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Commodity Price Shocks and Industrial Production of Pakistan

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ABSTRACT

Purpose - Several studies are available on the impact of energy prices on the overall economy and industrial output of Pakistan. However, there is no valuable work that has examined the impact of different groups of commodity prices on industrial output. This study is aimed to fill-in this gap and examines the impact of seven groups of commodities on the industrial output of Pakistan.

Design/methodology/approach - It uses the Structural Vector Auto Regression model for monthly data from July 2008 to June 2020.

Findings - The finding of our study suggests that food, education and clothing, and footwear price shocks have a negative and significant impact on industrial output. Whereas, the oil and transportation price shocks have a negative impact. The findings of this study may help policymakers to control the commodity prices that have a dominant-negative impact and provide insight into that all commodity price shocks are not alike for the industrial output of Pakistan.

Originality/value - This study contributes significantly to the topic under consideration and provides new insight that not all commodity price shocks are identical. Oil is no doubt the main source of energy. However, many other types of commodities significantly affect the industrial production of Pakistan. The results of our analysis provide a clear view that which type of commodity price shocks can lead to a boom and which to bust these industrial productions and provide useful information to a policymaker that will help them to achieve their goals more effectively.

Keywords: Commodity Price shocks; Industrial output; Inflation; Structural VAR

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 (Abbasi et al., 2021). Pakistan's economy has been facing many problems since its creation. The trade balance of the country mostly remains in deficit due to higher

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Article info

Received December 18, 2021
Accepted March 21, 2022
Published March 30, 2022

dependency on imports. Industrial production stability and development are much-needed factors for Pakistan's economy. However, commodity price shocks affect the stability and development of industrial output.

The shocks 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 the short run) causes growth of the profits in manufacturing. However, this rise in profits grounds stress for wage increases; this is what is 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 effect 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 on the manufacturing of industrial goods (Hammed, 2020). This reduction is partly because the increase in profits may not be complemented by the increase in expenditure for the 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 (Bustos et al.2020). Therefore, an increase in commodity prices, for the industrial sector can cause a spiral-type of inflation, which consequences slowdowns in industrial activities.

The commodity price shocks might have differential impacts, 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 (Knop and Vespignan, 2014; McLeod, 2018; Tiwari et al.2020).

Several studies are available on the impact of energy prices on the overall economy and industrial output of Pakistan (Ahmed et al, 2017; Khan et al.2021). 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 output. This study is aimed to fills-in this gap

and examines the impact of seven groups of commodities on the industrial output of Pakistan. 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, culture, and miscellaneous). This study expects some interesting guidelines for policymakers and governments. The results of the study are expected to help policymakers to bring stability as they can make policies to control the prices of those commodities which have a significant and large impact on the industrial production of Pakistan.

2. LITERATURE REVIEW

Commodities are basic economic goods or services that are fungible, hard assets, and interchangeable with the same type (Karl Marx, 1997). The history of commodities contains the history of man's civilization. According to their nature and specific characteristics, commodities are divided into two broad groups' primary and secondary commodities (Spraos, 1980). In the market economy, the price of commodities is determined by their demand and supply. 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). The 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 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, Gruss, 2014). The main objective of the research

on 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).

Most of the studies on the topic under discussion focused on oil price shocks. Whereas, in oil price shocks researchers differentiate between different types of oil price shocks like oil supply shock, oil demand shock, and shocks due to changes in aggregate demand (Kilian, 2009; Chen, 2019; Alao and Payaslioglu, 2021). Oil is always treated as an important factor of production therefore, an increase in the price of oil resulting from an oil supply shock increases the marginal cost of production for industries. 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; Mishra et al. (2021). Thus, the more the industry is oil intensive, the more its Producer Price Index (PPI) is affected by oil price shock (Tasi, 2015; Liu et al. 2020).

Jo et al. (2019) examine the impact of oil price shocks on the industrial production of the USA. The study employs the SVAR model and found that oil price shocks negatively affect the supply of oil-intensive industries. Chen and Zhu (2019) using monthly data from Oct-1996 to June 2017 examined the impact of oil price shocks on Chinese industries. The results of the study provide insight that oil price shocks adversely affect the producer price index and production of Chinese industries. Chen et al. (2020) examine the impact of oil price shocks on Chinese industries using the VAR and Granger Causality

method. It uses monthly data and found that oil price shocks affect Chinese industries conditional on the nature of the shocks.

