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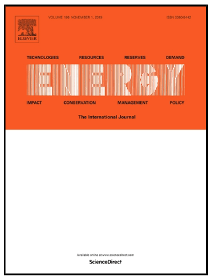

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The Impact of Oil Price Shocks on Stock Exchanges in Caspian Basin Countries

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ABSTRACT

In this work, the impact of oil price shocks on the stock exchanges of three countries in the Caspian Basin − Iran, Kazakhstan and Russia − was examined through a structural vector autoregression (SVAR) model. For the research, monthly data from the stock exchanges, the oil price, inflation, industrial production and exchange rates were collected between March 2005 and June 2018. According to the results of variance decomposition, in these three countries, the impact of negative oil price shocks on the stock exchanges was stronger than that of positive shocks, and constituted the largest source of changes in the three stock exchanges. In addition, according to the results of impulse response functions, the response of the stock exchanges in the three countries to negative oil shocks was highly significant. Consequently, these countries should avoid macroeconomic imbalances and falls in their stock exchanges due to the negative impact of the oil price, and should instead focus on industrial production that will contribute to exports. In this way, they can avoid the negative impact of oil price shocks on their stock exchanges.

Keywords: Caspian Basin, oil price shocks, stock exchanges, structural VAR
JEL Codes: C5, G1, L5, Q4

1. Introduction

In this work, the main aim was to examine the asymmetric impact of Brent oil price shocks on the stock exchanges of three Caspian Basin countries through structural vector autoregression (SVAR). It is known that Caspian Basin countries are not globally strong in medium- and high-tech industrial production,[1] and that they are highly dependent on oil production for export. Moreover, their own economies are susceptible to positive or negative impacts from oil prices. In this research, it is assumed that stock exchanges are largely dependent on fluctuations in the oil price in these countries. Oil price shocks are taken to be one variable that exerts a significant impact on their stock exchanges. In addition, it is assumed that the exchange rate and inflation can also influence the stock exchanges. Hence, the main question is how the oil price shocks, exchange rates, inflation and industrial production influence the stock markets. If there are significant impacts on stock exchanges, which variables show the strongest effects and how great are the impacts in these countries? Furthermore, as it is assumed that the oil price can have a significant impact on stock exchanges, then what about the impact of positive or negative shocks? In other words, which shocks have the stronger impacts on stock exchanges? This work seeks to answer these questions.

For the research, three Caspian Countries were chosen, because these countries have stock exchange markets and have consistently released data which enables the conducting of a time-series analysis. These countries are Iran, Kazakhstan and Russia. There are several reasons why the impact of oil price shocks on the stock exchanges of these countries has not hitherto been sufficiently researched. The first is that Kazakhstan and Russia were part of the Soviet Union until 1990. These countries had closed economic policies, and were not separate, independent countries with available specific data. Iran also followed an economic system which exhibited the features of traditional and closed economies, and did not release data which could make analysis convenient and easy. The second reason is that these countries did not follow transparency policies in the sharing of data about their economic policies, and were neither part of the free-market economy nor members of international organizations. The third reason is that there was too little time after the establishment of their stock exchange markets to make a time-series analysis feasible. To make a SVAR analysis, there must be relevant data covering a long time span. This work is one of first pieces of research using monthly data from March 2005 to June 2018 to examine the impact of oil price shocks on the stock exchanges of these three oil producing countries.[2]

Several variables were collected for the analysis; namely, stock exchange indexes, Brent crude oil price (Europe), nominal exchange rates, the consumer price index (CPI) and the industrial production index (IPI). There are several reasons why these variables were chosen for examination. First, the countries around the Caspian Basin are oil producers, and oil occupies an important position in their economies. It can therefore be expected that their stock

[1]Medium- and high-tech industries cover electrical and electrical equipment, transport equipment, machinery and chemicals and chemical products. For the classification, see OECD's isic rev. 3 technology intensity definition.
[2]According to the Energy Information Administration's international energy statistics for 2017, in the category of total petroleum and other liquids production, Russia ranks 3rd, Iran ranks 6th and Kazakhstan ranks 16th.

exchanges are dependent on fluctuations in the oil price, leaving them vulnerable to the impact of oil price shocks, either positive or negative. It is further assumed that stock exchanges can be impacted by CPI. As in every macroeconomic variable, CPI is expected to have a significant impact on share prices in the stock exchange markets, in particular in periods when countries face rising inflation rates, because this can give way to instability in the stock markets. For IPI, it is assumed that industrial production contributes to economies, and hence impacts on share prices. For instance, a trend towards economic growth through industrial production influences share prices positively in stock exchanges. In this work, exchange rates were taken into account because it is assumed that fluctuations in exchange rates have an impact on stock markets. For instance, it is expected in oil exporting countries that as the price of oil rises, it causes appreciation in exchange rates, which can influence share prices. It is also expected that a depreciation in exchange rates can decrease oil revenue based on the US dollar, which can negatively impacts on stock exchanges. Hence, fluctuations in exchange rates influence industrial production, and it is expected that production performance can affect inflation, which in turn impacts on stock exchanges.

