Economic Effects of Oil and Global Food Prices Shocks on Macroeconomic Variables in Pakistan

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DEDICATION

To my parents and husband

"Whether it was in my mental, physical, social, financial, or career development, they help me in every step of this journey."

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Shazia Kausar

ABSTRACT

Effect of fluctuation in oil price and global food price on macroeconomic variables is namely called oil and food price shock these fluctuations may include upward or downward movement in oil and food prices which are suggested by economic theory. These shocks are the main cause of policy vagueness and ambiguity in the economy. The spread of oil price shock and the association between these shocks and economic performance of a country give useful understanding to the policy makers regarding the fiscal and monetary policy. This study observe the transmission channels by which world crude oil and food price shocks disturbs the movements of carefully chosen macroeconomic variables which includes inflation rate, call money rate (as a proxy of interest rate), real effective exchange rate, stock price index, economic growth and quantum of industrial export for Pakistan economy by using quarterly data over the period of 1990 Q1 to 2018 Q4. A realistic and empirical analysis is supported by employing structural vector autoregressive model. To track the impact of world crude oil and food price shocks to Pakistan economy we employed Impulse response analysis and Forecast variance decomposition. Results reveals that world crude oil price shock has, negative impact on economic growth and real effective exchange rate, positive impact on inflation and call money rate. On the other way following world food price shock stock market do not have noticeable effect and call money rate and inflation have positive impact of shock. However the variation in call money rate are higher in presence of world oil price shock in comparison of food price. Forecast error Variance decomposition discloses that real effective exchange rate is most important base of deviation and instabilities in case of world crude oil price shock. On the other hand among all, we can say that real effective exchange rate is a main cause of deviations in Pakistan. This infers that supply and demand side instabilities initiated and originated by the external/exterior shocks which are the main cause of inflation and unemployment in Pakistan. To avoid these damaging affects to Pakistan's economy we need to search a path towards self-reliance in case of food and government should take the steps to maintain and achieve food security. Furthermore we needs to address the excess demand of oil by using other means of transportation and diversify our industrial sector in such manner that we produce high quality products by using other substitute as energy source instead of crude oil. By exploring the natural resources and crude oil

within the country balance of payment can recover its deficit and foreign dependence will also be condensed.

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LIST OF ACRONYMS

ADF	Augmented Dickey Fuller
AIC	Akaike Information Criterion
ARDL	Autoregressive Distributed Lag
COVID	Corona Virus Disease
ECM	Error Correction Model
EIA	Energy Information Administration
GDP	Gross Domestic Product
GFEVD	Generalized Forecast Error Variance Decomposition
HQ	Hannan-Quinn Information Criterion
IRFs	Impulse Response Functions
OECD	Organization for Economic Co-operation and Development
SBP	State Bank of Pakistan
SC	Schwarz Information Criterion
SVAR	Structural Vector Autoregressive
VAR	Vector Autoregressive
VECM	Vector Error Correction Model
WDI	World Development Indicator

CHAPTER 1

1 INTRODUCTION

1.1 Background of Study

Effect of fluctuation in oil price on macroeconomic variables is namely called oil price shock these fluctuations may include upward or downward movement in oil prices which are suggested by economic theory. These oil price shocks are the main cause of policy vagueness and ambiguity in the economy. The spread of oil price shock and the association between these shocks and economic performance of a country give useful understanding to the policy makers regarding the fiscal and monetary policy. The presence of oil price shock not only hurts the economy it also influence the monetary policy of an economy. Let suppose there is positive oil price shock in the economy, as oil price rise enhance inflation in the economy, then in the response of that particular shock central bank will increase the interest rate to tackle the problem of inflation.

As the world oil prices increases it will decrease the real income and may cause the loss of earning to the oil importing country. Perhaps this loss of earning is depending on the relative price elasticity of oil and how oil is being used by the producers in their production process. If the agents of economy like consumers are less responsive to the increase in oil prices this will leads to reduction of disposable income of consumers they will expend less on other goods and services which will reduce the GDP growth (Ghalayini, 2011). Furthermore an increase in oil price will increase the import bill of oil importing country as the payments are made in foreign currency, most probably these payments are made in the form of dollar, so the demand for foreign reserves will increase which will further increase the exchange rate. When exchange rate will increase then it means that foreign products are expensive for domestic consumers. Hence this increase in exchange rate will leads to lower market value of assets of the economic agents of oil importer economies. As most circulated and acceptable foreign currency is dollar and ultimately this rise in exchange rate will increase the demand of US dollar (Yılmaz & Altay, 2016). Escalation in exchange rate will cause outflow of foreign reserves and imports will become more expensive, as most of imports consist of machinery, raw material for industries like leather industry. Less availability of quality inputs and machines will hamper the growth of country and economic performance as well.

As most of the world institution those are related to international trade agreements are noisy and raises their voice for the free trade among countries. But the presence of free forces of demand and supply which is particularly called price mechanism which is very important for the developing economies like Pakistan which has the absolute share of food items in the country's total output. Free trade and pure price mechanism in the agro base economies may leads the economic prosperity and efficiency as in the absence of any protection from government from foreign competition will result in high rate of proficiency and efficient use of available resources. This price mechanism will also protect the poor farmers and consumers from the local monopolist. As in the presence of free trade agreements consumers will able to enjoy better quality products on lower prices and farmers will able to sell their produce in international market at higher possible rate. Most of the governments in Asia has been following price stabilizing policy and they are successfully achieving the results without any kind of protection against foreign/external rivalry. In the presence of such a huge foreign competition it is very difficult for the policy makers to introduce such versatile polies which may help to achieve economic stability. As the crude oil is nonrenewable natural resource and considered as main input in industry and also useful for transportation purpose hence its dependence is increasing with the passage of time and particularly dependence of resource poor countries, particularly developing countries, have been increase in the near future. For that reason it is very important that how this volatility affects the economic growth of an economy (Rafiq et al., 2009).

There is a bulk of empirical literature available including a seminal contribution by Hamilton (1983) which postulates that an upsurge in oil prices has a significant impact on the inflation trends of an economy (Younas & Khan, 2018). In Pakistan like developing nations, the government provides subsidies on oil and food prices for political reasons which mean customers do not face actual costs of the products. After a time lag, manufacturers also incline to transfer the load of greater input prices on customer prices. Likewise, swings in the rate of exchange, specifically weakening of local currency against a foreign currency like US dollars also exert inflationary pressure because the denomination of oil is US dollars. Since the global financial crisis 2008, Pakistan is fronting episode of stagflation (i.e. inflation and unemployment increase simultaneously. A series of supply-side shocks are documented as the root cause of current stagflation. These shocks unpleasantly influence the supply side performance via restricting the growth process which is already not enough to meet the demand burdens (Amjad et al., 2011). Consequently, there is an unmatched upsurge in poverty, unemployment, and domestic inflation levels.

A strand of literature reflects that there are several factors that can be involved in the increase in the cost of production and lead to global food inflation crisis, for example, energy price fluctuations, swings in the rate of exchange, biofuel expansion, and economic growth.

To calculate these influences, there is an immense need to establish an empirical model, especially for developing economies. Some other scholars highlight that the swings in food inflation are a result of shocks to demand and supply levels, higher prices, and market operations. Gilbert & Morgan (2010) quantitatively specify that high volatility in a commodity is caused by high price levels. Also, the swings in food prices have a substantial impact on consumers as well as producers. The upsurge in food prices and the anticipation of increasing food price trends encourage food producers to increase the production levels of food. Given that the selling price is above the input price, the producers will increase their investment that leads to higher profits. Moreover, as mentioned by Braun & Tadess (2012), food price swings are vital in the process of decision making of risk-averse households.

There are three kinds of factors involve in the high volatility of the commodity market of an economy. First of all, the quantity of the agricultural product differs because of several kinds of natural factors, for instance, drought alike natural disasters which make it hard to guarantee stability and consistency in the levels of production. The second factor is that the elasticity of food demand is small with respect to low price and supply elasticities of the agrarian items. Lastly, as a substantial amount of time is required for the production of agricultural products, the level of supplies cannot react to the swings that might happen in prices. According to OECD (2011), "there is little sense of the size of the cost of the fluctuations that occur in the price of agricultural goods and the mitigating effects of the fluctuations in applied fiscal policies". A strand of literature (Newbery & Stiglitz, 1981; Williams & Wright, 1991; Jha & Srinivasan, 1999) indicate that the price swings distributional effects may be significant but the loss creation from it will be lower in level, so it is very hard to regulate the economy with plans of price stabilization. Some other scholars (McGregor 1998; Timmer 2000; Dawe, 2001; Myers, 2006) mention that the welfare analysis snub the food price stability and its participation in food security and economic development.

During the period of 2006 to 2009, the global economy faced a severe upsurge in the prices of major agricultural products. In literature, it is recognized as the "Global Food Crisis" in which the food prices shoot up by a phenomenal amount during the global financial crisis period. According to an OECD report (2011), more than 60% increase was recorded in two years. The crisis did not finish there. The world food prices faced a sharp boost in 2010 again which surpassed the previous peak of 2008 before confining a little during the end of 2011. A boost in the recent food prices has raised serious concerns about food security, particularly with their impact on the most sensitive population segments for instance deprived and poor people and their families. Academics describe that the increasing trends of food prices are expected to increase for a short time but the volatility increase in the food prices provides an additional challenge.

There is a series of studies that have explored the consequences and basis of the increasing trends in food prices. An important study conducted by Trostle (2008) specifies that the quick expansion in the crude oil prices, upsurge in global demand, US dollar depreciation, and several other economic features are the key aspects that have all backed and involved in the growing prices. To restrict the local food price upsurge that worsens the condition by shrinking the situations, several arrangements have been booked by the importers and exporters. Gilbert & Morgan (2010) endorse that "additional factors specifically, the rapid economic growth, particularly in China and other Asian economies, and the speculative and expected trade in agricultural products which play in such price dynamics". However, Headey & Fan (2008) describe that in their critical and broad review that the India and China role may not be as great as advised because both economies are comparatively self-reliant in their respective food supply. Additionally, they are ambiguous in the sense that financial market speculation is the key source of the current global food price crisis that may cause the nonexistence of perfect connections between spot and futures prices.

Despite the upward trending rise in global food prices during the last couple of years, the policy suggestions for the poverty and overall economy are flawless. Heady & Fan (2008) mention that, at the macro level, the increase in food prices would have an influence on the magnitude of fuel and food import bills, trade allied and marketing policies, own pattern of food consumption, amount of foreign exchange reserves, exchange rate arrangements and so on. While the overall net impacts on the economic welfare of a country reliant on whether the country is a net food exporter or importer economy. Keeping a number of country-specific factors fixed, the impact would be larger if the economy is the importer of food products. On the other end, at a micro-level, Trostle (2008) describe that a rise in the price of basic necessities can be damaging for numerous consumer with lower earnings. Ivanic & Martin (2008) use virtual reality and identify that the deprived and poor people from low-income economies are normally the households of food consumption who disproportionally more influenced by the rise in global food prices. There are several indirect channels, other than the direct income effect, through which household welfare can be affected by an increase in food products. For instance, poor and deprived consumers are basically short of earnings with lower real income levels that may force them to forgo the education of their children, thus disturbing the development of human capital. A noble concern of the determinants of food products inflation and its volatility is essential to formulating an appropriate policy agenda to cope up with these problems. In this respect, in literature, the majority of the economies under consideration are small open economies, and their prime focus was on the interest that may be shifted to domestic food prices from external shocks.

Higher food price volatility or variability and high food prices are threats to food security in plenty of manners. Briefly speaking, variabilities in food prices perpetrate the costs of economic agents like government, producers, and consumers facing the liquidity constraints as it is very normal in developing economies case. High variability and higher pricing trends are often linked with one another and variability in prices are usually higher in the period of higher inflation because of the core rigidity in demand and supply. Similarly, high variability and higher pricing trends are mainly evil for both consumers and producers when they happen in the period of shocks and general economic uncertainty. The Asian continent is highly affected by the recent two global food price shocks along with the global financial crisis of 2008 as it has the highest population proportion in the world with the highest poverty rate and food insecurity. Additionally, several studies have verified that the global financial crisis year 2008 played a crucial role in increasing the number of hungry people around the world. The largest anticipated increase was observed in Asia.

The food price upsurge in 2008 had the highest influence on Asian economies. Another important thing to mention here is that the majority of the food prices around the world are dominated in the dollar terms that may have exaggerated the real rise in global food prices as many Asian economies remarkably appreciated against US dollars. Different researchers provide different justifications for the upsurge of global food prices in 2008. One reason behind this upsurge mentioned in the literature is “such a gigantic shock that was because of fall in real prices during the previous two decades, and otherwise, there was unusually low price volatility around the diminishing trend”. The global community and several national governments have overlooked that this empathetic consequence was the outcome of enormous world level attempts to boost food production after the crisis which increase during the 1970s. The food disaster also motivated the administrations to focus on increasing productivity and food production. In some of the countries, general assistance was provided by the global community to the deprived consumers who were affected most by the higher food prices of 2008. The instantaneous action taken by the government was to guard the domestic prices against the global upsurge in food prices. These kinds of actions and responses to the price increase varied from country to country. One thing is clear that every country restructured its trade policies to cope up with these crises as well as the protection of domestic producers. Researchers report that several trade policy interventions carried by different governments were proved operative in alleviating the swings of domestic food prices. However, every economy had to mediate by pursuing different strategy measures which were varied from each other.

World crude oil price and food price shock has a starring role in Pakistan economy. Pakistan is importing oil in a large quantity so slight change (increase) in world crude oil price may have damaging effect on economy. That is why it has great importance to examine the economy in the presence of crude oil price shock in situation of Pakistan. As oil is key input in major industries. After a keen evaluation of the previous literature, we are so far unable to figure out a single study that examines the oil price shocks and their effects on Pakistan's economy. So, the purpose of the current study is to examine the effect of oil price shocks on macro variables of Pakistan.

1.2 Overview of the Issue

Oil prices have been recognized as the most crucial variable in describing the economic activity of an economy. Macroeconomists believe that, in the majority of the developed economies, swings in oil prices were the key factor behind high inflation, high unemployment, and low economic growth of the mid and late 1970s. Fluctuations in oil prices can also suppress the GDP growth of an economy by influencing the demand and supply of goods other than oil. Concisely speaking, because of the escalation in the cost of production, an upsurge in oil prices can dampen the other goods supply. According to basic economics texts, there are always losers and winners in the swings of oil prices. In the recent COVID-19 oil price shocks, the winners are oil importing countries like Pakistan while losers are exporting countries like Russia and OPEC economies.

Consequences of the oil price shocks of the 1970s, it has been growing attention of the scholars in understanding the dynamic impacts of oil production shortfalls on the swings in real oil prices. A strand of literature documents that oil price shocks have been the key reason behind 1970s stagflation, the slowdown in factor productivity, higher inflation, and other US recessions. Oil prices have also been held responsible for changes in energy technologies, for far-reaching labor market adjustments, and fluctuations in monetary policy response functions. The research conducted during the last couple of years has confronted the general perceptions about the consequences and causes of oil shocks. The connection between unemployment, economic activity, and oil price swings is a noteworthy subject that has been researched predominantly in most advanced and industrialized economies.

A plethora of empirical literature has examined the linkages between economic activity and oil price swings but there is no serious attempt has yet been made on the linkages between global food and oil price shocks with major macro variables of Pakistan. The idea of a micro foundation can be used to explain the macroeconomic impacts of oil swings on an economy. When a positive oil price shock is observed by an economy, the general public is likely to think about the boost in gasoline prices as well. Since almost every consumer buys gasoline as it is a necessity for the households, an increase in gasoline prices leads to an increase in the expenditures of the general public. In other words, household budget allocation share to purchase of gasoline significantly increases with the oil price shocks which leaves less to spend on other products. The same is applicable for the suppliers whose products must be shipped from one point to another that require oil as input for example, train and airline industries. The shocks in oil prices make the production process more expensive for the companies, same as they affect the general public to do things they generally do. Likewise, the reverse holds for the negative shocks in oil prices.

So far we have discussed that how swings in the oil price (or shocks to oil prices) influence the business organizations and general households; how oil prices influence the macroeconomic variables of an economy is still ambiguous. As mentioned earlier, generally positive oil price shocks have a significantly negative impact on GDP growth and a positive influence on the inflation rate. In the case of inflation, the products made with the use of fuel as input are directly influenced by the oil price shocks. The costs like manufacturing and transportation indirectly increase the prices of products when oil prices shoot up. The increase in these kinds of costs affects the prices of several kinds of products, as manufacturers may transfer on production costs to customers. The degree to which oil shocks lead to buyer price upsurges be determined by how essential oil is for the making of a given kind of product and service.

The rationale behind this research are some historical and strategic issues that arose after 90’s in Pakistan. As Pakistan became atomic power in the year 1999. And after the successful experiment of atomic explosion at that time Pakistan had faced lots of restrictions from the developed countries that also hurts the trade agreements and contracts regarding oil exports (William Walker 2007). Furthermore after 2000 most of the commercial banks induce public to buy vehicles from banks on instalments basis which results in too many cars had been started running on road by the public which also increase the demand of oil (Shehzad 2015). Oil is significantly contributing in the balance of payment deficit because local exploration and production of oil is much more less than the domestic demand. Secondly rapid increase in world population, as well as population of Pakistan, enhance the world demand for food. We want to examine that this rise in population to which extend it effect the global food inflation. Perhaps population growth rate of Pakistan had declined over the period of time but still it is greater than 2 % (Ayhan, 2018).

1.3 Research Questions

The research questions are as follows:

- Is impressions of world crude Oil price and Food price shocks on performance of particular Macroeconomic Variables in Pakistan is significant.
- Is there exist a long run association and connection between external shocks (world crude oil and global food price) and Macroeconomic variables in Pakistan.

1.4 Objectives of the Research

The main purpose of conducting this research is as follows,

- To examine the impact of Oil and Global Food price shocks on particular Macroeconomic Variables in Pakistan.
- To examine long run association and connection between external shocks and macroeconomic variables in Pakistan.

1.5 Significance of the Research

There is emergent literature which inspect and put their eyes on the influence of exterior shocks such as world crude oil price shocks, remittances and global food prices on vast level performance of economy and macroeconomic variables of a nation. But when we thought about South Asian region is we were unable to find empirical analysis of the issue stated above. Perhaps many of Asian countries are importer of oil and food. To the greatest understanding we can say that our analysis covers monetary side, financial side and growth of economy simultaneously. This is the one of fewest and rarest study for Pakistan economy that exclusively and empirically assess macroeconomic effects of world crude Oil and Global Food price shocks on the economy using Structural VAR model by means of latest data of time series.

CHAPTER 2

2 LITERATURE REVIEW

Crude oil is the main foundation stone of prosperity and development of any economy and it is considered as vital raw material in the production process as well as it is the main energy source in the world. Oil plays a key role in each and every sector of the economy such as energy sector, transport sector and most importantly industrial sector (Nazir & Hameed, 2015). Oil is basically considered as main input in the production of electricity, it also needs to operate the machines in industry and transport goods and services from one place to another (Rafiq et al., 2009). As it is the matter of fact that each country has different resources as compare to other. Oil is a natural resources that is a gift of God. This geographic imbalance of hydrocarbons may cause the disparity among country and these resources poor country buy these products from abroad. Therefore a rise or fall in oil prices may cause different impact on economic performance and economic stability of oil importing and exporting country. For example the effects on oil importing country and oil exporting country varies. The countries those who exports oil will be benefited by the upsurge in oil prices and oil importing country will has a worsen impact on economy due to rise in oil price. Impact on oil importing country is depending on the elasticity of oil relative to price (Sek, 2017).

The economists and politicians have a greater interest in the title role and subjective importance of crude oil in the world economy. The scholars have attempted several time to examine the linkages between global or domestic oil price swings and major macro variables including unemployment, inflation, wage rates, GDP growth, and exchange rates. After a review of the bulk of studies, we observe that the literature is still far from reaching a universal harmony or consensus. This chapter deals with the review of some of the influential studies conducted by researchers in both developing and developed economies from a variety of perspectives. As the title of this dissertation suggests, the prime focus of the chapter is on the studies related to oil price shocks and food price shocks. A universal consensus among the researcher is that the majority of oil price shocks come from the supply disruption provoked by exogenous political actions in the MENA region, but during the last couple of years, this consent has been crushed. As mentioned by Kilian (2010) that latest research oil supply shocks has an effect on world crude oil price furthermore he claimed that in future this shortage of oil will increase the speculative demand of oil.

Beginning with the most prominent work by Hamilton (1983), the oil price impacts on an economy has been a widely discussed topic in energy economics. In order to find the impact of oil prices on macroeconomic variables of an economy, a commonly used approach is the VAR model which is developed by Sims (1980). Hamilton also uses this approach for the US data over the period of 1948 to 1980 and concludes that there is a strong association exists between oil prices and GNP growth of the country. The author also highlights that, after World War II, every recession of the country is followed by an increase in fuel prices at a higher rate. Some other scholars (Gisser & Goodwin, 1986; Mork, 1989; Lee et al. 1995; Younas & Khan, 2018) extends the analysis of Hamilton (1983) and report that the oil price shocks have adverse impacts on the GDP of an economy. Following the Hamilton (1983) analysis, Mork (1989) highlights by extending the study period of Hamilton's analysis up to 1988 that swings in oil price correlation with GNP growth only marginally significant. Also, more notably, there is an asymmetry exists in properties i.e. there is a strong negative correlation between GNP growth and positive oil price shocks but this correlation becomes insignificant when the US economy faces negative oil price shocks.