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 in 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 are among one the prominent studies on the impact of oil price shocks on industrial production. 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. Using the VAR model over the monthly data from Jan 2010 to 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.

Siddiqui (2004) examined the impact of the 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 the 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 the industry's stock returns in Pakistan.

Waheed et al (2018) 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 the 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. Ahmed et al. (2019) examine the impact of oil price shocks on five SARAC countries including Pakistan. The findings of the study revealed that oil price shocks affect different countries differently depending on the nature of policies, macroeconomic situation, and institutional setup. Sarwar et al. (2020) used quarterly data over the period 1990Q3 to 2019Q4 and employ a causality test and NARDL model for estimating the impact of oil prices on food, non-food, and industrial production. Results of the study suggest that oil price shocks negatively affect the industrial output through increased transportation costs. Overall, a review of the literature advocates that energy price shocks gained dominant attention in the examination of the relationship between commodity price and industrial output. There is no well-known study that has incorporated the impact of a different group of commodity prices.

3. RESEARCH METHODOLOGY

This study uses monthly data over the period July 2008 to June 2020. It aims to employ the Structural VAR model to examine the relationship between commodity prices and economic activities in Pakistan. The monthly industrial output data is collected from the Quantum Index of Manufacturing (QIM) published by the Pakistan Bureau of Statistics (PBS). The study also incorporates other macro-economic variables of the Pakistan economy namely money stock measure (m), long-term interest rate (lb) 3-month T bill rate (ir), and aggregate price index (inf). Further, we treat commodity prices (cp) for each group as the macroeconomic variables for the Pakistan economy. These groups are food, clothing and footwear, housing, oil, transport, education, and health.

Equation 1 expressed the SVAR model as follows;

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

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 the property that u_t is white noise with zero mean and variance-covariance matrix Ω . Consistently, the model can be written more compactly as;

$$A(L)y_t = B u_t \quad (2)$$

Where $A(L) = A_0 - A_1(L) - A_2 L^2 - \dots - A_p L^p$ and A_i is a coefficient matrix ($i = 0 \dots p$) and L is the 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) by A_0^{-1} .

$$A_0^{-1} A_0 y_t = A_0^{-1} A_1 y_{t-1} + \dots + A_0^{-1} A_p y_{t-p} + A_0^{-1} B u_t \quad (3)$$

So, the same model can be represented as;

$$y_t = C_1 y_{t-1} + \dots + C_p y_{t-p} + \varepsilon_t \quad (4)$$

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

$$C(L)y_t = \varepsilon_t \quad (5)$$

Where $C(L) = I - C_1(L) - C_2 L^2 - \dots - C_p L^p$ and C_i is the coefficient matrix ($i = 1 \dots p$) and L is the lag operator. Standard estimation methods like OLS permits us to attain consistent estimates of the reduced form parameters, the reduced form errors ε_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 to check the stationarity of data. For equation 6 the unit root hypothesis can be written as;

$$y_t = A_1 y_{t-1} + u_t \quad (6)$$

The hypothesis is;

$$H_0: A_1 = 0 \quad \text{Stationary (not unit root)}$$

$$H_1: A_1 \neq 0 \quad \text{Non-stationary (unit root)}$$

We will estimate our SVAR model separately for each group of commodity prices. Therefore, we need to impose separate restrictions for each commodity price.

3.1. Restrictions on oil Prices

Commodity Price equation

$$cpoil_t = \beta_1 cpoil_{t-p} + \mu_{oil} \quad 7$$

Aggregate industrial output

$$ip_t = \beta_2 ip_{t-p} + \beta_3 cpoil_{t-p} + \mu_{ip} \quad 8$$

Aggregate price-setting equation

$$inf_t = \beta_4 inf_{t-p} + \beta_5 ip_{t-p} + \beta_6 cpoil_{t-p} + \mu_{inf} \quad 9$$

Money demand equation

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

Money supply equation

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

Long bond yield

$$lb_t = \beta_{15} lb_{t-p} + \beta_{16} m_{t-p} + \beta_{17} r_{t-p} + \beta_{18} cpoil_{t-p} + \beta_{19} inf_{t-p} + \beta_{20} ip_{t-p} + \mu_m$$

The identification restriction used an information-based approach. The maximum number of parameters in A is N^{21} that is 36 and the maximum number of independent movements in the covariance matrix is $N(N+1)/2$. Thus, our SVAR model requires at least $N(N-1)/2$ full identified restrictions. Where oil price is assumed to be set independently from the macro-economic situation of Pakistan. Studies showed that oil price shocks are mainly caused by supply shocks in oil markets and by international