Why were the Caspian countries chosen for this paper? Although there has been considerable research incorporating the oil price into empirical analysis for developed oil producing countries and developing Gulf countries, the Caspian Basin countries have not been researched sufficiently. This research constitutes a unique and original application of a SVAR model to examine the impact of collected variables on the stock exchanges of these countries. Moreover, this work analyzes the countries using a large data set from a macroeconomic perspective. It is believed that this work can open a gate for new cases and replicated studies for countries where oil production is important, but which have not been sufficiently analyzed and discussed. Most importantly, it is believed that research into the Caspian Basin countries stemming from this analysis can yield significant results.

In Section 2, previous literature that considered the oil price and its impact on economic variables is discussed, and the differences and originality of this work are laid out in detail. Section 3 explains which variables were considered for data collection and outlines the main challenges to collecting data in these three countries, and the assumptions underlying this analysis are explained. In Section 4, empirical analysis conducted through the SVAR model is explained, and the results of variance decomposition and impulse response functions are examined. In Section 5, the political implications of the empirical analysis are discussed. In Section 6, the research is concluded.

2. Previous research and the current work

The oil price has been a significant factor in many economies. It not only affects countries which need to import oil products, but also impacts on economic variables in producer countries. A rising or falling oil price can affect economic growth. For oil exporting countries, a rising oil price can generate considerable revenue, as the price elasticity of oil demand is low. Conversely, a falling oil price can be a significant problem for oil exporting countries, as revenue starts decreasing.

Although the oil price and its shock effects have been analyzed empirically and theoretically, and discussed in a political context, research into producer countries has remained limited, especially for Caspian Basin countries. There are several reasons for this. Firstly, producer countries usually remained underdeveloped or developing in the Middle East and Caspian Basin, and this made it difficult for researchers to collect data and conduct empirical analyses before the 1990s. For instance, Russia's stock market opened in 1992, and Kazakhstan's was founded in 1993. The stock market in Iran has a long history, but in order to analyze the three countries together, a common starting point year is necessary. Secondly, these countries were not capitalist democracies, and usually isolated themselves from capitalist countries and international organizations which encouraged free-market economics. Thirdly, some countries followed communist policies and did not have free-market economies where variables could fluctuate freely and become appropriate for time-series analysis. Finally, as these countries followed closed economic policies and remained under the dominance of centrally planned economic policies, stock markets did not develop sufficiently to allow the impacts of macroeconomic variables on stock exchanges over a long time-span to be estimated. As these countries were not willing to engage with capitalist economies, they did not become part of international organizations which collected and shared countries' economic data internationally. Although the Caspian Basin countries' data was missing from the sources of international organizations, this work was effectively completed by collecting data from several other sources and the countries' own institutions.

Russia has been engaged in free-market and open economic policies since the early 1990s, following the collapse of the Soviet Union. This enabled the establishment of a stock exchange. Thus, estimating the impacts of macroeconomic variables or the oil price on the Russian stock exchange became possible, allowing for a time-series analysis. Kazakhstan separated from the Soviet Union and established its own stock exchange, and started implementing free-market economic policies. Hence, it became more engaged in the world economy as an independent country, mostly by exporting oil. Iran follows a different economic system that is based on traditional values, and it is a form that combines the values of capitalist economies with Islamic economics. Despite international embargos, it still exports Brent crude oil around the world as one of the largest producers. Whatever these countries' economic systems, the common point between them is that oil production plays an important role in their economies.

Of course, the Caspian Basin consists not only of the three economies discussed in this paper. There are two more countries, Azerbaijan and Turkmenistan, which share the Caspian coastline with Iran, Kazakhstan and Russia. These two countries had similar economic policies to the main countries discussed. Both had been part of the Soviet Union. After becoming independent, they could not engage with the capitalist economies with developed stock exchange markets. As these countries followed closed economic policies, their time-series data has remained limited and unsuitable for this analysis. Hence, this work could not include them, since they do not yield appropriate data for testing the assumptions in this research.