Different scholars use the oil price shocks' impacts on an economy from a variety of perspectives for instance (Leduc & Sill, 2004; Haung, et al. 2005; Cologni & Manera, 2008) have focused on the oil price shocks links with macroeconomic policies of the country. These researchers have analyzed the possibility of disappearing linkages between macroeconomic activity and oil price swings. Some other scholars (Dohner, 1981; Husain, et al., 2008) examine the connections between terms of trade and oil price shocks. They indicate that, for oil-importing countries, terms of trade get worse with the oil price increase. Some other researchers (Pierce & Enzler, 1974; Mork, 1994) links the oil prices with the money market and conclude that an upsurge in oil prices have a significant impact on the real money balances as it affects the economic growth, rate of interest, and money demand. Hooker (2002) mentions that the monetary authorities' reaction function is the key driver of 2nd round impacts of swings in oil prices. He further suggests that the fiscal and monetary policy response may not be neutral to negative food price shocks and positive oil price shocks. Burbidge & Harrison (1984) describe that the key force behind higher inflation trends of an economy is positive global oil price shocks.

Another contribution is made by Davis & Haltiwanger (2001) in which they use the VAR model to analyze the oil price shocks and indicate that these shocks have significant importance in the short run swings of job destruction. Their analysis covers the period of 1972 to 1988 and further mentions that the findings are asymmetric in nature i.e. response to oil shocks are job destructive and not the job creator. Also, the impression of oil shocks is almost double than the monetary policy shocks in the United States. Lee & Ni (2002) also apply the

VAR analysis on the industry level data of the US to analyze the impacts of oil shocks on different industries and highlight that there is a short-run impact of oil price shocks on the industrial outputs. Moreover, they explore that shocks to oil prices influence both industrial supply and demand forces. It lowers down the oil-intensive industries' supply and simultaneously declines the industrial demand of other sectors like the automobile. Additionally, Lippi & Nobili (2009) examine the structural shocks including industrial production, oil costs, and other macro variables for the United States data. Results conclude that positive oil demand shocks have a positive and consistent influence on the US GDP while negative supply shocks lower down the US output. Another study conducted by Francesco (2009) demonstrates the oil price shocks impacts on United Kingdom services and manufacturing data. He specifies that the linear data analysis reports the positive impact of oil shocks on the output of both services and manufacturing sectors while the asymmetric data analysis report that a positive oil price shock has a negative impact on the manufacturing sector and has no impact on the services sector of UK.

A seminal contribution is made by Brown & Yueel (2002) in which they explore the several transmission channels through which a shock to oil prices can influence an economy i.e. the macro variables of an economy. Due to swings in the marginal costs of the goods and services, the oil price shocks have a direct influence on the output levels. Also, there are some indirect impacts of oil price shock on the products and services. They mention that “there may also be sectoral adjustment effect of oil price shock that arises out of asymmetry in oil price shock impact on different sectors of the economy”. There is now a bulk of literature is available that examines the oil price shocks' impacts on the local economy especially on the exchange rate, GDP, and inflation levels. Some of the key studies from both developed and developing economies include (Hooker 2002; Cunedo & Garcia 2005; Blanchard & Gali, 2009; Younas & Khan, 2018; Rizwan et al., 2019).

There is another strand of literature that follows the analysis of Hamilton and establishes a negative association between oil shocks and macro variables of an economy. Hamilton is recognized as the father of oil price shocks impacts where he conducted several studies on this subject and conclude that US recessions are exaggerated by the oil price shocks. He further reports that seven out of eight postwar US recessions are processed by a shock in the prices of crude oil. He further highlights the importance of the oil price shocks for an economy as these shocks have strong associations with macro variables of an economy. After that several economists and researchers further extend Hamilton’s work in which some nullify his findings while others supported his conclusions via using different econometrical techniques and datasets to explore the linkages between oil price shocks and macro variables of the country.

The majority of the previous works on oil price shocks and volatility impacts on the economy are conducted from the perspective of advanced and developed countries. There is very limited literature available on this subject in the developing economies context. The prime reason behind the lack of literature availability on the developing economies is maybe their less reliance on crude oil. However, recently the developing economies are experiencing higher energy demands to meet the increasing industrial requirements. Overall, very few number of studies are available from the perspective of developing economies. Some important industries in this regard include Jbir et al. (2008) analysis for Tunisia, Cunado et al. (2005) study for six Asian economies, Kumar (2005) analysis for the Indian economy, Rafiq et al. (2008) research for Thailand, Younas & Khan (2018) for Pakistan economy.

Some researchers emphasize the strength and magnitude of the oil price shocks from different standpoints. An influential contribution in this regard is made by Burbidge & Harrison (1984). For the OECD countries, they use the VAR approach and conclude that oil price shocks have adverse impacts on the major macro variables of these economies. Though, they mention that there are discrepancies between the oil price shocks of 1973 and the oil price shocks of 1979. Relatively, the impact of oil price shocks on major macro variables is stronger in their conclusions. Blanchard & Gali (2007) observe the same kind of relationship strengths. In this study they contend that oil price shocks of the 1970s and 2000s are dissimilar due to four key reasons; 1) improved monetary policy, 2) more flexible labor markets, 3) minor share of crude oil in production, and 4) shortage of contemporaneous adverse shocks with recent oil price surprises. As per their conclusions, due to these four reasons, the impacts of 2000s oil price shocks are slighter than the oil price shocks of the 1970s.

Raymond & Rich (1997) apply the Markov-state switching approach to examine the oil price shocks impacts and specify that "that net real oil price increases contribute to the modifications of the mean growth rate of GDP during 1973-75 and 1980 recessions and it partially explains the shift of 1990-91 recessions". The Bohi (1991) analysis indicates that the recessions of the 1970s are not supported by the oil price shocks data. His analysis further determines that there is no connection exists between economic variables of the manufacturing sector and the energy concentration of four developed economies. Another key conclusion of the study claim that the monetary policy can be an alternative justification of recessions. Gal-Hochman et al. (2014) analysis reveal that "if inventory possessions are not taken into account, the influences of the several factors on food commodity price inflation would be misjudged". Though their model clarifies that the majority of price swings observed during 2001-11 are not able to explain in this perspective. Some other features, for instance, natural and weather shocks, trade policy, and speculation etc. which have not been incorporated in their analysis may be responsible for the persistent involvement in the shoot-up of food prices.

Bjornland (2000) use the datasets from four key economies including Norway, Germany, UK, and the US to define the dynamic impacts of oil price shocks, aggregate supply, and aggregate demand. Results reveal that, except for Norway, oil price shocks have a negative influence on the GDP of these economies. Cunado & Gracia (2003) examine the movement of GDP movement and behavior of oil prices in selected European economies by applying VAR cointegrating approach. Even though varied outcomes for different economies reveal, they indicate that oil price swings have negative influences on the general macro variable activity of an economy.

Abbott et al. (2009) provide a comprehensive analysis of the food crisis after reviewing a bulk of literature and research reports. They conclude that there are several factors involved that play a role in the upsurge of food prices. Some of the key factors include the introduction of biofuels, swings in food consumption patterns, global fluctuations in production due to natural and climate shocks, and depreciation of the exchange rates. But they fail to provide quantitative assessments of the percent contribution to the upsurge of food prices in terms of a particular factor for instance consumption of biofuels role in food prices. According to FAO report (2018), increasing demand for biofuels is only one among a series of elements that encourage a boost in the products and agricultural prices. Another USDA report (2016) also highlight the elements important to the price upsurge of food products and reveal that "the buildup in the commodity price reflects a trend of slower growth in the production process and more speedy growth in demand that led to a narrowing of the world balances of grains and oilseeds over the last decades". Some other reports specify the composite interaction of elements that define the dynamics of diverse food-centered crops. In recent years, biofuels is documented as one of the key supply and demand-side factors that involve in the boost of food products prices and increase in production. On average, the effect of biofuels on grain prices ranges from 20 to 60 percent in different studies. The global results of both the contribution of biofuels and increase in food products to this increase hide the regional level disparities.

Rose (2010) use the simulation-based method to analyze the impacts of biofuels. He mentions that "the weighted average of grain's price increased by 30% with the rate of growth of demand for biofuel observed between 2000 and 2007. This upsurge was highest for maize (39%) and lowest for wheat and rice that was 22% and 21%, respectively". The similar kind of analysis is conducted for the US ethanol production in 2007 which may have been "accountable for a 15 to 28% increase in the world price of maize and 10 to 20% rise in the world price of soy". In recent years, the data mention that rice and wheat crops, which have not been utilized to a greater range as the biofuels, are the crops that have the maximum percent increase in inflation. However, Lee et al. (1995) suggest the volatility adjusted measure and reveal that there is no sign that macroeconomic impacts of oil shocks be determined by the volatility. Lescaroux & Mignon (2009) apply the factor augmented VAR approach and report that there is a strong positive association exists between interest rate, PPI, CPI, and oil price shocks. Also, there is a negative impact of oil price shocks on investment, consumption, and output for the Chinese economy. In the same way, Tang et al. (2010) use the SVAR model for the Chinese economy to study the long-run and short-run impacts of oil price shocks. They mention that a rise in oil prices has a negative impact on investment and output but a positive influence on the rate of interest and inflation. Concisely speaking, positive oil price shocks have an adverse impact on the Chinese economy.

Chambers & Just (1982) examine the impact of the monetary aspects at the macro level on agricultural products in the United States. They reveal that "monetary policy has decreased the prices of domestic agricultural products and increased the demand whereas foreign exchange fluctuations have hurt the US agricultural product export position in the international markets". Barnett et al. (1983) review the linkages between expansionary monetary policy and the food prices and conclude that supply of money is a vital force in defining agricultural products prices. Similarly, Ng & Aksoy (2008) investigate the impact of food price increase on the food importing economies with low-income levels. They reveal that food price shocks have an adverse influence in the trading of food for low-income economies however the contradictory impacts are observed for the economies that fall in the middle-income category. Abbott et al. (2008) analysis revolves around the determinants of food prices. They identify three key factors behind food inflation which are consumption and development of biofuel production, swings in production level, and depreciation of the US dollar. Several scholars extend this later and report that the food prices are not only influenced by these factors but also some other aspects play the role that originates from complex global economic events.

Roach (2010) investigate the low-frequency swings in food prices and reveal that the rate of interest and exchange rate have a noteworthy impact in defining these low-frequency swings. Another influential study is conducted by Apergis & Rezitis (2011) in which they examine the connection between food prices and major macroeconomic variables. Results describe a cointegrating relationship between volatility in GDP, the real rate of exchange, the proportion of real deficit, and real money balances. Hochman et al. (2014) investigate the reasons for crisis within food prices by incorporating the impact of inventory on the volatility of prices. They mention that the influence of different factors on inflation associated with food price will be overestimated if the inventory level is not accounted for. Likewise, Tadesse et al. (2014) look at aspects that cause food price volatility. Results report that the interconnection between foreign shocks and financial markets, energy and food play a substantial part in describing the food price volatility. Paladines (2017) paper examines the linkages between food price and oil price shocks over the period of 1980 to 2015 for Ecuador's economy. He applies the SVAR approach to annual data and shows that global food price shocks have no impact on inflation and economic growth.

Another seminal contribution to this debate is made by Blinder (1982) for the US economy in which he discusses that “large unavoidable alterations in relative prices” are the main reasons behind the 1970s high inflation episode. He states that “despite the discordance of criticisms about ‘ruinous’ budget deficits and the excessive monetary growth, the dramatic speeding up of inflation between 1972 and 1974 can be traced to increasing food prices, mounting energy prices, and the end of the Nixon wage-price controls program”. He further claims that the early stimulus for hastening inflation in 1978 come predominantly from the food sector in the US. He also describes that the 1970s crisis is different from all previous crisis. On the same subject, Terrain et al. (2008) show that the removal of wage-price controls in 1973-74, two roughly harmonized food price shocks, and two oil price shocks from OPEC are the macroeconomic event that establishes great stagflation in the country. They further mention that aggregate demand and money supply are the players, however, communicate that in difference to the 1970s experience, supply shocks since that time have had much a smaller amount of an impact on inflation in the US. They describe that this is due to plenty of factors.

First of all, in the structure of the US economy, there have been several changes that happen over time (Blanchard & Galı, 2007). In the 1970s, food considers a minor element of the basket of consumption. Secondly, in the response to supply shocks via monetary policy, there have been a lot of changes. The central bank focused on core inflation. Similar kind of changes has been observed in the UK monetary policy as mention by Batini & Nelson (2005) while in several other countries are observed by Rogoff (2003). Thirdly, in difference to the 1970s experience, shocks in food price were in actual fact lacking in the 1980s-1990s and an index of world food prices depreciated gradually during that period. Though, a series of food price spikes are observed again in the 2000s (i,e. 2004, 2008, and 2012). These developments, joint with the view that food prices could persist raised for a continued period, elevated fears that food prices can again spill over into higher inflation levels. That distress was mainly serious for developing and emerging countries, while the food share in the baskets of consumable goods remains high and monetary policy may absent the trustworthiness to retain inflation anticipations fixed.

Apergis & Rezitis (2011) examine the swings in food prices and how they influence the major macro variables of Greece's economy. They use the GARCH and GARCH-X approaches to find the answers to understudied research questions. Results mention that there is a strong positive connection between deviances and volatility in food prices. These findings have significant implications for both consumers and suppliers because increasing volatility intensifies the uncertainty ambiguity in the food marketplaces. Once the supplier, consumer and participants get a signal of food price volatility then this may lead them to approach the government for increasing intervention in the investment resource allocation and it can lower down the general welfare of the country.

Another important study is conducted by Kavila & Roux (2017) in which they examine the linkages between inflation and major macroeconomic shocks via applying the VECM model on monthly data for 2009 to 2012. An important conclusion of the study is a positive connection between inflation and food prices in an economy. Additionally, Solaymani & Yusoff (2017) study the Malaysian economy in which they examine the effects of agricultural prices and high food prices on poverty level and economic performance. Results show that an increase in agricultural productivity level is a highly efficient approach to lower down the adverse influences of shocks on global food prices as compared to the agricultural support option. The study also mentions that there has been a substantial rise in the prices of agricultural products in 2006 and 2008, but after mid of 2008, a considerable reduction was detected as the financial crisis on track.

The reasons for swings in prices have been studied by several scholars (Mitchell, 2008; Abbot et al., 2008; Cooke & Robles, 2009; Gilbert & Morgan, 2010; Younas & Khan, 2018). Gilbert & Morgan (2010) report that the key reasons for price swings include insufficient long-run agricultural investment, fast economies of scale growth in China and other Asian countries, and inventory levels that are preserved small. Abbot et al. (2008) specify exchange rate depreciation is the key cause of inflation. Mitchel (2008) describes the diversion of food crops to biofuels production while Cooke & Robles (2009) and Gilbert (2010) indicate the speculations are the key reason for inflation. As far as emerging economies are concerned, there is a series of studies available that analyze the impact of external shocks on the economy. A persuasive study is conducted by Mackowiak (2007) for the US economy and concludes that shock to monetary policy not only influences the interest rate and rate of exchange but also affects the output and general price levels in the country. Allegret et al. (2012) mention that US monetary policy, external oil price shocks, and US output have significant importance in the stimulation of the rate of exchange, output, and domestic price of the East Asian economies. In the same way, Nguyen et al. (2014) identify that the US monetary policy shock and global oil price shocks are vital in defining the swings in major macro variables of East Asian economies relative to that of US variables.

CHAPTER 03

3 DATA AND METHODOLOGY

3.1 Data Construction

In this particular study, we used the quarterly data of variables including oil and global food prices along with the major macroeconomic variables of Pakistan for the period of 1990-2018. Our main emphasis is to reconnoiter the waves of worldwide food price and oil price shocks on major macroeconomic variables of Pakistan. These macroeconomic variables which are under consideration in this research to explore the economic performance of Pakistan and their long run behavior we may include six macroeconomic variables which may include monetary side variables (interest rate), variables which are related to twin deficit (GDP, real effective exchange rate) and stock market. These variables are stock price indices, inflation, economic growth, quantum of industrial export, real effective exchange rate (REER). Here oil price and global food price indices are two external variables , those variables which are not inside part of the model but they have an influence on the variables included in the model, and remaining all are internal variables more specifically we can say that endogenous variables. Internal variables are those whose are deliberately incorporated and measured in the model. Global food price, oil price, inflation, quantum of industrial export and call money rate measured in percentage and rest of the variables measured as million Rupees. Economic rationale behind the selection of the variables in our model is that oil price has substantial influence on cost of production and mobility cost of goods and resources as well which brings inflation in the country. As we know that Pakistan is spending its huge foreign reserves to come across import bills/expenditures so it is very important in the discussion to include the variabilities in the exchange rate. When inflation rise is a country in a particular period of time then monetary authority come in action and increase the interest rate. To measure at which extend our monetary authority response to these shocks we incorporate interest rate as a policy variable in our model. Food is necessity of life and oil is very important for movement, from one place to another, of resources and production of goods hence both plays a key role in a country's prosperity so we added economic growth as variable in our model. Stock market is also linked with both of the shocks so to examine the impact of oil and food price shocks on stock market we incorporate stock price indices in our matter of discussion. A major source of the secondary data is the International Financial Statistics (IFS), World Development Indicator (WDI) and State Bank of Pakistan (SBP). The statistical package we used in this research process is E-Views 9.0 and 10. Complete detail of each variable that we incorporated in this research process are given below:

3.2 Variables Description

3.2.1 Crude Oil

According to Energy Information Administration, “crude oil means a mixture of hydrocarbons that exists in liquid phase in natural underground reservoirs and remains liquid at atmospheric pressure after passing through surface separating facilities”. Generally speaking, it is an unrefined petroleum product which composes of organic materials and hydrocarbon deposits. It can be refined through highly innovative machines to make products that can be used by the general public for instance, petrol pump fuel, diesel, gasoline and other kinds of petrochemicals. Crude oil price has been measured in index/percentage form and year 2010 taken as the base year.

3.2.2 Stock Price Indices

The stock market means a platform where buying and selling of the shares of listed business organizations take place. While the stock price index is a measure of the stock market that assists the investors to evaluate the current market performance with some base period of past. According to the financial dictionary, “A group of stocks put together in a standardized way to provide a useful window into a sector or market's performance at a glance. That is, a stock index groups together a certain list of stocks and usually takes an average of their prices so as to provide an idea of how the industry or market represented in the stock index is doing. Very often, stock indices are weighted to prevent a few data points from overwhelming it”. Commonly, it works like weighted mean i.e. the price of selected stocks. The literature claims that oil price shocks have a direct association with this index because it starts decreasing with the anticipation of people about inflation rates in the short run. Lesser speed of GDP growth forecasts, in turn, worse income anticipations of corporations, which may lead to a shrinking trend on stock prices. On the other hand, an upsurge in food prices may also influence the stock prices negatively. To integrate the behavior of stock market towards these shocks which we incorporate in our model.

3.2.3 Real Effective Exchange Rate

The weighted average of a domestic currency as compared to a basket or group of other currencies is called REER. The word real is used because this index is adjusted to the inflation effects. As per the official site of IMF, “REER is the real effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs. An increase in REER implies that exports become more expensive and imports become cheaper; therefore, an increase indicates a loss in trade competitiveness”. The weights of this index are determined by relating the country’s comparative trade balance against each country included in the index making. Researchers discuss that a rise in global food prices and global oil prices have a significant impression on the food and oil-importing country's exchange rate. Pakistan is an agricultural country with big oil-importing bills as compared to food-importing bills. So the REER of Pakistan is highly unpredictable to oil price shocks relative to food price shocks.

3.2.4 Quantum of Industrial Exports

Export is a function of foreign trade whereby the products manufactured in one economy are dispatched to another economy for further trade or sale. The trade of such products contributes to the gross output of the manufacturing economy. History has proven that oil is a major input of the industrial production function of Pakistan so positive oil price shocks severely damage the industrial exports of the country while positive food price shocks have a minor influence on the industrial exports of the country.

3.2.5 Call Money Rate

According to Federal Reserves, "call money rate is the rate at which short term funds are borrowed and lent in the money market". As per the financial dictionary, "the call money rate is the interest rate on a type of short-term loan that banks give to brokers, who in turn lend the money to investors to fund margin accounts". Concisely speaking, it is a rate at which short term funds to be lent and borrowed in the money markets. Same as interest rate, restrictive and tight liquidity circumstances increase the call money rate and the reverse is applicable for easy liquidity conditions. In this research call money rate is used as a proxy for the rate of interest in Pakistan due to the unavailability of the data before 2004. The literature claims that (Rizwan et al., 2019) global food price shocks and global oil price shocks have a direct impact on the inflation rate which pushes the monetary authorities to intervene and re-examine the monetary policy to cope up with this inflation.

3.2.6 Inflation Rate

The inflation rate means the gradual increase in the price of consumer basket products which leads to a reduction in the purchasing power of the domestic currency. As per SBP, "Inflation refers to an overall increase in the Consumer Price Index (CPI), which is a weighted average of prices for different goods. The set of goods that make up the index depends on which are considered representative of a common consumption basket. Therefore, depending on the country and the consumption habits of the majority of the population, the index will comprise different goods". Any central bank of an economy work on the dual mandate i.e. control of inflation without increasing the unemployment rate. As we conclude in the literature review section, the inflation rate is highly sensitive to external shocks like global food price shocks and global oil price shocks. So when these shocks influence the inflation rate then the central bank reacts to control the inflation because it is part of its dual mandate.