¹ $N=6$

¹ $N(N+1)/2 = 21$

¹ $N(N-1)/2 = 15$

crises that affect the demand for oil ([Hamilton, 1985](#)). Thus, the oil price is treated as exogenous in our model. We also assume that the 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 the lag of publication of data of these variables. The restriction on money supply depends on the timing at which information is available to a 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 banks mainly because these are available once ([Asaleye et al., 2021](#); [Gordon and Leeper, 1994](#)). Moreover, our model implicitly assumes that the financial market quickly reacted to the shocks in both goods and money markets. Thus, the long-term deposit interest rate is reflected by bond yields that observed any new information quickly.

We impose 16 zero restrictions to estimate our industrial output SVAR model. Thus, in total 20 parameters are to be estimated with 21 independent movements of the covariance matrix. Our model has one over-identified restriction.

3.2. Restrictions for Food Prices

Commodity Price equation

$$cpf_t = \beta_1 cpf_{t-p} + \mu_f \quad 13$$

Aggregate industrial output

$$ip_t = \beta_2 ip_{t-p} + \mu_{ip} \quad 14$$

Aggregate price-setting equation

$$inf_t = \beta_3 inf_{t-p} + \beta_4 ip_{t-p} + \beta_5 cpf_{t-p} + \mu_{inf} \quad 15$$

Money demand equation

$$m_t = \beta_6 m_{t-p} + \beta_7 r_{t-p} + \beta_8 inf_{t-p} + \beta_9 cpf_{t-p} + \beta_{10} ip_{t-p} + \mu_m \quad 16$$

Money supply equation

$$r_t = \beta_{11} r_{t-p} + \beta_{12} m_{t-p} + \beta_{13} lb_{t-p} + \beta_{14} cpoil_{t-p} + \mu_m \quad 17$$

Long bond yield

$$lb_t = \beta_{15} lb_{t-p} + \beta_{16} m_{t-p} + \beta_{17} r_{t-p} + \beta_{18} cpf_{t-p} + \beta_{19} inf_{t-p} + \beta_{20} ip_{t-p} + \mu_m \quad 18$$

The above system of equations is similar to oil price with few changes. The aggregate output equation does not include food price as it is not directly related to industrial production. On the other hand, money demand is directly affected by food prices Roussel et al, 2021; Khan and Ahmed, 2014 ;). Thus, the money demand equation also includes food prices. We impose 16 zero restrictions thus, a total of 20 parameters are to be estimated with 21 independent movements of the covariance matrix. Our model has one over-identified restriction.

3.3. Restrictions for Housing Prices

Commodity Price equation

$$cph_t = \beta_1 cph_{t-p} + \beta_2 ip_{t-p} + \beta_3 m_{t-p} + \beta_4 lb_{t-p} + \mu_h \quad 19$$

Aggregate industrial output

$$ip_t = \beta_5 ip_{t-p} + \mu_{ip} \quad 20$$

Aggregate price-setting equation

$$inf_t = \beta_6 inf_{t-p} + \beta_7 ip_{t-p} + \beta_8 cph_{t-p} + \mu_{inf} \quad 21$$

Money demand equation

$$m_t = \beta_9 m_{t-p} + \beta_{10} r_{t-p} + \beta_{11} inf_{t-p} + \beta_{12} ip_{t-p} + \mu_m \quad 22$$

Money supply equation

$$r_t = \beta_{13} r_{t-p} + \beta_{14} m_{t-p} + \beta_{15} lb_{t-p} + \mu_m \quad 23$$

Long bond yield

$$lb_t = \beta_{16} lb_{t-p} + \beta_{17} m_{t-p} + \beta_{18} r_{t-p} + \beta_{19} cph_{t-p} + \beta_{20} inf_{t-p} + \beta_{21} ip_{t-p} + \mu_m \quad 24$$

Housing prices reacted immediately to production activities (Zhou et al, 2020; Woodford, 2002; Goldberg and Knetter, 1997). The housing assets are forward-looking, so they react instantly to the macroeconomic situation of an economy. Further, the money supply has a 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. Thus, a total of 21 parameters are to be estimated with 21 independent movements of the covariance matrix. So, our model is perfectly identified.