2.1 Previous research

There has always been interest in researching oil price shocks and their influence on economic factors. A leading work on oil price shocks and macroeconomic performance was written by Hamilton (1983). Thereafter, a considerable amount of research contributed to the oil price related literature. In recent years, significant works about oil prices and their impact on stock exchanges in large oil-producing countries have been published. Ono (2011) examined the impact of oil prices on real stock returns for the BRIC countries between January 1999 and September 2009, using vector autoregression (VAR) models.[3] In this work, three variables were used: oil prices, stock returns and industrial production. Real stock returns responded positively to price indicators in China, India and Russia, but in Brazil, there was no statistically significant response to the oil price. In addition, in this research, variance decomposition shows that the contribution of oil price shocks to volatility in real stock returns was large and statistically significant for China and Russia. Kopytin (2014) discussed the effects of oil price dynamics on share quotations between January 2000 and August 2012 for two oil exporting countries; Russia and Norway. The variables that were used in this work were the Brent oil price, the S&P 500 stock index, the trade-weighted USD index, the global short-term interest rate, the exchange rate of national currencies, the domestic short-term three-month interest rate, and the value of the main stock index. A VAR model was used in this research. It was found that oil prices were not a systematic risk factor for the stock markets in Russia and Norway. Rodriguez (2015) tested for non-linearity in the relationship between the oil price and real stock return of Canada, Germany, the UK and the US using monthly data from February 1971 to August 2012. According to the empirical results of this research, an increase in oil prices had a statistically significant negative impact on the stock markets of all countries. Moreover, according to the results of the linear and asymmetric specifications, the impact of oil prices on all countries was statistically significant, with the exception of Canada. Kang, Ratti and Yoon (2015) used a time-varying structural VAR model to analyze the impact of structural oil price shocks on the U.S. stock market return via monthly data spans from January 1968 to December 2012. The contribution of oil supply to real stock return variation after 24 months trended downward from 17% in 1973 to 5% in 2012. Demirer, Jategaonkar and Khalifa (2015) examined whether oil price risk is systematically priced in a cross-section of stock returns at firm-level in oil exporting countries. Gulf Cooperation Council (GCC) nations were analyzed using data collected between March 31, 2004 and March 31, 2013. In this work, cross-sectional tests were implemented. It was estimated that stocks that are more sensitive to oil price fluctuations yield higher returns. Le and Chang (2016) used daily data from December 1, 1997 to July 15, 2016 to investigate the relationship between two important commodities (oil and gold) and three financial variables (interest rate, exchange rate and stock price) via an ARDL co-integration

[3]The BRIC countries are Brazil, Russia, India and China.

test. This research found that oil price shocks do not have an impact on the Japanese stock market in the long-run, but in the short-term, have a negative impact.

Elian and Kisswani (2017) analyzed Kuwait's stock exchange market to examine whether changes in Brent and West Texas Intermediate (WTI) impacted on stock market returns. This research consisted of daily data spans from January 3, 2000 to December 9, 2015. In this research, a co-integration test, autoregressive distributed lag (ARDL) was implemented to estimate the long-term relationship between these two variables. The empirical results of this paper showed the oil price and Kuwait stock market returns to be co-integrated in a long-run relationship where oil price shocks negatively impact on stock returns. Waheed et al. (2017) examined the impact of oil prices on firm-level stock returns in Pakistan, using panel data analysis. In this research, data was collected annually between 1998 and 2004. The overall oil price (WTI) shows that the oil price sent a positive signal to the stock market that stimulated firm-level stock returns in Pakistan. Nusair and Al-Khasawneh (2017) analyzed the effects of oil price shocks on the market returns of the GCC countries using daily data extending from January 5, 2004 to February 8, 2016. Quantile regression analysis was used in the paper. It was found that the oil price and stock markets are likely to boom or crash together. Uzo-Peters, Laniran and Adenikinju (2018) examined the impact of Brent oil price shocks on oil-related stocks in Nigeria. This work used a daily stock price and oil price from January 4, 2007 to December 31, 2014 to conduct the analysis using a VAR model. It was estimated that oil related company returns responded negatively to oil price shocks.