3.2.7 Global Food Price Index

The food price index is an index that use to measure the swings in the basket of the food products' prices during a specified period of time. Food and Agriculture Organization developed an index called "FAO Food Price Index (FFPI)" in 1996. There are several reasons for the development of this index. The global population has significantly increased during 1996-2020 and the world agricultural production has also increased by nearly 70% during the same period. Several commodities trade has also increased for instance, dairy products, meat, vegetable oil, and cereals upsurge by 190, 130, 220, 240, and 66% respectively during the same period. Food product prices have been transacted in the foreign market as measured by FFPI have raised as compared to the unit prices of the products by more than 10% since 1996. In 2000, the prices of these food products hit the lowest point of the last 60 years and then lead to 45 years highest in 2011. Additionally, the nominal prices of the products showed a monthly basis high volatility. In the perspective of swings in uncertainty, prices, and production, the FFPI has been recognized as a most vital and reliable indicator of the food products in international markets. It is used to examine the swings in food product prices at the international level and widely quote and release every Thursday. Statistically speaking, it is a Laspeyres price index which is measured as the weighted average of the food products prices including dairy products, meat, vegetable oil, and cereals. These products represent 40% of the gross agricultural goods product trade. The intention behind the selection of these products is their strategic and high significance in world trade and food security. While the reason behind the selection of the Laspeyres price index is easy to update feature. According to FAO, "prices of commodities are combined in the various sectors using trade weights calculated from average export values over a chosen three-year base period, where the trade weights appear most stable relative to their trend values". In order to lower down the variation impacts in both globally traded quantities and prices, a 3 year base period is selected. The period of 2014 to 2016 was selected as a base period because it was recognized as the most appropriate period for the majority of the global market during the last decade. After a while, it is noteworthy to examine that inputs price when new circumstances influence their timeliness, representativeness, and availability. With the progress of trade arrangements, it is authoritative to update the period of the base to make sure that the weighted product basket remains applicable.

3.2.8 GDP (Constant 2010 US$)

GDP means the market value of all finally produced products and services in an economy during a particular period. According to the Britannica dictionary, "Gross domestic product (GDP), the total market value of the goods and services produced by a country's economy during a specified period of time. It includes all final goods and services—that is, those that are produced by the economic agents located in that country regardless of their ownership and that are not resold in any form. It is used throughout the world as the main measure of output and economic activity". Per capita measure of GDP is widely used to evaluate the economic growth and living standards of an economy. Some researchers (Hakan et al., 2010) report that the external shocks like global food price and global oil price shocks have a significantly negative impression on the economic growth or GDP per capita of a country (Hakro & Omezzine, 2010; Alom, 2011). The GDP used in this study has an upward trend that needs to be removed before running any estimations. We deflate this trend to acquire the economic growth for our study. We subtract the current GDP from the previous GDP simply and divided the whole by the current GDP for this purpose. This process is shown below:

$$Economic\ Growth = (Y_t - Y_{t-1})/Y_t$$

GDP growth is used widely to evaluate the changes in the production of products and services during a period as compared to some base periods of the past. There are two basic types of this variable. Researchers use both measures in different studies i.e. in real terms called real GDP while in nominal terms called nominal GDP. Literature mention that a positive oil price shock has a negative influence on the oil-importing countries' GDP like Pakistan. Also, the impact of oil price shock is much severe as compared to global food price shocks impacts on these countries (Jongwanich & Park, 2011).

3.3 Theoretical Framework

After a keen evaluation of a plethora of literature, we conclude that an oil price shock, either positive or negative, affects the several macro variables of an economy for example, exchange rate, economic growth, inflation rate, and per capita income. An oil price shock influence the real economy from different transmission mechanism that includes supply and demand-side channels. Supply-side influences are associated with the manufacturing cost of production. For instance, as crude oil is recognized as a key input factor of the production process, an increase in oil price rapidly increases the production costs. As per economic theory this association is more significant for the products that are produced from petroleum products. Positive oil price shocks increase the transportation cost that leads to an upsurge in the cost associated with the goods and services distribution. Moreover, an increase in oil prices indirectly influences manufacturing and heating costs. When production cost increases then producers lower down the production of goods and services that leads to supply reduction of the country. The demand side impacts of swings in oil prices are due to changes in investment and consumption patterns of the general public. Economic theory and literature indicates that the changes in oil prices have direct impacts on the spending and consumption patterns of households.

Similarly, Upadhyaya (2015) mentions that a rise in the prices of oil causes a rise in the general inflation level which increases the prices of the final goods due to an increase in the cost of production. Gbatu et al. (2017) further extends the analysis and specify that this relationship strengthen with the reduction in demand for consumption and real income of an economy. Furthermore, since the oil price elasticity of demand is commonly small, a rise in prices of oil may push the consumer to lower down their spending on other products that may lead to a reduction in demand for products (Basnet & Upadhyaya, 2015). These kinds of direct and indirect channels can lower down the overall economic growth of the country. It can be observed from the literature that macro-econometricians involve in four kinds of jobs; "1) describe and summarize macroeconomic data, 2) make macroeconomic forecasts, 3) quantify what we know about the true structure of the macroeconomy, and 4) advice or act as policymakers". If we have a look at the literature, following the 1970s recession and oil crisis, none of the univariate time series or structural models approach seems reliable. Sims (1980) VAR model filled this and make things easy for the researchers to study oil price shocks and other kinds of shocks' impacts on a different set of variables. According to Younas & Khan (2018) specify that there are three kinds of VAR models; 1) structural, 2) recursive, and 3) reduced-form VAR model. The following chart defines the transmission channels of oil price shocks' impacts on an economy. It can be recognized as a theoretical foundation for our research dissertation (see Figure 1).

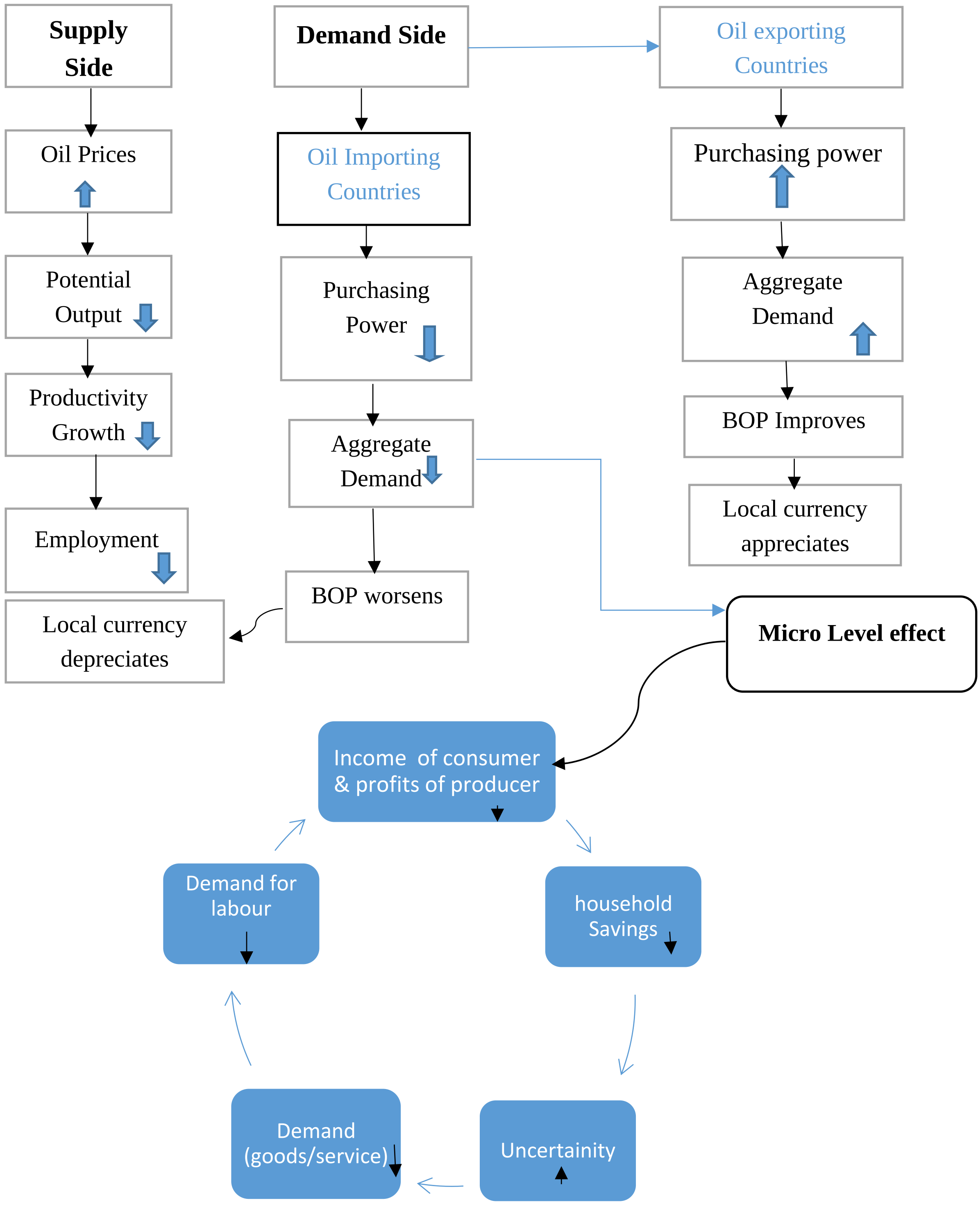

Figure 1 Theoretical Framework

From the supply side, an upsurge in oil prices is representative of the reduction in the basic input of production availability which further lowers down the potential output of the country (Mignon, 2008). Accordingly, an increase in marginal production cost slows down the factor productivity and output growth. The reduction in growth efficiency has an adverse impact on real wages which further lowers down employment rate (Chuku et al., 2010). The flow chart also explains the supply-side shocks. A rise in the oil prices lowers down the output in the short-run because of the resource utilization reduction which further increases unemployment and lowers down the income. The wealth effect transfer is the next significant transmission channel of shock in oil prices. This channel highlights that an increase in prices of oil interchanges the power of purchase to oil-exporting economies from oil-importing economies. A consistent boost in the oil prices would reflect an improvement in the balance of payments and being a significant windfall in earnings of the oil-exporting economies. The wealth transfer is likely to increase the aggregate demand of oil-producing economies and reverse is expected in the case of oil-importing economies (Galesi & Lombardi, 2009). This is because of the assumption marginal propensity to consume is higher in oil-exporting economies. Likewise, oil price shocks in oil-importing economies are spread through the demand-side by reducing the demand for products. Kilian (2010) describes that an upsurge in oil prices may influence the expenditures of consumers via four related channels; operating cost effects, uncertainty effect, income effect, and discretionary precautionary saving effect. This implies that a boost in oil prices deteriorates oil-importing economies terms of trade (Dohner, 1981).

Moreover, Hooker (2010) concludes that a shock in oil prices put inflationary pressure on the economy along with a reduction in total output. Tang et al. (2010) supported this claim by stating that a variety of oil-based products is included in the basket of the consumer price index. They further mention that increase in unexpected inflation is the first impact caused by the upsurge in oil prices. Though, as per Galesi & Lombardi (2009), domestic response to these oil price shocks defines the degree of pass-through effect. This sign recommends that a reduction in output and a rise in inflation rate are the two expected impacts of oil shocks. Operating through supply-side effect, a shock to oil price introduces shock to production cost which also put pressure on the prices and labor costs (Ibid, 2010). In other words, it represents a rise in oil price cause a high rate of inflation. It can also be inferred as the second effect of positive oil shocks is giving an upsurge to wage-price loops (Galesi & Lombardi, 2009). Refer to the real balance transmission channel, an increase in oil prices lead to a rise in money demand. Since the central bank unable to meet the growing money demand, as a result, there is a rise in the rate of interest and a lower down the growth via the reduction in investment. As mentioned by Brown & Yucel (2002), “Instead, working through the price-monetary transmission mechanism, oil price shock will reduce investment due to the lessening the producer's profits and equally reduces money demand from the producers for the purpose of investment”.

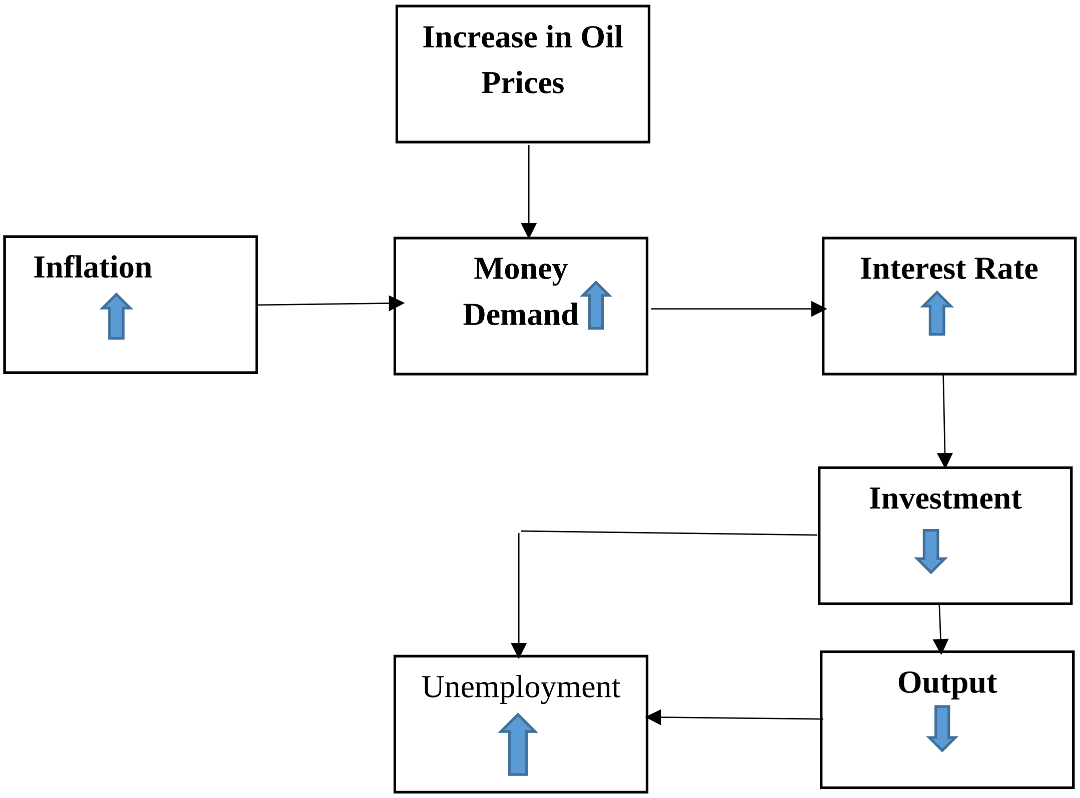

Figure 2 Monetary Effect Flowchart

The central bank of an economy can respond to oil price shocks through a significant channel called the monetary policy channel (Younas & Khan, 2018). Tang, et al. (2010) highlights that, as mentioned in the above figure too, a contractionary monetary policy by the central bank in order to cope up with the inflation caused by oil price shocks will discourage the investors that decrease the output in long run. According to liquidity preference theory, a reduction in money supply to cope up with inflation increase the interest rate that lowers down the investment because an increase in interest means an increase in the cost of borrowing. This reduction in investment leads to a lower down the output of the country. So we can say that this type of monetary policy response to oil price shocks may have adverse impacts on the real economy via a reduction in investment.

The "sectoral adjustment effect channel" sheds light on the irregular influences of oil shocks within different sectors of the country. Brown and Yucel (2002) put forward that the likely justification for this irregular adjustment would be dependent on the abnormality in the prices of petroleum products, adjustment costs, the negative impact of uncertainty on the investment environment, and monetary policy response. Chuku et al. (2010) determine that a positive oil price shock further weaken the economic activity by an upsurge in the cost of production. On the other hand, a negative oil price shock boosts the economic activities via an offset of adjustment costs. These kinds of costs may take place from sectoral discrepancies and lack of harmony between firms or due to energy to output ratio is implanted in the capital stock. Lilien (1982) and Hamilton (1988) indicate that, in the existence of sectoral imbalances, positive or negative oil price shocks need reduction or growth of oil intensive sectors. Kumar (2009) determines that these kinds of arrangements need adjustment in production that cannot be attained in a short period. It is also known as the dispersion hypothesis. Additionally, oil price asymmetry leads to the underutilization of resources and an increase in the rate of unemployment.

Finally, the psychological impact postulates that the uncertainty level determines how long a positive oil price shock persists and how badly it influence the economic activities of the country via lowering down the investment demand of businesses and the consumer demand of products. This channel is documented as an “uncertainty channel” (Burnanke, 1983; Pindyck, 1991). Different researchers reported different findings of the linkages between external shocks and uncertainty level. Ferderer (1996) and Galesi & Lombardi (2009) indicate that, following positive oil price shocks, uncertainty motivates consumers and firms to hang up unalterable consumption and investment decision. If “energy-to-output ratio fixed in the capital stock”, a business organization must select an energy-intensive process of production while purchasing capital. For households, the uncertainty will predominantly applicable durable consumer products specifically “energy using consumer durables”. Future oil price uncertainty may cause downward and upward swings in the prices of oil. It is very important to mention here is that when future prices of oil become highly uncertain, the investment postponing or consumption postponing decision worth significantly affected (Chuku et al., 2010). The net incentive to consume or invest decreases that leads to a reduction in the long-run output prospects. The scholars also highlight that oil and food price shocks are the key reasons behind the weaker economic or GDP growth of an economy (Headey & Fan, 2008; Galesi & Lombardi, 2009). The transmission channels that we discussed in the figure indicate that an upsurge in the prices of food takes to a rise in the bills of importing food which further lowers down the exports of the country. As export is the main element of the GDP of the country, so a reduction in export means a reduction in the output of the economy which is also known as the net export channel. Whereas, global food price shock weakens the food demand which eventually lowers down the exports of the country that again leads to decreases in the economic growth of the country. Similarly, a rise in the oil and food prices also boosts the rate of interest and money demand which puts a negative impression on the rate of exchange of an economy (Alom, 2011).

3.4 Methodology

The main emphasis of that research process is to standardize the liaison between shocks and macroeconomic variables/indicators of Pakistan. Here if impact of external shocks (oil and global food price) persist over the long period of time then we will go for ARDL approach and we will find the Cointegration between variables if long term association exists between the variables then further we employ the ECM approach to determine the speed with which these shocks adjusts in the long time period as well. Furthermore if there is no long run link amongst selected interior variables then it means that oil and food price shocks have short sway on other variables in the model then we will go for estimation of VAR and particularly SVAR model to observe the short run impact of external shocks on selected macroeconomic variables of Pakistan. Basically here to achieve our objectives we gathered and employed quarterly data for 29 years that series consist of time period from 1990 Q1 to 2018 Q4. Here we used 8 variables in the estimation process structural auto regressive (SVAR) scheme. Actually we incorporate three econometric models here, in first model we have taken oil price shock as exterior variable and it is purely exogenous, another model in which food price is reflected as external cause and last in which we incorporate both oil and food price shocks together as exogenous.

To find whether selected macroeconomic variables of Pakistan and external shocks has any link over the large period of time the researcher will test for Cointegration at first. Two groups of variables are related to each other in the long run if a linear blend of the variables has a lesser order of integration.

3.4.1 Stationarity Problem

The data of a variable which is measure in excess of the period of time is called stationary if the value of its mean ad variance do not show any alteration over the long period of time. Proceeding the divergent, when average value and variance of variables do not converge to its long run average and variance then that time series process is called non stationary. We infer that a nonstationary process has time variant average (mean), variance and covariance. Inflation, national income, consumption shows upward trend over the passage of time just like most of the other macroeconomic variables. Hence, if a time series process is nonstationary over the longer period of time then it does mean that this process has a unit root. Thus in econometrics stationarity of a time series process is determine by the unit root test.

At the time of determination of stationarity of time series process most of the researchers and econometricians concerned and desired that the particular process should be stationary. The initial point of any econometric/ economic analysis is to study and inspect the attributes of time series process that is under consideration, by using statistical tests and graphs as well. Graphical representations of data set is very common tool and it helps us to quickly detect the presence of any trend in the data. Perhaps graphs are not considered as reliable as the statistical tools are. Hence statistical tests are used for detection of trend and stationarity in the data for ultimate decision. Therefore statistical tests suggests us about the presence of unit root in the economic data. The unit root tests are those which are consist of statistical procedure to determine the presence of stationarity in a time series data of a variable.

3.4.2 Non-stationary Data and Cointegration

Two important areas in the econometrics that have received a lot of attention are nonstationary time series model and dynamic panel data. A time series data of a variable is called nonstationary when it has time variant mean and variance. By adding the cross sectional dimension to the time series data it offers an advantage in testing for nonstationary and long run affiliation. Cointegration tests are used to accomplish when two time series process are nonstationary and both of them have long run stable relationship. By using Cointegration tests we can examine the nonstationary variable/process those have mean and variance that varies over the long period of time (Rao, 2007).