3.4. Restrictions for Transportation Prices

Commodity Price equation

$$cpt_t = \beta_1 cpt_{t-p} + \mu_t \quad 25$$

Aggregate industrial output

$$ip_t = \beta_2 ip_{t-p} + \beta_3 cpt_{t-p} + \mu_{ip} \quad 26$$

Aggregate price-setting equation

$$inf_t = \beta_4 inf_{t-p} + \beta_5 ip_{t-p} + \beta_6 cpt_{t-p} + \mu_{inf} \quad 27$$

Money demand equation

$$m_t = \beta_7 m_{t-p} + \beta_8 r_{t-p} + \beta_9 inf_{t-p} + \beta_{10} ip_{t-p} + \mu_m \quad 28$$

Money supply equation

$$r_t = \beta_{11} r_{t-p} + \beta_{12} m_{t-p} + \beta_{13} lb_{t-p} + \beta_{14} cpt_{t-p} + \mu_m \quad 29$$

Long bond yield

$$lb_t = \beta_{15} lb_{t-p} + \beta_{16} m_{t-p} + \beta_{17} r_{t-p} + \beta_{18} cpt_{t-p} + \beta_{19} inf_{t-p} + \beta_{20} ip_{t-p} + \mu_m \quad 30$$

The transportation price is taken as exogenous in our model and it determines by the demand and supply of transportation and depends on many other factors like fuel price, capital, operational cost, depreciation cost, maintenance cost, and lubricants (Shain et al, 2009). The aggregate industrial input equation takes into account transportation costs as most industrial activities involve the movements of labor, raw materials, and finished

products from one place to another (Redding and turner, 2015). The rest of the restrictions are similar to oil prices.

3.5. Restrictions on Education Prices

Commodity Price equation

$$cpedu_t = \beta_1 cpedu_{t-p} + \mu_{edu} \quad 31$$

Aggregate industrial output

$$ip_t = \beta_2 ip_{t-p} + \beta_3 cpedu_{t-p} + \mu_{ip} \quad 32$$

Aggregate price-setting equation

$$inf_t = \beta_4 inf_{t-p} + \beta_5 ip_{t-p} + \beta_6 cpedu_{t-p} + \mu_{inf} \quad 33$$

Money demand equation

$$m_t = \beta_7 m_{t-p} + \beta_8 r_{t-p} + \beta_9 inf_{t-p} + \beta_{10} ip_{t-p} + \mu_m \quad 34$$

Money supply equation

$$r_t = \beta_{11} r_{t-p} + \beta_{12} m_{t-p} + \beta_{13} lb_{t-p} + \beta_{14} cpedu_{t-p} + \mu_m \quad 35$$

Long bond yield

$$lb_t = \beta_{15} lb_{t-p} + \beta_{16} m_{t-p} + \beta_{17} r_{t-p} + \beta_{18} cpedu_{t-p} + \beta_{19} inf_{t-p} + \beta_{20} ip_{t-p} + \mu_m \quad 36$$

We treat education prices 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 the literature (Barro, 1991; Patrinos and Psacharopoulos, 2011; Otalú and Anderu, 2015; Tsaurai and Ngcobo, 2020).

3.6. Restrictions for Health Prices

Commodity Price equation

$$cpchel_t = \beta_1 cpchel_{t-p} + \mu_{hei} \quad 37$$

Aggregate industrial output

$$ip_t = \beta_2 ip_{t-p} + \mu_{ip} \quad 38$$

Aggregate price-setting equation

$$inf_t = \beta_3 inf_{t-p} + \beta_4 ip_{t-p} + \beta_5 cpchel_{t-p} + \mu_{inf} \quad 39$$

Money demand equation

$$m_t = \beta_6 m_{t-p} + \beta_7 r_{t-p} + \beta_8 inf_{t-p} + \beta_9 cp_{hel}_{t-p} + \beta_{10} ip_{t-p} + \mu_m \quad 40$$

Money supply equation

$$r_t = \beta_{11} r_{t-p} + \beta_{12} m_{t-p} + \beta_{13} lb_{t-p} + \beta_{14} cp_{hel}_{t-p} + \mu_m \quad 41$$

Long bond yield

$$lb_t = \beta_{15} lb_{t-p} + \beta_{16} m_{t-p} + \beta_{17} r_{t-p} + \beta_{18} cp_{hel}_{t-p} + \beta_{19} inf_{t-p} + \beta_{20} ip_{t-p} + \mu_m \quad 42$$

We treat health prices 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 (Cooper et al. 2019; Frenkel and Jovanovic, 1980).

