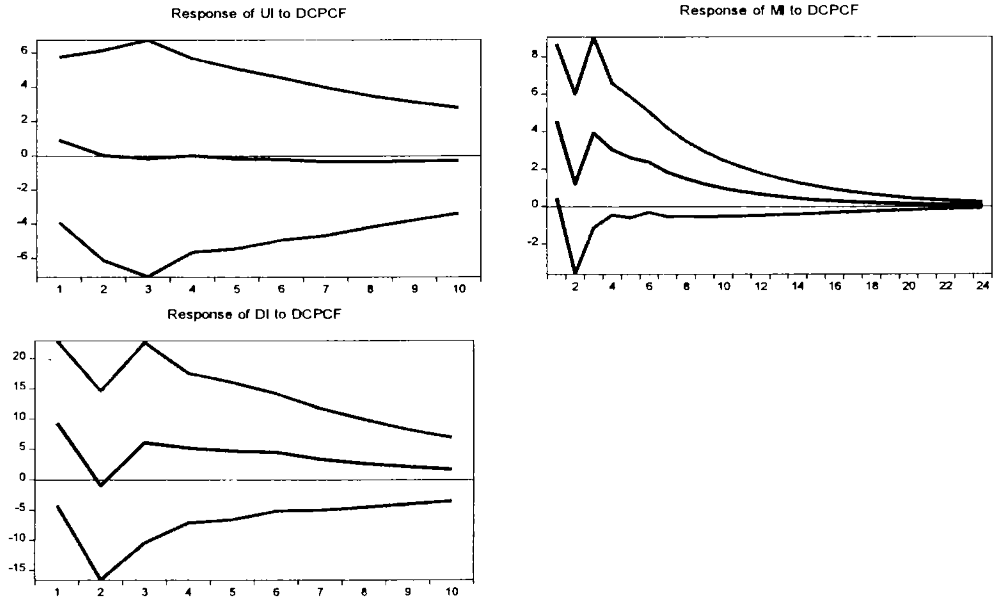

Figure 5.11: Impulse responses with clothing and footwear prices

Above figure shows that in response to clothing and footwear price the upstream industries export has no impact. Whereas, midstream industries export that consists of export of "raw cloth" shows positive impact. The downstream industries export also has a positive impact. But this response is not significant. Being a small open economy that suffers severely from balance of payment deficit the domestic price shocks have less impact on exports. However, the impact is expected to work through the channel of domestic production of exportable industries. And through the increase in cost of production reduces the comparative advantage in trade. Further, the transmission of price shock to industrial prices affects the competitiveness of export.

Table 5.3 below summarized the responses of export of textile industry chain to commodity price shocks.

Table5.3: Summarized responses of textile industry chain industries to commodity price shocks

Commodity prices	Upstream industries	Midstream industries	Downstream industries
Energy	Decrease	Increase*	Increase*
Food	Increase	Decrease*	Increase*
Education	Decrease	Decrease*	Increase*
Health	Decrease	Decrease	Increase
Housing	Decrease	Mixed	Increase
Transportation	Increase	Increase	Increase*
Clothing and footwear	No impact	Increase	Increase

Note: * shows that response is significant for at least one month.

5.5.CONCLUSION

This study examines the impact of commodity price shocks on the textile industry chain of Pakistan. We dis-aggregate commodity prices into seven groups namely energy, food, education, health, housing, transportation and clothing and footwear. The textile industry chain of Pakistan consists of three sub-industries. The upstream industries mainly include cotton spinning industries; the midstream industries include weaving units and downstream industries are made up of garments manufacturing. We used monthly data from July 2008 to June 2020 and employ SVAR methodology for our analysis. The findings of our study provide the insight that downstream industries are the most affected industries with the commodity price shocks. However, the impact of these shocks is positive. Whereas, midstream industries are adversely affected by food and education price shocks. These results provide guidance to policy makers to provide subsidies to only those industries that are adversely affected by commodity price shocks. Further, study also revealed the fact that not all commodity price shocks are bad for the export of textile industries chain as it increases the export of some industries significantly.

Chapter 6

CONCLUSION AND POLICY IMPLICATIONS

This study examines the impact of commodity price shocks on the economic activities of Pakistan on three different levels. First at macro level, where it investigates the impact of commodity price shock on aggregate variables and then it delves to examines the impact of these shocks on thirteen LSMI of Pakistan and thereafter at dynamic transmission level where it addresses the role of commodity price shocks on the exports of textile industrial chain of Pakistan. This study goes further to investigate the impact of commodity price shocks by disaggregating commodity price indices into seven different groups namely food, clothing and footwear, housing, energy, transport, education, health and others. We used monthly data over July 2008 to June 2020 and employed SVAR model for our analysis.

The results of our study provide the insight that all commodity price shocks are not alike for the macro economy of Pakistan and different commodity price groups effect the economy differently with different magnitude. Energy price shocks has dominant positive impact on interest rate, food price shocks on inflation and health price shocks on exchange rate. Whereas, education price shocks have dominant negative impact on output. Moreover, different commodity price shocks have differential impact on different industries. Further, the pattern of response of industries to energy and health price shocks have positive and dominating impact on supply side of industries. Whereas, the food, transportation and housing price shocks have dominating impact on industries through demand side. Further, the education and clothing and footwear price shocks shows mixed impact on demand and supply side The results of base-line model adds more strength to our analysis and provide the information about response of aggregate industrial output to commodity price and other macroeconomic shocks. The results of base-line analysis are somehow consistent with the finding of individual industry analyses.

The textile industry chain of Pakistan is made of three sub-industries. The upstream industries mainly include cotton spinning industries; the midstream industries include weaving units and downstream industries are made up of garments manufacturing. The upstream industries export mainly consists of raw cotton and different types of yarn has not been affected by any of the price shocks significantly. One of the possible reasons for these results is that the export of upstream industries products does not have much value addition and its export depends on the international price of cotton and international demand. The export of midstream and downstream industries increases with energy price shocks. It may be through the channel of exchange rate depreciation. As Pakistan is a net importer of oil, the increase in energy prices resulting from the increase in oil prices (that has highest share in energy group) leads to an increment in payment to foreign countries and reduction in foreign reserves and exchange rate depreciation. The exchange rate depreciation makes domestic commodities cheaper to foreign buyers as in result of the export increases. The food and education price shocks decrease the export of midstream industries as these shocks put inflationary pressure on the prices of final products of these industries and reduce, the export competitiveness. However, the same price shocks increase the exports of downstream industries. It might be due to the fact that these industries have the highest value addition and have the advantage of product differentiation. The findings of our study provide insight that downstream industries are the most affected industries with commodity price shocks. However, the impact of these shocks is positive. Whereas, midstream industries are adversely affected by food and education price shocks.

6.1.POLICY IMPLICATIONS AND SUGGESTIONS

The study's results provide useful information to policymakers that may help them achieve their goals more effectively. 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 both at macro and micro level. The results of the analysis provide useful information to policymakers that will help them to achieve their goals more effectively. For example, if policy makers want to achieve higher production of Pakistan's second largest export industry leather, in this scenario the results of our analysis provide a clear view that which type of commodity price shocks can lead to boom and which to busts to leather industry. Further, it can help policymakers to focus on control of type of inflation that is more harmful and allow the one that generates a positive impact. Moreover, the results of our analysis also provide helpful information about the impact of commodity price shocks on sectoral adjustment of labour and other resources. Humilton (1988) first explains this effect through general equilibrium model. However, Jo et al. (2019) and Keave and Prasad (1996) finds that although shocks in oil prices lead to unemployment and change in real wage it does not shows a clear view of sectoral shifts of resources. Our results are consistent with these findings, as we can see through summarized results figures that different commodity price shocks cause different impacts, but we can't say that these impacts are large enough to shift resources among industries. However, it is more likely that they can cause unemployment and changes in real wages in the short run. Moreover, our analysis is based on limited data set, it is possible that strong evidence of resource shifts can be found for large sample data and among other sectors like services.

Further, in order to improve the situation of trade deficit of Pakistan, our results provide guidance to policymakers to provide subsidies to only those industries that exports are adversely affected by commodity price shocks. As all industries in the textile industry chain are not affected by these shocks equally, so one policy for all is not a good option. Further, the study also revealed the fact that not all commodity price shocks are bad for the export of textile industries chain as it increases the export of some industries significantly.

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 more exciting go-through. Further, more research can be done on the response of individual industries demand and supply to other macroeconomic shocks that are treated as exogenous in our analysis. Further, the impact of commodity price shocks on profits and stock returns of industries with larger data sets will be interesting to go through. Moreover, the dynamic transmission impact of commodity price shocks on textile industry chains can be examined on export quantity and with export value to isolate the impact of exchange rate movements. Further, the studies can be done by including foreign variables like weighted aggregate consumption of major textile partners of Pakistan and weighted aggregate exports of major textile competitors of Pakistan to make the results more efficient. Moreover, the asymmetric impact of commodity price shocks can be analyzed by disaggregating commodity price shocks in positive and negative shocks. Another extension could be the use of MSVAR or TVAR models and to obtain impulse responses under different regimes.

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APPENDIX

Table 1: Description of data

No	Variable	Variable Definition and Construction	Source
1.	Food Prices (cpf)	Weighted average of prices of Food and non- Alcoholic beverages, Alcoholic beverages and Tobacco and Restaurant and Hotels.	Constructed using data from Pakistan Bureau of Statistics (PBS).
2.	Clothes and footwear prices (cpcf)	Weighted average of prices of Cotton Cloth, Woolen Cloth, Ready Made Garments, Woolen Readymade Garments, Hosiery, Dopatta, Cleaning & Laundering, tailoring and footwear.	Constructed using data from Pakistan Bureau of Statistics (PBS).
3.	Housing prices (cph)	Weighted average of prices of House Rent, Construction Input Item price and Construction Wage Rate.	Constructed using data from Pakistan Bureau of Statistics (PBS).
4.	Energy prices (cpen or cpoil)	Weighted average of prices of Water, Electricity, Gas and other Fuels, Kerosene Oil, Fire Wood Whole.	Constructed using data from Pakistan Bureau of Statistics (PBS).
5.	Education prices (cpedu)	Weighted average of Tuition fee of private and Govt schools, colleges and universities and coaching fee for all grades.	Constructed using data from Pakistan Bureau of Statistics (PBS).

6.	Transportation prices (cpt)	Weighted average of prices of Motor Vehicle, Motor Vehicle Accessories, Motor Fuel, Mechanical Service, Motor Vehicle Tax and Transport Services.	Constructed using data from Pakistan Bureau of Statistics (PBS).
7.	Health and Others prices (cphel)	Weighted average of prices of health, communication, recreations and culture, miscellaneous.	Constructed using estimates developed by WHO and UNICEF
8.	Consumer Price Index (Inf)	Monthly percentage change in Consumer Price Index.	Constructed using data from Pakistan Bureau of Statistics (PBS)
9.	Industrial production (IP)	Obtain from monthly Quantum Index of Manufacturing (QIM)	Author constructed using data of different Census of Manufacturing Industries (CMI) Pakistan and Pakistan Bureau of Statistics (PBS).
10.	Interest Rate (rate or lb)	Real monthly interest rate is the lending interest rate adjusted for inflation as measured by the GDP deflator.	Constructed using data from State Bank of Pakistan (SBP)
11.	Exchange rate (ER)	Monthly weighted effective exchange rate.	Constructed using data from State Bank of Pakistan (SBP)

12.	Textile industry output	Obtain from the Quantum Index of Manufacturing (QIM) for Yarn, cloth, woolen and carpet yarn, woolen and worsted cloth and woolen blankets.	Author constructed using data of different Census of Manufacturing Industries (CMI) Pakistan and Pakistan Bureau of Statistics (PBS).
13.	Textile industry whole sale price index (WPI)	Obtain from the WPI of Cotton yarn (popular fiber, mgm, suriya textile, abdullah textile, bajwa), cloth (grey cloth, drill dyed), woolen and carpet yarn, woolen and worsted cloth and woolen blankets.	Author constructed using data from different publication of Pakistan Bureau of statistics (PBS).
14.	Food &Bev and Tabacco output	Obtain from the Quantum Index of Manufacturing (QIM) for sugar, cigarettes, cooking oil, vegetable ghee, wheat and grain milling, soft drinks, jucies,syrups and squashes glucose and tea blended.	Author constructed using data of different Census of Manufacturing Industries (CMI) Pakistan and Pakistan Bureau of Statistics (PBS).
15.	Food &Bev and Tabacco WPI	Obtain from the WPI of sugar, cigarettes, cooking oil, vegetable ghee, wheat and grain milling, soft drinks, jucies,syrups and squashes glucose and tea blended.	Author constructed using data from different publication of Pakistan Bureau of statistics (PBS).
16.	Coke and Petroleum Product output	Obtain from the Quantum Index of Manufacturing	Author constructed using data of different

		(QIM) for coke, kerosene oil, motor spirits, high speed diesel, furnace oil, lubricating oil and LPG.	Census of Manufacturing Industries (CMI) Pakistan and Pakistan Bureau of Statistics (PBS).
17.	Coke and Petroleum Product WPI	Obtain from the WPI of coke, kerosene oil, motor spirits, high speed diesel, furnace oil, lubricating oil and LPG.	Author constructed using data from different publication of Pakistan Bureau of statistics (PBS).
18.	Automobiles output	Obtain from the Quantum Index of Manufacturing (QIM) for cars, motorcycle, tractors, trucks and buses.	Author constructed using data of different Census of Manufacturing Industries (CMI) Pakistan and Pakistan Bureau of Statistics (PBS).
19.	Automobiles WPI	Obtain from the WPI of cars, motorcycle, tractors, trucks and buses.	Author constructed using data from different publication of Pakistan Bureau of statistics (PBS).
20.	Fertilizer output	Obtain from the Quantum Index of Manufacturing (QIM) for phosphorus fertilizer, nitrogen. fertilizer.	Author constructed using data of different Census of Manufacturing Industries (CMI) Pakistan and Pakistan Bureau of Statistics (PBS).

21.	Fertilizer WPI	Obtain from the WPI of phosphorus fertilizer, nitrogen fertilizer.	Author constructed using data from different publication of Pakistan Bureau of statistics (PBS).
22.	Paper &Board output	Obtain from the Quantum Index of Manufacturing (QIM) for paper and paper board.	Author constructed using data of different Census of Manufacturing Industries (CMI) Pakistan and Pakistan Bureau of Statistics (PBS).
23.	Paper &Board WPI	Obtain from the WPI of for paper and paper board.	Author constructed using data from different publication of Pakistan Bureau of statistics (PBS).
24.	Electronics output	Obtain from the Quantum Index of Manufacturing (QIM) for refrigerators, TV sets, electric fans, electric meters, air conditioners, electric bulbs and electric motors.	Author constructed using data of different Census of Manufacturing Industries (CMI) Pakistan and Pakistan Bureau of Statistics (PBS).
25.	Electronics WPI	Obtain from the WPI of refrigerators, TV sets, electric fans, electric meters, air conditioners, electric bulbs and electric motors.	Author constructed using data from different publication of Pakistan Bureau of statistics (PBS).

26.	Chemicals output	Obtain from the Quantum Index of Manufacturing (QIM) for caustic soda, toilet soap, soap and detergents, paints and varnishes, soda ash, sulphuric acid and matches.	Author constructed using data of different Census of Manufacturing Industries (CMI) Pakistan and Pakistan Bureau of Statistics (PBS).
27.	Chemicals WPI	Obtain from the WPI of caustic soda, toilet soap, soap and detergents, paints and varnishes, soda ash, sulphuric acid and matches.	Author constructed using data from different publication of Pakistan Bureau of statistics (PBS).
28.	Leather products output	Obtain from the Quantum Index of Manufacturing (QIM) for upper leather, sole leather and footwear.	Author constructed using data of different Census of Manufacturing Industries (CMI) Pakistan and Pakistan Bureau of Statistics (PBS).
29.	Leather products WPI	Obtain from the WPI of upper leather, sole leather and footwear.	Author constructed using data from different publication of Pakistan Bureau of statistics (PBS).
30.	Engineering products output	Obtain from the Quantum Index of Manufacturing (QIM) for heavy machinery and equipment, safety razer blades, sewing machines, bicycles and chaff cutters.	Author constructed using data of different Census of Manufacturing Industries (CMI) Pakistan and

			Pakistan Bureau of Statistics (PBS).
31.	Engineering products WPI	Obtain from the WPI of heavy machinery and equipment, safety razer blades, sewing machines, bicycles and chaff cutters.	Author constructed using data from different publication of Pakistan Bureau of statistics (PBS).
32.	Rubber products output	Obtain from the Quantum Index of Manufacturing (QIM) for cycle tyres, cycle tubes, motor tyres and motor tubes.	Author constructed using data of different Census of Manufacturing Industries (CMI) Pakistan and Pakistan Bureau of Statistics (PBS).
33.	Rubber products WPI	Obtain from the WPI of cycle tyres, cycle tubes, motor tyres and motor tubes.	Author constructed using data from different publication of Pakistan Bureau of statistics (PBS).
34.	Non-metallic mineral products output.	Obtain from the Quantum Index of Manufacturing (QIM) for cement, glass plates and sheets.	Author constructed using data of different Census of Manufacturing Industries (CMI) Pakistan and Pakistan Bureau of Statistics (PBS).
35.	Non-metallic mineral products WPI	Obtain from the WPI of cement, glass plates and sheets.	Author constructed using data from different publication of Pakistan

			Bureau of statistics (PBS).
36.	Pharmaceuticals output	Obtain from the Quantum Index of Manufacturing (QIM) for tablets, liquids/syrups and ointments.	Author constructed using data of different Census of Manufacturing Industries (CMI) Pakistan and Pakistan Bureau of Statistics (PBS).
37.	Pharmaceuticals WPI	Obtain from the WPI of tablets, liquids/syrups and ointments.	Author constructed using data from different publication of Pakistan Bureau of statistics (PBS).
38.	Money stock measure (M2)	It is the sum of currency outside banks; demand deposits other than those of the central government; the time, savings, and foreign currency deposits of resident sectors other than the central government; bank and traveler's checks; and other securities such as certificates of deposit and commercial paper.	Constructed using data from State Bank of Pakistan (SBP)
39.	T. Bill rate (ir)	3 monthly short term T bill rate	Constructed using data from Pakistan Bureau of Statistics (PBS).

40.	Upstream industries export (USI)	Export of raw cotton, cotton yarn, cotton carded and combed and yarn other than cotton yarn in million US dollars.	Constructed using data from Pakistan Bureau of Statistics (PBS).
41.	Midstream industries export (MSI)	Export of cotton cloth in million US dollars.	Constructed using data from Pakistan Bureau of Statistics (PBS).
42.	Downstream industries export (DSI)	Export of hosiery (knitwear), bed-wear, towels, canvas goods and tarpaulin, ready-made garments, artificial silk and synthetic textile and other textile made-up(excluding towels and bed-wears) in US million dollar.	Constructed using data from Pakistan Bureau of Statistics (PBS).

APPENDIX 1

Table 1: Lag length criteria for energy prices

VAR Lag Order Selection Criteria						
Endogenous variables: CPE Y INF RATE ER						
Exogenous variables: C DCOVID DNOV DMAR						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2100.611	NA	61908635	32.13046	32.56725	32.30795
1	-1175.177	1724.672	73.64109	18.48753	19.47030*	18.88688
2	-1115.38	106.9096	43.59408	17.9603	19.48906	18.58152
3	-1064.598	86.94438	29.6764	17.56967	19.64442	18.41275*
4	-1036.856	45.39652	28.76553	17.52812	20.14885	18.59307
5	-999.8709	57.71921	24.37481	17.34653	20.51324	18.63334
6	-965.5549	50.95405	21.65715	17.20538	20.91808	18.71405
7	-940.6385	35.1095	22.37698	17.20664	21.46533	18.93718
8	-909.5599	41.43813	21.27559	17.11454	21.91921	19.06694
9	-876.2134	41.93574*	19.78367*	16.98808*	22.33874	19.16234
10	-851.9119	28.71995	21.40361	16.99866	22.89531	19.39479
11	-826.9302	27.6313	23.31109	16.99894	23.44157	19.61693
12	-805.9081	21.6591	27.50528	17.05921	24.04782	19.89906

Note: * indicates lag order selected by the criterion.LR is sequential modified LR test statistic (each test at 5% level). FPE is Final prediction error AIC is Akaike information criterion. SC is Schwarz information criterion and HQ is Hannan-Quinn information criterion.

Table 2: Lag length criteria for food prices

VAR Lag Order Selection Criteria						
Endogenous variables: CPF Y INF RATE ER						
Exogenous variables: C DCOVID DMAR DNOV						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2070.187	NA	39044033	31.66949	32.10628	31.84698
1	-1184.752	1650.128	85.13865	18.63261	19.61538*	19.03196
2	-1133.297	91.9954	57.1907	18.23177	19.76053	18.85299
3	-1091.899	70.8784	44.8803	17.98332	20.05806	18.82640*
4	-1062.596	47.95114	42.48584	17.91811	20.53884	18.98306
5	-1040.783	34.04056	45.3057	17.96641	21.13313	19.25322
6	-1001.683	58.05763	37.43974	17.75277	21.46547	19.26144
7	-967.3228	48.41683	33.52664	17.61095	21.86964	19.34149
8	-936.7083	40.81934	32.10141	17.52588	22.33055	19.47828
9	-900.6528	45.34247	28.64994	17.35838	22.70903	19.53264
10	-858.5216	49.79147*	23.65812*	17.09881	22.99545	19.49494
11	-828.7221	32.95995	23.95269	17.02609*	23.46872	19.64408
12	-810.7682	18.498	29.60716	17.13285	24.12146	19.9727

Note: * indicates lag order selected by the criterion.LR is sequential modified LR test statistic (each test at 5% level). FPE is Final prediction error. AIC is Akaike information criterion. SC is Schwarz information criterion and HQ is Hannan-Quinn information criterion.