3.4.3 Cointegration Background

For the purpose of examining the time series data, the variance and mean of the series do not change over time or remain constant to validate the use of the OLS approach on an econometrical model. In other words, the time series must be stationary or time-independent because the non-stationary time series process violates the constant variance and mean the assumption of the OLS approach that provides misleading or biased parameters. Econometricians suggest different techniques to handle the non-stationary time series data. A commonly used approach in the literature is called Cointegration analysis. More strictly, the Cointegration can be explained by series x_t and y_t both with I(1) as the stationary process

$$u_t = y_t - \beta x_t$$

Literature suggests that the use of OLS and other techniques like OLS may provide spurious results. Alternatively speaking, the use of OLS on non-stationary variables can provide a significant relationship between the uncorrelated variables. This spurious relationship is due to the existence of unit roots in the understudied data series. While variables may also establish a long-run equilibrium association even however there is a short-run equilibrium deviation. Because of these kinds of problems Engle & Granger (1987) develop a Cointegration technique to examine the linkages between nonstationary time series variables. They mention that the two or more variables will be co-integrated if they establish a long-run equilibrium relationship.

3.4.4 Tests for Cointegration

As mentioned earlier, the two or more variables will be co-integrated if they establish a long-run equilibrium relationship time-independent but Rao (2007) highlights that if we unable to find such kind of association then it does not mean that there is no relationship exists but only support the non-existence of relationship. By upgrading the Engle & Granger test of Johansen introduce the test to find out long term/run bond between variables. This tests suggests us that there is no need for identification of dependent variable separately in the model. Hence this test is useful for the research process in which researcher is unable to decide which variable is dependent variable and it also avoids the issue in which error terms passes its effect to the next time period error term. The most popular tests for Cointegration for time series data is Johansen test which is given below.

3.4.4.1 Johansen test

This test can tell apart that among variables is there any multiple cointegrating vectors in the series. Basically Johansen Cointegration test is used for multivariate and multi equation model. It is emerges from VAR model.

Let suppose a VAR model

$$X_t = C_1^* X_{t-1} + C_2^* X_{t-2} + \ldots\ldots\ldots\ldots\ldots + C_p^* X_{t-p} + U_t$$

Where $C_i^* = C^{-1} C_i$ and $U_t = B e_t$

We specified our VAR model that involves a set of variables represented by the following vector X_t. Now we have to test whether there is cointegrating relationship exists between variable or not. And here n x n linear relationship can be made. The following steps are involve in Johansen test for Cointegration:

In step one we find the order of integration, by applying ADF test and all most many of the economic variables becomes stationary at first difference, because for Johansen-Juselius test it is necessary that all the variables must be I (1) it means that there should be first order of autocorrelation. If order of integration is mix of I (0) and I (1) then we cannot apply Johansen-Juselius test. And if order of assimilation is blend of I (2) then it is very complicated to handle with the Π matrix. In step two find the optimal lag length. For this purpose AIC, SIC, HQ, LM criteria is used. Here we start from the general model and include all the maximum lags of the variables and then step by step estimate different models with different specifications and note down the AIC and SIC. Choose the model who have low AIC, SIC values. Researcher may use any criteria that are stated above. Next we have to find the optimal model which may include deterministic part as well. Here $\Pi Y_{t-1} + \epsilon_t$ portion of model stated above shows the long run coefficients and rest of the portion shows short run. In this step we have to choose the most appropriate model that may include just intercept, intercept and trend and no intercept and trend. Pantula principle is that it estimate the most restricted model and further it estimate the rank of pie matrix. It also estimate the least restricted model as well. Next we check the rank of the matrix if the rank is full it means that there are no independent rows and columns exists. If rank (r) of the matrix is zero it tells us that there is no Cointegration between the variables and there is no cointegrating equation in the long run. And we can simply estimate VAR in this condition. Here the hypothesis which we have to test is that H_O; Rank of pie matrix = r (There is Cointegration or rank is full) and H_1; R = r =1 (There is no Cointegration or rank is reduced). Here stopping rule is that where we reject the null hypothesis then we have to stop. It consist of the Chi – Square distribution statistic and depends on the likelihood ratio. Maximum Eigen values are used in test statistic and maximum Eigen values are called the characteristic root of a matrix. Find the trace of the matrix. Basically trace of the matrix is the sum of the diagonal values. Critical values of the J & J test are develop by them in their paper. On the basis of these values we can accept or reject the null hypothesis.

3.4.5 Auto Regressive Distributed Lag (ARDL) Model

There is a strand of literature that empirically specifies that the Cointegration tests like “Johansen Cointegration” cannot be directly used if the under studies data series exhibit mixed integration order. For example, if 2 variables are stationary at the level and the remaining are stationary at the first difference then we cannot apply the Johansen Cointegration analysis. In order to cope up with this mixed order of integration problem, the ARDL approach is developed by the statistician Pesaran & Shin (1999). This is an econometric technique that works like OLS and can be applied on both non-stationary and stationary data series and mixed order of integration series. In order to capture the data generating process, this technique takes adequate lags. Another distinctive feature of this technique is that a dynamic ECM can also be derived via simple linear transformation. It also overcomes the spurious relationship problem that arises from the non-stationary data series. Also, without losing the long-run equilibrium information, the ECM integrates the short-run dynamics with the long run. In order to establish the ARDL approach, consider the following regression;

$$Y_t = \alpha + \beta Z_t + \epsilon_t$$

And the ECM version of the ARDL approach can be demonstrated as;

$$\Lambda Y_t = \alpha_0 + \sum_{i=1}^{t} \beta_i \Lambda Y_{t-i} + \sum_{i=1}^{t} \text{Ϙ}_i \Lambda S_{t-i} + \sum_{i=1}^{t} \Pi_i Z_{t-i} + \lambda 1 Y_{t-i} + \lambda 2 S_{t-i} + \lambda 3 S_{t-i} + \mu_t$$

Here Yt shows the GDP growth and St shows stock prices and Zt shows the exchange rate and part of equation with λ shows long run association. The null hypothesis is "Πs =0 which means that there is the nonexistence of long-run relationship between the variables which we included in the model". Hashim-Pesaran test is used for testing the presence of Cointegration. This method includes dependent variable lags and other variables' current values. The general form of the auto regressive distributed lag model is as under:

$$Y_t = \alpha + \beta Y_{t-1} + \beta Y_{t-2} \dots \dots \dots + \beta_n Y_{t-n} + \beta Z_t + \beta_1 Z_{t-1} + \beta_2 Z_{t-2} \dots \dots + \beta_m Z_{t-m} + \varepsilon_t$$

This approach determines both short-run and long-run adjustments. Its coefficient (Ϙs) shows that when disequilibrium occurs in the economy then how much time it will take to adjust. And short run parameters (β**)** shows the short-run impact of the shock on the variable.

3.4.6 Vector autoregressive (VAR) model

VAR model enables the huge response on the independent and dependent variables (or past values of the variables) reverse causality grounded on the autoregressive process. The literature on the VAR model validates that all variables in the estimation process are endogenous in nature and no exogenous variable exists with the assumption of uncorrelated white noise error or disturbances terms. Before start the estimation process of the VAR model, there is an immense need to find the optimal lag length for the model. There are several methods available in the literature that are commonly being used to find the optimal lags. Some of them include "Akaike Information Criterion (AIC), Schwartz Bayesian Criterion (SBC), and Hannan Quinn criterion (HQC)". Detailed discussion on SVAR is given below.

3.4.6.1 Structural Vector Autoregressive (SVAR) Model

There are different versions of the VAR methodology reported by the scholars in the literature. A reduced-form VAR specifies each variable as a linear function of the past values of its own and all other variables past values being recognized the disturbance terms are the variables shock movements after incorporating previous values. Another assumption here is that disturbance terms are correlated if the variables are correlated with one another. On the other hand, recursive VAR establishes the disturbance term in every regression to be un-correlated with the disturbance term in the previous equation. Careful selection of contemporaneous values as regressor are added in this process. Each equation estimation through OLS generates residuals that are not correlated across equations. Alternatively, SVAR is based on the economic theory to define the contemporaneous linkages between variables. It involves "identifying assumptions" that create causal relations between variables. Researchers call it a generation of instrumental variables.

According to basic econometrics, when there are multiple series are under consideration then there is a need to incorporate the interdependence among them. The estimation of simultaneous equations with lags is one method to do it which is also called the "dynamic simultaneous equations model". Though this procedure requires two steps; 1) classification of exogenous and endogenous variables and 2) imposition of some restriction on the parameters to attain the identification. Sims (1980) highlight that this process requires several arbitrary decisions and develop an alternative approach called VAR. This is actually a generalization of the AR model of times series. The OLS can easily be used on the estimation of the VAR model. After estimation, we can analyze how the variables react when some other variable is shocked above its mean. The following figure 3 is explaining the Structural vector autoregressive model estimation procedure step by step in an explicit way.

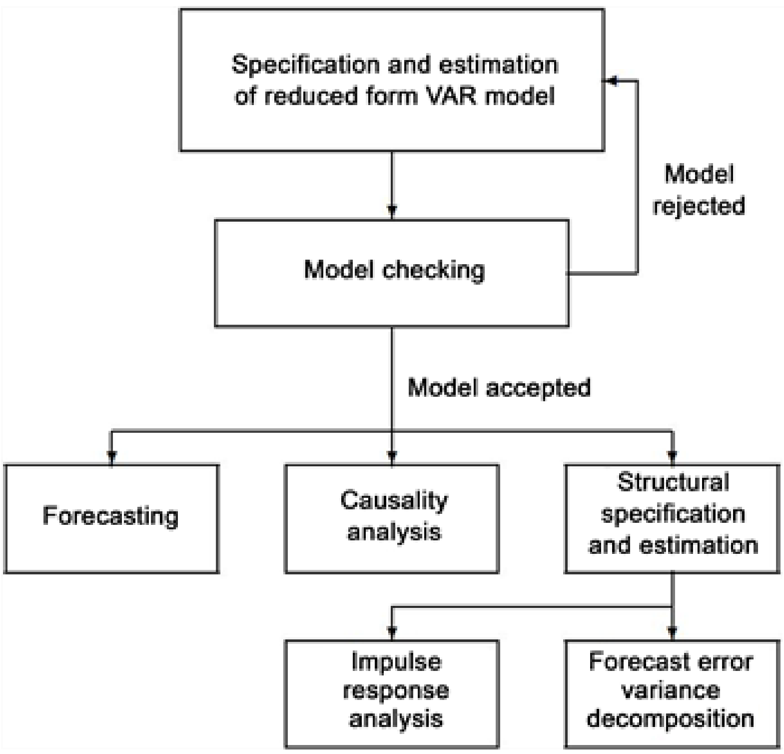

Figure 3 VAR Methodology Flowchart

The following regression indicate the general specification of the SVAR model;

$$CX_t = C_1X_{t-1} + C_2X_{t-2} + \cdots \ldots\ldots\ldots\ldots. + C_pX_{t-p} + e_t$$

Where X_t is a (n x 1) endogenous variables vector (Global Oil price, CMR as a proxy of domestic interest rate, REER, the quantum of industrial exports, the economic growth, annual stock price indices, and the inflation rate). C is (n x n) contemporaneous coefficients matrix associations on the endogenous variables; C's are (n x n) matrices explore the dynamic interactions between variables, e_t is an (n x 1) error terms vector, and P represents total lags. We assumed that the residuals of the model are linearly associated with structural shocks. It represents by $U_t = Be_t$ where B is (n x n) matrix which describes the structural shocks impacts. So we can describe the above regression model as;

$$CX_t = C_1X_{t-1} + C_2X_{t-2} + \cdots \ldots\ldots\ldots\ldots. + C_pX_{t-p} + Be_t$$

We can describe the reduced form as;

$$X_t = C_1^*X_{t-1} + C_2^*X_{t-2} + \cdots \ldots\ldots\ldots\ldots. + C_p^*X_{t-p} + U_t$$

Where $C_1^* = C^{-1}C_i$ and $U_t = Be_t$. Our VAR model consists of several variables which are reported by vector X_t. Where variables appear on LHS are Global Oil price, domestic interest rate, REER, quantum of industrial export, inflation rate, the economic growth, and the stock price index respectively.

3.4.6.1 Structural VAR Model Description

Following Breitung et al. (2004), our estimation starts with SVAR (p) model. Where A is a (k x k) "invertible structural coefficients matrix", Xt is the endogenous variable vector $(ASI_t, QIE_t, REER_t, CMR_t, CPI_t, EG_t, {}^{OPI_t}/_{FPI_t})$, where εt ~ (0, ∑ε). B is another (k x k) structural coefficients matrix that signifies the structural shock impacts. The lag (p) is determined by using AIC or SC criterion. The reduced form of the model can be described by pre-multiplying the previous model with the inverse of matrix A, A-1 which is transcribed as:

$$CX_t = C_1X_{t-1} + C_2X_{t-2} + \cdots \ldots\ldots\ldots\ldots. + C_pX_{t-p} + u_t$$

Where X_t is a (n x 1) endogenous variables vector (Global Oil price, CMR as a proxy of domestic interest rate, REER, the quantum of industrial exports, the economic growth, annual stock price indices, and the inflation rate) while e_t is an (n x 1) vector of structural error terms and P is total lags. Additionally, we assume that structural shocks are linearly linked with the residuals of the model. It represents by $U_t = Be_t$ where B is (n x n) matrix which describes the structural shocks impacts. As mentioned earlier, our VAR model consists of several variables which are reported by vector X_t. Where variables appear on LHS are Global Oil price, domestic interest rate, REER, quantum of industrial export, inflation rate, the economic growth, and the stock price index respectively.

The next stage is to impose some restrictions on the parameters to recognize the structural form parameters. We suppose that the "structural variance-covariance matrix is a diagonal matrix and is normalized as an identity matrix". There are different approaches use by scholars to impose restrictions. We use a recursive identification/ordering scheme. The variables contemporaneous connections are captured by B. After defining the matrices, a number of restrictions are the next stage. Breitung et al.(2004), advocate us about the number of restrictions and suggests K(K-1)/2 number of added restrictions/constraints should employed, here K shows number of variables. In our analysis, we have 7 and 8 variables in our models. So, for the 7 variables case, we require 21 restrictions. While, for the 8 variables case, we need 28 restrictions. The economic theory remains under consideration during the restriction imposition process. Three models we incorporate into the research process and results are explained and discussed below.

3.4.6.2 SVAR with Block Exogeneity

In order to allow more accurately for the external shocks on major macroeconomic variables of Pakistan economy the researcher consider the following SVAR model with block exogeneity. Whereas Block exogeneity refers that the local/internal variables will not affect the external variables either with lags or contemporaneously.

$$\sum_{i=0}^{n}\begin{bmatrix}A11(i) & A12(i)\\ A21(i) & A22(i)\end{bmatrix}\begin{bmatrix}X1 & (t-i)\\ X2 & (t-i)\end{bmatrix}=\begin{bmatrix}\varepsilon 1t\\ \varepsilon 2t\end{bmatrix}$$

Where A_{12} (i) =0 for each i=0……….n because the model assumes that Pakistan economy is a small open economy. X_1(t-i) is a vector of external shocks/variables and X_2(t-i) is a vector of local/domestic variables. ε_{1t} is a vector of structural shocks of external origin and ε_{2t} is a vector of domestic/interior shocks. External variables/shocks include crude oil prices and global food price index whereas internal variables include call money rate, quantum od industrial exports, real effective exchange rate, economic growth, stock prices index and inflation rate/CPI.

3.5 Estimation of the Model

Here we estimate three models which are briefly explained below:

3.5.1 Model with Oil Price as Exogenous

First of all we introduce a SVAR model in which there are 7 variables with exterior oil price shock. Without consideration of the economic situation/condition of country next we adopt that oil price is exterior shock (Tang et al. 2010). Now ordering of variables is as (Stock Indices, REER, QIE, CMR, INF, EG and OPI) for the 7 variables model with oil price. We put restrictions on the variables on the basis of economic theory and follow the recursive ordering of variables that is also suggested by economic theory. Oil price is added in the model the matrix form of the recursive ordering is mention in appendix.

For recursive ordering and the purpose of analysis here we adopt that oil price shock is not affected by all other shocks which may arise in the economy due to economic variables which are included in the model and that shock can affect all other interior variables thus here we put six constraints ($\varepsilon_{opi} = c_{77} * \varepsilon_{opi}$). Secondly, here we assume that economic growth/growth of GDP is mainly caused by oil price shockwave therefore we put 5 restraints here ($\varepsilon_{eg} = c_{66} * \varepsilon_{eg} + c_{67} * \varepsilon_{opi}$). Thirdly, we take on that CPI/inflation shock is affected by itself, shock of economic growth and oil price shock whereas these three disturb the movement of all other variables which are incorporated in the model. At this juncture we put 4 restrictions, ($\varepsilon_{inf} = c_{55} * \varepsilon_{inf} + c_{56} * \varepsilon_{eg} + c_{57}.* \varepsilon_{opi}$). The next shock in the list is the shock of call money rate. Here we undertake that it is not affected by real effective exchange rate, quantum of industrial export and stock price shocks hence we put 3 restrictions here for the contemporary period though it is while it is pretentious by rest of the shock in the list ($\varepsilon_{cmr} = c_{44}. \varepsilon_{cmr} + c_{45} * \varepsilon_{inf} + c_{46} * \varepsilon_{eg} + c_{47} * \varepsilon_{opi}$). Fifth shock in our analysis is the shock of real effective exchange rate and here we adopt that it is not affected by stock prices shock therefore we put 2 restrictions here for the contemporary period while it is pretentious by all rest of the shocks in our analysis ($\varepsilon_{reer} = c_{33} * \varepsilon_{reer} + c_{34} * \varepsilon_{cmr} + c_{35} * \varepsilon_{inf} + c_{36} * \varepsilon_{eg} + c_{37} * \varepsilon_{opi}$). The last restriction which we have applied in our analysis is the shock of quantum of industrial export and here we have taken that it is not affected by stock prices perhaps all rest of the shock have a strong influence on it ($\varepsilon_{qie} = c_{22} * \varepsilon_{qie} + c_{23} * \varepsilon_{reer} + c_{24}\ \varepsilon_{cmr} + c_{25} * \varepsilon_{inf} + c_{26} * \varepsilon_{eg} + c_{27} * \varepsilon_{opi}$). Matrix notation of the model is given below:

$$\begin{bmatrix} c_{11} & c_{12} & c_{13} & c_{14} & c_{15} & c_{16} & c_{17} \\ 0 & c_{22} & c_{22} & c_{24} & c_{25} & c_{26} & c_{27} \\ 0 & 0 & c_{33} & c_{34} & c_{35} & c_{36} & c_{37} \\ 0 & 0 & 0 & c_{44} & c_{45} & c_{46} & c_{47} \\ 0 & 0 & 0 & 0 & c_{55} & c_{56} & c_{57} \\ 0 & 0 & 0 & 0 & 0 & c_{66} & c_{67} \\ 0 & 0 & 0 & 0 & 0 & 0 & c_{77} \end{bmatrix} = \begin{bmatrix} \varepsilon_{asi} \\ \varepsilon_{qie} \\ \varepsilon_{reer} \\ \varepsilon_{cmr} \\ \varepsilon_{inf} \\ \varepsilon_{eg} \\ \varepsilon_{opi} \end{bmatrix}$$

3.5.2 Model with Global Food Price as Exogenous

Food is a basic necessity of life and food price inflation plays an important role which may disturb the economic performance of a country as well. This depends on that whether that country is food importer or exporter. Rise in food price on international basis has a positive impact on food exporter country because it will increase the foreign earnings of that country contrary to it food importer country will have bad impact on their economy and by this inflation they will lose their foreign reserves as well. It will hampers the BOT and then BOP of a country and in turn it affects growth of the country. International rise in food prices transfers its impact on each country via different frequencies. Here we Here we form a model in which we check the effects of global food prices on macro level in Pakistan because the latest rise in food prices draw the responsiveness of the researches and concerned we put restrictions on the basis of the economic theory. Now we introduce second model with seven variable Structural VAR model with global food price. Furthermore in this study we adopt that, on the basis of the article of (Tang 2010), global food price is taken as exterior variable and other variables are completely endogenous. Now we sort our variables as (REER, QIE, CMR, INF, Stock price Indices, EG and FPI) for the 7 variables model with global food price. The matrix form of the ordering is prearranged in appendix.