3.7. Restrictions for Clothing and footwear prices

Commodity Price equation

$$cp_{cf}_t = \beta_1 cp_{cf}_{t-p} + \mu_{cf} \quad 43$$

Aggregate industrial output

$$ip_t = \beta_2 ip_{t-p} + \mu_{ip} \quad 44$$

Aggregate price-setting equation

$$inf_t = \beta_3 inf_{t-p} + \beta_4 ip_{t-p} + \beta_5 cp_{cf}_{t-p} + \mu_{inf} \quad 45$$

Money demand equation

$$m_t = \beta_6 m_{t-p} + \beta_7 r_{t-p} + \beta_8 inf_{t-p} + \beta_9 ip_{t-p} + \mu_m \quad 46$$

Money supply equation

$$r_t = \beta_{10} r_{t-p} + \beta_{11} m_{t-p} + \beta_{12} lb_{t-p} + \beta_{13} cp_{cf}_{t-p} + \mu_m \quad 47$$

Long bond yield

$$lb_t = \beta_{14} lb_{t-p} + \beta_{15} m_{t-p} + \beta_{16} r_{t-p} + \beta_{17} cp_{cf}_{t-p} + \beta_{18} inf_{t-p} + \beta_{19} ip_{t-p} + \mu_m \quad 48$$

We treat clothing and footwear prices as exogenous. Further, we don't add clothing and footwear prices in aggregate industrial output as it doesn't have a direct impact on industrial production.

4. RESULTS & ANALYSIS

Table 1 shows the unit root test results. Where *lcpcf* is a log of food prices, *lcpedu* is a log of education prices, *lcphe* is a log of health prices, *lcph* is a log of housing prices, *lcpt* is a log of transportation prices, *lcpcf* is a log of clothing and footwear prices, *lcpoil* is a log of oil prices, *linf* is a log of inflation, *ir* is short term interest rate, *lb* is long term interest rate, *lm* is a log of money supply and the *lip* is a log of industrial output.

Table 1. Results of Unit Root Test					
Variables	ADF Test at Level		ADF Test at First Diff		Order 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)
Lcpcf	-2.203	0.206	-10.9**	0.000	I (1)
Lcph	-1.93	0.314	-3.30*	0.010	I (1)
lcphe	-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)
Ir	-1.95	0.306	-4.00**	0.001	I (1)
Lb	-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

All the variables of our analysis are stationary at first difference except clothing and footwear price that is stationary at level. We have to use SIC for the selection of lag length as it is best fitted for small samples. The lag length criteria for each commodity price are given in Appendix. To get a better understanding of the results, we represent the response of individual macro variables to each commodity price in one place.

Figure 1 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 the second month. Thereafter, it starts to rise and the impact

of oil price shocks dies out in 3rd month. The decline in IP may be due to a reduction in the production of oil-intensive industries. This decline is offset by the higher production in non-oil-intensive industries. However, this response is insignificant. These results are consistent with the findings of Fukunaga et al, 2011 and Scholtens and Yurtsever, 2012 that oil price shocks affect only oil-intensive industries so, the aggregate impact of industrial output depends on the nature of industries in the country.

In response to food price shocks, industrial output decreases significantly in the first month. As households spend a large portion of their budget on food items increase in their 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. These findings are consistent with the study of Ahmed et al, 2011 that noted the negative impact of international food price shocks on industrial output. Clothing and footwear price shocks also have a significant negative impact on industrial output in the short run. This decline is maybe because the textile industry is the largest manufacturing industry and a reduction in this industry's production significantly reduces aggregate industrial output.