Table 3: Lag length criteria for education prices

VAR Lag Order Selection Criteria
Endogenous variables: CPEDU Y INF RATE ER
Exogenous variables: C DCOVID DNOV DMAR

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2260.113	NA	6.94E+08	34.54716	34.98395	34.72465
1	-1261.11	1861.779	270.7544	19.78954	20.77231*	20.18889
2	-1214.997	82.44433	197.2089	19.46965	20.9984	20.09086
3	-1172.645	72.51109	152.5394	19.20674	21.28149	20.04982*
4	-1145.315	44.72094	148.7852	19.17145	21.79218	20.23639
5	-1119.042	41.00193	148.2915	19.15216	22.31887	20.43897
6	-1082.041	54.94128	126.5046	18.97032	22.68302	20.47899
7	-1047.162	49.14763*	112.396	18.82064	23.07932	20.55117
8	-1019.183	37.30571	112.0019*	18.7755	23.58017	20.7279
9	-1000.098	24.00013	129.2701	18.86513	24.21578	21.03939
10	-969.8863	35.70527	127.8747	18.78616	24.6828	21.18228
11	-938.0268	35.23854	125.4882	18.68222	25.12485	21.30021
12	-908.7908	30.12197	130.7395	18.61804*	25.60665	21.45789

Note: * indicates lag order selected by the criterion.LR is sequential modified LR test statistic (each test at 5% level). FPE is Final prediction error. AIC is Akaike information criterion. SC is Schwarz information criterion and HQ is Hannan-Quinn information criterion.

Table 4: Lag length criteria foe health prices

VAR Lag Order Selection Criteria
Endogenous variables: CPHEL Y INF RATE ER
Exogenous variables: C DCOVID DNOV DMAR

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2000.986	NA	13683569	30.621	31.05779	30.79849
1	-1099.718	1679.636	23.47378	17.34421	18.32698*	17.74356
2	-1054.889	80.14843	17.43348	17.04377	18.57253	17.66499*
3	-1018.462	62.36756	14.75109	16.87064	18.94538	17.71372
4	-987.671	50.3852	13.65289	16.78289	19.40362	17.84784
5	-971.5582	25.14585	15.87221	16.91755	20.08426	18.20436
6	-934.8259	54.54178	13.59559	16.73979	20.45249	18.24846
7	-903.6753	43.89408	12.78132	16.6466	20.90528	18.37713
8	-876.8097	35.82085	12.95323	16.61833	21.423	18.57073
9	-848.7236	35.32035	13.04422	16.57157	21.92222	18.74583
10	-817.4576	36.9507	12.69903	16.47663	22.37327	18.87275
11	-779.2886	42.21728*	11.32585*	16.27710*	22.71973	18.89509
12	-756.4409	23.54	12.99904	16.30971	23.29832	19.14956

Note: * indicates lag order selected by the criterion.LR is sequential modified LR test statistic (each test at 5% level). FPE is Final prediction error. AIC is Akaike information criterion. SC is Schwarz information criterion and HQ is Hannan-Quinn information criterion.

Table 5: Lag length criteria for housing prices

VAR Lag Order Selection Criteria Endogenous variables: CPH Y INF RATE ER Exogenous variables: C DCOVID DNOV DMAR						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2097.466	NA	59028443	32.08282	32.51961	32.26031
1	-1117.085	1827.075	30.53937	17.60734	18.59012*	18.0067
2	-1075.336	74.64111	23.76461	17.35358	18.88234	17.97480*
3	-1036.444	66.58752	19.371	17.1431	19.21784	17.98618
4	-1008.425	45.85036	18.6977	17.09734	19.71807	18.16229
5	-987.6066	32.48883	20.24136	17.16071	20.32742	18.44751
6	-951.2431	53.99434	17.43518	16.98853	20.70123	18.4972
7	-912.7699	54.21219	14.66967	16.78439	21.04308	18.51493
8	-875.2393	50.04089*	12.64866*	16.59453	21.3992	18.54693
9	-850.7803	30.75904	13.4571	16.60273	21.95339	18.77699
10	-826.4421	28.76328	14.55092	16.61276	22.5094	19.00888
11	-798.6246	30.7678	15.1812	16.57007*	23.0127	19.18806
12	-781.8145	17.31957	19.09303	16.69416	23.68277	19.53401

Note: * indicates lag order selected by the criterion.LR is sequential modified LR test statistic (each test at 5% level). FPE is Final prediction error. AIC is Akaike information criterion. SC is Schwarz information criterion and HQ is Hannan-Quinn information criterion.

Table 6: Lag length criteria for transportation prices

VAR Lag Order Selection Criteria Endogenous variables: CPT Y INF RATE ER Exogenous variables: C DCOVID DNOV DMAR						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2225.85	NA	4.13E+08	34.02803	34.46482	34.20552
1	-1287.136	1749.422	401.6387	20.18388	21.16665*	20.58323
2	-1231.23	99.95335	252.2001	19.7156	21.24436	20.33682*
3	-1194.654	62.62158	212.9164	19.54022	21.61496	20.3833
4	-1165.741	47.31221	202.7528	19.48093	22.10166	20.54587
5	-1147.508	28.45519	228.258	19.58345	22.75017	20.87026
6	-1108.126	58.47697	187.8225	19.36554	23.07824	20.87421
7	-1077.757	42.79218	178.678	19.2842	23.54288	21.01473
8	-1042.062	47.593	158.4076	19.12215	23.92682	21.07455
9	-1009.053	41.51201*	148.0534*	19.0008	24.35145	21.17506
10	-983.1653	30.59408	156.3736	18.98735	24.88399	21.38348
11	-950.232	36.42627	150.9787	18.86715*	25.30978	21.48514
12	-933.9659	16.75896	191.4541	18.99948	25.98809	21.83933

Note: * indicates lag order selected by the criterion.LR is sequential modified LR test statistic (each test at 5% level). FPE is Final prediction error. AIC is Akaike information criterion. SC is Schwarz information criterion and HQ is Hannan-Quinn information criterion.

Table 7: Lag length criteria for clothing and footwear prices

VAR Lag Order Selection Criteria Endogenous variables: DCPCF Y INF RATE ER Exogenous variables: C DCOVID DNOV DMAR						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1912.198	NA	4456661	29.4992	29.93816	29.67757
1	-1116.817	1481.473	34.79091	17.73766	18.72532*	18.13899
2	-1068.693	85.96107	24.5163	17.38463	18.92099	18.00892
3	-1026.654	71.88441	19.0182	17.12448	19.20955	17.97174*
4	-1001.334	41.36142	19.12775	17.11961	19.75337	18.18982
5	-984.7964	25.75341	22.12436	17.2488	20.43127	18.54198
6	-951.0845	49.92453	19.8293	17.11579	20.84697	18.63194
7	-914.8519	50.89163	17.25096	16.9443	21.22418	18.68341
8	-883.6563	41.43536	16.378	16.84971	21.67829	18.81178
9	-853.0604	38.30321*	15.88898*	16.76428	22.14156	18.94931
10	-831.5245	25.31705	17.96449	16.81717	22.74315	19.22516
11	-802.3658	32.05234	18.39839	16.75368*	23.22836	19.38463
12	-782.7082	20.10771	22.24002	16.83524	23.85862	19.68915

Note: * indicates lag order selected by the criterion.LR is sequential modified LR test statistic (each test at 5% level). FPE is Final prediction error. AIC is Akaike information criterion. SC is Schwarz information criterion and HQ is Hannan-Quinn information criterion