For recursive ordering and the purpose of analysis here we adopt that food price shock is not affected by all other shocks which may arise in the economy due to economic variables which are included in the model and that shock can affect all other interior variables thus here we put six constraints ($\varepsilon_{opi} = c_{77} * \varepsilon_{opi}$). Secondly, here we assume that economic growth/growth of GDP is mainly caused by food price shockwave therefore we put 5 restraints here ($\varepsilon_{eg} = c_{66} * \varepsilon_{eg} + c_{67} * \varepsilon_{opi}$). Thirdly, we take on that CPI/inflation shock is affected by itself, shock of economic growth and food price shock whereas these three disturb the movement of all other variables which are incorporated in the model. At this juncture we put 4 restrictions, ($\varepsilon_{inf} = c_{55} * \varepsilon_{inf} + c_{56} * \varepsilon_{eg} + c_{57}. * \varepsilon_{opi}$). The next shock in the list is the shock of call money rate. Here we undertake that it is not affected by real effective exchange rate, quantum of industrial export and stock price shocks hence we put 3 restrictions here for the contemporary period though it is while it is pretentious by rest of the shock in the list ($\varepsilon_{cmr} = c_{44}. \varepsilon_{cmr} + c_{45} * \varepsilon_{inf} + c_{46} * \varepsilon_{eg} + c_{47} * \varepsilon_{opi}$). Fifth shock in our analysis is the shock of real effective exchange rate and here we adopt that it is not affected by stock prices shock therefore we put 2 restrictions here for the contemporary period while it is pretentious by all rest of the shocks in our analysis ($\varepsilon_{reer} = c_{33} * \varepsilon_{ree\ r} + c_{34} * \varepsilon_{cmr} + c_{35} * \varepsilon_{inf} + c_{36} * \varepsilon_{eg} + c_{37} * \varepsilon_{opi}$). The last restriction which we have applied in our analysis is the shock of quantum of industrial export and here we have taken that it is not affected by stock prices perhaps all rest of the shock have a strong influence on it ($\varepsilon_{qie} = c_{22} * \varepsilon_{qie} + c_{23} * \varepsilon_{reer} + c_{24}\ \varepsilon_{cmr} + c_{25} * \varepsilon_{inf} + c_{26} * \varepsilon_{eg} + c_{27} * \varepsilon_{opi}$). Matrix notation of the model is given below:

$$\begin{bmatrix} c_{11} & c_{12} & c_{13} & c_{14} & c_{15} & c_{16} & c_{17} \\ 0 & c_{22} & c_{22} & c_{24} & c_{25} & c_{26} & c_{27} \\ 0 & 0 & c_{33} & c_{34} & c_{35} & c_{36} & c_{37} \\ 0 & 0 & 0 & c_{44} & c_{45} & c_{46} & c_{47} \\ 0 & 0 & 0 & 0 & c_{55} & c_{56} & c_{57} \\ 0 & 0 & 0 & 0 & 0 & c_{66} & c_{67} \\ 0 & 0 & 0 & 0 & 0 & 0 & c_{77} \end{bmatrix} = \begin{bmatrix} \varepsilon_{asi} \\ \varepsilon_{qie} \\ \varepsilon_{reer} \\ \varepsilon_{cmr} \\ \varepsilon_{inf} \\ \varepsilon_{eg} \\ \varepsilon_{fpi} \end{bmatrix}$$

3.5.3 Model with Both Oil and Food Price Indices as Exogenous

Third model we incorporate this discussion is basically 8 variables model in which we take account of both exterior variables (oil and food prices) as an exogenous. According to Fardous Alom (2011) we will put K (K-1)/2 other restrictions so here we will add 28 restrictions. In that model oil and food prices are taken as completely exogenous and both of these shocks are affecting output growth, inflation, real effective exchange rate, call money rate, stock price indices and quantum of industrial exports. The matrix form of the ordering is prearranged in appendix.

For recursive ordering and the purpose of analysis here we adopt that oil price shock is just affected by itself but it affect rest of the variables in the model so we have added 7 constraint here ($\varepsilon_{opi} = c_{88} * \varepsilon_{opi}$). The next shock in our exploration is food price shock is affected by oil prices and it do not influenced by all other shocks which may arise in the economy due to economic variables which are included in the model and food price shock can affect all other interior variables thus here we put six constraints ($\varepsilon_{fpi} = c_{77} * \varepsilon_{fpi} + c_{78} * \varepsilon_{opi}$). Secondly, here we assume that economic growth/growth of GDP is mainly caused by food price shockwave therefore we put 5 restraints here ($\varepsilon_{eg} = c_{66} * \varepsilon_{eg} + c_{67} * \varepsilon_{fpi} + c_{68} * \varepsilon_{opi}$). Thirdly, we take on that CPI/inflation shock is affected by itself, shock of economic growth and food price shock whereas these three disturb the movement of all other variables which are incorporated in the model. At this juncture we put 4 restrictions, ($\varepsilon_{inf} = c_{55} * \varepsilon_{inf} + c_{56} * \varepsilon_{eg} + c_{57} .* \varepsilon_{fpi} + c_{58} * \varepsilon_{opi}$). The next shock in the list is the shock of call money rate. Here we undertake that it is not affected by real effective exchange rate, quantum of industrial export and stock price shocks hence we put 3 restrictions here for the contemporary period though it is while it is pretentious by rest of the shock in the list($\varepsilon_{cmr} = c_{44} . \varepsilon_{cmr} + c_{45} * \varepsilon_{inf} + c_{46} * \varepsilon_{eg} + c_{47} * \varepsilon_{fpi} + c_{48} * \varepsilon_{opi}$). Fifth shock in our analysis is the shock of real effective exchange rate and here we adopt that it is not affected by stock prices shock therefore we put 2 restrictions here for the contemporary period while it is pretentious by all rest of the shocks in our analysis ($\varepsilon_{reer} = c_{33} * \varepsilon_{ree\ r} + c_{34} * \varepsilon_{cmr} + c35 * \varepsilon_{inf} + c_{36} * \varepsilon eg + c_{37} * \varepsilon_{fpi} + c_{38} * \varepsilon_{opi}$). The last restriction which we have applied in our analysis is the shock of quantum of industrial export and here we have taken that it is not affected by stock prices perhaps all rest of the shock have a strong influence on it ($\varepsilon_{qie} = c_{22} * \varepsilon_{qie} + c_{23} * \varepsilon_{reer} + c_{24} \varepsilon_{cmr} + c_{25} * \varepsilon_{inf} + c_{26} * \varepsilon_{eg} + c_{27} * \varepsilon_{fpi} + c_{28} * \varepsilon_{opi}$).

Matrix notation of the model is given below:

$$\begin{bmatrix} c_{11} & c_{12} & c_{13} & c_{14} & c_{15} & c_{16} & c_{17} c_{18} \\ 0 & c_{22} & c_{22} & c_{24} & c_{25} & c_{26} & c_{27} c_{28} \\ 0 & 0 & c_{33} & c_{34} & c_{35} & c_{36} & c_{37} c_{38} \\ 0 & 0 & 0 & c_{44} & c_{45} & c_{46} & c_{47} c_{48} \\ 0 & 0 & 0 & 0 & c_{55} & c_{56} & c_{57} c_{58} \\ 0 & 0 & 0 & 0 & 0 & c_{66} & c_{67} c_{68} \\ 0 & 0 & 0 & 0 & 0 & 0 & c_{77} c_{78} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \ c_{88} \end{bmatrix} = \begin{bmatrix} \varepsilon_{asi} \\ \varepsilon_{qie} \\ \varepsilon_{reer} \\ \varepsilon_{cmr} \\ \varepsilon_{inf} \\ \varepsilon_{eg} \\ \varepsilon_{fpi} \\ \varepsilon_{opi} \end{bmatrix}$$

3.5.4 Impulse Response Function

Impulse response function (IRF) examine the variables' time horizon and their reaction to an unexpected shock to a variable of the model. In fact, it tracks the impact of exogenous variables on the set of variables of the model. In simple words, how the variables of the VAR model respond to an external shock like global food price or oil price shocks. Hence, for the 2 variables system, there will be 4 IRFs. Likewise, for 3 variables, there will be 9 IRFs. As mentioned earlier, an external shock influences the dependent variable while shock happens via disturbance term. In this research project, we will apply the IRF concept to evaluate the oil price shocks and food price shocks impact on the key macro variables from Pakistan. The standard IRF is based on the SVAR model estimates of this study. The common way of producing IRFs includes a non-linear function of the VAR parameters estimates. The process is optimal for all horizons if the VAR overlaps with the data generating process. It will produce biased IRFs if the VAR does not overlaps with the data generating process.

3.5.5 Generalized Forecast Error Variance Decomposition

The IRFs technique provides the visual display of the impact of external shocks like global food price shock and global oil price shock impacts on the major macro variable of the understudied economy. In simple words, after estimating the VAR model, IRFs are used to get the short-run swings in all variables of the model via charts. In order to get the quantitative figures on the impact of external shocks like global food price shock and global oil price shock impacts on the major macro variable of the understudied economy, we need some other approach. As mentioned by (Younas & Khan, 2018; Rizwan et al., 2019), Generalized forecast error variance decompositions (GFEVD) is the best approach to find these kinds of quantitative analysis. The variance decomposition actually provides a different approach to analyze the dynamics of the VAR model. They offer dependent variable swings proportion that occurs because of their own shocks relative to the shocks to other variables. According to Rizwan et al. (2019), “This is done by determining how much of the s-step ahead forecast error variance for each variable is explained innovations to each explanatory variable (s = 1,2,…)”.

3.5.6 The Cholesky Decomposition

The standard SVAR model includes short-run analysis and Cholesky decomposition schemes which were introduced by Sims (1980). Sometimes Cholesky decomposition is known as a World causal chain. This technique attains orthogonalization which executes a recursive structure on the variables’ contemporary relationships in a particular model. As mentioned by Sims (1980), “under a triangular scheme, how the variables are associated to each other and ordered in the VAR will determine which variable is affected by which other variables in their recursive way”. Cholesky decompositions is easy to understand and simple to apply tool which widely used by the researcher in VAR families related research papers. The Cholesky decomposition is like the “causal chain” of the shocks. According to Whelan (2016), the 1st shock influence all variables of the model in a specified time period of (t). The next shock only influences two of them during the same period, and the last shock influence only the last variable of the model at the same period. He further mentions that the reasoning generally depends on the claim such as some specific variables are gluey and do not react instantaneously to some shocks.

CHAPTER 4

4 EMPIRICAL RESULTS AND DISCUSSION

4.1 Descriptive Statistics

Table 1 designates the descriptive statistics of data which includes mean, median, standard deviation, skewness, probability, sum of square and kurtosis of data. Mean and median shows the average value of data and standard deviation is basically the square root of variance which indicates that how the values are disperses around its mean value. Skewness shows the flatness of the distribution and in probability theory skewness is the measure of asymmetry of any probability distribution. If the value of skewness is between -0.5 and 0.5 then it shows that data are fairly symmetrical. Kurtoses tells us about the tallness of distribution in other words it is all about the tail of the probability distribution. It actually measures the outliers' presence in the distribution. Low value of kurtoses shows that data have light tails or less outliers and low value of kurtoses is assumed to be good for the certain data set.

Table 4. 1 Descriptive Statistics

Variables	ASI	CMR	INF	FPI	OPI	QIE	REER	EG
Mean	1473.16	8.89	7.34	121.61	117.11	163.91	106.12	37.869
Median	1564.77	9.215	6.81	111.99	107.44	161.25	104.51	38.014
Maximum	2540	13.38	19.29	165.99	183.70	234.5	124.79	43.942
Minimum	0	1.86	1.54	92.37	70.45	113.12	93.43	32.25
Std. Dev.	617.17	2.91	4.18	23.65	31.10	37.10	9.29	2.85
Skewness	-1.03	-0.47	0.64	0.38	0.37	0.22	0.30	-0.10
Kurtosis	4.195	2.78	3.32	1.57	2.24	1.89	1.97	2.21
Jarque Bera	26.58	4.47	8.25	12.2815	5.26	6.62	6.63	3.20
Probability	0.000002	0.11	0.02	0.002	0.07	0.04	0.036	0.20
Sum	164994.3	995.84	822.45	13619.98	13116.26	18358.0	11884.89	4392.80
Sum Sq. Dev.	42279480	942.5438	1938.67	62125.69	107360.9	152814.2	9572.007	937.33
Observations	112	112	112	112	112	112	112	112

4.2 Graphical Analysis

By graphical representation of data we can easily view the behavior of any series. Figure 4 is the simple line graph of all variables that is given below. It indicates that only GDP per capita has trend over the passage of time. Remaining all variables are fluctuating around its mean value.

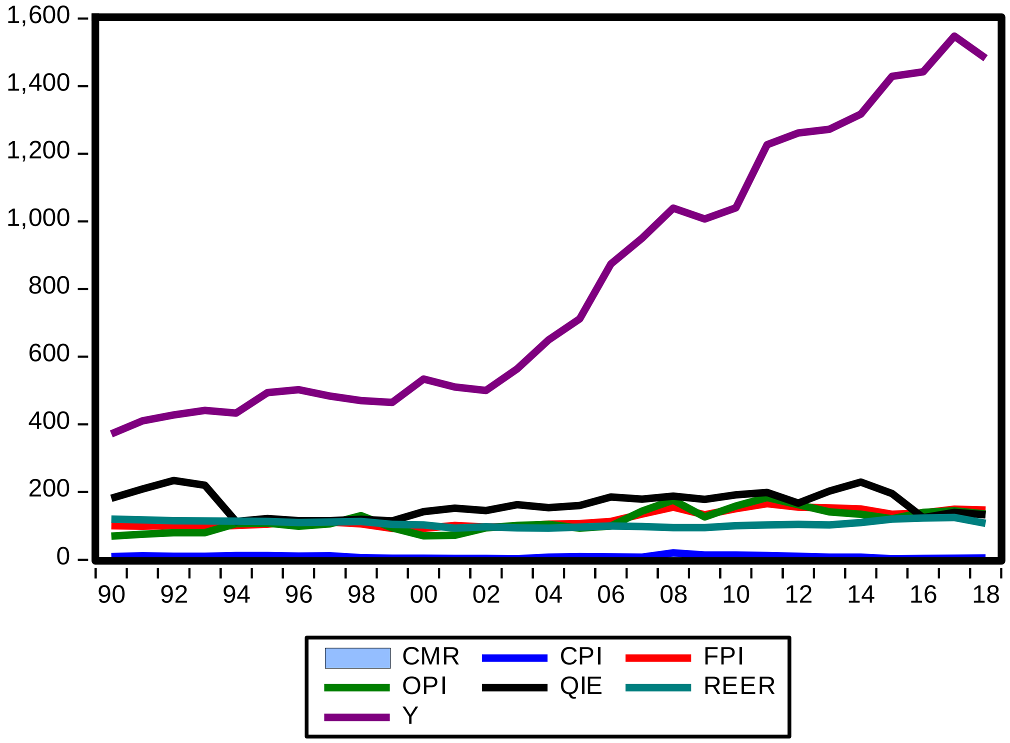

Figure 4 Simple plot of time series data

4.3 Pair wise Correlation

Table 2 demonstrates the pair wise correlation among variable series. Correlation matrix that is given below indicates us about the absence of strong relationship among variables except oil price indices and global food price indices. The degree of relationship among oil price index and food price index is strong as the value of correlation coefficient is 0.91. As we know that correlation lies between -1 and +1. If degree of correlation is perfectly negative than value of correlation be -1 and if value of correlation is +1 then it means that degree of relationship among two variables is perfectly positive. If value of correlation is greater than 0.5 then degree of relationship between variables is high weather it is negative or positive it depends on the sign of correlation coefficient. By viewing the table we can see that there is no strong connection/affiliation between variables.

Table 4.2 Correlation Matrix

Variables	**ASI**	**CMR**	**EG**	**FPI**	**INF**	**OPI**	**QIE**	**REER**
ASI	1.00	-0.28	0.61	0.21	-0.23	0.31	-0.39	-0.50
CMR	-0.28	1.00	0.02	0.32	0.48	0.38	0.05	0.03
EG	0.61	0.02	1.00	0.62	-0.06	0.58	0.03	-0.16
FPI	0.21	0.32	0.62	1.00	0.26	0.91	0.30	0.03
INF	-0.23	0.48	-0.06	0.26	1.00	0.34	0.23	-0.14
OPI	0.31	0.38	0.58	0.91	0.34	1.00	0.12	-0.03
QIE	-0.39	0.05	0.03	0.30	0.23	0.12	1.00	-0.07
REER	-0.50	0.03	-0.16	0.03	-0.14	-0.03	-0.07	1.00

4.4 Unit Root Analysis

In time series analysis, according to basic econometrics, we cannot directly apply OLS methodology on a regression because data must be stationary before the run of OLS. Unit root means whether the variance and mean of a time series are the same or changing with time after incorporating the autoregressive structure. Sometimes it is referred to as a stationarity problem. In simple words, a unit root test means a test of examining that a time series variable is non-stationary or stationary using an autoregressive model. If the variable of an econometric model is non-stationary then it can cause several problems during the estimation process. Econometricians called it "spurious regression" results which means apparently results are significant but in reality, they are meaningless (Phillis, 1986; Engle & Granger, 1987).

Another problem with the non-stationary data is that a time series can exhibit stochastic trends or deterministic trends in the series. A very important difference between these types of variables is that deterministic trend series can easily be converted into stationary data after de-trending them. On the other hand, the stochastic trending variable should be differenced to attain the stationarity of the variable. If a variable becomes stationary after the first difference then we can say that a particular variable has a unit root because it is not stationary at level. Similarly, if a variable is stationary after two differences then we call it integrated of degree one I (2). There are several tests that are developed by the statisticians and econometricians to check the stationarity problem in time series data. Augmented Dickey-Fuller (ADF) test is a famous and highly used technique to check whether a series exhibit unit root or not. Some other unit root tests often use by the researcher include; "Phillips–Perron test, KPSS test here the null hypothesis is that trend is stationarity rather than the presence of a unit root, ADF-GLS test, Sargan-Bhargava test, and Zivot–Andrews test". In this research, we use the ADF test to evaluate the presence of unit roots in our understudied variables. We use this test because it shows very reliable findings for a big sample size as our data also have a big sample size. Another reason for using this test over other unit root tests is that in several Monte Carlo iterations papers we observe that the Phillips–Perron test does not always have accurate size even in fairly big sample size, while the ADF is more strong in general (Banerjee et al., 1993).

4.4.1 Augmented Dickey–Fuller Test

As mentioned earlier, the non-stationary null hypothesis can be checked via using the ADF test is the best approach due to several reasons for instance, this test works fine on both log-transformed variable and raw indices in both at first difference and levels. The unit root null hypothesis is "H_0: $\beta = 0$, that the data generating process (DGP) for the time series can be categorized as a non-stationary $I(1)$ process, is tested against the alternative hypothesis is that H_1: $\beta < 0$ based on the t-statistic of the β estimate (Hamilton 1994) and Campbell & Perron (1991)". The ADF statistic is negative in nature which infers that the bigger the negative number the higher is the null hypothesis rejection. In other words, there is a problem of non-stationarity is rejected at some given confidence level.

Table 3 of this study specifies the findings of ADF test results. We apply this test to evaluate the order of integration of our non-stationary variables EG, CPI, OPI, INF, CMR, REER, QIE and FFPI. To identify whether a variable is stationary or not ADF test is applied where the findings indicate that CPI, REER, FFPI, OPI, CMR, QIE, and ASI variables are non-stationary at the level. When we take the first difference of these variables they become stationary. For robustness, we take the log of all variables and apply the ADF test again where results show that all variables stationary at the level and some of them are stationary at first difference. This conversion of data series describes that our datasets have mixed integration order. For details, see the table of results of the augmented Dickey-Fuller (ADF) test.

Table 4.3 Augmented Dicky Fuller Unit Root Test

Variable	**Unit Root Test**					
	Level		**1st Diff**		**Level of sig**	**Order**
	Intercept	**Trend & Intercept**	**Intercept**	**Trend & Intercept**		
EG	0.63 (2.97)	1.73 (3.58)	4.52 (2.98)	4.72 (3.59)	5%	I (1)
CPI	2.22 (2.97)	2.28 (3.58)	6.61 (2.98)	6.47 (3.58)	5%	I (1)
REER	1.85 (2.97)	1.71 (3.58)	3.27 (2.98)	3.89 (3.59)	5%	I (1)
FPI	1.05 (2.97)	2.11 (3.58)	5.29 (2.98)	5.18 (3.58)	5%	I (1)
OPI	2.09 (2.97)	4.33 (3.63)	5.69 (2.98)	5.62 (3.595)	5%	I (1)
CMR	2.05 (2.97)	1.99 (3.58)	4.80 (2.98)	4.78 (3.595)	5%	I (1)
QIE	2.199(2.97)	2.16 (3.58)	5.01 (2.98)	4.63 (3.595)	5%	I (1)
ASI	2.31(2.89)	2.17 (3.45)	10.65 (2.89)	10.65 (2.89)	5%	I (1)

4.5 Test for Cointegration

Johansen test for Cointegration displays two results table which are given below described below. At first table it shows the results of trace. Table 4 shows the results of trace. Results of Johansen Cointegration test is as follows:

Table 4.4 Results of Johansen Cointegration test

Hypothesize no of Cointegration	Eigen value	Trace Statistic	Critical value at 5%	Probability**
None	0.26	128.93	159.53	0.65
At most 01	0.23	95.93	125.62	0.72
At most 02	0.21	67.33	95.75	0.80
At most 03	0.15	41.36	69.82	0.92
At most 04	0.08	23.67	47.86	0.96
At most 05	0.07	14.13	29.80	0.83
At most 06	0.04	5.80	15.49	0.72
At most 07	0.01	0.91	3.84	0.34

Trace test indicates no Cointegration at 5% critical value

* denotes rejection of null hypothesis at 5% critical value

**denotes Mackinnon Haug Michelis (1999) p values

Trace indicates that there is no Cointegration in long run whereas the level of significance is 5%. And the second table reports the results of maximum Eugen values. And Maximum Eigen values indicates that there is no Cointegration in long run on the 5% level of significance. As the p values of each no of cointegrating vector is greater than 5% so we may reject the null hypothesis and it determine that there is no long run cointegrating vector among variables.