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

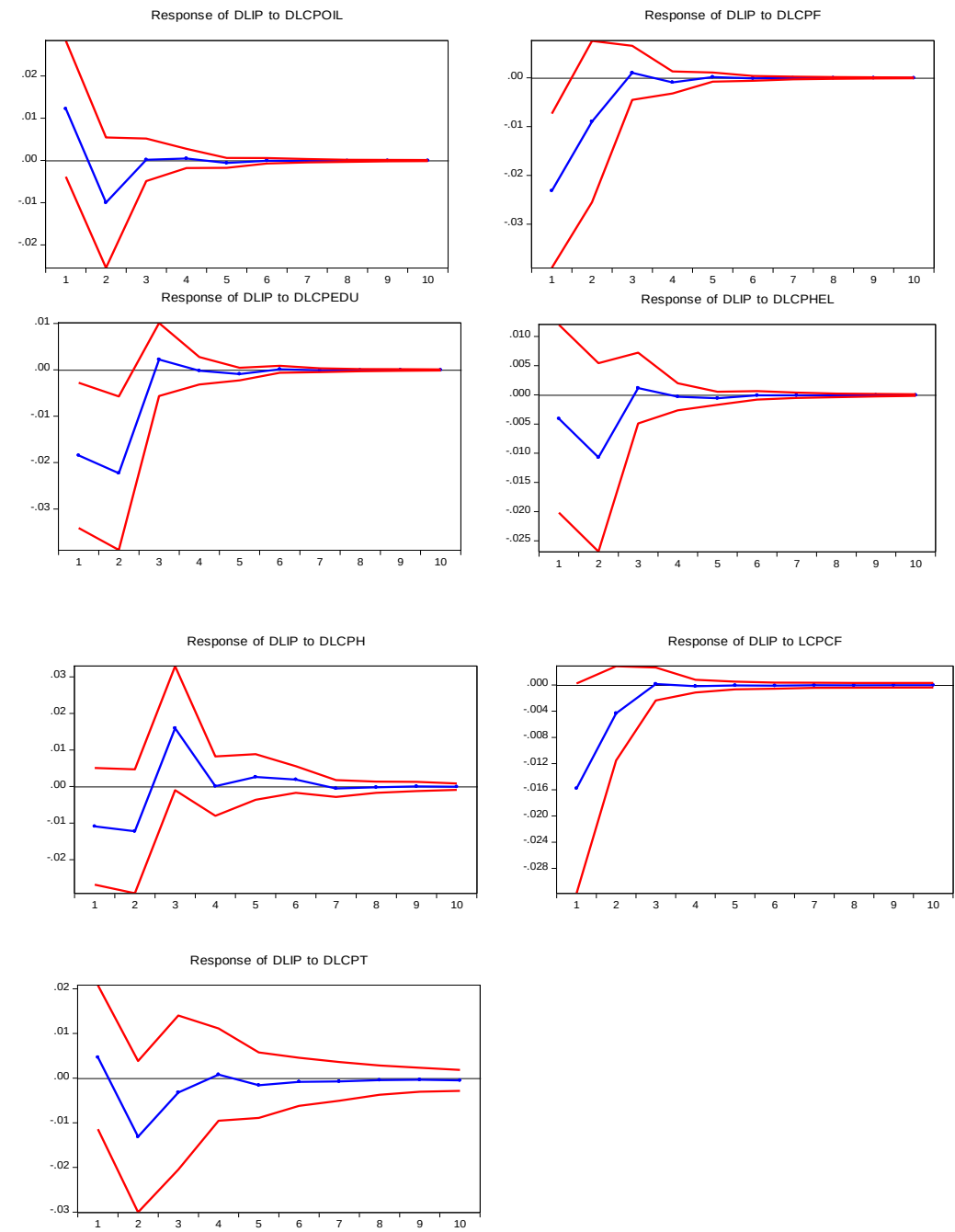


Figure 1: IRF of commodity prices and industrial output

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, the industrial output shows a significant positive impact in 3rd month. This positive impact on industrial output may be due to an increase in aggregate demand resulting from the wealth effect.

5. CONCLUSION

This study examines the impact of seven groups of commodity prices on the industrial output of Pakistan. It uses monthly data over the period July 2008 to June 2020 and employs the SVAR model for data analysis. We note that oil price shocks have a negative but insignificant impact on the industrial output of Pakistan. Oil is no doubt the main source of energy that plays an important role in industrial production and economic growth. However, the strength of the impact of oil price shocks depends on many factors like oil intensity in production, the share of oil import in total domestic consumption, monetary policy, government support, and efficiency of industries. Moreover, the education, food and clothing, and footwear price shock negatively and significantly affect the industrial output. Whereas, transportation and health price shocks have a negative insignificant impact and housing price shock has a mixed impact on industrial output.

Moreover, the results of our analysis show 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. The results of the analysis provide useful information to a policymaker that will help them to achieve their goals more effectively. For example, if policymakers want to achieve higher production in Pakistan's industry, 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 in the industry. Further, it can help policymakers to focus on control of the type of inflation that is more baneful and permit the one that renders positive results.

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