Figure 1: Impulse responses of macro variables for energy price model

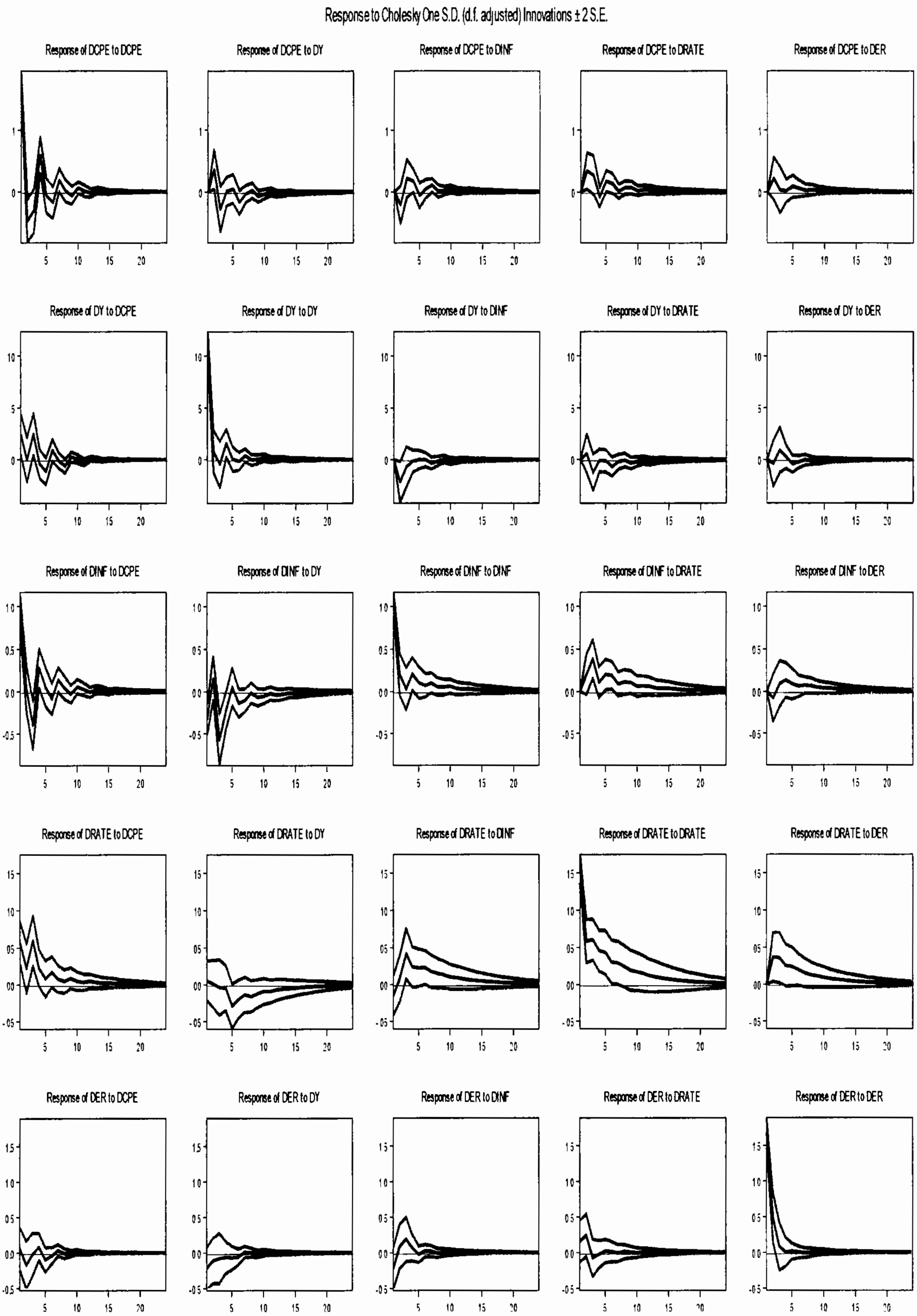


Figure 2: Impulse responses of macro variables with food price model

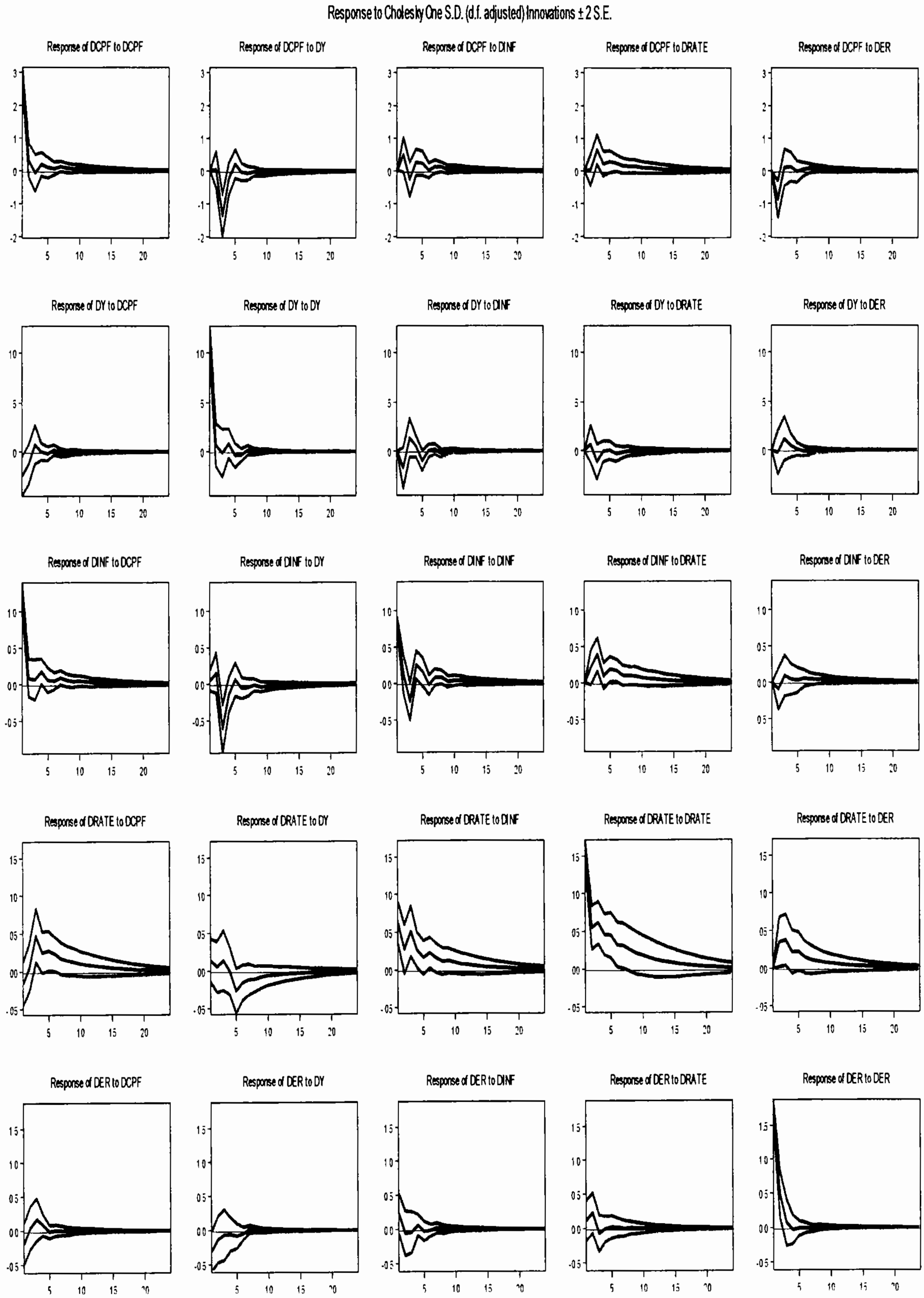


Figure 3: Impulse responses of macro variables with education price model

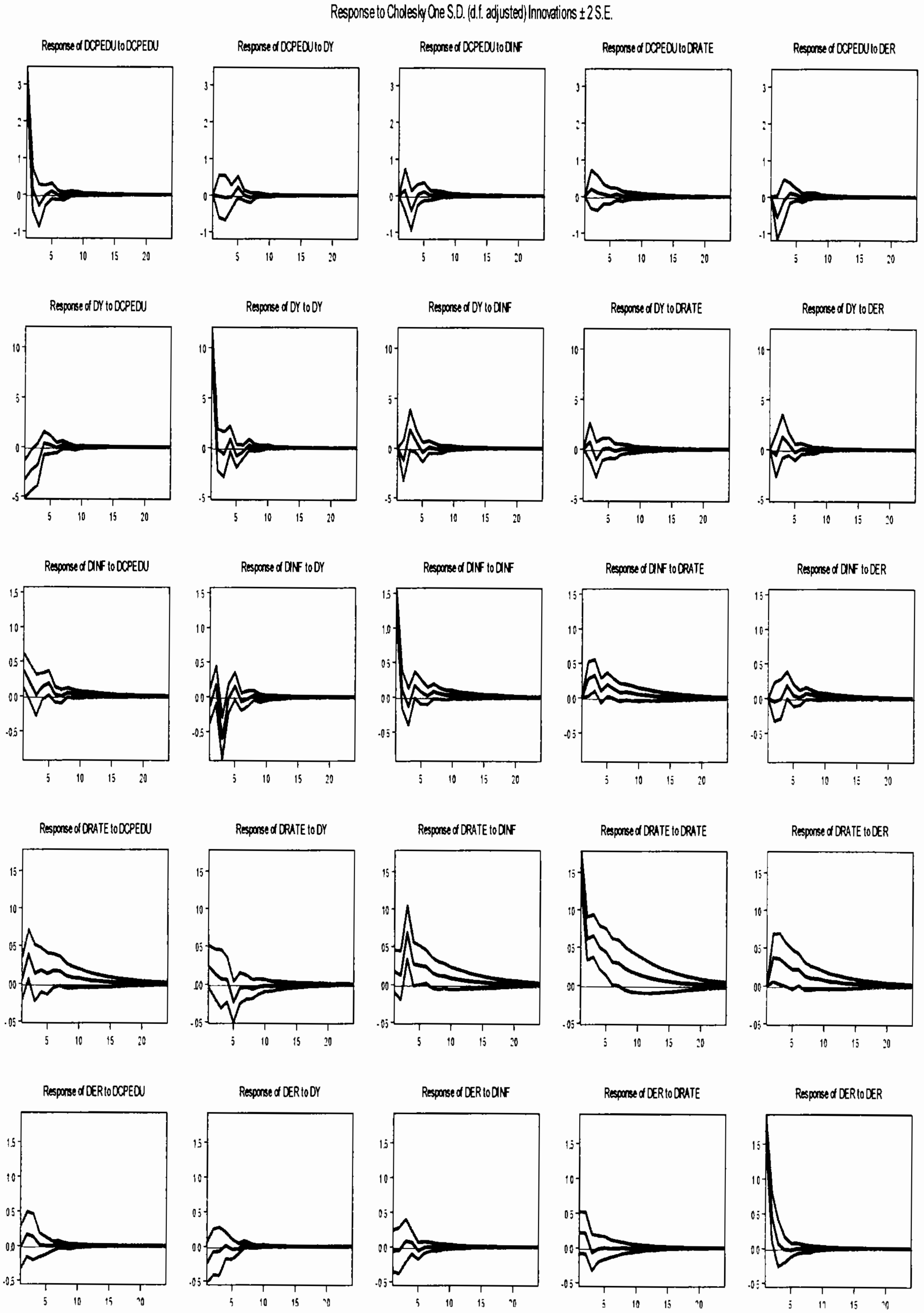


Figure 4: Impulse responses of macro variables for health price model

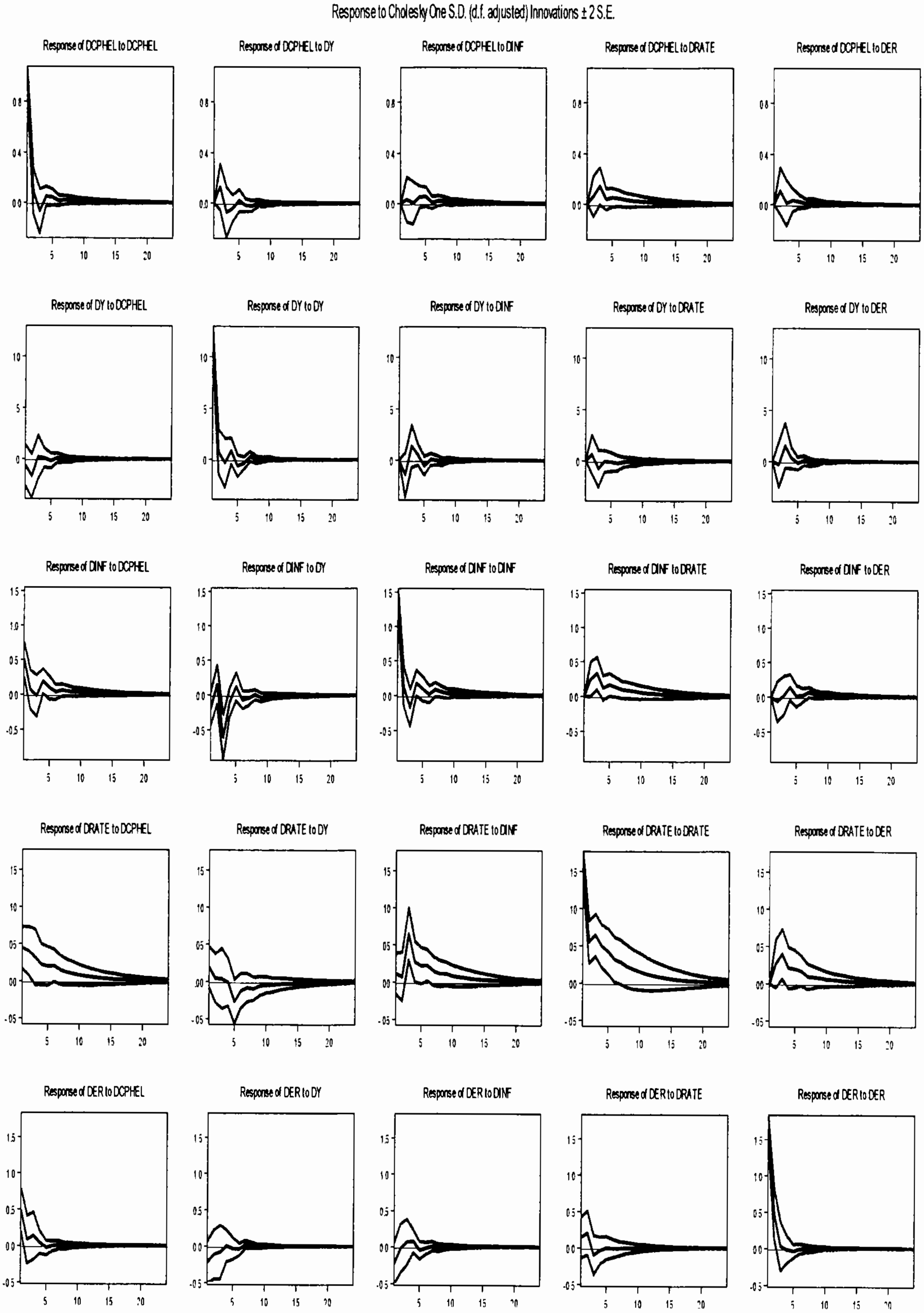


Figure 5: Impulse responses of macro variables with housing price model

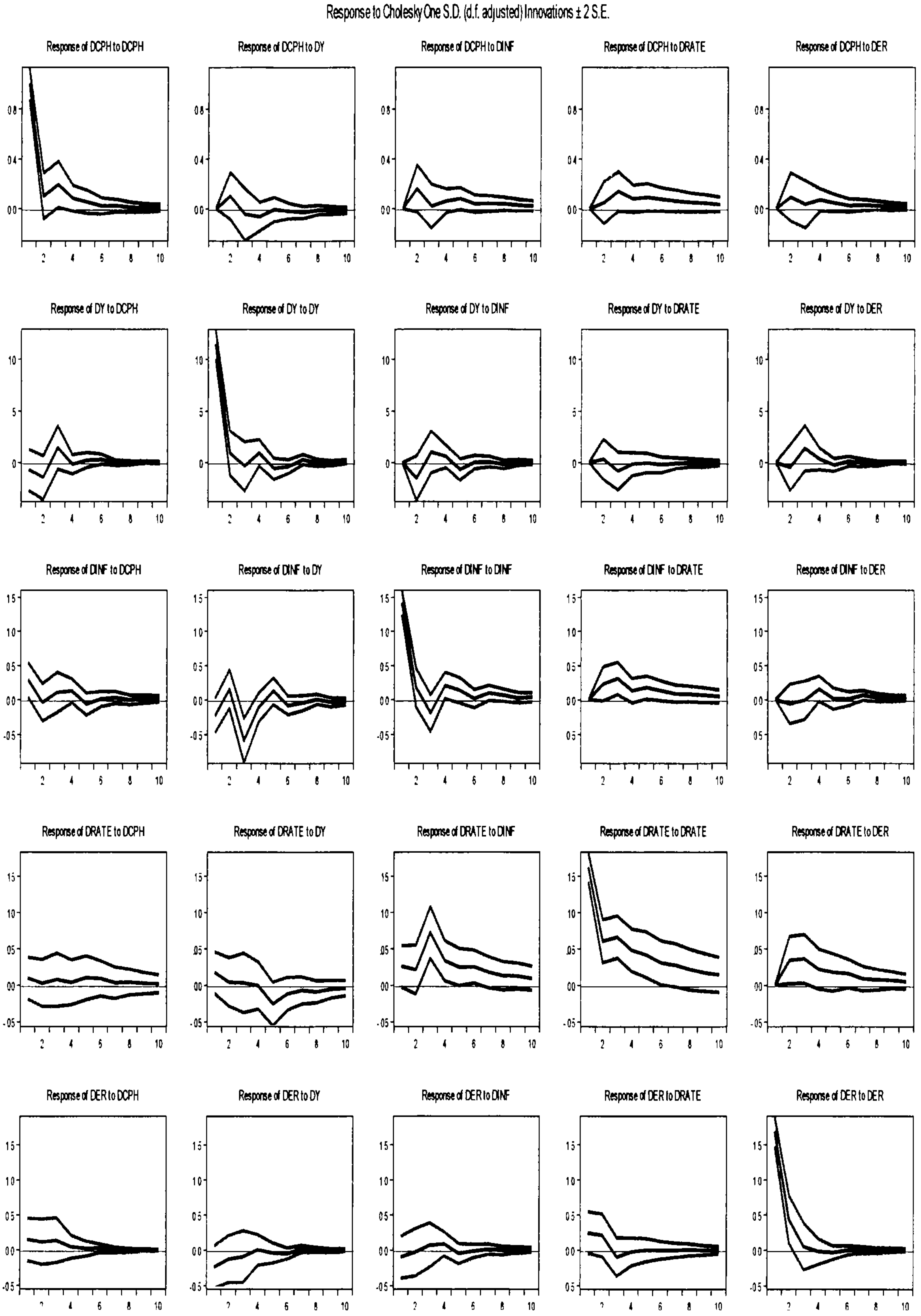


Figure 6: Impulse responses of macro variables for transportation price model

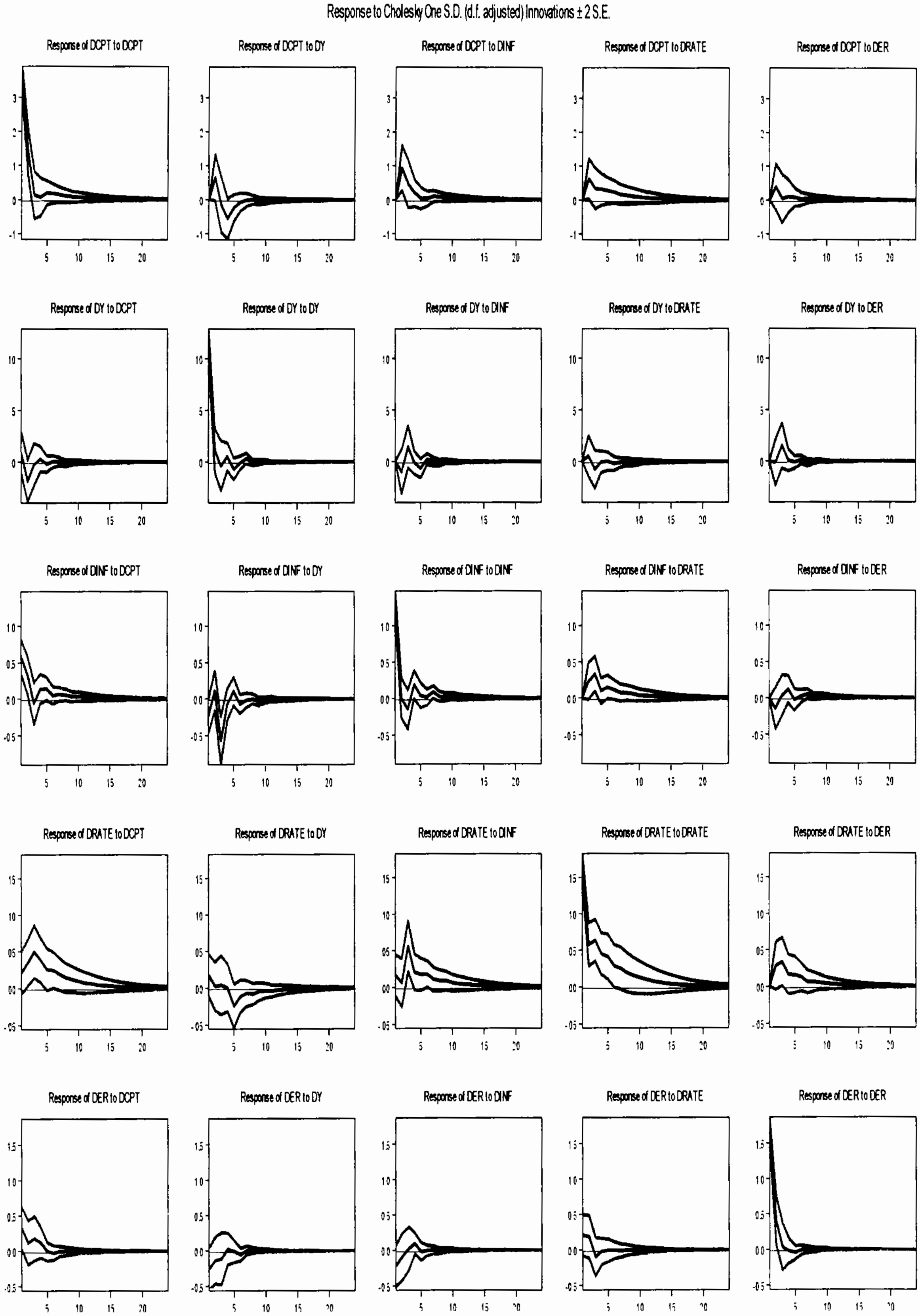
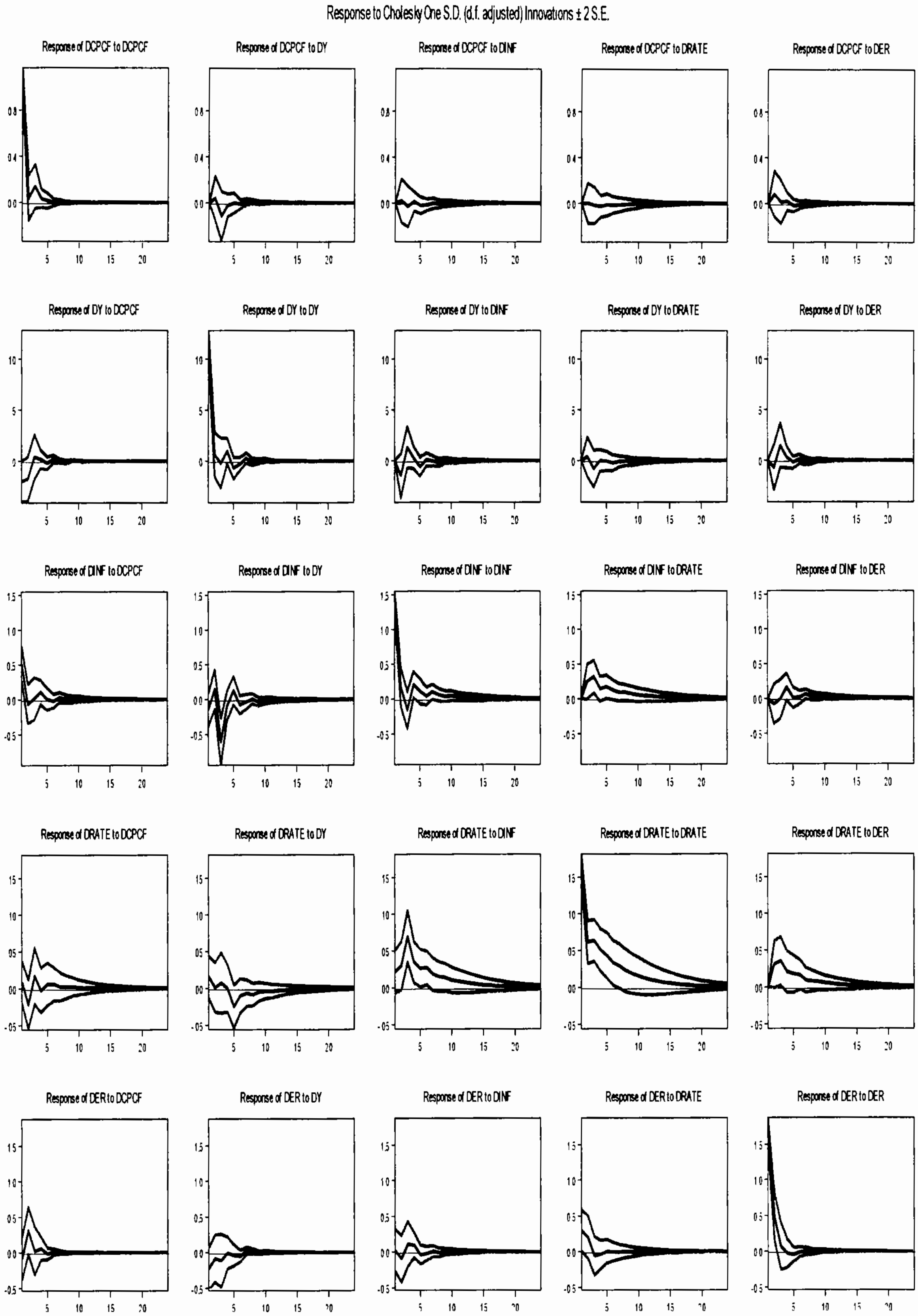


Figure 7: Impulse responses of macro variables for clothing and footwear price model



APPENDIX 2

Table 1: Results of unit root test of macro variables with original data

Variables	ADF Test at Level		ADF Test at First Diff		Oder of Integration
	t Statistics	P Values	t Statistics	P Values	
lcpcf	-3.65**	0.005	-	-	I (0)
lcpedu	-1.46	0.54	-11.38**	0.000	I (1)
lcpf	-2.203	0.206	-10.9**	0.000	I (1)
lcph	-1.93	0.314	-3.30*	0.010	I (1)
lcphel	-2.84	0.05	-10.24**	0.000	I (1)
lcpoil	-1.162	0.689	-5.56**	0.000	I (1)
lcpt	-2.22	0.20	-8.16**	0.000	I (1)
Lip	-1.50	0.529	-5.24**	0.000	I (1)
linf	-2.28	0.176	-11.02**	0.000	I (1)
Lm	-0.59	0.867	-4.66**	0.000	I (1)
Lir	-1.95	0.306	-4.00**	0.001	I (1)
Llb	-1.75	0.34	-5.37**	0.000	I (1)

Note. CV at 5% level with intercept=-2.88 and CV at 1% level with intercept=-3.48

Table 2: leg length selection for macro base-line model (for oil prices)

VAR Lag Order Selection Criteria
Endogenous variables: DLCPOIL DLIP DLINF DLM DLIR DLLB
Exogenous variables: C DCOVID

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1824.35	NA	0.00	-29.47	-29.19	-29.36
1	1914.39	168.36	0.00	-30.35	-29.25033*	-29.90
2	1994.58	142.13	0.00	-31.07	-29.15	-30.28626*
3	2033.04	64.42	0.00	-31.11	-28.36	-29.99
4	2086.04	83.58	0.00	-31.38	-27.82	-29.93
5	2130.24	65.41	0.00	-31.52	-27.13	-29.73
6	2189.86	82.41	6.39e-22	-31.90	-26.69	-29.78
7	2217.73	35.79	0.00	-31.77	-25.73	-29.32
8	2264.42	55.41981*	0.00	-31.94172*	-25.08	-29.16

Table3: leg length selection for macro base-line model (For food prices)

VAR Lag Order Selection Criteria Endogenous variables: DLCPF DLIP DLINF DLM DLIR DLLB Exogenous variables: C DCOVID						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	1829.07	NA	0.00	-29.55	-29.27	-29.43
1	1916.91	164.25	0.00	-30.39	-29.29134*	-29.94
2	1991.87	132.85	0.00	-31.02	-29.10	-30.24214*
3	2028.94	62.09	0.00	-31.04	-28.30	-29.93
4	2082.35	84.24	0.00	-31.32	-27.76	-29.87
5	2124.70	62.66	0.00	-31.43	-27.04	-29.64
6	2180.96	77.76	7.38e-22	-31.76	-26.54	-29.64
7	2213.90	42.32	0.00	-31.71	-25.67	-29.25
8	2260.21	54.96065*	0.00	-31.87327*	-25.01	-29.09

Table 4: leg length selection for macro base-line model(For education prices)

VAR Lag Order Selection Criteria Endogenous variables: DLCPEDU DLIP DLINF DLM DLIR DLLB Exogenous variables: C DCOVID						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	1748.55	NA	0.00	-28.24	-27.96	-28.13
1	1836.08	163.67	0.00	-29.07	-27.97698*	-28.63
2	1917.99	145.17	0.00	-29.82	-27.90	-29.04080*
3	1960.93	71.93	0.00	-29.93	-27.19	-28.82
4	2003.45	67.05	0.00	-30.04	-26.47	-28.59
5	2056.97	79.20	0.00	-30.32	-25.93	-28.54
6	2104.49	65.68	2.56e-21	-30.51	-25.30	-28.39
7	2138.13	43.21	0.00	-30.47	-24.44	-28.02
8	2186.66	57.60207*	0.00	-30.67741*	-23.82	-27.89

Table 5: leg length selection for macro base-line model (For health prices)

VAR Lag Order Selection Criteria Endogenous variables: DLCPHEL DLIP DLINF DLM DLIR DLLB Exogenous variables: C DCOVID						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	1873.80	NA	0.00	-30.27	-30.00	-30.16
1	1961.37	163.76	0.00	-31.11	-30.01431*	-30.67
2	2023.88	110.78	0.00	-31.54	-29.62	-30.76259*
3	2057.96	57.07	0.00	-31.51	-28.77	-30.40
4	2103.71	72.17	0.00	-31.67	-28.10	-30.22
5	2160.76	84.41	0.00	-32.01	-27.62	-30.23
6	2208.95	66.60	0.00	-32.21	-27.00	-30.09
7	2243.63	44.55	0.00	-32.19	-26.15	-29.74
8	2298.06	64.60342*	4.22e-22	-32.48875*	-25.63	-29.70

Table 6: leg length selection for macro base-line model (For housing prices)

VAR Lag Order Selection Criteria
Endogenous variables: DLCPH DLIP DLINF DLM DLIR DLLB
Exogenous variables: C DCOVID

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1853.31	NA	0.00	-29.94	-29.67	-29.83
1	1940.63	163.28	0.00	-30.77	-29.67697*	-30.33
2	2004.74	113.64	0.00	-31.23	-29.31	-30.45148*
3	2047.69	71.93	0.00	-31.34	-28.60	-30.23
4	2094.59	73.97	0.00	-31.52	-27.96	-30.07
5	2146.47	76.76	0.00	-31.78	-27.39	-30.00
6	2194.46	66.34	0.00	-31.98	-26.76	-29.86
7	2224.86	39.05	0.00	-31.88	-25.85	-29.43
8	2280.47	66.00898*	5.62e-22	-32.20278*	-25.34	-29.42

Table 7: leg length selection for macro base-line model (For transportation prices)

VAR Lag Order Selection Criteria
Endogenous variables: DLCPT DLIP DLINF DLM DLIR DLLB
Exogenous variables: C DCOVID

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1719.89	NA	0.00	-27.77	-27.50	-27.66
1	1808.96	166.56	0.00	-28.63	-27.53603*	-28.19
2	1872.59	112.78	0.00	-29.08	-27.16	-28.30269*
3	1905.57	55.23	0.00	-29.03	-26.29	-27.92
4	1961.73	88.59	0.00	-29.36	-25.79	-27.91
5	2005.51	64.77	0.00	-29.49	-25.10	-27.70
6	2060.93	76.59	0.00	-29.80	-24.59	-27.69
7	2098.45	48.20	0.00	-29.83	-23.79	-27.38
8	2152.56	64.22907*	4.50e-21	-30.12298*	-23.26	-27.34

Table 8: leg length selection for macro base-line model (For clothing & footwear prices)

VAR Lag Order Selection Criteria
Endogenous variables: LCPCF DLIP DLINF DLM DLIR DLLB
Exogenous variables: C DCOVID

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1422.07	NA	0.00	-22.93	-22.65	-22.82
1	1972.77	1029.77	0.00	-31.30	-30.19969*	-30.85
2	2039.90	118.98	0.00	-31.80	-29.88	-31.02319*
3	2071.45	52.83	0.00	-31.73	-28.99	-30.62
4	2113.31	66.03	0.00	-31.83	-28.26	-30.38
5	2169.57	83.23	0.00	-32.16	-27.77	-30.37
6	2219.20	68.61	3.97e-22	-32.38	-27.16	-30.26
7	2247.92	36.88	0.00	-32.26	-26.22	-29.81
8	2298.23	59.71863*	0.00	-32.49152*	-25.63	-29.71