Table 4.5 Unrestricted Cointegration Rank Test

Hypothesize no of Cointegration	Eigen value	Max Eigen Statistic	Critical value at 5%	Probability**
None	0.26	33.00	52.36	0.88
At most 01	0.23	28.60	46.23	0.85
At most 02	0.21	27.97	40.08	0.70
At most 03	0.15	18.29	33.88	0.86
At most 04	0.08	8.95	27.58	1.00
At most 05	0.07	8.33	21.13	0.88
At most 06	0.04	4.89	14.26	0.76
At most 07	0.01	0.91	3.84	0.34

Maximum Eigen value indicates no Cointegration at 5% level

* denotes rejection of null hypothesis at 5% critical value

**denotes Mackinnon Haug Michelis (1999) p values

Results of trace and maximum Eigen values displays that the variable are not interrelated to each other in the long run. Hence there is no Cointegration vector in the long run so we will go for the short analysis. According to Engle Granger Theorem, if the is no long run association between variables then there is no error correction mechanism.

4.6 Vector Error Correction Model (VECM)

Error correction model (ECM) is an applicable approach for the multivariate time series analysis where the variables express the stochastic movement which is also recognized as long run Cointegration. ECM is a theory based approach which is beneficial when we have to estimate the short term and long run influence of time series data of different variables. Here error correction refers that how long it will take to reach its equilibrium level after the last period deviation from equilibrium. Henceforth ECMs shortly determines the speed at the shock will recover in a variable.

Table 6 shows the results of error correction model. In the results table first row indicates the value of slope coefficients and first row of intercept (C) shows the speed of adjustment towards equilibrium when shocks occurs in specific period of time. Normally value of adjustment parameter lie between 0 and -1 in one/single equation model but in multivariate exploration it is not obligatory. And each second row of table indicates the standard error of the respective parameter and 3rd row indicates the value of t statistic.

Table 4.6 Results of Vector Error Correction Model

Error Correction	**D(EG)**	**D(ASI)**	**D(CMR)**	**D(INF)**	**D(QIE)**	**D(REER)**	**D(OPI)**	**D(FPI)**
CointEq1	-0.27 -0.06 [-4.394]	-10.87 -9.18 [-1.184]	-0.07 -0.05 [-1.378]	0.06 -0.08 [0.754]	-0.32 -0.68 [-0.468]	0.20 -0.12 [1.689]	0.87 -0.49 [1.787]	0.34 -0.24 [1.421]
D(EG(-1))	0.10 -0.11 [0.934]	4.34 -16.31 [0.266]	0.03 -0.09 [0.287]	-0.02 -0.14 [-0.166]	0.11 -1.21 [0.088]	-0.08 -0.21 [-0.363]	-0.32 -0.86 [-0.364]	-0.12 -0.42 [-0.281]
D(ASI(-1))	0.00 0.00 [-0.417]	-0.02 -0.14 [-0.159]	0.00 0.00 [-0.113]	0.00 0.00 [0.091]	0.00 -0.01 [-0.008]	0.00 0.00 [0.173]	0.00 -0.01 [0.118]	0.00 0.00 [0.064]
D(CMR(-1))	0.09 -0.13 [0.726]	3.67 -19.02 [0.193]	0.02 -0.10 [0.229]	-0.02 -0.16 [-0.124]	0.11 -1.41 [0.079]	-0.07 -0.25 [-0.279]	-0.30 -1.01 [-0.298]	-0.12 -0.49 [-0.239]
D(INF(-1))	-0.07 -0.11 [-0.677]	-1.66 -16.01 [-0.104]	-0.02 -0.09 [-0.242]	0.01 -0.14 [0.084]	-0.16 -1.19 [-0.134]	0.05 -0.21 [0.239]	0.31 -0.85 [0.362]	0.14 -0.42 [0.339]
D(QIE(-1))	0.00 -0.01 [-0.236]	-0.07 -1.85 [-0.036]	0.00 -0.01 [-0.084]	0.00 -0.02 [0.029]	-0.01 -0.14 [-0.046]	0.00 -0.02 [0.083]	0.01 -0.10 [0.126]	0.01 -0.05 [0.117]
D(REER(-1))	0.05 -0.06 [0.851]	2.18 -8.50 [0.256]	0.01 -0.05 [0.256]	-0.01 -0.07 [-0.157]	0.04 -0.63 [0.069]	-0.04 -0.11 [-0.334]	-0.14 -0.45 [-0.316]	-0.05 -0.22 [-0.234]
D(OPI(-1))	0.00 -0.02 [-0.046]	0.06 -3.35 [0.018]	0.00 -0.02 [-0.026]	0.00 -0.03 [-0.004]	-0.01 -0.25 [-0.029]	0.00 -0.04 [0.009]	0.01 -0.18 [0.053]	0.01 -0.09 [0.062]
D(FPI(-1))	-0.01 -0.05 [-0.122]	-0.87 -7.38 [-0.117]	0.00 -0.04 [-0.006]	0.00 -0.06 [0.056]	0.03 -0.55 [0.053]	0.01 -0.10 [0.069]	-0.02 -0.39 [-0.044]	-0.02 -0.19 [-0.090]
C	0.07 -0.14 [0.522]	16.43 -20.27 [0.810]	-0.01 -0.11 [-0.089]	-0.06 -0.17 [-0.366]	-0.71 -1.51 [-0.472]	-0.10 -0.26 [-0.378]	0.57 -1.07 [0.527]	0.45 -0.53 [0.856]

4.7 Selection of lag length criteria

Table 7 directed us about the choice of the lag selection criteria for the model. Here we have considerd Schwarz criteria for the selection of optimum and lag length criteria. Hence the results confers we will consider 1 lag length for our analysis.

Table 4.7 Selection of Lag Length Criteria

Lag	Log L	L R	AIC	SC	HQ
0.00	-3212.00	-	61.92	62.13	62.01
0.01	-2465.45	1363.89	48.80	50.63 *	49.59 *
0.02	-2454-28	18.86	49.81	53.27	51.21
0.03	-2434-11	30.49	50.66	55.74	52.72
0.04	-2382.33	70.70	50.89	57.60	53.61
0.05	-2249.24	161.24	49.56	57.89	52.94
0.06	-2229.68	20.69	50.42	60.38	54.46
0.07	-2188.23	37.47	50.85	62.45	55.55
0.08	-1875.33	234.67	46.06	59.29	51.42

* Indicated lag order selected by the criterion

LR: Sequential modified LR test statistic (each at 5 % level). FPE: Final prediction error, AIC: Akaike information criteria, SC: Schwarz information criteria, HQ: Hannan Quinn information criterion.

4.8 Granger Causality Test

Table 8 directs us to Block Exogeneity/Granger Causality test results. Here block exogeneity means that Pakistan economy is not large enough which may affect the price, demand and supply at the international / world market. Indication of Granger cause and effect association can be observed for other all the variables where degree of freedom is 1 for all variables and p value is greater than 5 percent. Here in table 8 when ASI (stock price index) is considered as dependent variable and we can clearly view that probability value of REER (null hypothesis is that ASI do not have cause and effect association with REER) is bigger than 5 % so at this juncture we accept the null hypothesis. Correspondingly as we can view that ASI do not have cause and effect association with any variable in the list.

Next REER (effective exchange rate) is considered as dependent variable and we can clearly view that probability value of all the variables excluding economic growth (null hypothesis is that REER do not have cause and effect association with E.G) is bigger than 5 % so at this juncture we consent the null hypothesis. Correspondingly we may reach the decision that REER causes economic growth. When INF (inflation) is considered as dependent variable and we can clearly view that probability value of all the variables comprised into the model (null hypothesis is that INF do not have cause and effect association with other REER, CMR, E.G, separately) is bigger than 5 % so at this juncture we consent the null hypothesis. Correspondingly we can say that INF is not causing any variable in model.

When CMR (call money rate) is considered as dependent variable and we can clearly view that probability value of all the variables comprised into the model (null hypothesis is that CMR do not have cause and effect association with other REER, INF, E.G, and OPI separately) is bigger than 5% so at this juncture we consent the null hypothesis. Correspondingly we can say that INF is not causing any variable in model. Next E.G (economic growth) is considered as dependent variable and we can clearly view that probability value of all the variables excluding economic growth (null hypothesis is that E.G do not have cause and effect association with REER, CMR, E.G, and INF separately) is bigger than 5% so at this juncture we consent the null hypothesis. Correspondingly we may reach the decision that economic growth causes REER.

Table 4.8 Granger Causality / Block Exogeneity Tests

ASI is dependent variable			
Excepted	**Chi square**	**d.f**	**Probability**
REER	0.072	1.000	0.788
CMR	0.091	1.000	0.763
INF	0.664	1.000	0.415
EG	0.111	1.000	0.739
OPI	0.033	1.000	0.855
REER is dependent variable			
ASI	1.980	1.000	0.159
CMR	0.102	1.000	0.750
INF	0.192	1.000	0.662
EG	5.972	1.000	0.015
OPI	0.526	1.000	0.468
CMR is dependent variable			
ASI	0.175	1.000	0.676
REER	0.097	1.000	0.755
INF	11.088	1.000	0.001
EG	0.709	1.000	0.400
OPI	0.350	1.000	0.554
INF is dependent variable			
ASI	0.390	1.000	0.532
REER	0.870	1.000	0.351
CMR	0.224	1.000	0.636
EG	1.489	1.000	0.222
OPI	0.052	1.000	0.819
EG is dependent variable			
Excepted	**Chi sq**	**d.f**	**Probability**
ASI	3.134	1.000	0.077
REER	6.597	1.000	0.010
CMR	0.315	1.000	0.575
INF	2.473	1.000	0.116
OPI	0.427	1.000	0.513

4.9 Residual Diagnostic

The term “residuals” in a time series model are those values that are deliberately not included into the model and consider as extra in such circumstances the estimated econometric model gave influenced results. In statistics and econometrics errors or residual are the gap between actual observations and the estimated observations and can be express or written as under as under:

$$e_t = y_t - \check{y}_t.$$

Residual tells us about the adequacy of the econometric model and determine that model is fully describing the characteristics of the data. A good fitted econometrics models residuals has following properties; 1) residuals (error terms) are uncorrelated/independent with each other. If residuals have any association then it means there is some information that is missing in econometric model which researcher must has integrated in their econometric model, 2) the residuals, in simple form called error term, should have zero mean analysis. Contrary to it forecasting of that model shows biased and instable/unreliable results. These two properties are consider as essential but there are two more properties of residual which are very helpful, 3) variance of error term should be constant, and 4) Residuals distribution should be normal.

4.9.1 Test for Model Stability

Test for model stability are available in EVIEWS. Here we applied the CUSUM and CUSUM Square tests because both of them are widely used by the economic and financial scholars. CUSUM stands for Cumulative sum of recursive residuals and the CUSUM square (CUSUMSQ) tests are mainly advantageous to evaluate the estimated parameters stability (Pesaran, 1997). Cumulative sum test detects the systematic changes which may exist in the regression coefficients, on the other hand the cumulative sum of squares test govern about the unexpected changes which may occur in the regression coefficients. Figure 4.5 and 4.6 graph the results of CUSUM and CUSUMSQ respectively. As we can see that our plotted results are inside the critical red line which proves, at 5 percent confidence intervals of the parameters stability, the absence of any instability of coefficients and here we can say that the residual variance is stable over time for macroeconomic variables of Pakistan. The CUSUM test is useful for determination of model stability. The CUSUM test for model stability is constructed on the base of the cumulative sum of residuals of models equations. The parameters which we estimate will be reflected stable if residuals graph/plot remain inside the red parallel critical lines. Graphical representation of the test is given below. (see Figure 8 and 9)

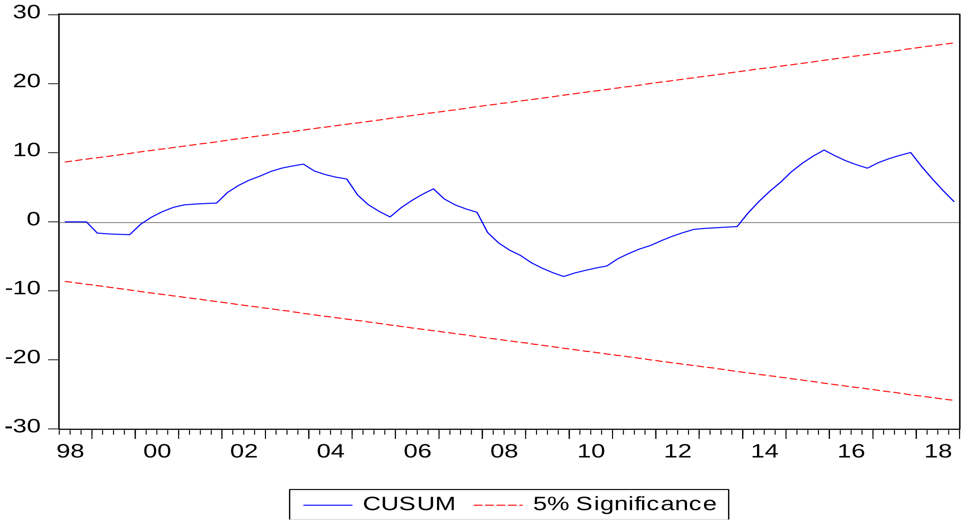

Figure 5 CUSUM Test of parameter stability

CUSUM of Squares test also calculated just like CUSUM test and interpretation is also same but the difference is that its graph consist of residuals square while CUSUM test considers simply the values of the residuals. Now by viewing the graph 4.6 we can say that our estimated model is stable because it is within the red critical lines.

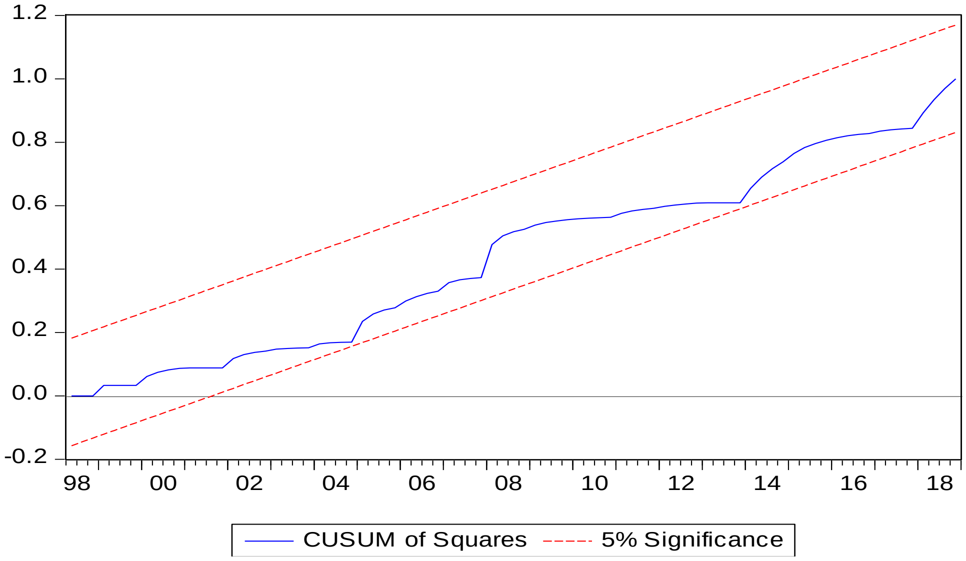

Figure 6 CUSUM Square Test of parameter stability

4.9.2 Heteroscedasticity

In econometrics series of a random variable is heteroskedastic if the random disturbance is change over time. As we know that variability is measure by variance and other measure of dispersion i.e. range. Hence we can say that heteroscedasticity is nonexistence of constant variance. The word heteroskedastic basically derived from Greek word *hetero* which means different and *skedasis* which means dispersion. The presence of heteroscedastic in a time series variable is chief concern when we analyzing the variance, covariance and regression line. Heteroscedasticity overruled the statistical significance which undertake the error term has constant variance. If variance of residuals is not constant with time then results of estimated regression parameters will be unbiased but they will not be efficient.

4.9.2.1 General Tests for Detection of Heteroscedasticity

There are a number of test that has been in use for the detection of heteroscedasticity. Few famous and well known tests are Levene's test, Glodfeld & Quandt Test, Park Test, Glejser Test, White Test, and Brusch & Pegan Test.

4.9.2.2 VAR Residual Heteroscedasticity Test

Table 9 demonstrates the results of VAR Residual Heteroscedasticity Test. Results of joint component indicates nonexistence of heteroscedasticity in the estimated Structural VAR model as probability value is smaller than 5 percent. It means that variance of residuals is constant over the period of time.

Table 4.9 VAR Residual Heteroscedasticity Test

Joint test				
Chi sq	**d.f**	**Probability**		
293.983	252.000	0.036		
Individual components				
R Square	**F (12,98)**	**Probability**	**Chi sq (12)**	**Probability**
0.148	1.418	0.171	16.424	0.173
0.119	1.101	0.368	13.183	0.356
0.076	0.674	0.773	8.461	0.748
0.068	0.596	0.841	7.553	0.819
0.103	0.938	0.513	11.432	0.492
0.093	0.842	0.608	10.372	0.583
0.097	0.878	0.572	10.771	0.549
0.127	1.184	0.306	14.050	0.298
0.116	1.072	0.392	12.878	0.378
0.161	1.571	0.113	17.908	0.119
0.091	0.817	0.633	10.090	0.608
0.200	2.048	0.028	22.253	0.035
0.095	0.855	0.594	10.525	0.570
0.127	1.188	0.303	14.095	0.295
0.185	1.855	0.050	20.547	0.057
0.092	0.826	0.623	10.197	0.599
0.156	1.511	0.133	17.332	0.138
0.118	1.089	0.378	13.057	0.365
0.132	1.240	0.267	14.631	0.262
0.095	0.852	0.597	10.491	0.573
0.150	1.443	0.160	16.671	0.162

4.9.3 Autocorrelation

In regression analysis to draw right inference on the basis of estimated parameters it is very essential that error term should white noise. Here White noise error terms mean expected value of mean is zero, there is no autocorrelations among error terms, constant variance of the error term, and error term follows normal distribution. In applied research it is assumed by the investigators that these assumptions are satisfied without applying any test for them. Since after the innovative work by Durbin & Watson (1950) diagnostic test for error term progress very quickly in literature. There are the several test for detection of autocorrelation for in VAR model which are Lijung & Box Test, Breush & Godfrey L.M Test, and Rao F. Test.

Size and power of the test, stated above, are different for different conditions for instance large sample, small sample, stability, VAR model etc. Hence these conditions are usually exist when we analyze time series data. The lijung & Box and LM tests are most frequently and commonly applied by the researchers to identify presence of autocorrelation in VAR models. Most of the economic data and economic analysis comprise of time series and existence of residuals in econometric model is common. Reason behind the presence of error term is that researchers have constraints they cannot include all the relevant variable in research process on the other hand errors are correlated because most of the economic variables have memory and economic agents also make decision on the basis of past. This is renowned as the problem of autocorrelation. There are other explanations for existence of autocorrelation in the econometric model which may be the exclusion of relevant variable, misspecification of the variable and etc. Hence in presence of autocorrelation in the data estimates will no more efficient. Hence in case of time series data analysis it is obligatory and imperative for researcher to determine the presence of autocorrelation. RAO test basically follows F distributed and (q,f) degree, and it is equal to typical F statistic in case of single equation modeling. Perhaps LM test is multivariate and most commonly and comprehensively applied by researchers in their analysis. It draw too much attention because of its simplicity and easy to estimate. Many software are available and offers the estimates of the test. That is why we used this LM test for the detection of autocorrelation. (see Table 10

Table 4.10 VAR Residual serial Correlation LM Test

Hypothesis: no serial correlation at lag						
Lag	LRE * STAT	d.f	Probability	Rao F statistic	d.f	Probability
1	7.166	36	1	0.193	36,415.5	1
2	5.015	36	1	0.135	36,415.5	1
Hypothesis: no serial correlation at lag						
1	7.166	36	1	0.193	36,415.5	1
2	17.012	72	1	0.244	36,415.5	1
* Edgeworth expansion corrected likelihood ratio statistic						

4.9.4 Normality test

In Econometrics, the normality tests are basically used to define that whether data of variables is transformed in to an econometric modeled properly and it follows the properties of a normal distribution. Table 11 shows the results of the multivariate form of the Jarque Bera tests. Basically it is the comparison of 3^{rd} and 4^{th} moments, which indicates skewness and kurtosis respectively, which follows normal distribution. While estimating the normality test we choose the option of Cholesky (Lutkepohl) because this statistic depends on the ordering of the variables. As in our analysis we are considering recursive ordering of in variables (each model has different ordering which we have specified above in detail). Hence the results of VAR residual normality test indicates that our variables follows normal distribution. Table is given below:

Table 4.11 Results of VAR Residual Normality Test

Component	Skewness	Chi sq	d.f	Probability
1	3.24	192.40	1	0.0000
2	-1.05	20.13	1	0.0000
3	2.29	95.93	1	0.0000
4	0.93	15.74	1	0.0001
5	-1.96	70.43	1	0.0000
6	-0.62	7.02	1	0.0081
Component	**Kurtosis**	**Chi sq**	**d.f**	**Probability**
1	22.07	1666.23	1	0.0000
2	9.28	180.99	1	0.0000
3	20.58	1416.65	1	0.0000
4	9.32	182.89	1	0.0000
5	15.20	681.84	1	0.0000
6	5.89	38.26	1	0.0000
Joint		4166.86	6	0.0000
Component	**Jarque Bera**	**d.f**	**Probability**	
1	1858.63	2.00	0.0000	
2	201.12	2.00	0.0000	
3	1512.59	2.00	0.0000	
4	198.63	2.00	0.0000	
5	752.27	2.00	0.0000	
6	45.28	2.00	0.0000	
Joint	4568.52	12.00	0.0000	

4.10 Results of Structural Vector Auto Regressive (SVAR) Models

4.10.1 SVAR Model with Oil Price Shocks

First of all we estimated the SVAR model in which oil price shock is given to the economy and then we check the results that how other macroeconomic variables answer back to the shock. Here we adopt that oil price is only affected by itself and other variables do not affect oil prices. Estimated SVAR parameters are given in appendix. Appendix Table shows that maximum of the estimated parameters are statistically significant. As p value of maximum of the parameters is less than 0.05. Results of SVAR coefficients and all other matrix are specified in appendix.