Figure 1: IR of macro model with oil prices

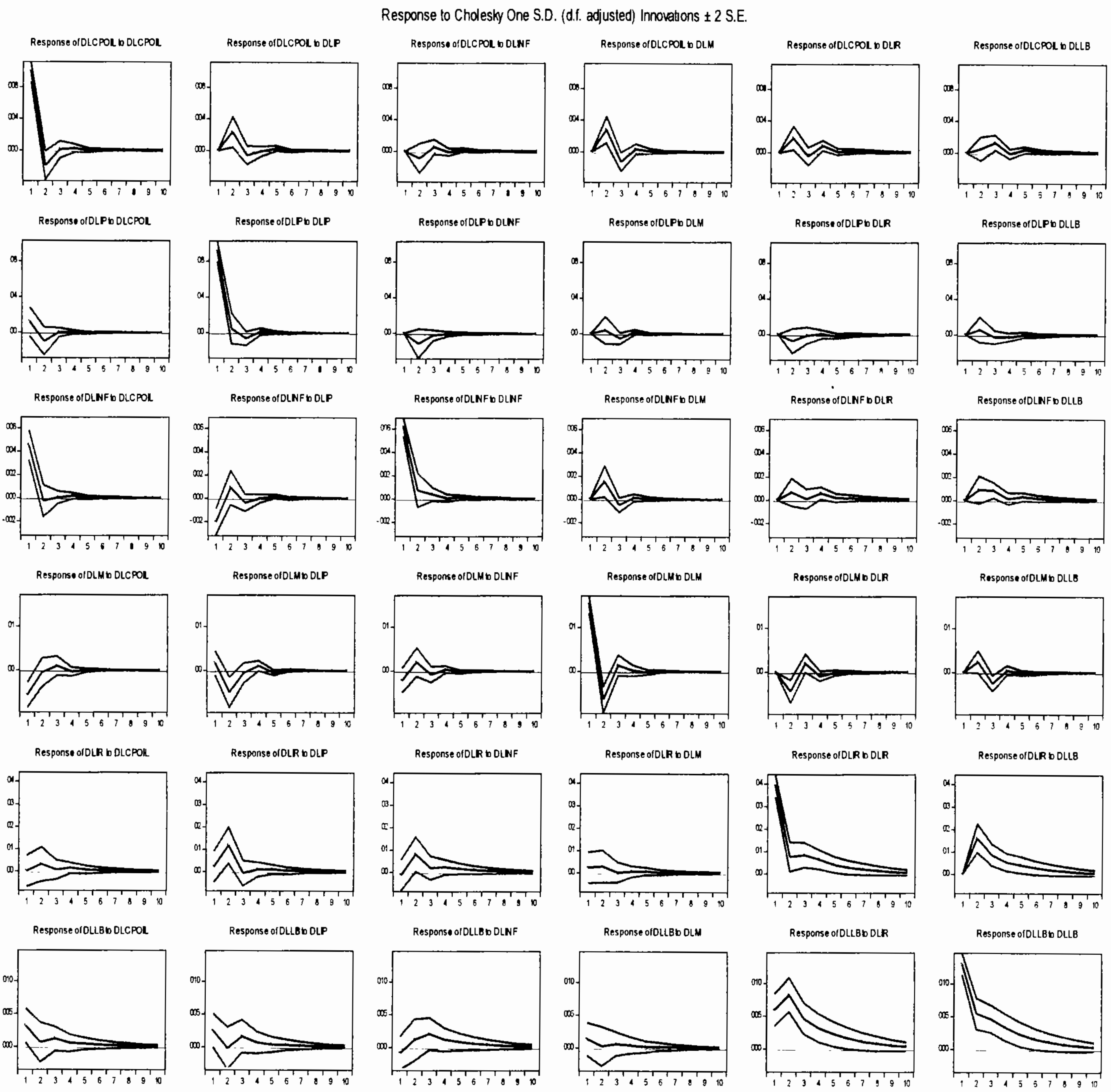


Figure 2: IR of macro model with food price

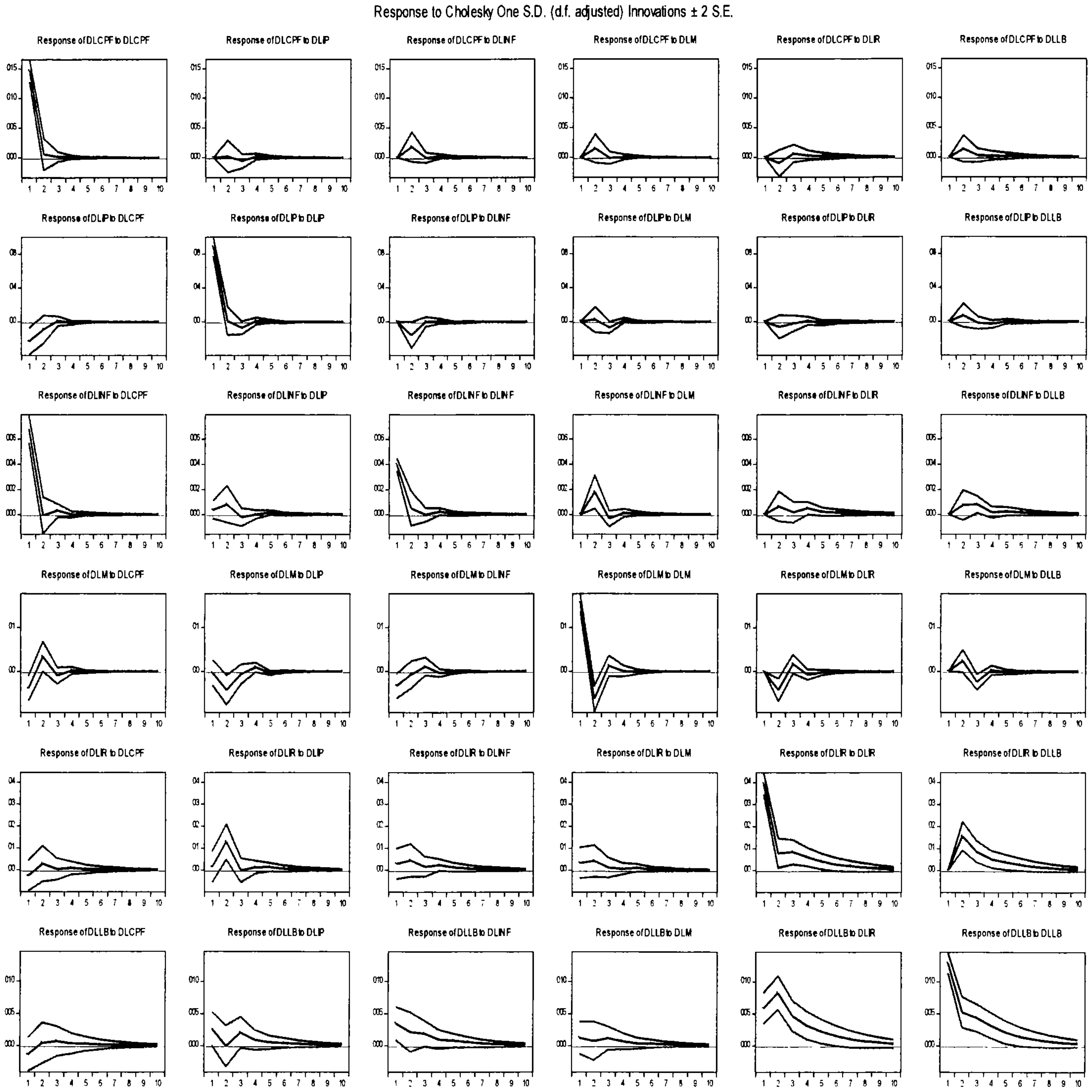


Figure 3: IR of macro model with education price

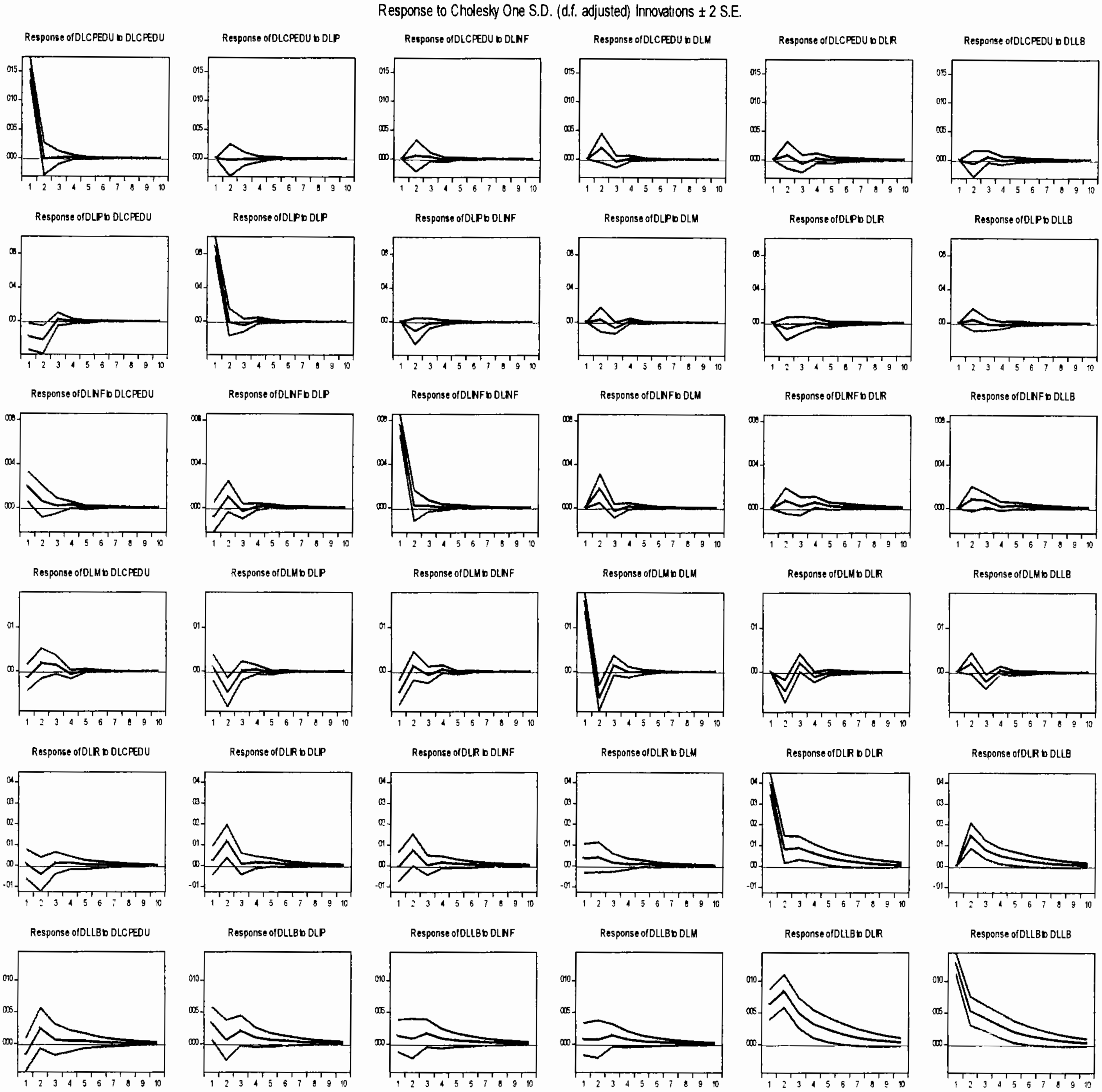


Figure 4: IR of macro model with health price

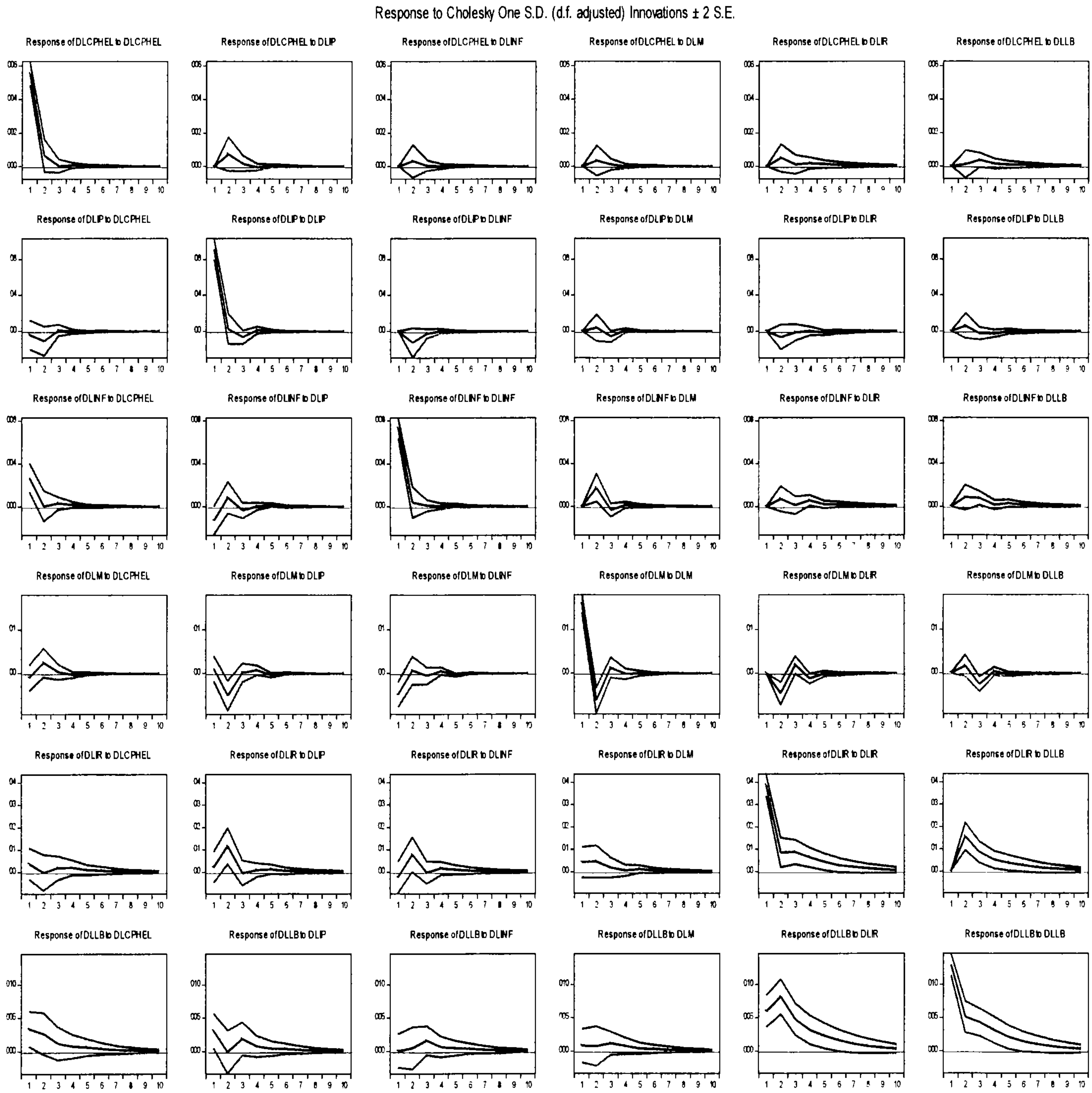


Figure 5: IR of macro model with housing prices

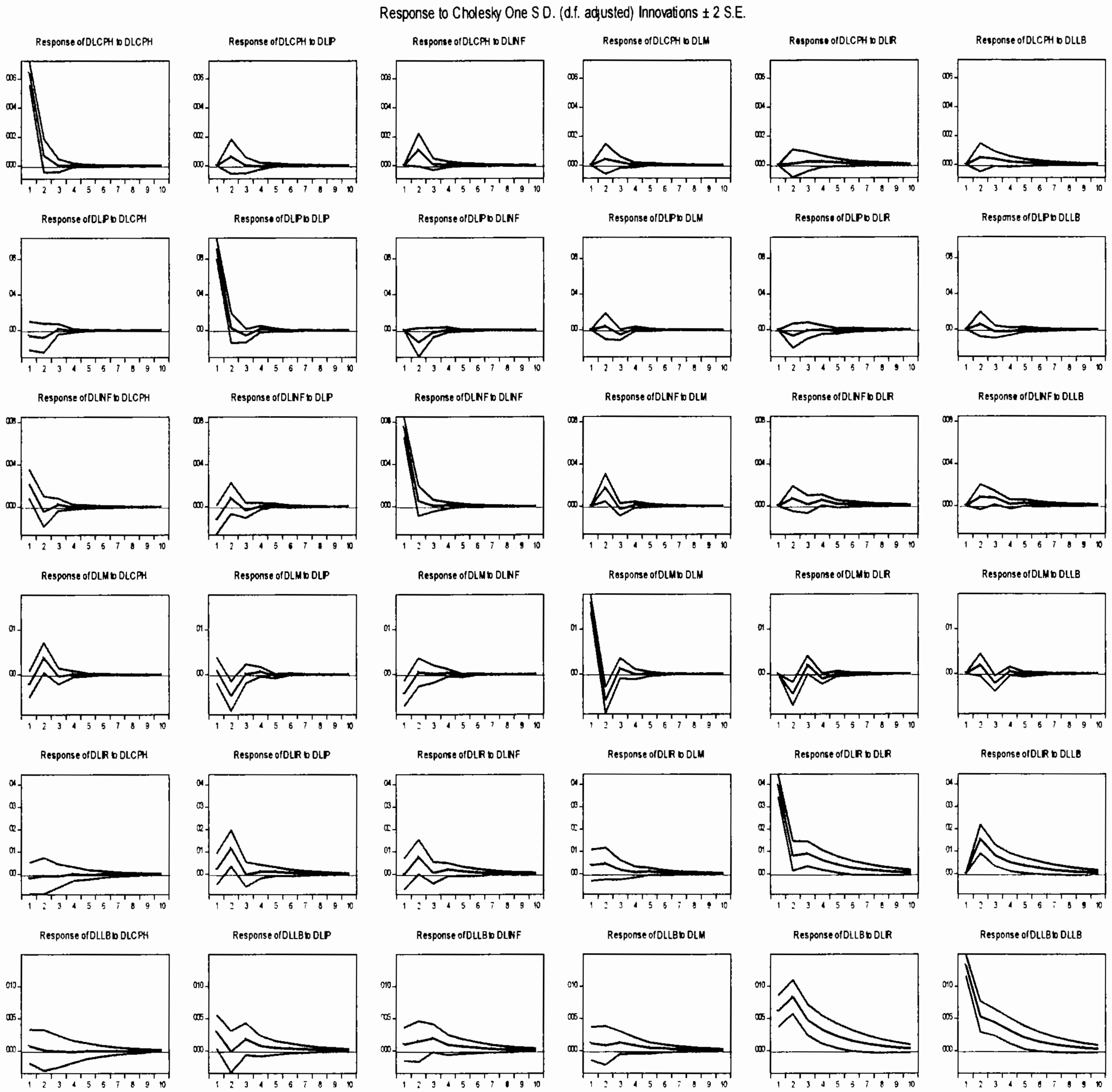


Figure 6: IR of macro model with transportation price

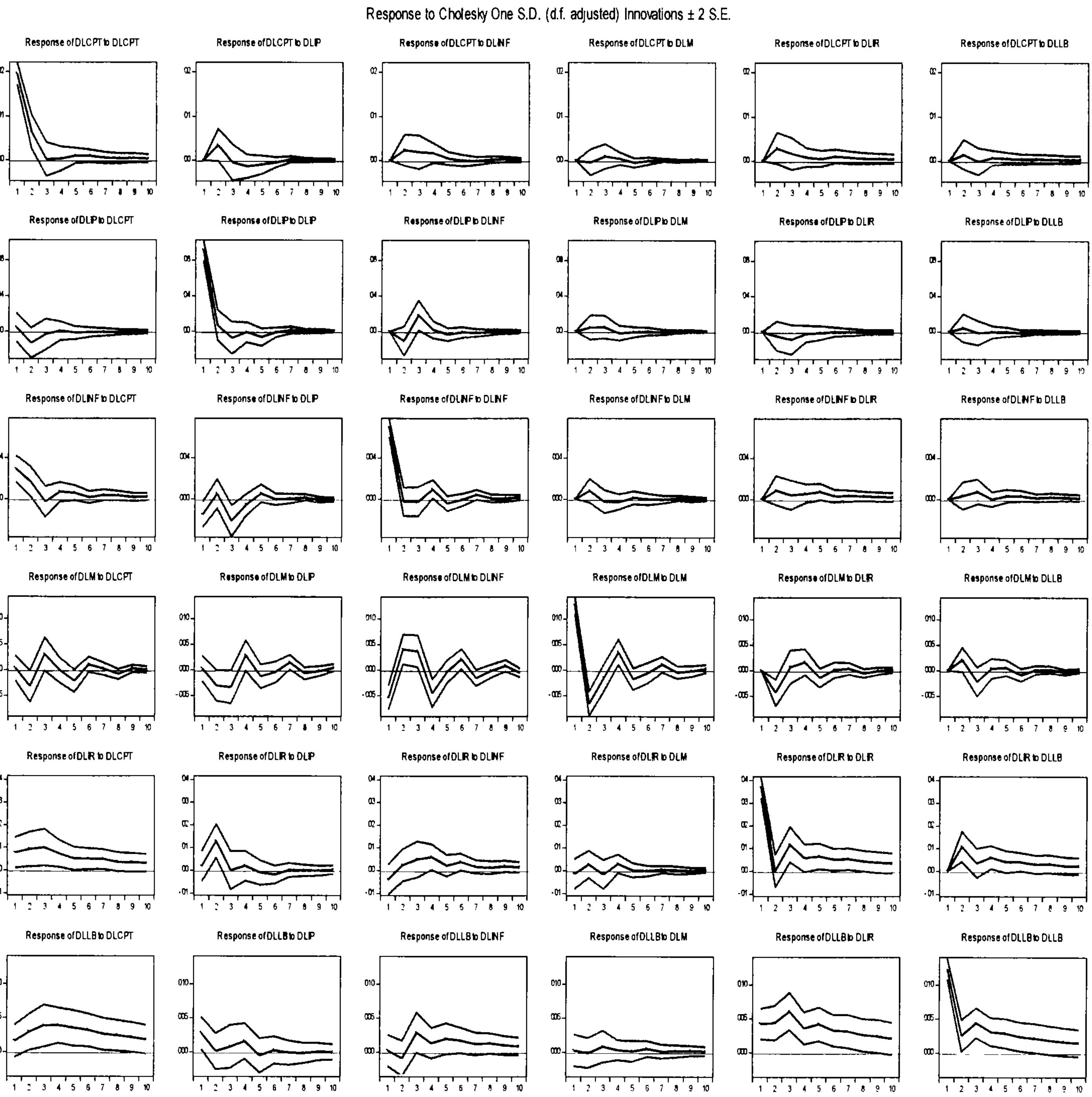


Figure 7: IR of macro model with clothing and footwear price

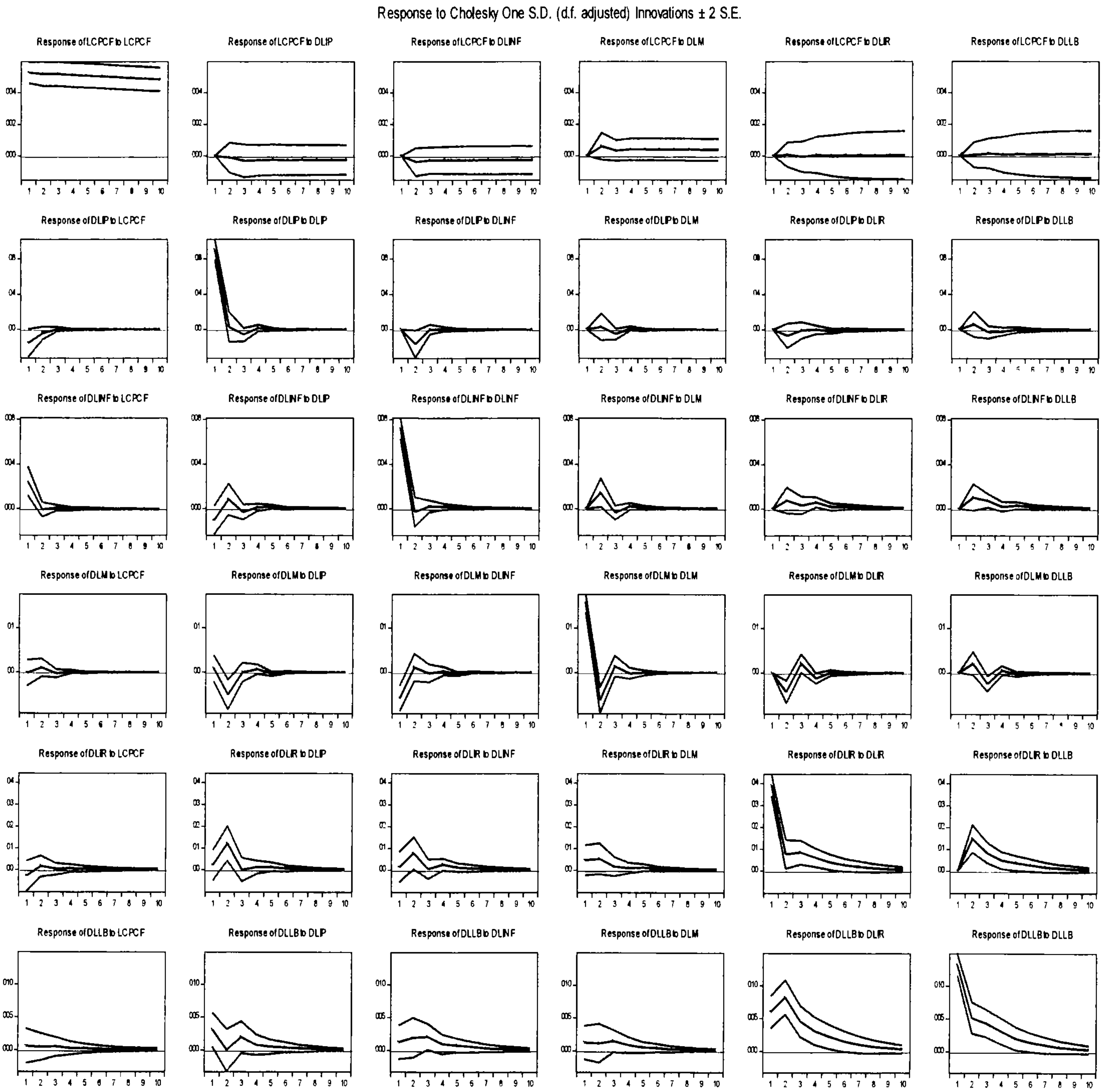


Table 9: SD for automobile industry

Commodity price	SD of industrial output	SD of industrial price
Oil	8.85 (1 2)	10.87 (1 2)
Food	8.82 (1 1)	10. 83 (1 1)
Education	8.82 (1 1)	10.83 (1 1)
Health	8.83 (1 1)	10.83 (1 1)
Housing	8.83 (1 1)	10.83 (1 1)
Transportation	8.85 (1 1)	10.83 (1 1)
Clothing and footwear	8.82 (1 1)	10.83 (1 1)

Note: The Standard deviation (SD) of each group of commodity price is estimated through reduce VAR model of equations 1.58 and 1.59. The lag length of VAR models are given in brackets.

Table 10: Standard deviation for industries

Industries	SD of industrial output	SD of industrial price
Chemical industry	8.272 (1 1)	3.837 (1 1)
Electronics industry	47.15 (1 1)	1.67 (1 1)
Engineering Industry	26.17 (1 1)	1.95 (1 1)
Fertilizer	28.66 (1 2)	16.00 (1 2)
Food	42.41 (1 1)	4.16 (1 1)
Leather	20.22 (1 2)	4.74 (1 2)
Non Metallic Minerals	26.52 (1 1)	3.67 (1 1)
Paper and Board	17.68 (1 1)	8.76 (1 1)
Petroleum	81.14 (1 1)	13.67 (1 1)
Pharmaceutical	8.85 (1 2)	10.87 (1 2)
Rubber	10.52 (1 1)	2.60 (1 1)
Textile	66.12 (1 1)	1.67 (1 1)

Note: The Standard deviation (SD) of each group of commodity price is same and estimated through reduce VAR model of equations 1.58 and 1.59. The lag length of VAR models are given in brackets.

Figure 8: Impulse response of automobile for oil price shocks

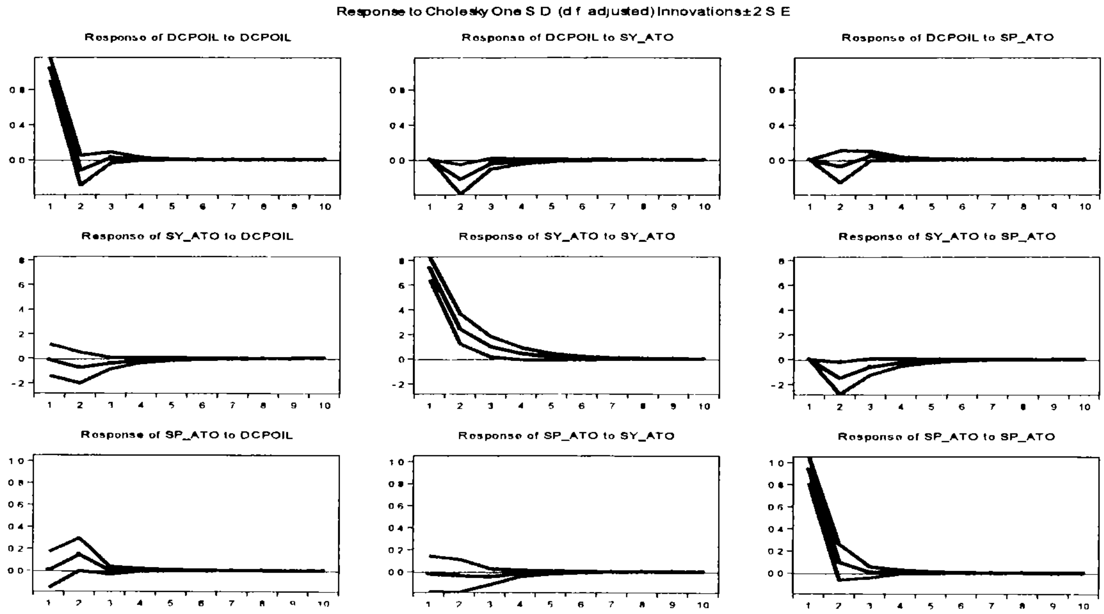


Figure 9: Impulse response of chemical industry with oil price shocks

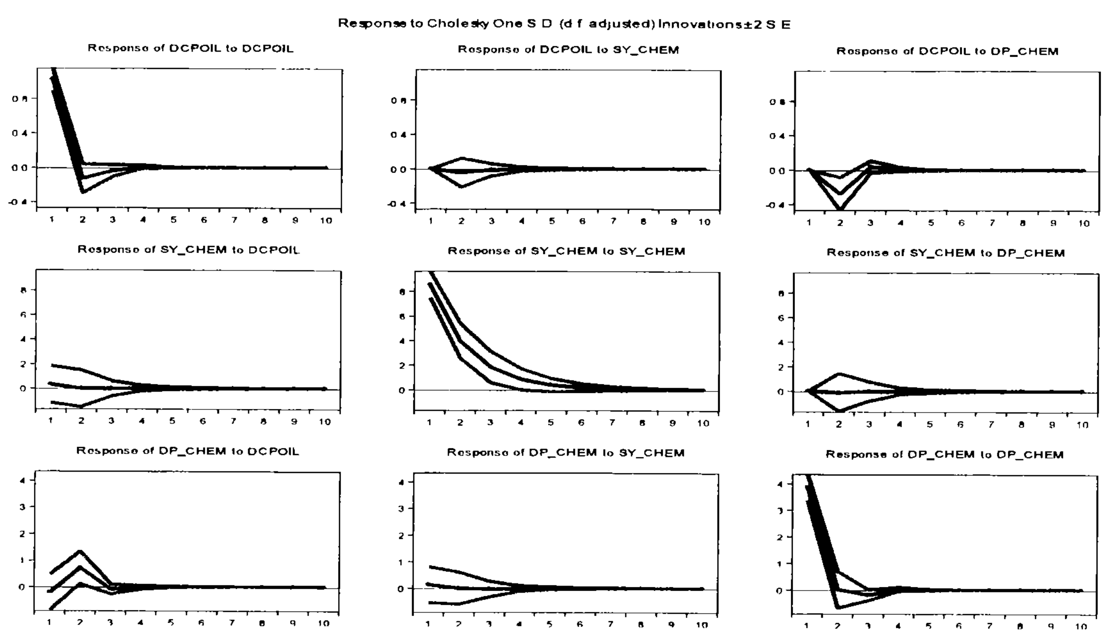


Figure 10: Impulse response of electronic industry with oil price shocks

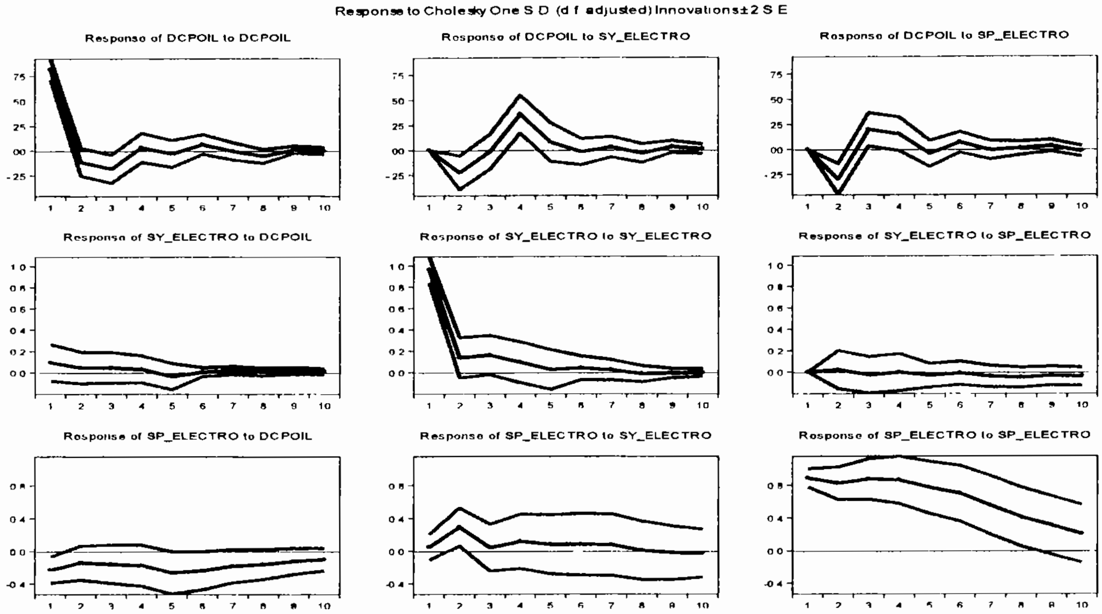


Figure 11: Impulse responses of engineering industry with oil price shock

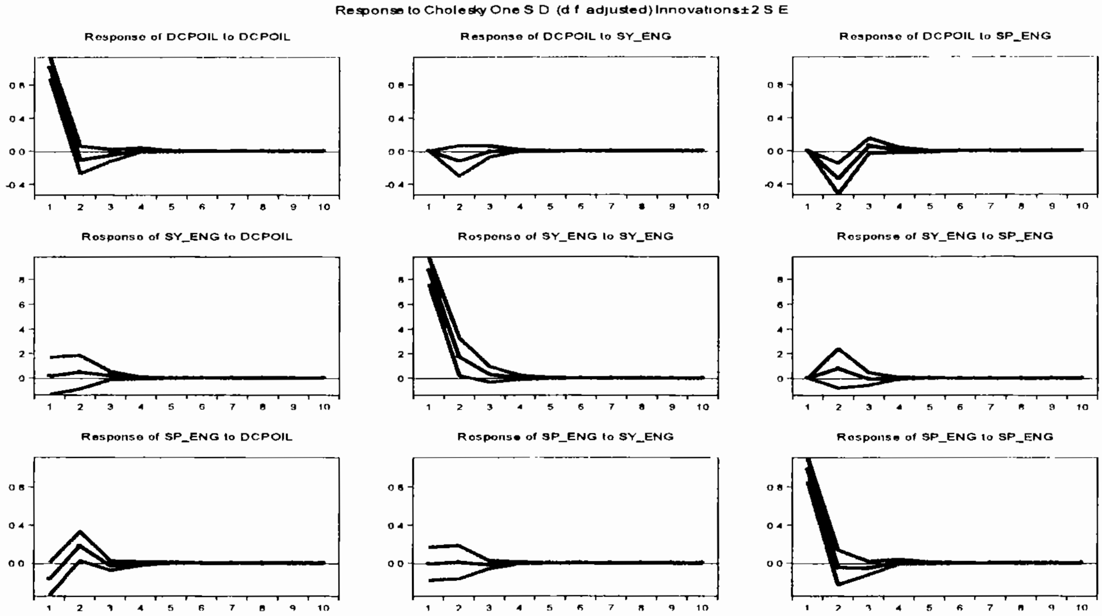


Figure 12: Impulse response of fertilizer industry with oil price shocks

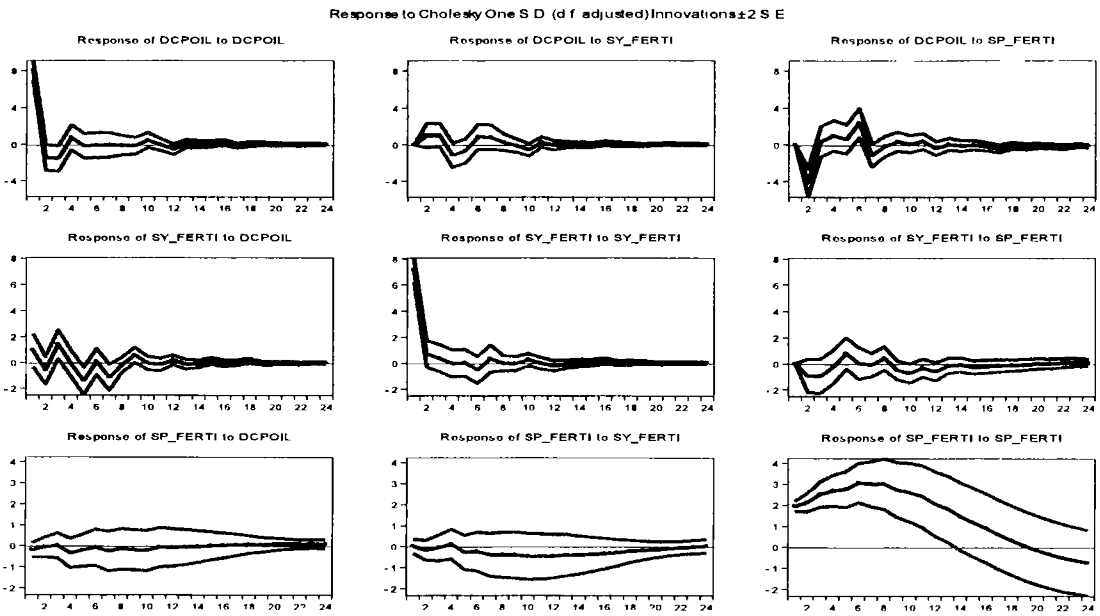


Figure13: Impulse response of food industry with oil price shocks

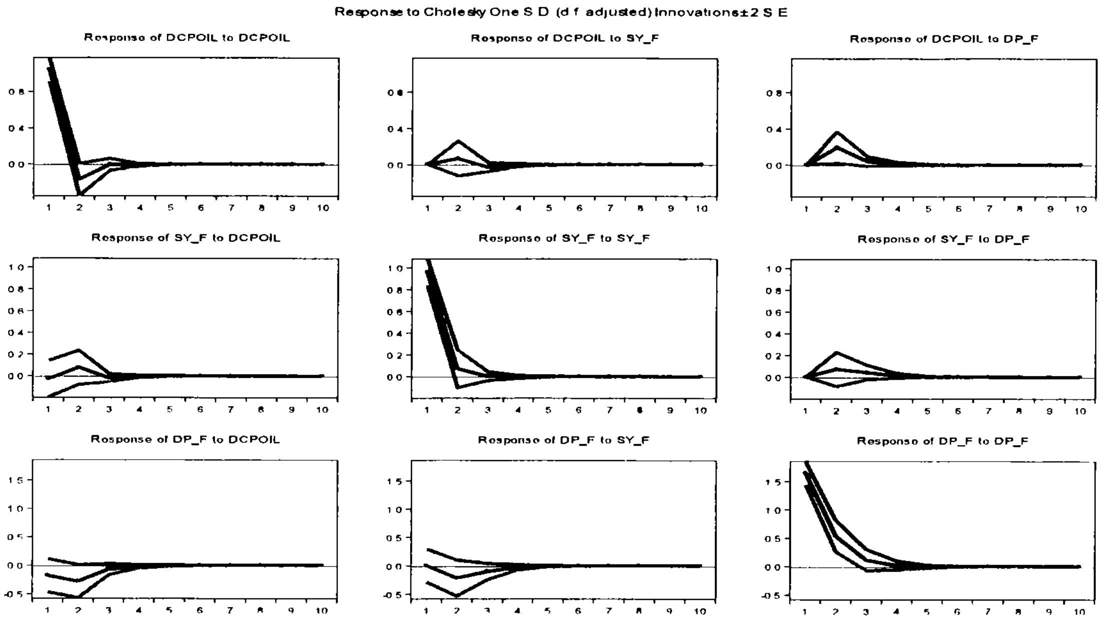


Figure 14: Impulse responses of leather industry with oil price shocks

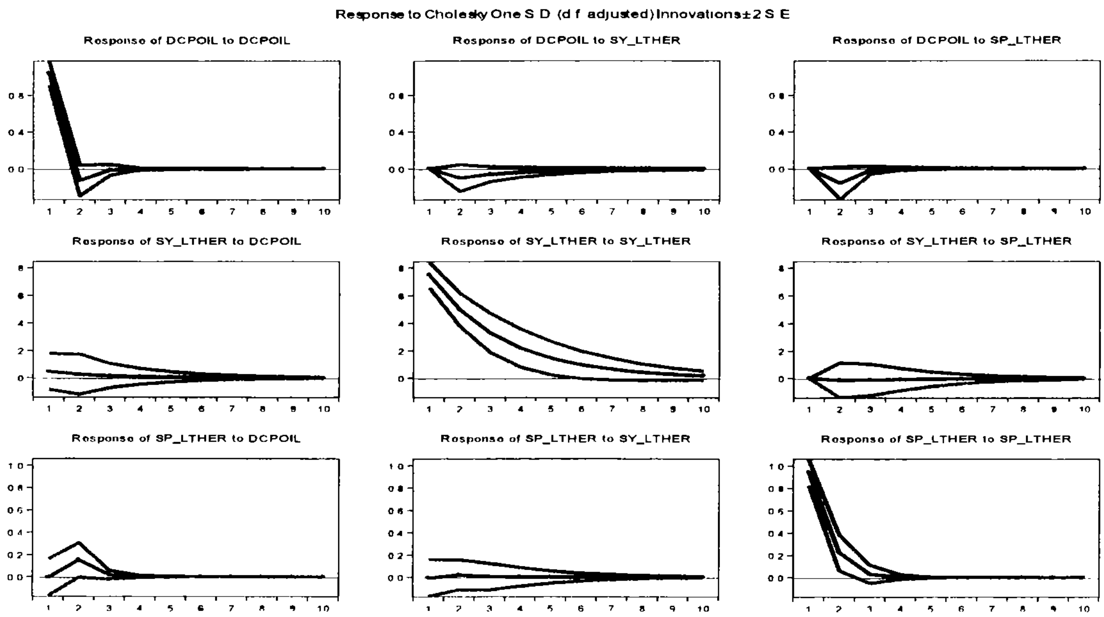


Figure 15: Impulse responses of NMM industry with oil price shocks

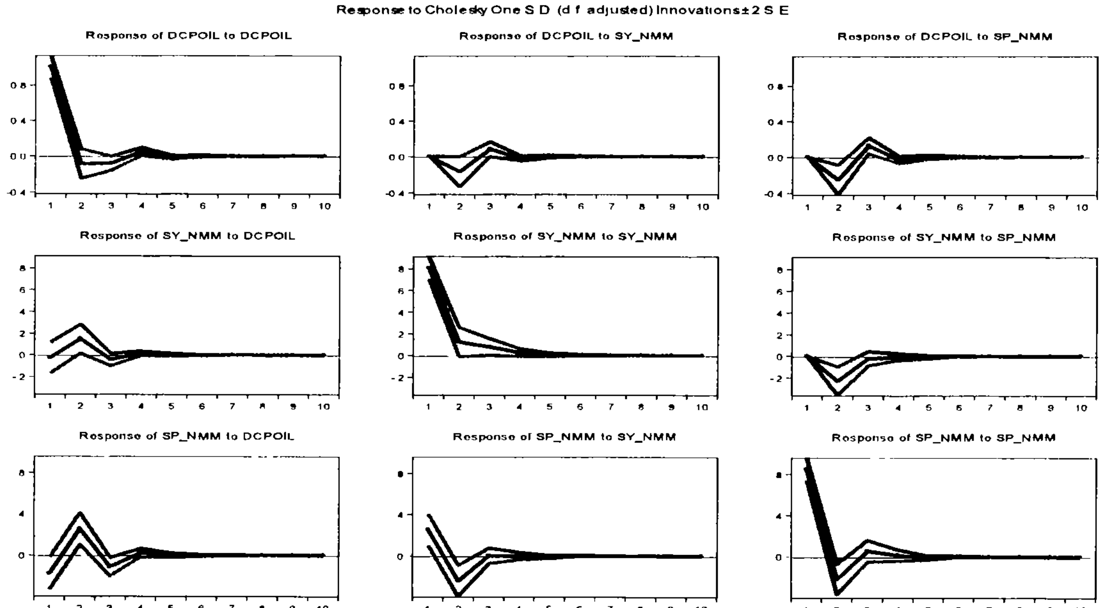


Figure 16: Impulse responses of paper and board industry with oil price shocks

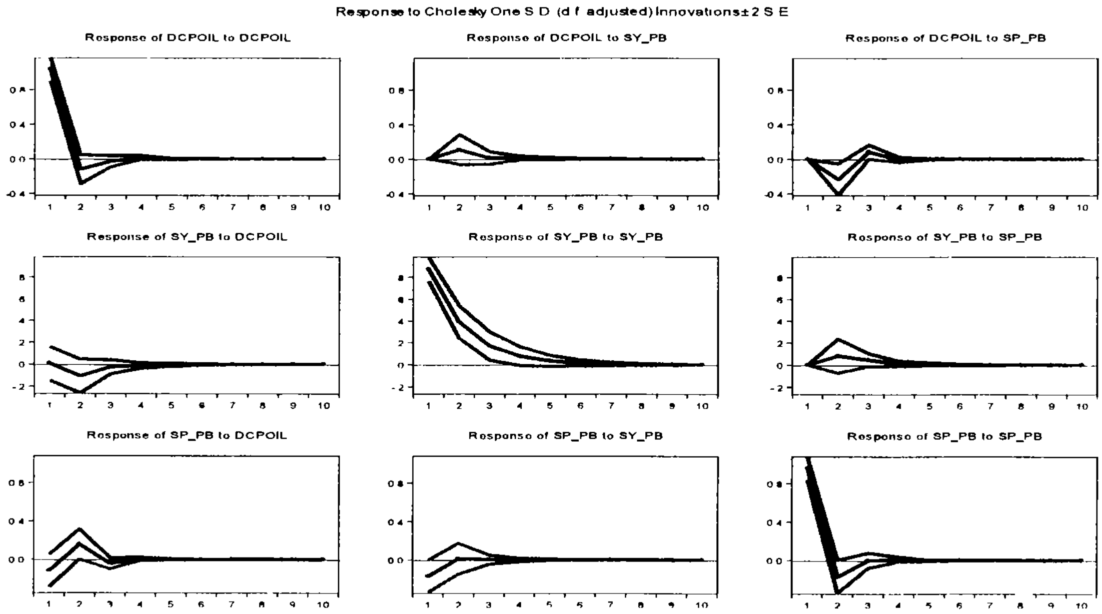


Figure 17: Impulse responses of petroleum industry with oil price shocks

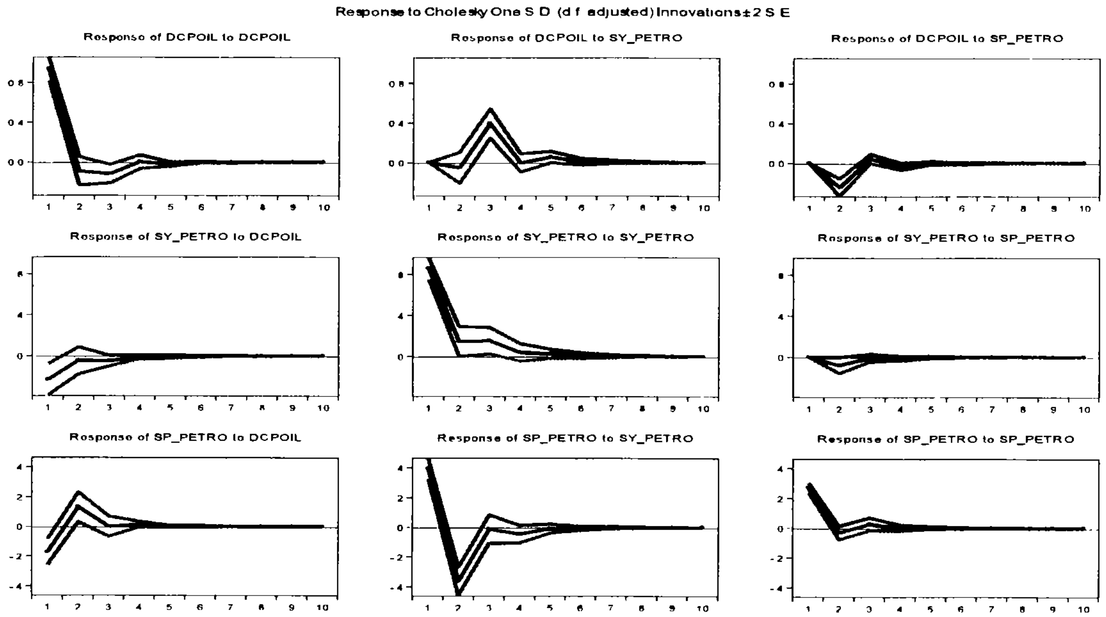


Figure 18: Impulse responses of pharmaceutical industry with oil price shocks

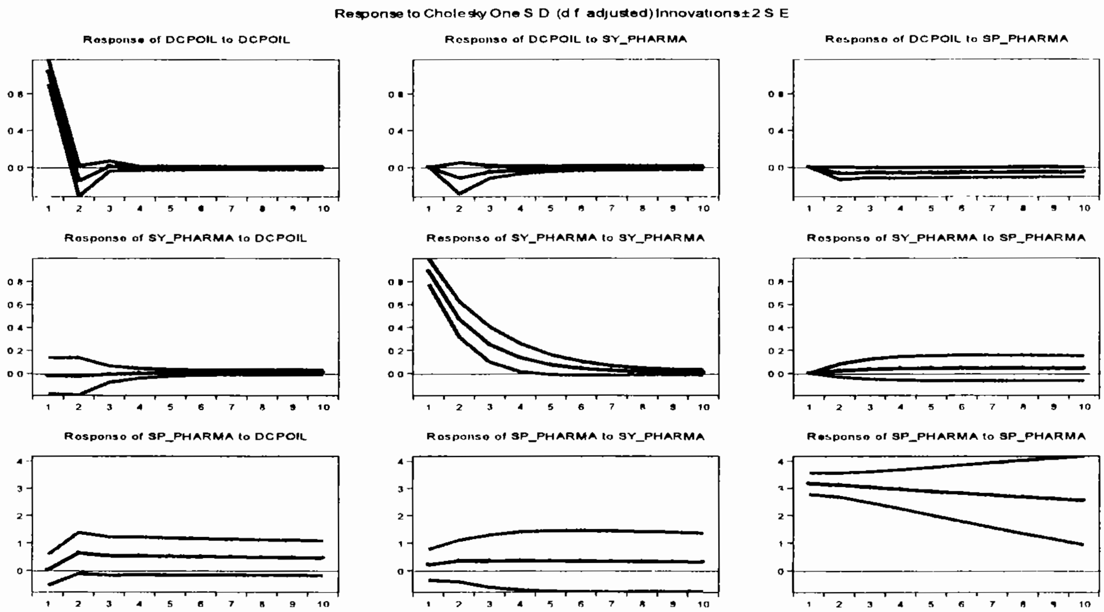


Figure 19: Impulse responses of rubber industry with oil price shocks

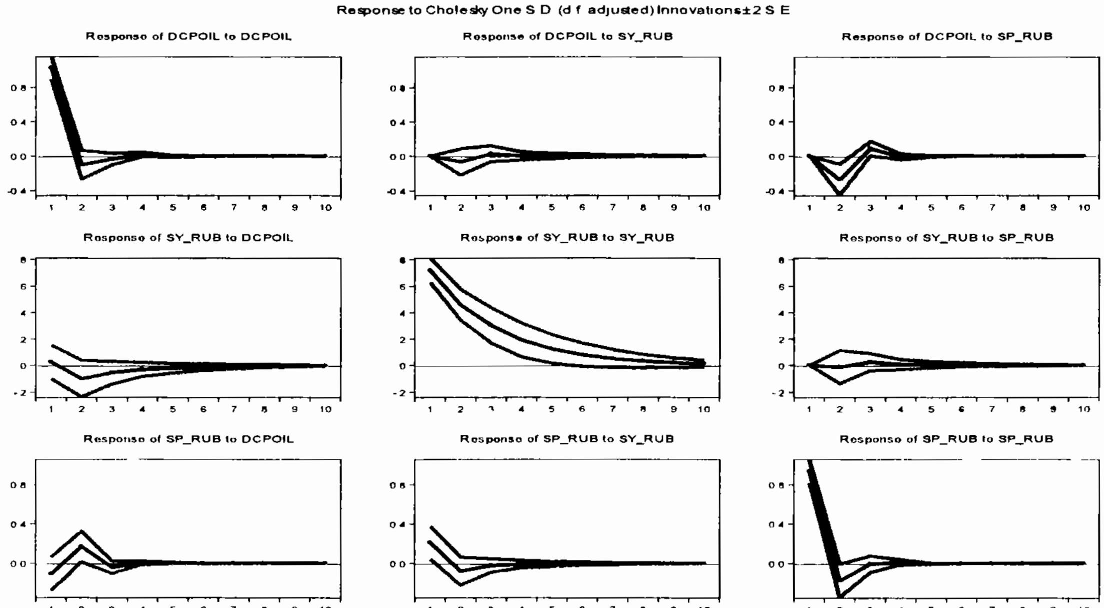
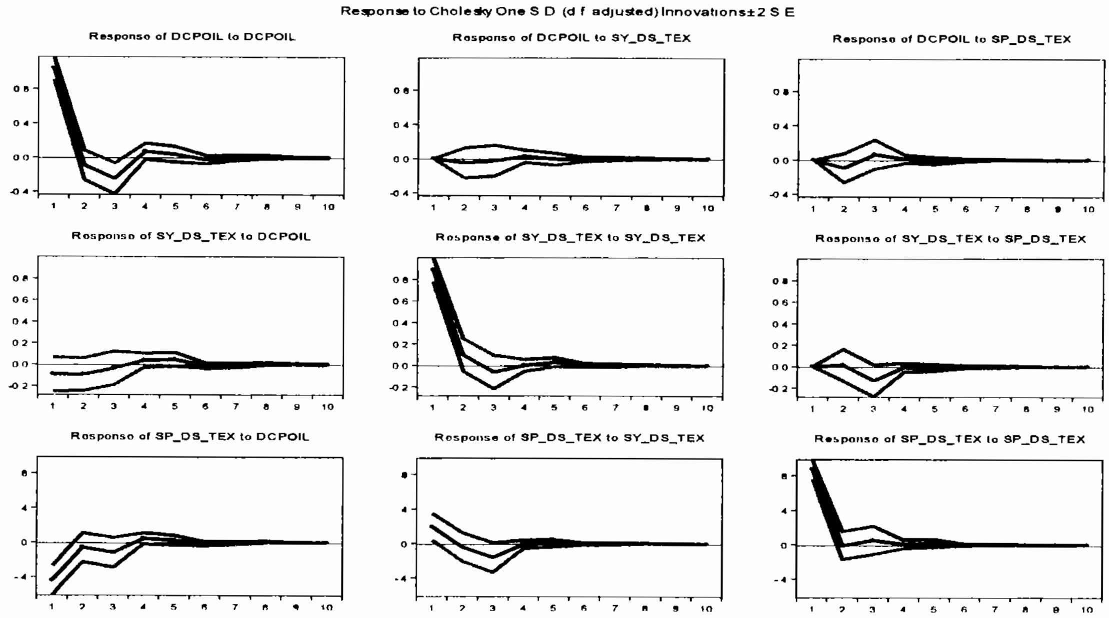


Figure 20: Impulse responses of textile industry with oil price shocks



APPENDIX 3

Table 1: lag length criteria with energy price model for upstream industries

VAR Lag Order Selection Criteria
Endogenous variables: DCPE Y_TEX UI DRATE DER
Exogenous variables: C DCOVID

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1939.21	NA	5778265.00	29.76	29.98	29.85
1	-1809.80	245.00	1174069.00	28.16	28.93304*	28.47701*
2	-1772.14	68.42	969762.40	27.97	29.29	28.51
3	-1737.01	61.14	834824.5*	27.81700*	29.68	28.58
4	-1712.81	40.28	852370.50	27.83	30.24	28.81
5	-1697.47	24.34	1001757.00	27.98	30.94	29.18
6	-1677.16	30.71	1098200.00	28.05	31.56	29.48
7	-1657.33	28.45	1222821.00	28.13	32.19	29.78
8	-1622.72	47.03	1097107.00	27.98	32.59	29.85
9	-1601.23	27.55	1216789.00	28.03	33.19	30.13
10	-1579.27	26.48	1358455.00	28.08	33.79	30.40
11	-1558.48	23.49	1569263.00	28.14	34.40	30.69
12	-1516.18	44.56266*	1330833.00	27.88	34.68	30.65

Table 2:Lag length criteria with food price model for upstream industries

VAR Lag Order Selection Criteria
Endogenous variables: DCPF Y_TEX UI DRATE DER
Exogenous variables: C DCOVID

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2001.405	NA	14933175	30.70847	30.92795	30.79765
1	-1876.025	237.3608	3227029	29.17595	29.94413*	29.48810*
2	-1850.415	46.528	3203729.*	29.16664	30.48352	29.70175
3	-1829.396	36.58291	3420806	29.22741	31.093	29.98548
4	-1807.922	35.73396	3641598	29.28126	31.69555	30.26229
5	-1780.963	42.80508	3583736	29.25135	32.21434	30.45534
6	-1757.339	35.70759	3735398	29.27235	32.78404	30.6993
7	-1729.855	39.44286	3700410	29.23442	33.29481	30.88434
8	-1698.814	42.17726	3505986	29.1422	33.75129	31.01508
9	-1671.256	35.34199	3544126	29.10314	34.26094	31.19898
10	-1643.069	33.99621	3597782	29.05449	34.76099	31.37329
11	-1618.338	27.9401	3913537	29.0586	35.3138	31.60037
12	-1582.136	38.13709*	3642842	28.88757*	35.69147	31.6523

Table 3: lag length criteria with education price model for upstream industries

VAR Lag Order Selection Criteria
Endogenous variables: DCPEDU Y_TEX UI DRATE DER
Exogenous variables: C DCOVID

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2000.538	NA	14736925	30.69524	30.91472	30.78443
1	-1876.01	235.7472	3226333.*	29.17573	29.94392*	29.48788*
2	-1856.803	34.89532	3531961	29.26417	30.58106	29.79928
3	-1833.226	41.03579	3626811	29.28589	31.15148	30.04396
4	-1818.884	23.86645	4304997	29.44861	31.8629	30.42964
5	-1803.766	24.00463	5076049	29.59948	32.56247	30.80347
6	-1784.959	28.42606	5694680	29.69402	33.20572	31.12098
7	-1769.792	21.76562	6808538	29.84415	33.90455	31.49407
8	-1745.722	32.70641	7175123	29.85835	34.46744	31.73123
9	-1719.47	33.66568	7399375	29.83924	34.99704	31.93509