4.10.1.1 Impulse Response Function for Oil Price Shock

Here the Figure 7 reveals the reaction of economic variables of Pakistan's (those which we incorporate in our model) to oil price shock. Even though many of the IRFs demonstrate that they are statistically important and signs of these responses are according to our expectation and which we formulate on the foundation of economic theory. By viewing the figure we reached the decision that the stock prices, inflation, Call money rate and the real effective exchange rate answer back to the shock negatively with each one standard deviation (S.D.) improvement in oil price escalation while growth of economic growth respond positively. When there is oil price shock in global level then stock price index behave in a manner that it continually moves away from origin up to the 10 month. Next real exchange rates respond highly to oil price shock and it do not stretch itself to zero level even after the 10 periods. Whereas interest rate decreases when oil price shock occurs into the economy and like real effective exchange rate and stock price indices it also do not reaches to zero even after 10th time period. Effects of oil price shock to inflation is positive and effect of shock dies out after 8th time period where inflation approach/reaches to the axis. The impact of shock on economic growth is positive initially and then it effects negatively. As we can view that Graph of E.G moves upward up to the 8.5th time period and after that gradually it tend to decline.

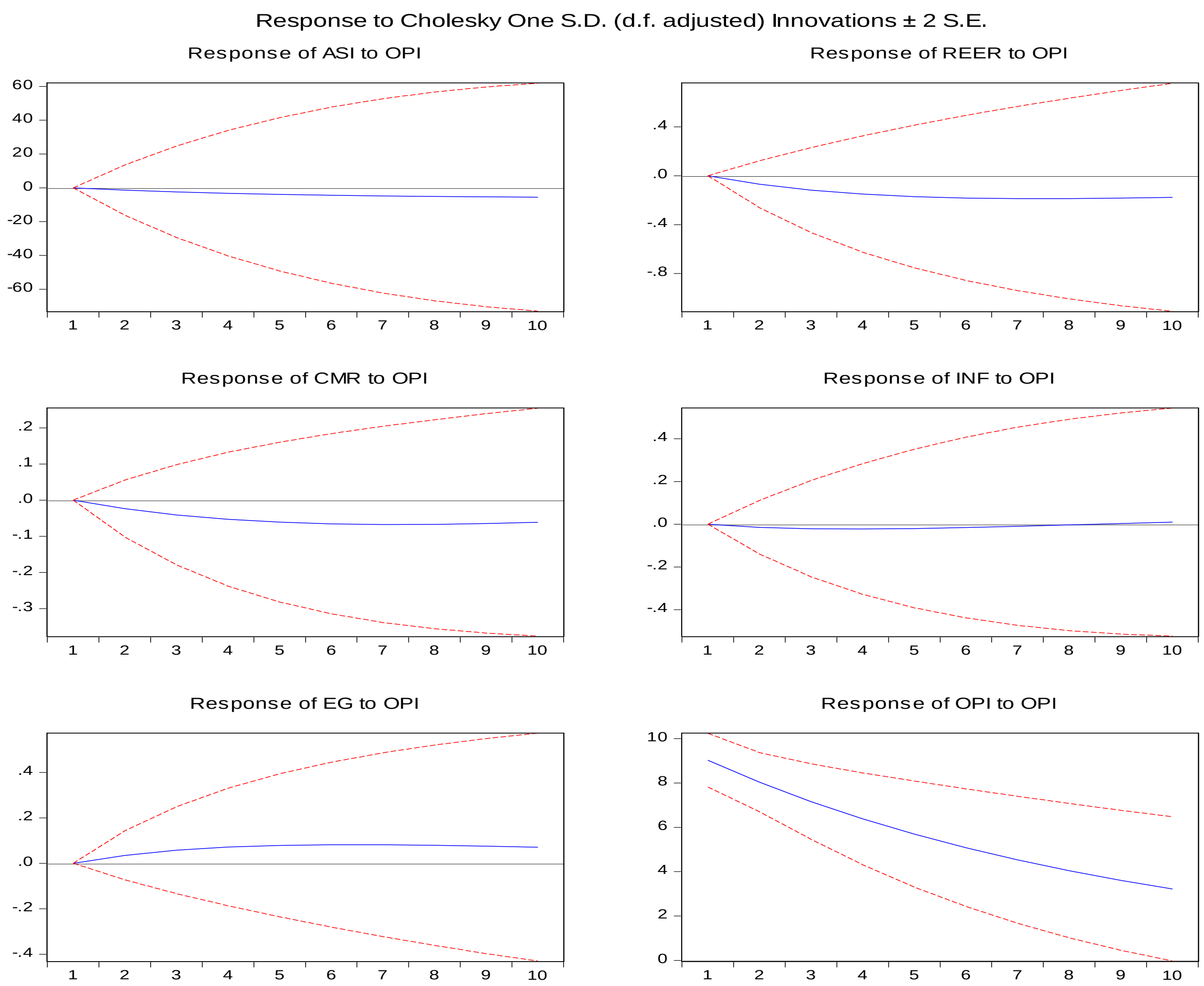

Figure 7 Impulse Responses of Interior Variables to Oil Price Shock

4.8.2 SVAR Model with Global Food Price as Exogenous

Here we estimated the SVAR model in which food price shock has been given to the economy and then we check the results that how other macroeconomic variables have respond this shock. Here we take up the food price is only affected by itself and other variables do not affect food prices. Estimated SVAR parameters are given in appendix. Appendix Table shows that maximum of the estimated parameters are statistically significant. As p value of most of the parameters is less than 0.05. Results of SVAR coefficients and all other matrix are specified in appendix.

4.8.2.2 Impulse Response Function for Food Price Shock

Here the Figure 8 reveals the reaction of economic variables of Pakistan's (those which we incorporate in our model) to international food price shock. Even though many of the IRFs demonstrate that they are statistically significant and signs of these responses are according to our expectation and which we formulate on the foundation of economic theory. By viewing the figure we reached the decision that the stock prices, inflation, Call money rate and the real effective exchange rate, Inflation and economic growth all the variables answer back to the shock positively with each one standard deviation (S.D.) improvement in food price escalation. When there is food price shock in global level then stock price index behave in a manner that it continually moves away from origin up to the 9 month perhaps after it starts moving downward with very slow movement . Next real exchange rates respond highly to food price shock and it stretch itself to zero level even in between 3.5 time period and it cross the axis and starts mounting up to 10^{th} periods. Whereas interest rate decreases when food price shock occurs into the economy and like stock price indices it also do not reaches to zero even after 10^{th} time period. Effects of food price shock to inflation is positive and effect of shock expires after 8^{th} time period where inflation approach/reaches to the axis. The impact of shock on economic growth is positive. As we can view that Graph of E.G moves upward up to the 10^{th} time period and after that gradually it tend to upsurge.

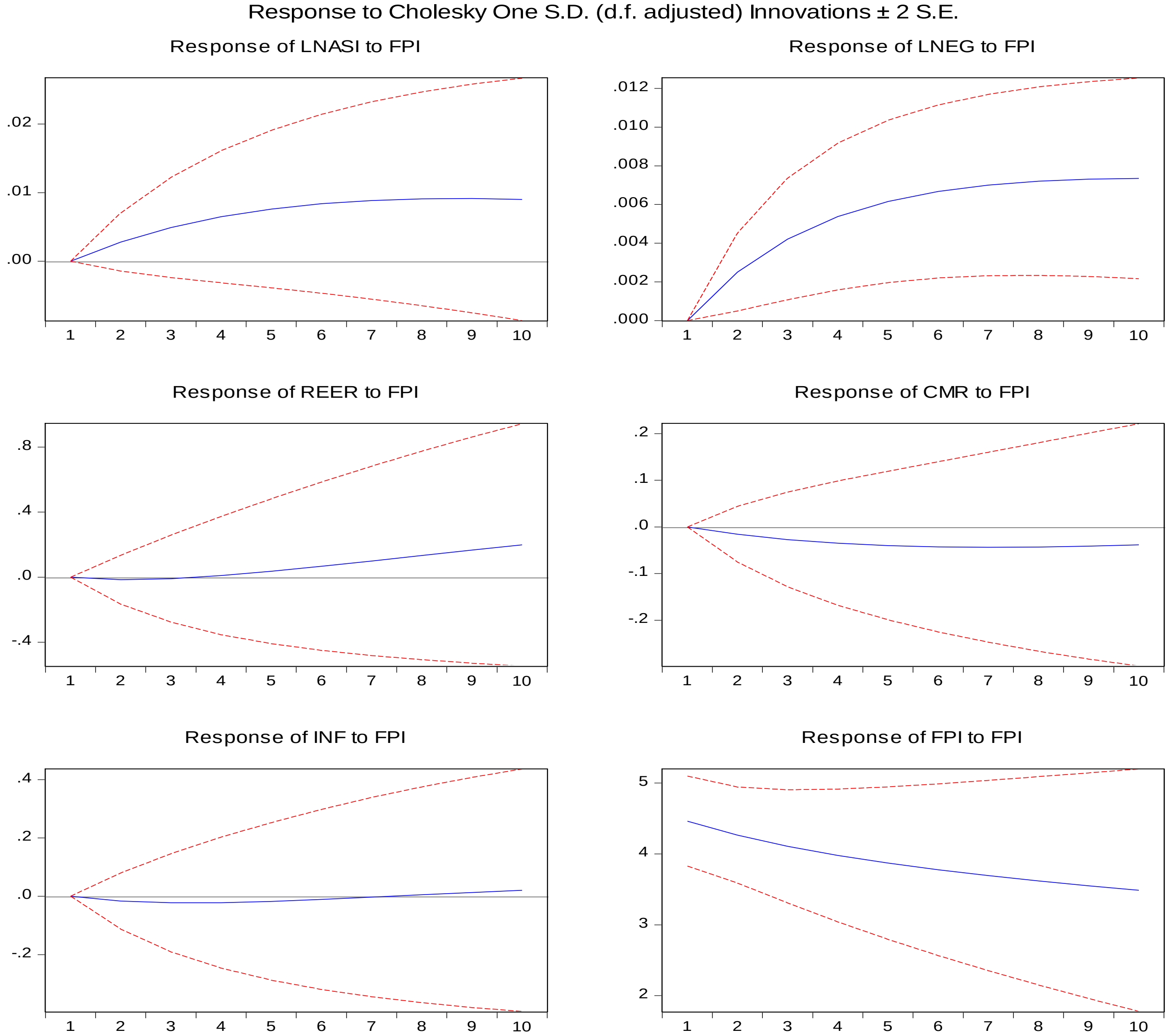

Figure 8 Impulse Responses of Interior Variables to Food Price Shock

4.8.3 SVAR Model with both Oil and Food Price Indices as Exogenous

Table of this estimation is given in appendix which shows the values of coefficients and their probability value of each coefficients. Results demonstrates that many of the coefficients of structural VAR model are statistically significant. Results of SVAR coefficients and all other matrix are specified in appendix.

4.8.3.1 Impulse Response Function for Simultaneous Oil and Food Price Shocks

Here the Figure 9 reveals the reaction of economic variables of Pakistan's (those which we incorporate in our model) to oil and international food price shock. Even though many of the IRFs demonstrate that they are statistically significant and signs of these responses are according to our expectation and which we formulate on the foundation of economic theory. By viewing the figure we reached the decision that the stock prices, inflation, and the real effective exchange rate and economic growth answer back to the shock positively with each additional standard deviation (S.D.) expansion in oil and food price escalation. When there are oil and food price shockwaves in global level then stock price index behave in a manner that it continually moves away from origin up to the 10th in presence of both shocks. Next real exchange rates respond highly to oil price shock and it stretch it towards axis but it do not approach to zero in presence of both shocks together. In case of call money rate it respond positively to 1st shock and reach near to zero at 1oth time period perhaps it respond negative in case of occurrence of exterior food price shock and cut the origin at 7.5th time period. Effects of food and oil price shock to inflation is positive but in case of oil price shocks it shows the gradual and steady movement equivalent to axis. The impact of shocks on economic growth is positive. As we can view that Graph of E.G moves upward up to the 10th time period.

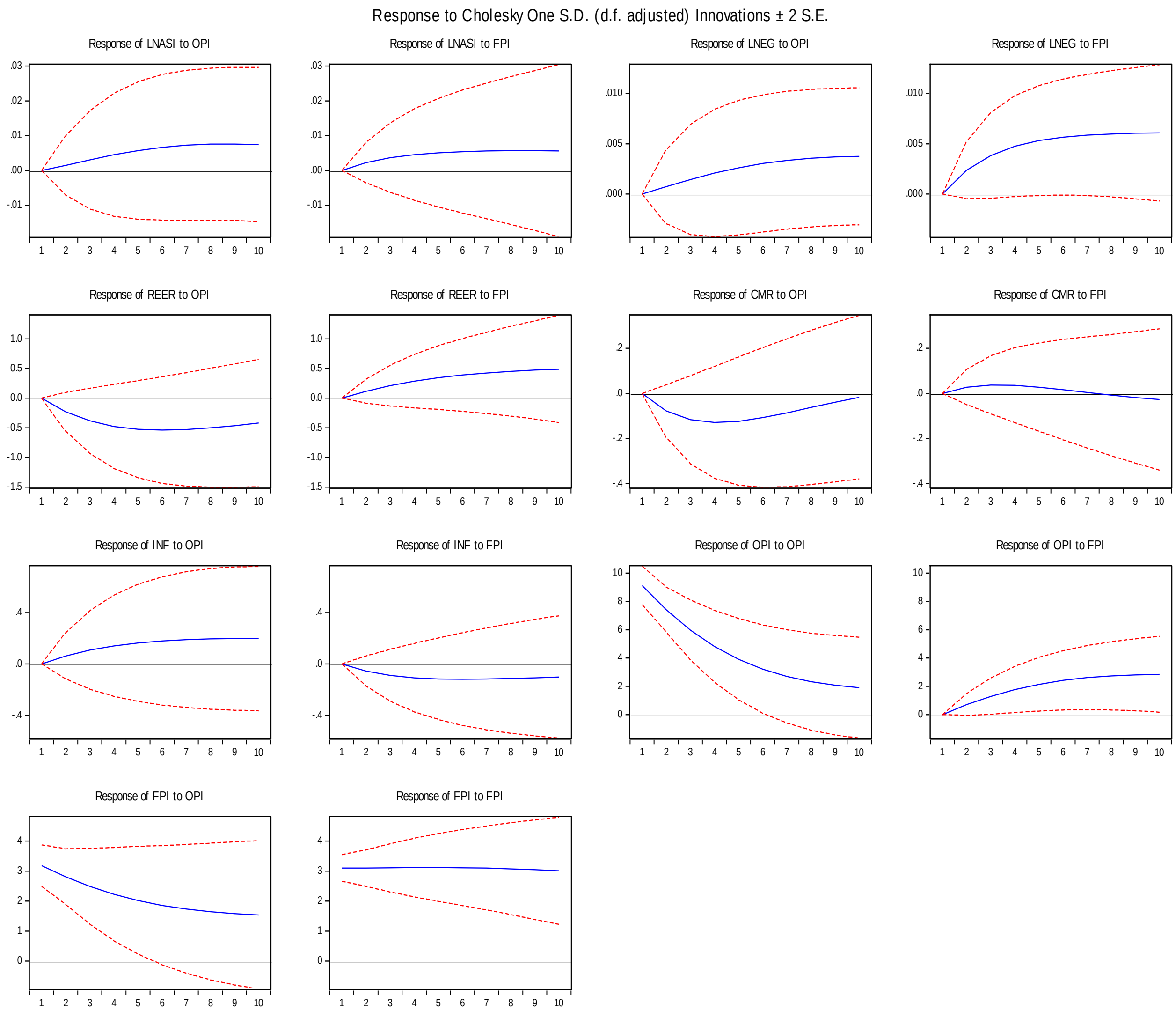

Figure 9 Impulse Responses of Interior Variables to Both Oil and Food Shocks

4.10.4 Forecast Error Variance Decomposition (FEVD)

4.10.4.1 FEVD Analysis for World Crude Oil Price Shock

Table 12 demonstrates FEVD in reaction to the oil price shock up to 15time period. Results of variance decompositions are overall sustained by the IRFs analysis. The stock price is highly responsive to oil price shock. The variability in the stock prices due to international/global oil price shock at first time period is zero while it is 7.68 percent in the third period and then it tends to upturn slowly and gradually. Hence the effects of shock step by step grows up at the end of fifteen month where the world oil price shock explains 16.33 percent of variation in stock prices respectively. The real effective exchange rate is also highly responsive to oil price shock. Quantum of industrial exports is mildly exaggerated by the world oil price shocks as results of variance decomposition which we can view. The movements in the real effective exchange rate due to world oil price shock at start of 1st month is zero percent while it is 8.96 percent in the next time period and then it tends to increase, up to 15 month, slowly and gradually from 8.89, to 28.70 respectively in the last month variations in REER due to oil price shock is 1.15 percent higher than the variation which are explained by shock in 14th period. Just like stock price index and real effective exchange rate call money rate is also highly responsive to oil price shock. The variation in the call money rate due to oil price shock at second time period was 3.90 percent and it increases up to 10 months then in 11 month call money rate negatively affected by oil price shock and then it tends to increase again and then decline again in 14th time period. According to the results of variance decomposition inflation is not so highly responsive to oil price shock unlike other variables. The variation in inflation due to oil price shock at second time period is 3.51 percent while it is 4.10 percent in the last time period. Just like inflation, economic growth is also not highly responsive to oil price shock. The variation in economic growth / industrial production due to oil price shock at second time period was 3.51 percent while it is 5.73 percent in the last given time.

Table 4.12 Generalized Forecast Error Variance Decomposition of Oil Price Indices

Period	**S.E.**	**ASI**	**QIE**	**REER**	**CMR**	**INF**	**EG**	**OPI**
1	417.22	0.00	0.00	0.00	0.00	0.00	0.00	100.00
2	463.22	0.00	0.35	8.96	3.90	3.70	3.51	79.57
3	507.36	7.68	7.19	8.89	3.49	3.09	3.92	65.74
4	546.61	10.40	7.34	9.29	8.32	2.94	3.87	57.84
5	580.12	10.98	6.14	20.32	8.80	3.24	5.47	45.06
6	612.35	11.03	5.87	20.92	10.96	3.06	6.03	42.12
7	630.66	15.87	5.50	19.65	10.39	3.36	5.77	39.47
8	653.37	16.21	5.73	20.42	10.11	3.27	5.88	38.38
9	699.62	14.91	5.50	23.14	11.55	3.14	6.49	35.27
10	751.72	14.65	6.04	24.59	11.21	3.43	6.41	33.66
11	780.05	17.02	6.34	24.50	10.67	3.50	6.10	31.88
12	791.36	16.75	6.31	25.69	10.48	3.44	6.03	31.30
13	805.93	16.60	6.16	25.95	11.08	3.48	6.19	30.54
14	833.28	16.49	6.39	27.19	10.68	3.86	5.99	29.40
15	855.80	16.33	6.78	28.70	10.28	4.10	5.73	28.08
Cholesky Ordering: ASI QIE REER CMR INF EG OPI								

4.10.4.2 FEVD Analysis for Global Food Price Indices

Table 13 demonstrates FEVD of food price indices up to 15, whereas each period shows one month, time period. Results of variance decompositions are overall do not sustained by IRFs analysis. The stock price is highly responsive to oil price shock. The variability in the stock prices due to international/global food price shock at first time period is zero. The stock price indices is not very much responsive to food price shock. The variation in the stock prices in occurrence of food price shock at initial time was 0.48 and then it tends to decline up to 4th time period and then it again starts moving upward slowly and gradually. Therefore the effects of shock step by step grows up at the end of fifteen month food price shock explains 1.39 percent of variation in stock prices respectively. Quantum of industrial exports is greatly influence by food price shocks as results of variance decomposition can be seen. The real exchange rate is also less reactive to food price shock. The variation in the effective exchange rate due to food price shock at first month is 1.02 percent while it is 8.96 percent in the next time period then it fluctuates up and down. Call money rate is also less responsive to food price shock. The deviation in the call money rate in line of food price shock at first time period was 0.01 percent and it increases up to 11 months then after 11 month call money rate was negatively affected by food price shock. According to the results of variance decomposition inflation is highly responsive to food price shock unlike other variables. The deviation in inflation because of world food price shock at first time period is 27.38 percent after short period of time effect of shock wave off. Just like inflation, economic growth is also highly responsive to food price shock. The variation in economic growth / industrial production due to food price shock has been increasing over the period of time.