10	-1691.334	33.93601	7517124	29.79135	35.49785	32.11016
11	-1670.332	23.72756	8655835	29.85239	36.10759	32.39416
12	-1600.16	73.92094*	4796803	29.16275*	35.96665	31.92748

Table 4: Lag length criteria with housing price model for upstream industries

VAR Lag Order Selection Criteria
Endogenous variables: DCPH Y_TEX UI DRATE DER
Exogenous variables: C DCOVID

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1849.755	NA	1474502	28.3932	28.61269	28.48239
1	-1726.51	233.3182	329196.3	26.89329	27.66147*	27.20543*
2	-1703.781	41.29515	341511.5	26.92795	28.24483	27.46306
3	-1675.722	48.83428	327495.4*	26.88126*	28.74684	27.63933
4	-1659.868	26.38387	379859.4	27.02088	29.43517	28.00191
5	-1636.746	36.71155	396381	27.04956	30.01255	28.25356
6	-1616.826	30.10853	437195.5	27.12712	30.63881	28.55407
7	-1594.958	31.38352	471871.8	27.17493	31.23532	28.82485
8	-1571.773	31.50317	504046.9	27.20264	31.81174	29.07552
9	-1547.381	31.28155	534765.1	27.21192	32.36972	29.30776
10	-1523.949	28.26159	583733	27.23586	32.94236	29.55466
11	-1502.422	24.31973	666800.9	27.28889	33.54409	29.83066
12	-1462.014	42.56782*	582075.8	27.05365	33.85755	29.81838

Table 5: Lag length criteria with health price model for upstream industries

VAR Lag Order Selection Criteria
Endogenous variables: DCPHEL Y_TEX UI DRATE DER
Exogenous variables: C DCOVID

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1836.049	NA	1196114	28.18396	28.40344	28.27315
1	-1713.467	232.0649	269756.3*	26.69415*	27.46233*	27.00630*
2	-1693.209	36.80519	290608.4	26.76654	28.08343	27.30165
3	-1669.751	40.82614	298961.9	26.7901	28.65568	27.54817
4	-1653.68	26.74521	345616	26.92641	29.3407	27.90744
5	-1634.626	30.25314	383754.6	27.01719	29.98018	28.22119
6	-1595.936	58.47832	317807	26.80818	30.31987	28.23514
7	-1576.398	28.03843	355440.3	26.89158	30.95197	28.5415
8	-1547.033	39.90056*	345491	26.82494	31.43403	28.69782
9	-1527.305	25.30035	393597.8	26.90542	32.06322	29.00127
10	-1502.063	30.44481	417928.3	26.90172	32.60822	29.22053
11	-1486.249	17.86613	520905.5	27.04197	33.29717	29.58374
12	-1452.023	36.05448	499733.1	26.90112	33.70502	29.66585

Table 6: Lag length criteria with transportation price model for upstream industries

VAR Lag Order Selection Criteria
Endogenous variables: DCPT Y_TEX UI DRATE DER
Exogenous variables: C DCOVID

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2022.862	NA	20721573	31.03606	31.25554	31.12524
1	-1892.109	247.5319	4125252.*	29.42151*	30.18970*	29.73366*
2	-1873.445	33.90813	4553654	29.51825	30.83514	30.05336
3	-1851.487	38.21727	4792989	29.56469	31.43028	30.32276
4	-1840.784	17.81152	6014221	29.78296	32.19725	30.76399
5	-1823.378	27.63676	6848018	29.8989	32.86189	31.1029
6	-1804.643	28.3172	7691055	29.99455	33.50624	31.42151
7	-1776.396	40.5377	7530791	29.94498	34.00537	31.5949
8	-1749.974	35.90172	7656387	29.92327	34.53236	31.79615
9	-1720.259	38.10832*	7488940	29.85128	35.00907	31.94712
10	-1699.836	24.63196	8559040	29.92116	35.62766	32.23996
11	-1667.827	36.16244	8331132	29.81416	36.06936	32.35592
12	-1637.545	31.90067	8488437	29.73351	36.53741	32.49824

Table 7: Lag length criteria with clothing and footwear price model for upstream industries

VAR Lag Order Selection Criteria
Endogenous variables: DCPCF Y_TEX UI DRATE DER
Exogenous variables: C DCOVID

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1852.225	NA	1531171	28.43092	28.6504	28.5201
1	-1725.787	239.3637	325581.5*	26.88224*	27.65043*	27.19439*
2	-1703.221	40.99793	338606.1	26.9194	28.23629	27.45451
3	-1679.416	41.43178	346493.6	26.93765	28.80323	27.69572
4	-1661.698	29.48468	390623.4	27.04882	29.46311	28.02986
5	-1646.081	24.79674	457091.7	27.19207	30.15506	28.39607
6	-1626.213	30.02953	504559.9	27.27042	30.78211	28.69738
7	-1604.078	31.76659	542364.5	27.31416	31.37455	28.96408
8	-1582.596	29.18885	594608.9	27.36788	31.97697	29.24076
9	-1549.259	42.75235*	550322.8	27.2406	32.39839	29.33644
10	-1530.216	22.96816	642345.6	27.33154	33.03804	29.65035
11	-1502.09	31.77542	663429	27.28382	33.53902	29.82559
12	-1466.449	37.54539	622858.8	27.12137	33.92527	29.8861

Figure 1: The Impulse responses with energy price model for upstream industries

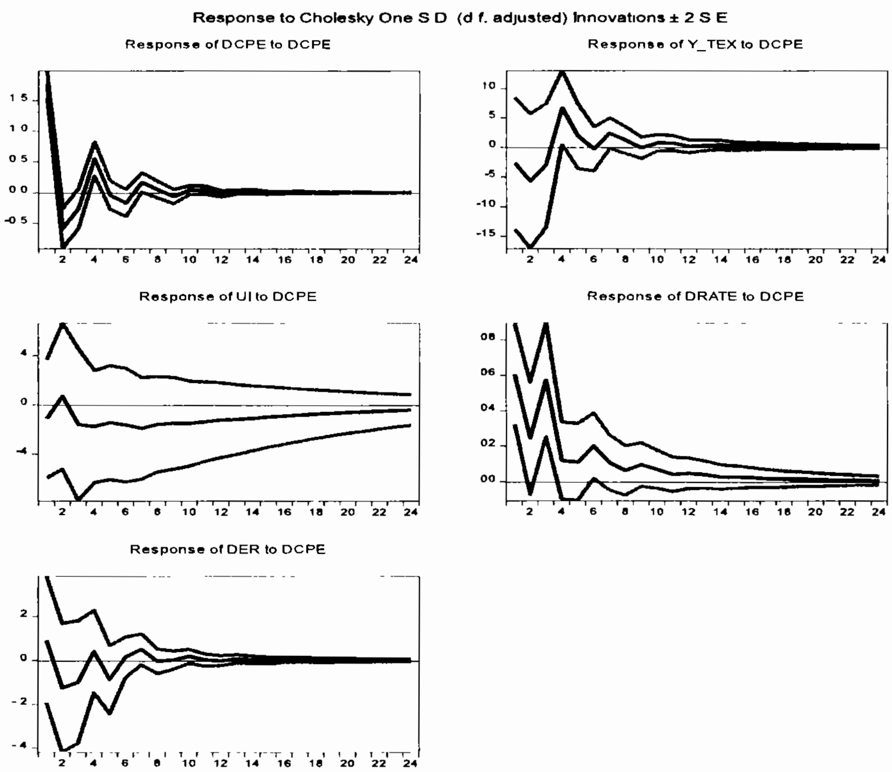


Figure 2: The Impulse responses with energy price model for midstream industries

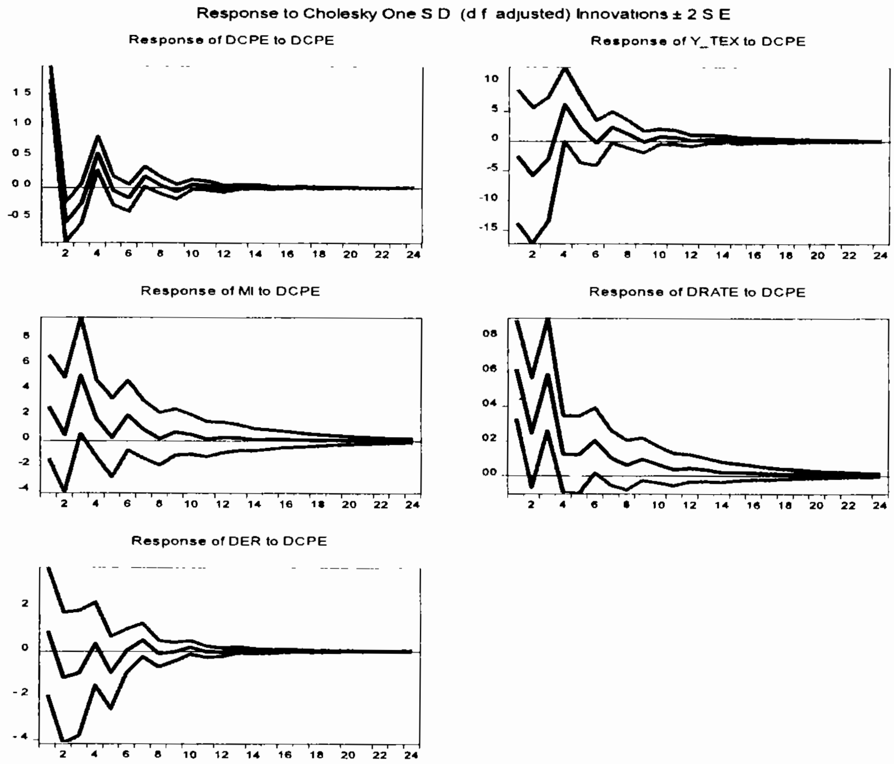


Figure 3: Impulse responses with energy price model for downstream industries

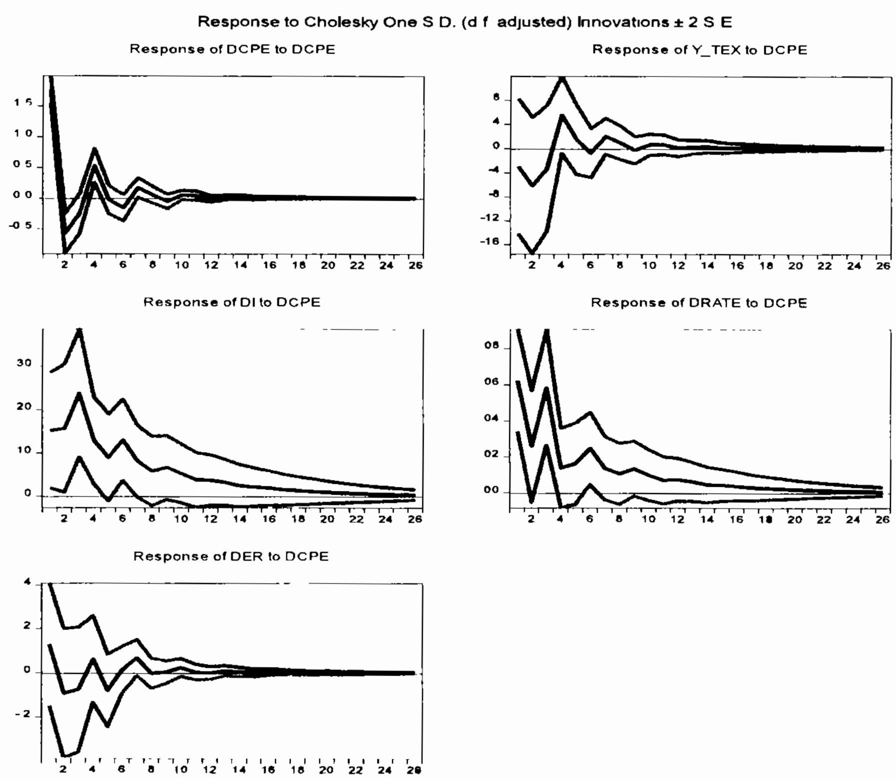


Figure 4: Impulse responses with food price model for upstream industries

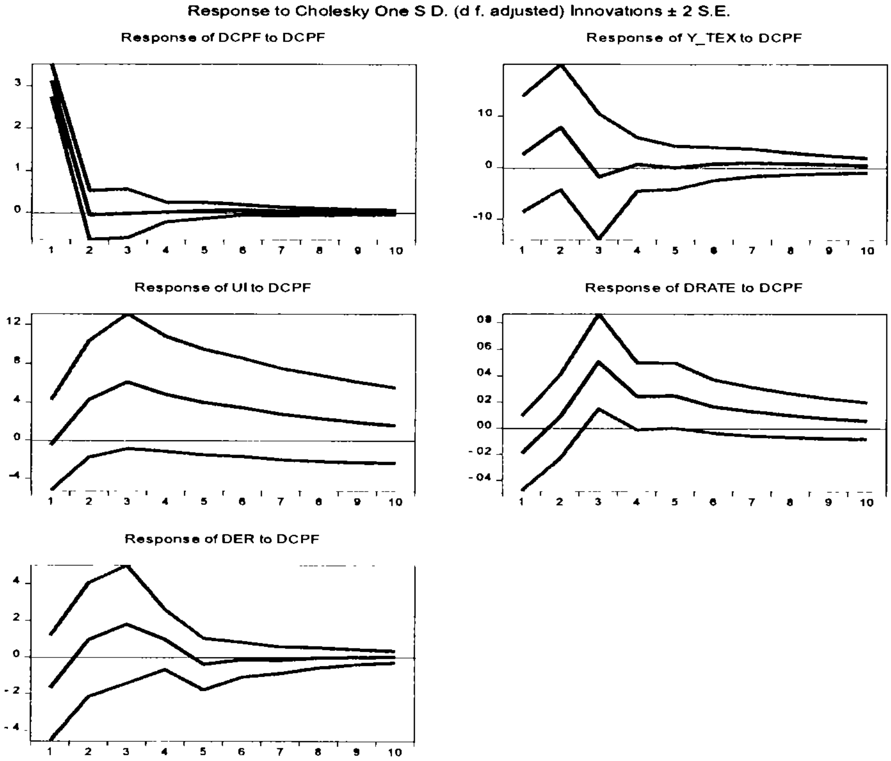


Figure 5; The Impulse responses with food price model for midstream industries

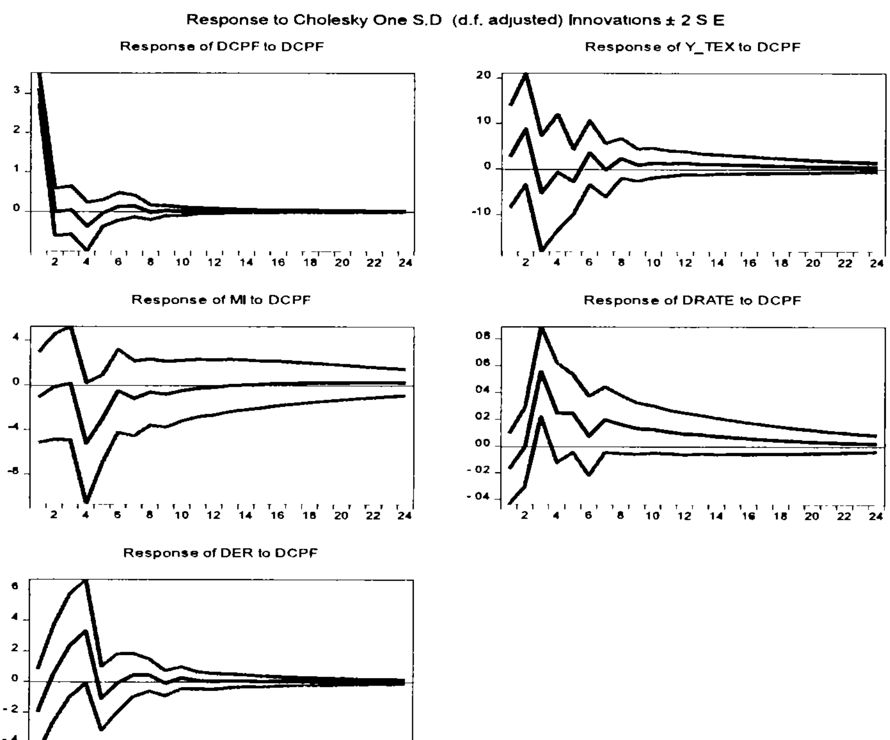


Figure 6: The Impulse responses with food price model for downstream industries

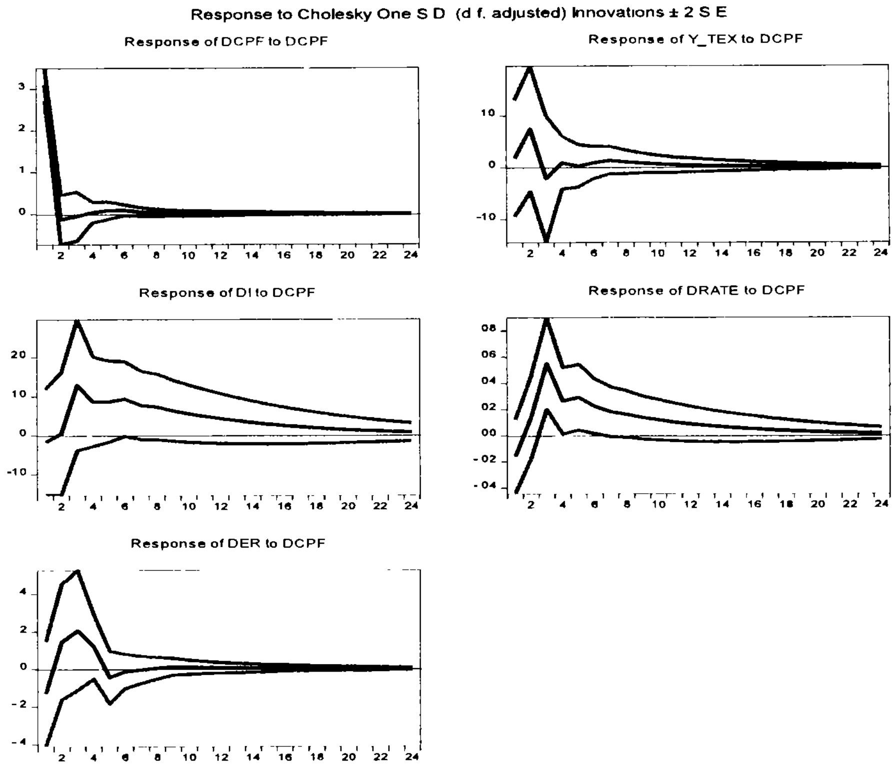


Figure 7: The Impulse responses with education price model for upstream industries

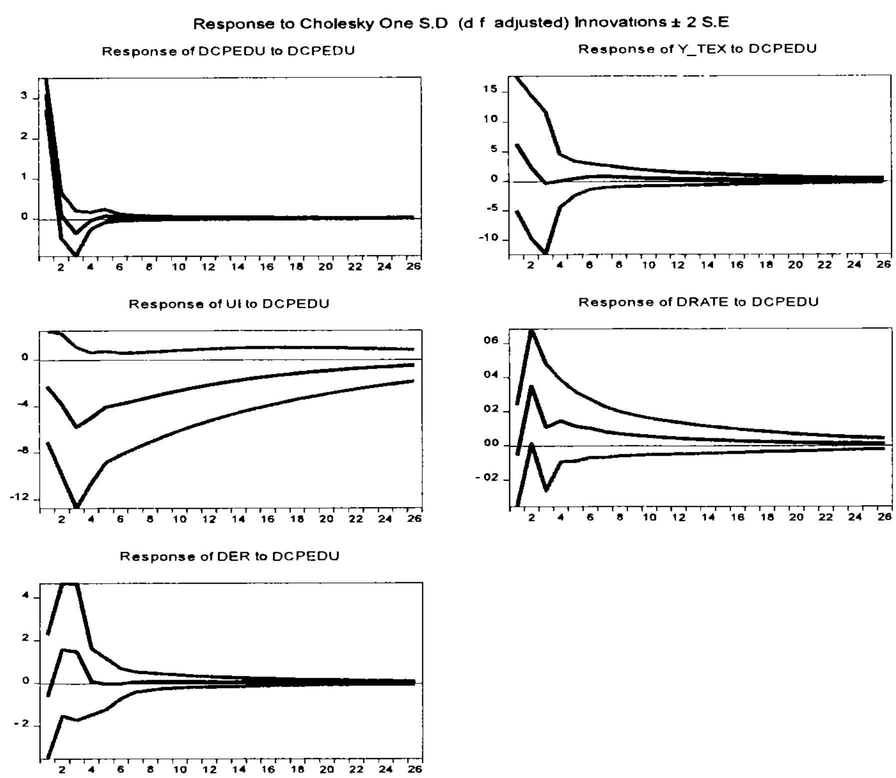


Figure 8: The impulse response with education price model for midstream industries

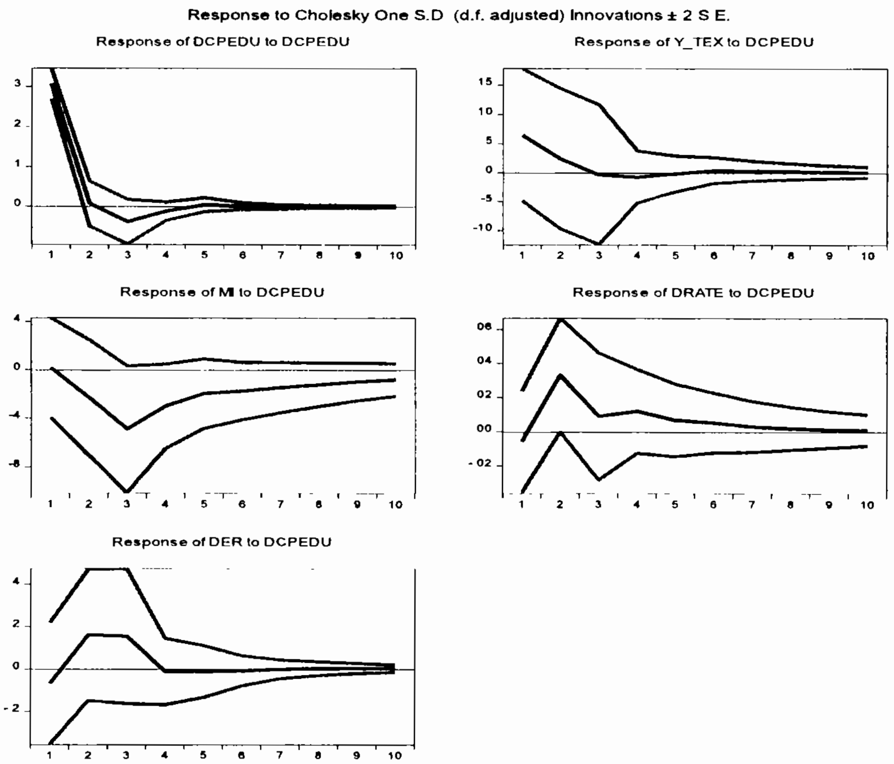


Figure 9: The impulse response with education price model for downstream industries

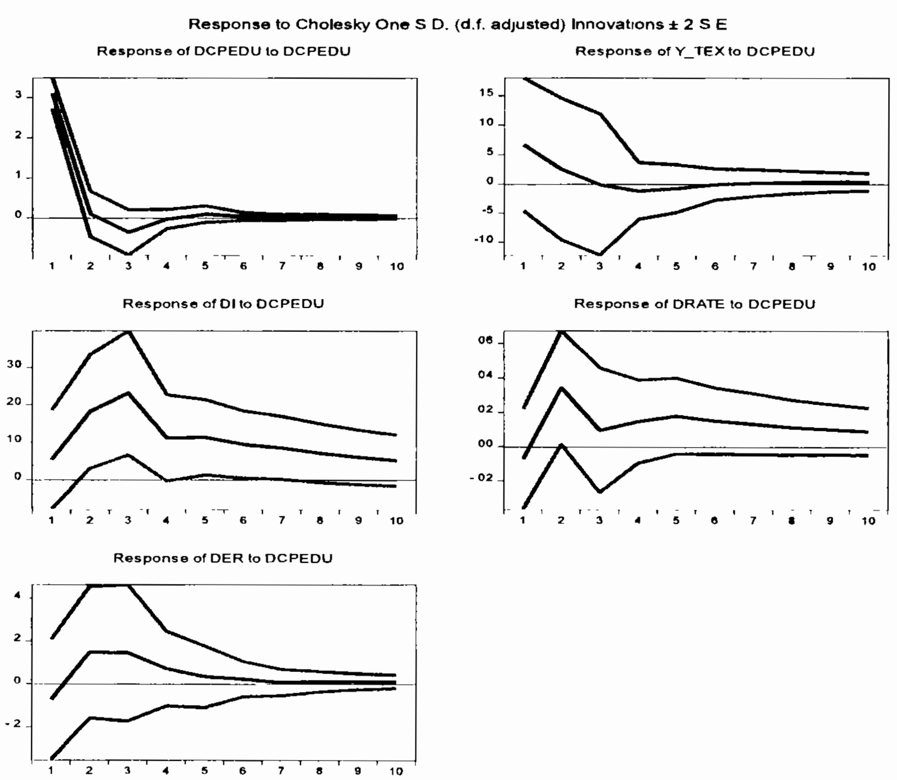


Figure 10: The Impulse responses with transportation price model for upstream industries

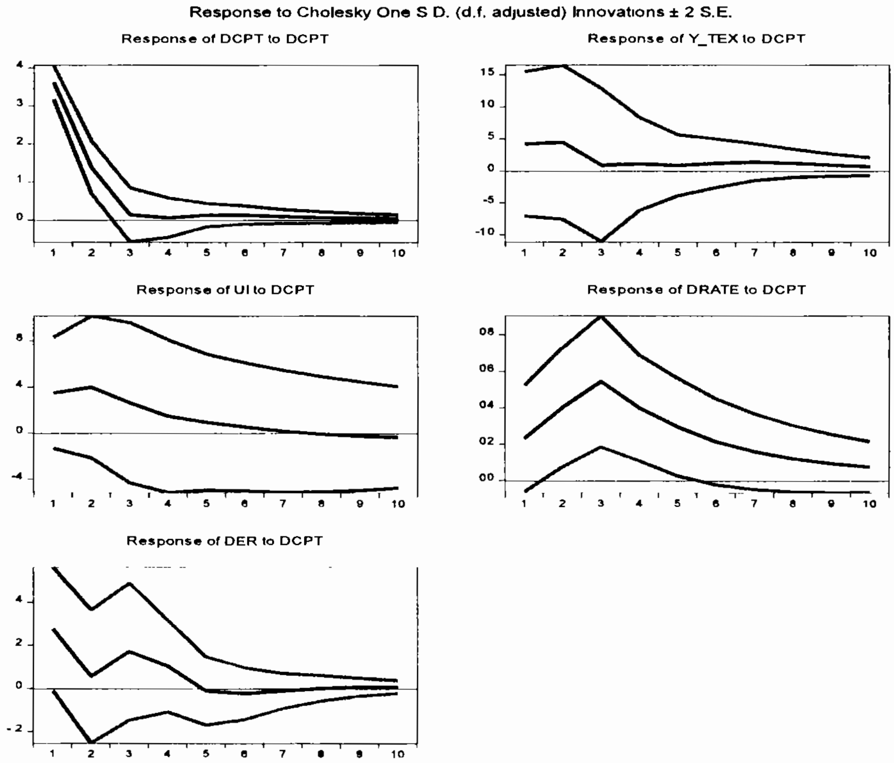


Figure 11: The Impulse responses with transportation price model for midstream industries