Table 4.13 Generalized Forecast Error Variance Decomposition of Food Price Indices

Period	**S.E.**	**ASI**	**QIE**	**REER**	**CMR**	**INF**	**EG**	**FPI**
1.00	203.30	0.48	1.36	1.02	0.01	27.38	0.61	69.13
2.00	245.99	0.31	1.98	0.91	0.16	27.62	1.51	67.51
3.00	273.40	0.28	2.51	0.79	0.38	26.98	2.67	66.39
4.00	292.21	0.33	2.97	0.73	0.55	26.53	3.65	65.24
5.00	306.14	0.43	3.36	0.72	0.66	26.21	4.43	64.20
6.00	316.88	0.53	3.68	0.75	0.72	25.99	5.03	63.29
7.00	325.38	0.64	3.96	0.82	0.75	25.83	5.49	62.51
8.00	332.23	0.75	4.18	0.92	0.75	25.71	5.83	61.85
9.00	337.80	0.85	4.37	1.05	0.75	25.60	6.09	61.29
10.00	342.38	0.94	4.53	1.20	0.73	25.50	6.29	60.81
11.00	346.15	1.04	4.66	1.37	0.71	25.39	6.44	60.40
12.00	349.27	1.13	4.76	1.55	0.69	25.27	6.54	60.05
13.00	351.86	1.22	4.85	1.74	0.68	25.15	6.62	59.74
14.00	354.01	1.30	4.92	1.94	0.66	25.03	6.68	59.47
15.00	355.80	1.39	4.98	2.13	0.64	24.90	6.73	59.24
Cholesky Ordering: ASI QIE REER CMR INF EG FPI								

4.8.4.3 FEVD Analysis for Simultaneous Global Oil and Food Price Shocks

Table 14 demonstrates FEVD of world oil and food price indices up to 15, whereas each period shows one month, time period. Results of variance decompositions are overall do not sustained by IRFs analysis. The stock price is highly responsive to oil price shock. Results of variance decompositions are in to some extend support the impulse response analysis. The stock price index is more receptive to world oil and global food price shock. Initially the variability in the stock prices due to oil and global food price shock increases and then it remains constant over the period of time. Quantum of industrial exports is highly responsive to global food price shock in comparison of oil price shock. The effective exchange rate is also less responsive to both oil and global food price shocks. The variability arise in the effective exchange rate because of world oil and global food price shock at first increases than remain constant in both cases. Call money rate is also more responsive in both the cases of crude oil and global food price shock. According to the results of variance decomposition inflation is highly responsive to oil and global food price shock unlike other variables. The variation in inflation, due to both the exogenous variables, reaches double digits as clearly seen from table. Just like other macroeconomic variables economic growth is also less reactive to crude oil and global food price shocks. The deviation in economic growth / industrial production due to both shocks has been increasing over the period of time but over the long period of time impact of both the shocks is wave off except in the caser of inflation.

Table 4.14 Generalized Forecast Error Variance Decomposition of Oil Price Indices

Period	**S.E.**	**ASI**	**QIE**	**REER**	**CMR**	**INF**	**EG**	**OPI**	**FPI**
1	367.90	3.65	0.20	0.18	7.73	21.29	0.57	66.37	0.00
2	381.68	3.50	0.82	0.17	9.61	21.09	1.37	62.38	1.06
3	386.77	3.52	1.49	0.23	9.98	21.24	1.81	60.22	1.51
4	388.16	3.62	1.80	0.32	10.01	21.26	1.96	59.36	1.68
5	388.62	3.71	1.95	0.38	10.00	21.22	2.02	58.98	1.74
6	388.79	3.77	2.01	0.42	9.98	21.20	2.04	58.81	1.77
7	388.86	3.80	2.03	0.44	9.97	21.18	2.05	58.74	1.78
8	388.89	3.82	2.04	0.45	9.97	21.17	2.06	58.71	1.78
9	388.91	3.82	2.05	0.46	9.97	21.17	2.06	58.70	1.78
10	388.91	3.83	2.05	0.46	9.97	21.17	2.06	58.69	1.78
11	388.92	3.83	2.05	0.46	9.97	21.16	2.06	58.69	1.78
12	388.92	3.83	2.05	0.46	9.97	21.16	2.06	58.69	1.78
13	388.92	3.83	2.05	0.46	9.97	21.16	2.06	58.69	1.78
14	388.92	3.83	2.05	0.46	9.97	21.16	2.06	58.69	1.78
15	388.92	3.83	2.05	0.46	9.97	21.16	2.06	58.69	1.78

Table 4.15 Generalized Forecast Error Variance Decomposition of Food Price Indices

Period	**S.E.**	**ASI**	**QIE**	**REER**	**CMR**	**INF**	**EG**	**OPI**	**FPI**
1	26.18	0.38	8.63	0.28	6.46	15.20	2.87	38.40	27.76
2	27.24	1.07	8.66	0.42	7.81	15.47	4.06	38.17	24.33
3	27.67	1.64	8.93	0.38	8.30	15.87	4.58	37.57	22.73
4	27.82	1.96	9.13	0.42	8.41	16.01	4.75	37.25	22.07
5	27.88	2.16	9.23	0.49	8.42	16.04	4.81	37.07	21.78
6	27.90	2.28	9.28	0.54	8.41	16.03	4.84	36.98	21.65
7	27.90	2.35	9.30	0.57	8.40	16.02	4.84	36.93	21.59
8	27.91	2.38	9.30	0.59	8.39	16.01	4.85	36.91	21.57
9	27.91	2.39	9.31	0.60	8.39	16.01	4.85	36.90	21.56
10	27.91	2.40	9.31	0.60	8.39	16.01	4.85	36.90	21.55
11	27.91	2.40	9.31	0.60	8.39	16.01	4.85	36.89	21.55
12	27.91	2.40	9.31	0.60	8.39	16.01	4.85	36.89	21.55
13	27.91	2.40	9.31	0.60	8.39	16.01	4.85	36.89	21.55
14	27.91	2.40	9.31	0.60	8.39	16.01	4.85	36.89	21.55
15	27.91	2.40	9.31	0.60	8.39	16.01	4.85	36.89	21.55
Cholesky Ordering: ASI QIE REER CMR INF EG OPI FPI									

CHAPTER 5

5 CONCLUSION AND POLICY RECOMMENDATIONS

To study relationship between external shocks and selected macroeconomic variables previous researcher used different methods and techniques. VAR models are basically most appropriate for multivariate analysis. To achieve the objectives of the research we applied SVAR technique. In this research, researcher comprehensively explore the macroeconomic influence of global crude oil price and global food price shocks on the major macroeconomic variables of Pakistan economy and then specifically analyze these variables behavior including domestic call money rate, quantum of industrial export, the real effective exchange rate, inflation rate, the economic growth, stock price index. To analyses the effect of external shocks on the performance of Pakistan economy we choose different variables from different sector of economy i.e. monetary side and other policy variables which are related to balance of payment. The time series data of Pakistan on quarterly basis has been used over the period of 1990 Q1 to 2018 Q4. Moreover, the investigation has been invigorated with the help of Impulse response functions as well as variance decomposition of variables. Impulse response analysis discovered that world crude oil and global food price shocks have diverse inflationary belongings. The impulse response analysis suggests that while following oil price shock, inflation immediately increase and throughout the whole time period inflationary effect in the economy is positive and follows increasing trend. When food price shock exist in the economy inflation also increase gradually with the passage of time. Furthermore following the positive world crude oil price shock it has positive impact on economic growth initially then after eighth month it inclines to downward. Whereas while following the positive food price shock economic growth increases and it diverges from axis over the period of time and it do not returned to the axis as time passes. The rationale behind is that when global food prices rise then it positively affect the balance of trade because Pakistan is basically an agrarian economy and most of the exports are consist on their agricultural products or agro based goods. Similarly by following world crude oil and global food price shocks the call money rate responds positively in both the cases. Impulse response function shows that effective exchange rate is an important source of variability in the economy and while following both, world crude oil and global food price shocks, real effective exchange rate behaves positively. Perhaps deviation in effective exchange rate is greater in the case of global food price shock. Stock prices are considered as most volatile in an economy when there is positive world oil and global food price shock, stock prices indices behaves positively initially in case of positive global food price shock whereas in presence of positive oil price shock stock ASI behaves negatively. While examining the effect of shocks on quantum of industrial exports we observe that it behaves positively in the presence of global food price shock and in case of world crude oil price shock quantum of industrial exports initially rise up to fourth month then it moves downward. Rise in oil prices is a main cause to lower down the firms earnings that shrink the worth of their stocks and it will hampers the performance of stock market.

Forecasts error variance decomposition also supports the findings on the basis of Impulse response analysis. The results clearly indicates that oil and global food price shocks affect stock price indices, quantum of industrial exports, real effective exchange rate, call money rate, inflation and economic growth. This suggests us that supply side and demand side disruption are attributable to exterior shocks and these shocks are the key foundation of high inflation and high unemployment in Pakistan. External shocks are main source of instability in Pakistan because these external shocks contributed higher rate of inflation and that hampers economic growth as well as worsens the exchange rate. Policy recommendations are as follows:

- To avoid these damaging affect oil and food price shocks to Pakistan's macroeconomic variables such as inflation, economic growth there is a need to search a path towards self-reliance in case of food and government should take the steps to maintain and achieve food security i.e by giving incentives to the farmers in the form of subsidies, ceiling and floor price, abolition of tariffs on machinery imports etc.
- Exchange rate has positive impact of both (oil and food price) shocks which leads to rise in current account deficit. There is need of putting some import restrictions and we should try to explore natural resources and minerals within the country and other energy sources to reduce such a high external reliance on crude oil which also severely affect the balance of payment of the country that also has a huge contribution in twin deficit which is faced by the economy by several decades.
- Furthermore, quantum of industrial exports has a positive impact of oil price shock in this regard industrialists needs to address the excess demand of oil by using other means of transportation and diversify industrial sector in such manner that they produce high quality products by using other, substitute as means of input in a production process, energy source instead of crude oil.
- According to our analysis positive oil and food price shocks increase inflation. To control inflation monetary authority should opt the contractionary monetary policy by increasing interest rate and open market operations by vending bonds and securities.

- By exploring the natural resources and crude oil within the country's balance of payment can recover its deficit and foreign dependence will also be condensed.
- Govt should also take action to attract foreign investment in energy sector specifically in oil refineries by giving incentives to Multi-National Companies in the form of tax holidays, concentrated markets, good infrastructure and provision of specialized labor etc.

  Finally, we may conclude that by reducing the foreign dependence on oil will lessen the inflation and unemployment (stagflation) because increase in oil price enhance the transportations cost of goods and services. When oil prices will be stable than cost of production will not fluctuate and ultimately prices of goods and services will not swing also.

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APPENDIX

Model One

$$\begin{bmatrix} c_{11} & c_{12} & c_{13} & c_{14} & c_{15} & c_{16} & c_{17} \\ 0 & c_{22} & c_{22} & c_{24} & c_{25} & c_{26} & c_{27} \\ 0 & 0 & c_{33} & c_{34} & c_{35} & c_{36} & c_{37} \\ 0 & 0 & 0 & c_{44} & c_{45} & c_{46} & c_{47} \\ 0 & 0 & 0 & 0 & c_{55} & c_{56} & c_{57} \\ 0 & 0 & 0 & 0 & 0 & c_{66} & c_{67} \\ 0 & 0 & 0 & 0 & 0 & 0 & c_{77} \end{bmatrix} = \begin{bmatrix} \varepsilon_{asi} \\ \varepsilon_{qie} \\ \varepsilon_{reer} \\ \varepsilon_{cmr} \\ \varepsilon_{inf} \\ \varepsilon_{eg} \\ \varepsilon_{opi} \end{bmatrix}$$

Table 4.8 Estimated parameters of SVAR Model

Coefficient	**Coefficient**	**Std. Error**	**z-Statistic**	**Prob.**
C(1)	-0.191	1.298	-0.147	0.883
C(2)	-7.306	1.426	-5.122	0.000
C(3)	4.228	1.454	2.908	0.004
C(4)	-0.516	1.517	-0.340	0.734
C(5)	6.891	1.509	4.566	0.000
C(6)	4.719	2.997	1.575	0.115
C(7)	-6.506	2.999	-2.170	0.030
C(8)	15.634	3.095	5.052	0.000
C(9)	-47.892	3.212	-14.908	0.000
C(10)	0.001	0.039	0.038	0.969
C(11)	0.124	0.038	3.312	0.001
C(12)	-1.158	0.038	-30.179	0.000
C(13)	-0.070	0.098	-0.713	0.476
C(14)	-0.355	0.097	-3.643	0.000
C(15)	-3.245	0.062	-52.394	0.000

Estimated matrices of SVAR model are given below:

Estimated A matrix:

1	0	0	0	0	0	0
-0.18482	1	0	0	0	0	0
-7.25375	6.398382	1	0	0	0	0
4.215841	-6.14769	0.004584	1	0	0	0
-0.5176	15.53746	0.123589	-0.07079	1	0	0
7.066761	-38.5266	-1.06973	-0.23257	-3.25891	1	0
9.422936	-7.64628	0.273512	0.135909	-0.78085	-0.34838	1

Estimated B matrix:

1	0	0	0	0	0	0
0	1	0	0	0	0	0
0	0	1	0	0	0	0
0	0	0	1	0	0	0
0	0	0	0	1	0	0
0	0	0	0	0	1	0
0	0	0	0	0	0	3.097687

Estimated S matrix:

1	0	0	0	0	0	0
0.184821	1	0	0	0	0	0
6.071196	-6.39838	1	0	0	0	0
-3.10745	6.17702	-0.00458	1	0	0	0
-3.32436	-14.3094	-0.12391	0.070791	1	0	0
-5.00813	-13.5144	0.664844	0.463266	3.258905	1	0
-13.5885	-7.32482	-0.13803	0.08076	1.916186	0.34838	3.097687

Estimated F matrix:

5.860889	-2.13089	-0.01829	-0.17173	-0.41716	0.006226	0.183674
2.162901	4.322766	-0.02798	-0.07693	-0.02719	0.017697	0.374753
176.8578	609.8313	10.25638	-15.8705	12.62561	1.217423	57.2192
-25.8781	-45.4147	-2.29345	7.577742	5.254483	-0.01158	-5.04243
22.99015	-223.251	-3.73984	5.231803	5.361525	0.167157	-11.1893
640.7133	445.5918	-20.2474	11.61321	24.24574	12.52189	157.2863
489.1207	788.7693	-17.2105	-12.3644	16.48644	9.981937	185.6911

Model Two

$$\begin{bmatrix} c_{11} & c_{12} & c_{13} & c_{14} & c_{15} & c_{16} & c_{17} \\ 0 & c_{22} & c_{22} & c_{24} & c_{25} & c_{26} & c_{27} \\ 0 & 0 & c_{33} & c_{34} & c_{35} & c_{36} & c_{37} \\ 0 & 0 & 0 & c_{44} & c_{45} & c_{46} & c_{47} \\ 0 & 0 & 0 & 0 & c_{55} & c_{56} & c_{57} \\ 0 & 0 & 0 & 0 & 0 & c_{66} & c_{67} \\ 0 & 0 & 0 & 0 & 0 & 0 & c_{77} \end{bmatrix} = \begin{bmatrix} \varepsilon_{asi} \\ \varepsilon_{qie} \\ \varepsilon_{reer} \\ \varepsilon_{cmr} \\ \varepsilon_{inf} \\ \varepsilon_{eg} \\ \varepsilon_{fpi} \end{bmatrix}$$

Table 4.9 Estimated parameters of SVAR Model

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	-0.185	1.318	-0.140	0.888
C(2)	-7.190	1.426	-5.043	0.000
C(3)	4.291	1.451	2.958	0.003
C(4)	-0.524	1.509	-0.347	0.728
C(5)	11.935	1.509	7.907	0.000
C(6)	5.614	3.030	1.853	0.064
C(7)	-6.418	3.037	-2.113	0.035
C(8)	15.638	3.099	5.046	0.000
C(9)	-21.718	3.247	-6.688	0.000
C(10)	-0.003	0.037	-0.088	0.930
C(11)	0.128	0.037	3.428	0.001
C(12)	-0.139	0.038	-3.627	0.000
C(13)	-0.062	0.097	-0.645	0.519
C(14)	-0.025	0.097	-0.261	0.794
C(15)	-1.898	0.062	-30.678	0.000

Estimated a Matrix

1	0	0	0	0	0
-0.185	1	0	0	0	0
-7.190	5.614	1	0	0	0
4.291	-6.418	-0.003	1	0	0
-0.524	15.638	0.128	-0.062	1	0
11.935	-21.718	-0.139	-0.025	-1.898	1

Estimated B Matrix

1	0	0	0	0	0
0	1	0	0	0	0
0	0	1	0	0	0
0	0	0	1	0	0
0	0	0	0	1	0
0	0	0	0	0	1

Estimated S Matrix

1	0	0	0	0	0
0.185175	1	0	0	0	0
6.150763	-5.61416	1	0	0	0
-3.082	6.399971	0.003295	1	0	0
-3.35139	-14.5199	-0.12785	0.062314	1	0
-13.5005	-6.45694	-0.10408	0.143535	1.898002	1

Estimated F Matrix

5.90	-2.37	-0.01	-0.12	-0.42	0.03
2.23	3.91	-0.02	0.00	-0.03	0.07
190.30	522.56	11.71	0.87	12.25	8.34
-27.31	-36.18	-2.42	5.77	5.29	-0.55
19.30	-199.35	-4.11	0.70	5.44	-0.84
517.18	607.85	-13.07	24.38	15.31	38.77

<u>Model Three</u>

$$\begin{bmatrix} c_{11} & c_{12} & c_{13} & c_{14} & c_{15} & c_{16} & c_{17} & c_{18} \\ 0 & c_{22} & c_{22} & c_{24} & c_{25} & c_{26} & c_{27} & c_{28} \\ 0 & 0 & c_{33} & c_{34} & c_{35} & c_{36} & c_{37} & c_{38} \\ 0 & 0 & 0 & c_{44} & c_{45} & c_{46} & c_{47} & c_{48} \\ 0 & 0 & 0 & 0 & c_{55} & c_{56} & c_{57} & c_{58} \\ 0 & 0 & 0 & 0 & 0 & c_{66} & c_{67} & c_{68} \\ 0 & 0 & 0 & 0 & 0 & 0 & c_{77} & c_{78} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & c_{88} \end{bmatrix} = \begin{bmatrix} \varepsilon_{asi} \\ \varepsilon_{qie} \\ \varepsilon_{reer} \\ \varepsilon_{cmr} \\ \varepsilon_{inf} \\ \varepsilon_{eg} \\ \varepsilon_{fpi} \\ \varepsilon_{opi} \end{bmatrix}$$

Table 4.10 Estimated parameters of SVAR Model

Coefficients	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	-0.185	1.256	-0.147	0.883
C(2)	-7.254	1.418	-5.114	0.000
C(3)	4.216	1.445	2.918	0.004
C(4)	-0.518	1.498	-0.346	0.730
C(5)	7.067	1.501	4.708	0.000
C(6)	9.423	4.656	2.024	0.043
C(7)	6.398	3.024	2.116	0.034
C(8)	-6.148	3.029	-2.030	0.042
C(9)	15.537	3.081	5.044	0.000
C(10)	-38.527	3.232	-11.920	0.000
C(11)	-7.646	10.097	-0.757	0.449
C(12)	0.005	0.038	0.121	0.904
C(13)	0.124	0.038	3.281	0.001
C(14)	-1.070	0.038	-27.837	0.000
C(15)	0.274	0.125	2.197	0.028
C(16)	-0.071	0.097	-0.730	0.465
C(17)	-0.233	0.097	-2.398	0.017
C(18)	0.136	0.301	0.452	0.651
C(19)	-3.259	0.062	-52.909	0.000
C(20)	-0.781	0.221	-3.535	0.000
C(21)	-0.348	0.034	-10.205	0.000
C(22)	3.098	0.220	14.071	0.000

Estimated A matrix:

1	0	0	0	0	0	0
-0.18482	1	0	0	0	0	0
-7.25375	6.398382	1	0	0	0	0
4.215841	-6.14769	0.004584	1	0	0	0
-0.5176	15.53746	0.123589	-0.07079	1	0	0
7.066761	-38.5266	-1.06973	-0.23257	-3.25891	1	0
9.422936	-7.64628	0.273512	0.135909	-0.78085	-0.34838	1

Estimated B matrix:

1	0	0	0	0	0	0
0	1	0	0	0	0	0
0	0	1	0	0	0	0
0	0	0	1	0	0	0
0	0	0	0	1	0	0
0	0	0	0	0	1	0
0	0	0	0	0	0	3.097687

Estimated S matrix:

1	0	0	0	0	0	0
0.184821	1	0	0	0	0	0
6.071196	-6.39838	1	0	0	0	0
-3.10745	6.17702	-0.00458	1	0	0	0
-3.32436	-14.3094	-0.12391	0.070791	1	0	0
-5.00813	-13.5144	0.664844	0.463266	3.258905	1	0
-13.5885	-7.32482	-0.13803	0.08076	1.916186	0.34838	3.097687

Estimated F matrix:

5.860889	-2.13089	-0.01829	-0.17173	-0.41716	0.006226	0.183674
2.162901	4.322766	-0.02798	-0.07693	-0.02719	0.017697	0.374753
176.8578	609.8313	10.25638	-15.8705	12.62561	1.217423	57.2192
-25.8781	-45.4147	-2.29345	7.577742	5.254483	-0.01158	-5.04243
22.99015	-223.251	-3.73984	5.231803	5.361525	0.167157	-11.1893
640.7133	445.5918	-20.2474	11.61321	24.24574	12.52189	157.2863
489.1207	788.7693	-17.2105	-12.3644	16.48644	9.981937	185.6911