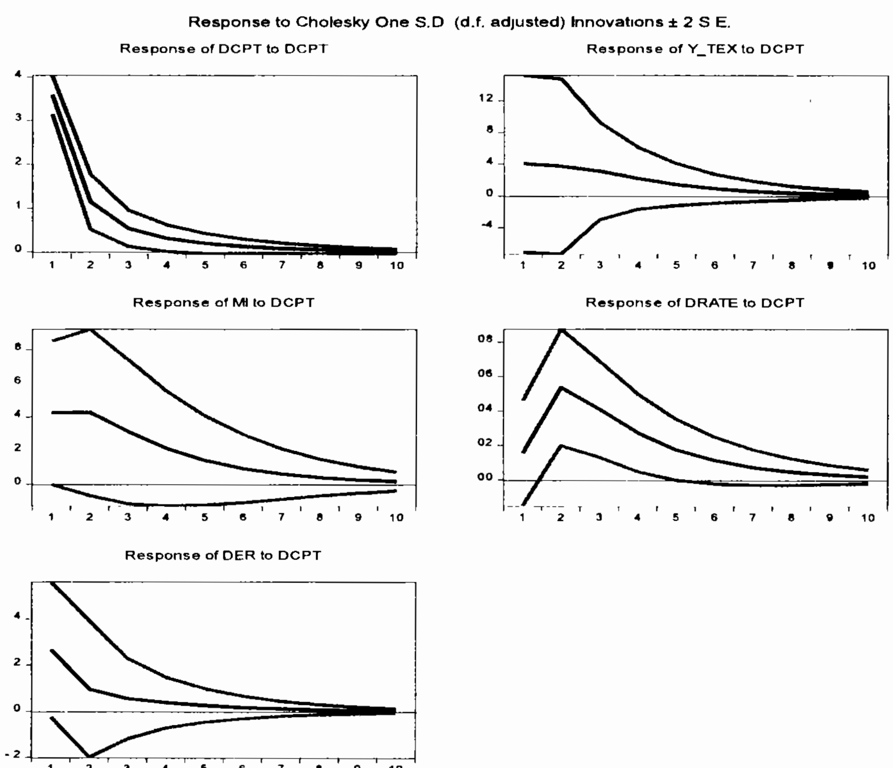


Figure 12: The Impulse responses with transportation price model for downstream industries

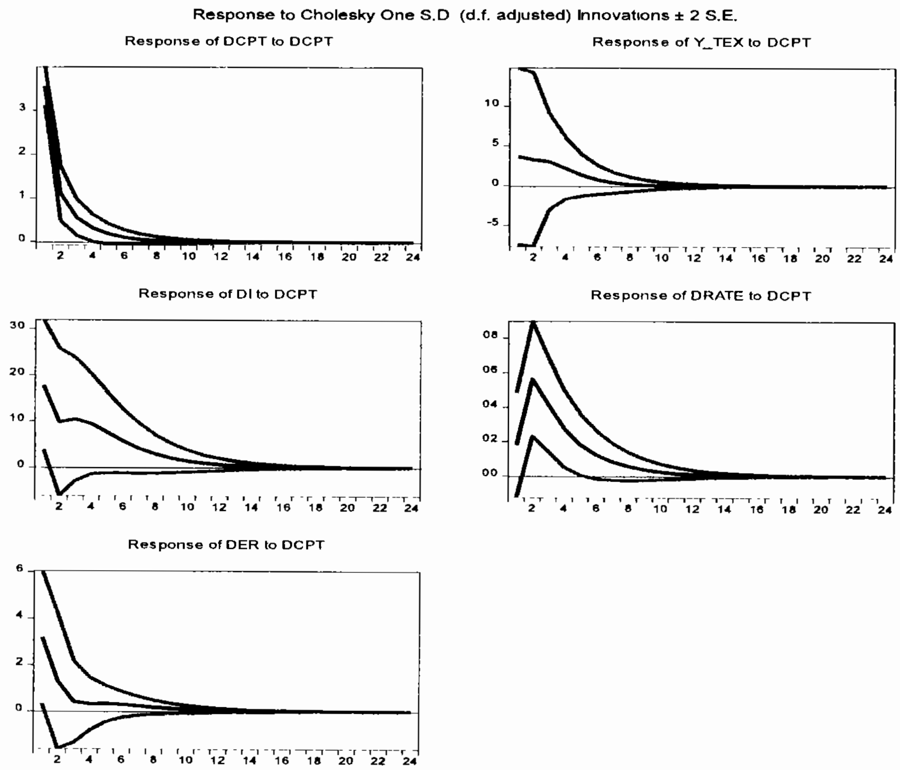


Figure 13: The Impulse responses with housing price model for upstream industries

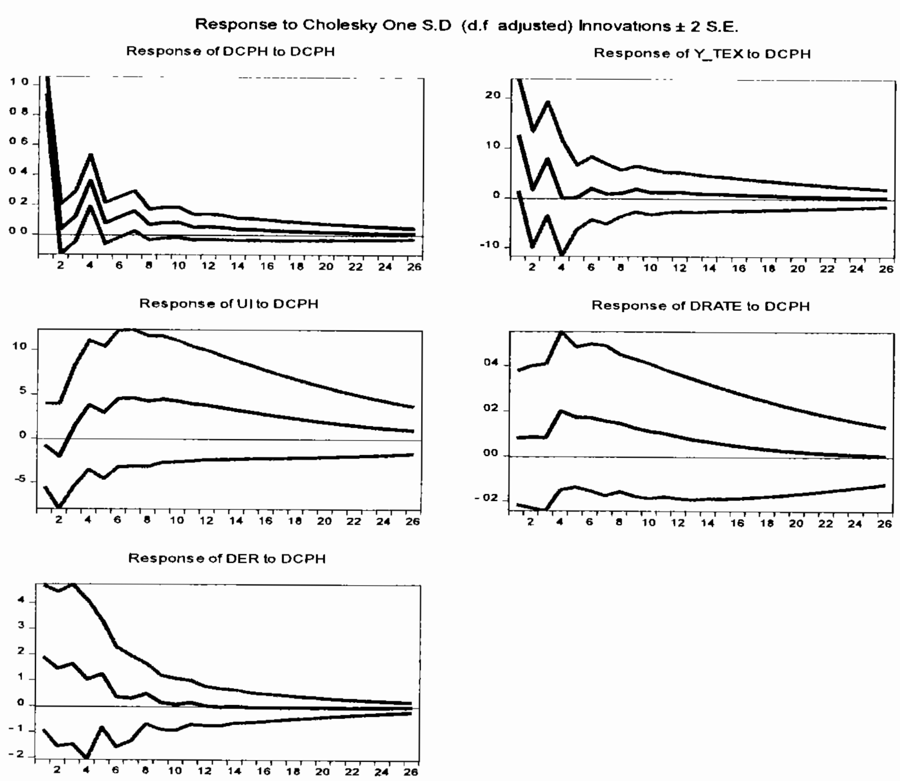


Figure 14: The Impulse responses with housing price model for midstream industries

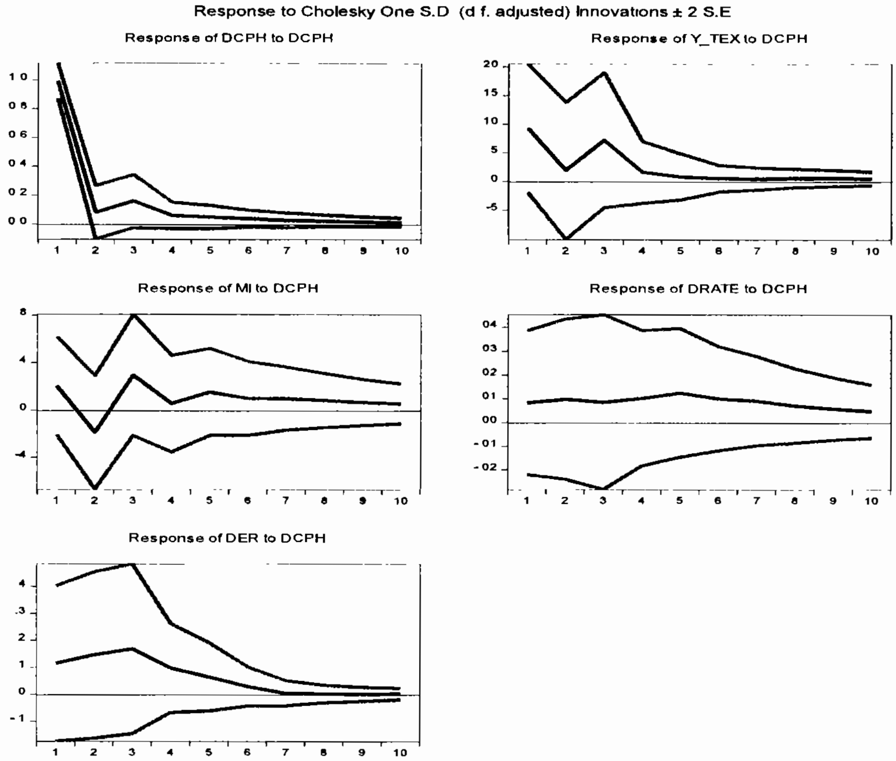


Figure 15: The Impulse responses with housing price model for downstream industries

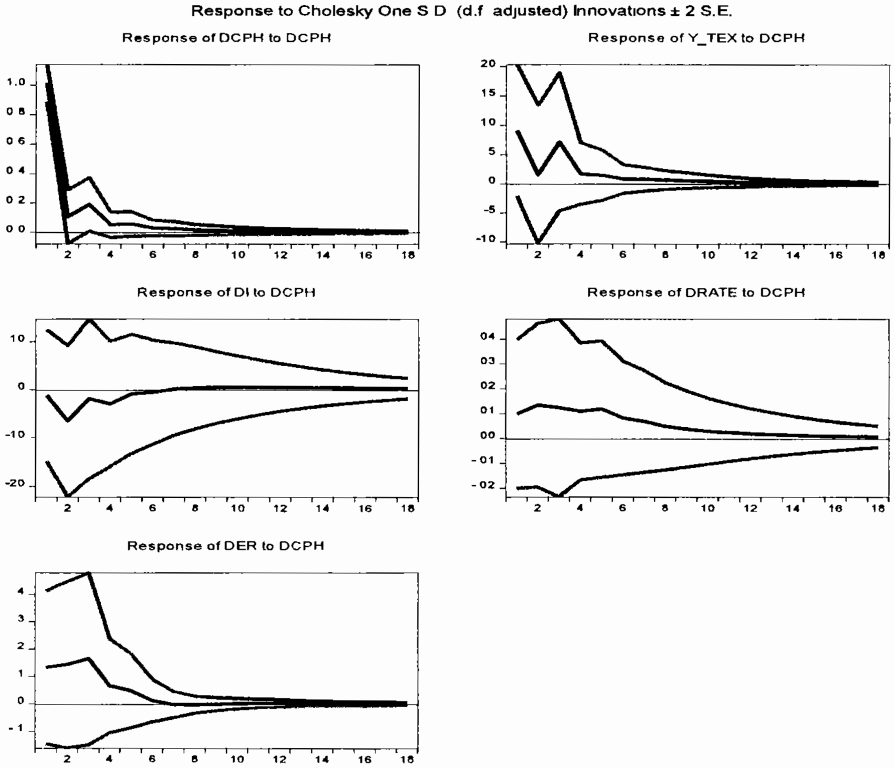


Figure 16: The Impulse responses with health price model for upstream industries

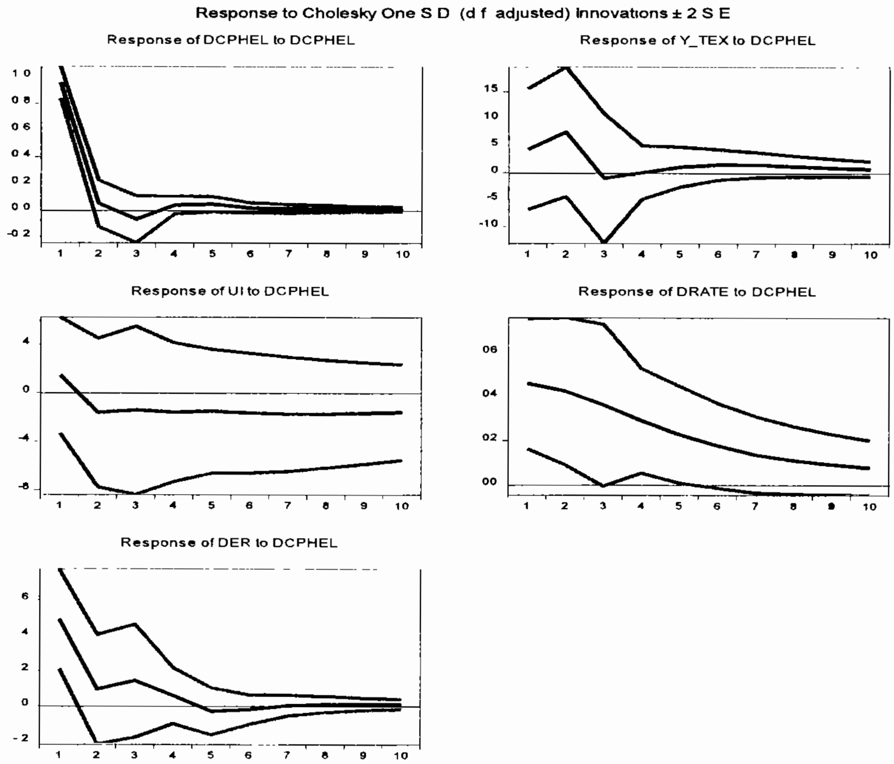


Figure 17: The Impulse responses with health price model for midstream industries

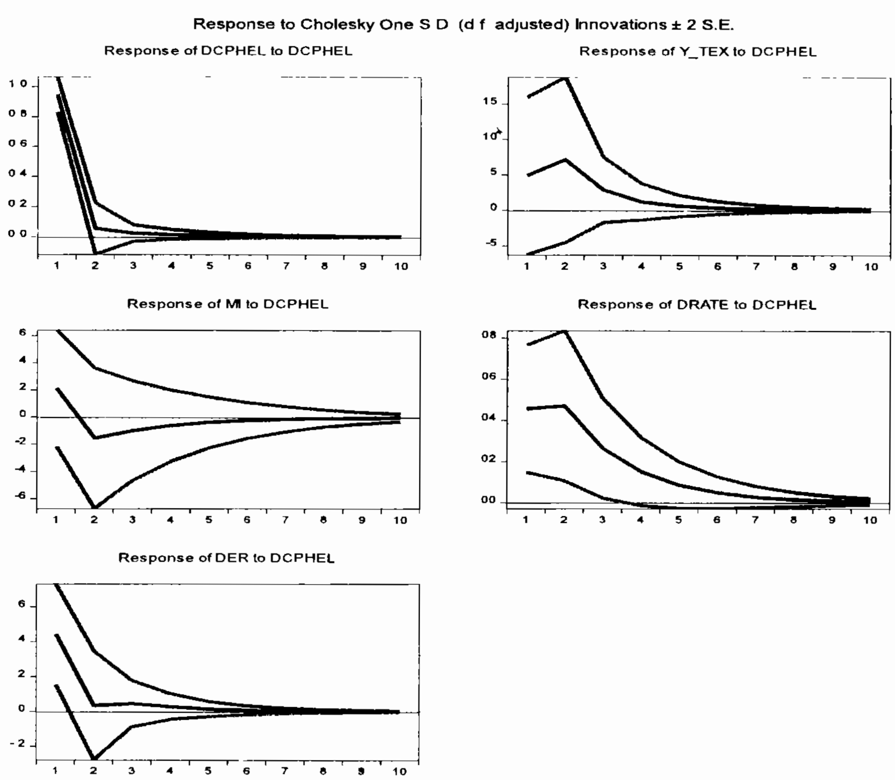


Figure 18: The Impulse responses with health price model for downstream industries

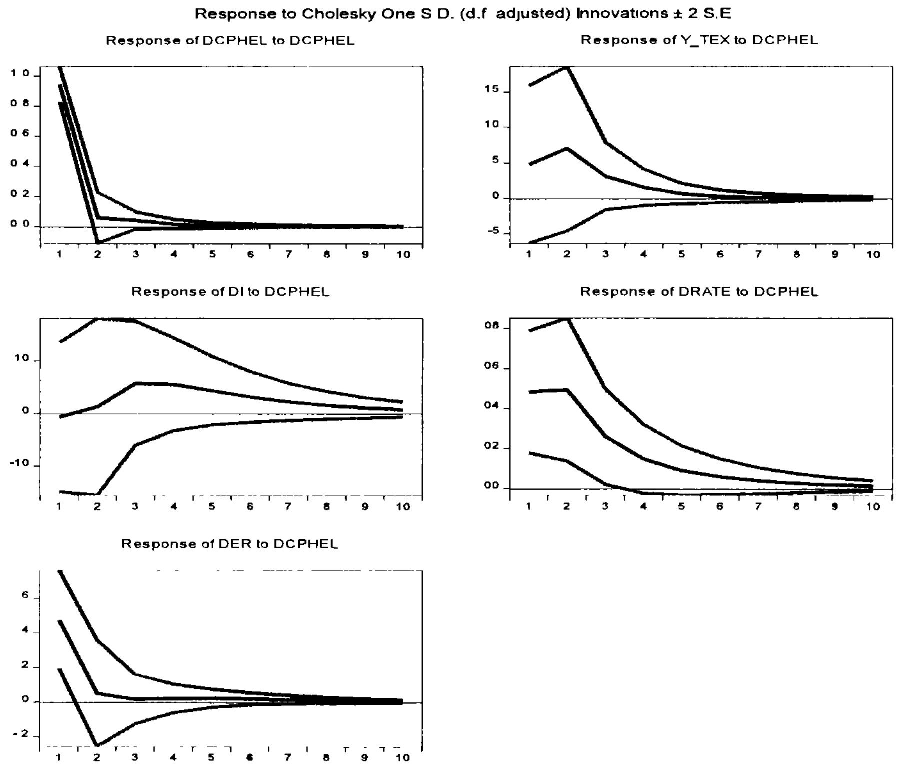


Figure 19: The Impulse responses with cloth and footwear price model for upstream industries

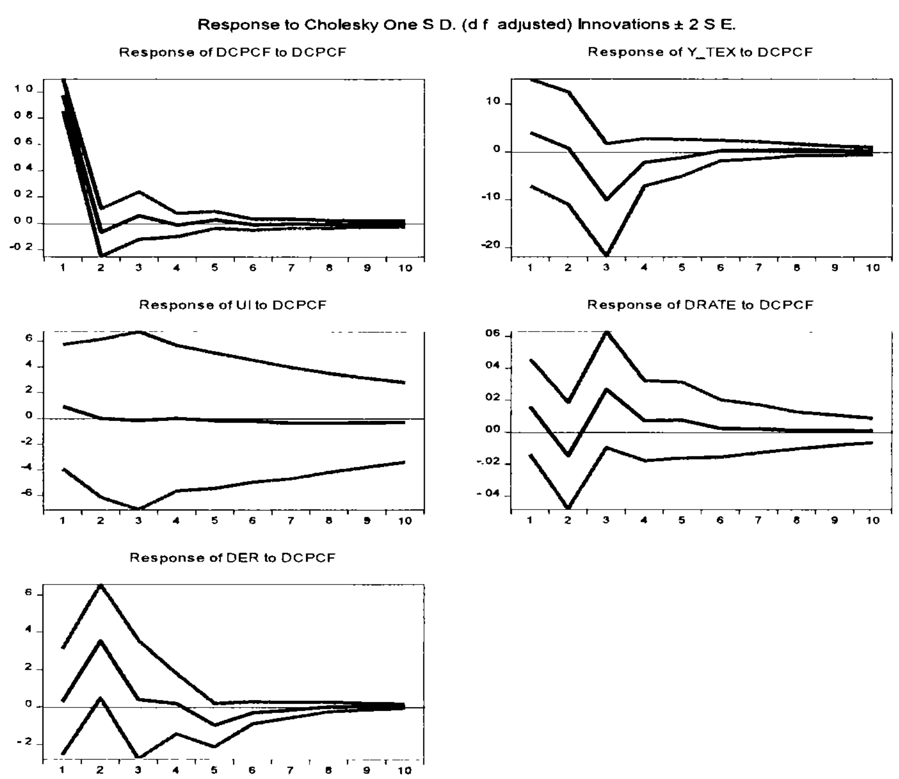


Figure 20: The Impulse responses with cloth and footwear price model for midstream industries

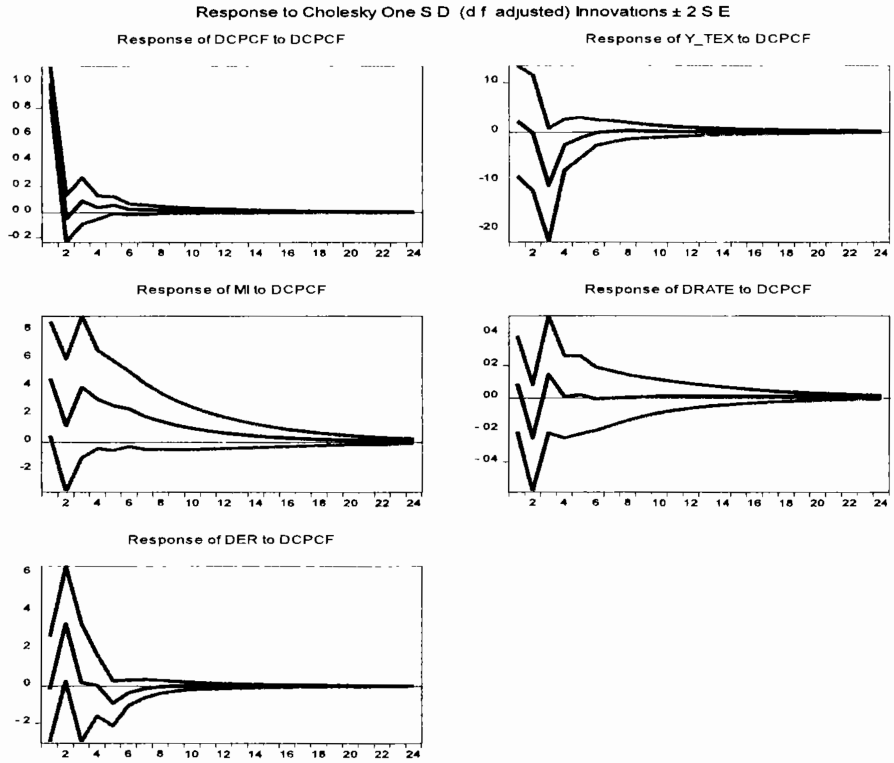


Figure 21: The Impulse responses with cloth and footwear price model for downstream industries