2.2 The current work

In general, the research outlined above took two variables into account; the oil price and stock exchange. This research extends the literature by taking into account not only the impact of oil price shocks on stock exchanges, but also by assessing how inflation, industrial production and exchange rates can influence stock exchanges. The works discussed above usually used VAR or ARDL models to explain the impact of the oil price on stock markets. Unlike recent previous works, this paper examines stock exchanges using a SVAR model. For the first time, especially with the inclusion of Iran in the analysis, Caspian Basin countries are examined here, in terms the of positive and negative oil price shocks on stock exchanges. Moreover, the impact of the macroeconomic variables CPI, IPI and exchange rates on the stock exchanges of Caspian Basin countries are analyzed. This constitutes a significant contribution to the literature, opening a new discussion of oil price shocks on the countries in the region.

3. Assumptions and data collection

3.1 Assumptions

Caspian Basin countries are oil producing countries which do not focus on industrial production for exporting. Oil production constitutes an important share of GDP. Oil rent as a percentage of GDP was 20% in Iran, 24.9% in Kazakhstan and 13.9% in Russia in 2012.[4] In terms of exports, oil's share is considerable – 80% of total exports in Iran and 50-60% of government revenue. In Kazakhstan, oil exports were more than 50% of total exports. The figure was approximately 70%, in Russia and oil and gas revenue provided 52% of government revenue in 2012.[5] It was found through research that there was a positive relationship between the oil price and recession in Russia. A decreasing oil price goes hand-in-hand with recession in the country (Pönkä and Zheng, 2019). It was found that there was a positive relationship between the oil price and GDP growth (Bass, 2019; Alekhina and Yoshino, 2018; Kuboniwa, 2012). Polbin et al. (2019) claimed that oil price dynamics were the most important source of real GDP and real exchange rate fluctuations. Ji et al. (2015) pointed out that any oil supply which contributes to export and government revenue promotes economic growth and causes appreciation in the exchange rate. In turn, this limits any increase in inflation. Bhar and Nikolova (2010) reminds us that the energy sector was privatized in the 1990s, coinciding with the creation of a stock exchange in Russia. The greater part of the stock exchange was dominated by companies related to the oil and gas industry. It was estimated that the oil price is the main source of output fluctuations and government revenue in Iran (Mehrara and Oskoui, 2007; Kiani and Pourfakhraei, 2010; Farzanegan, 2011). In addition, research has shown that oil exports are positively correlated with economic growth in the former communist countries (Egert, 2012). Therefore, it is expected that the impact of industrial production on their stock exchanges is limited. Manufacturing industries are generally less competitive than oil-related industries in terms of export. This is a weakness of Caspian Basin countries. Hence, because of dynamic oil production, it is assumed that industrial production does not have a significant impact on their stock exchanges. Furthermore, lower economic growth stimulates CPI-based inflation, which can also have a significant effect on the stock markets. In other words, when the demand for domestically produced goods decreases, it stimulates inflation (Ünal, 2018). In addition, when the oil price decreases, this causes depreciations in the exchange rate and ultimately results in an inflationary effect (Pönkä and Zheng, 2019:12; Polbin et al. 2019: 5; Qiang et al. 2019: 232-33).

A rising oil price stimulates revenues in terms of foreign currency. This causes appreciation in exchange rates. This then stimulates demand for manufactured products from other countries, which, in turn, weakens industrial production; the so-called *Dutch disease* effect. In the case of Kazakhstan, Köse and Baimaganbetov (2015) state that there is a strong positive linear relationship between the national currency and the oil price. Nurmakhanova and Katenova (2019), in their empirical findings, point out that higher oil prices create appreciation in the exchange rate of Kazakhstan. Additional references reveal Dutch disease effects in Kazakhstan (Egert and Leonard, 2008; Kutan and Wyzan, 2005; Kuralbayeva et al., 2001). A rising oil price negatively affects the economy by making it more vulnerable to Dutch disease. Dülger et al. (2013) point out that the Russian economy displays some symptoms of Dutch disease by examining the real appreciation of the ruble and deindustrialization. Thus, the country needs to design policies to cushion the economy against

[4]Source: World Bank (World Development Indicator: contribution of natural resources to GDP).
[5]Source: EIA (country reports). For Kazakhstan, see OEC's report in 2012.

oil price shocks. Mironov and Petronevich (2015) examined the symptoms of Dutch disease during the oil boom period, the 2000s. They found some symptoms, such as a negative impact of the real effective exchange rate on manufacturing growth, a growth in the total income of workers and a positive link between the real effective exchange rate and capital returns. However, it is pointed out that the shift from manufacturing to the service sector cannot be explained solely by the appreciation of the ruble. In addition, some research also found the symptoms of Dutch disease in Russia (Algieri, 2011; Oomes and Kalcheva, 2007). A depreciation in the exchange rate can stimulate a lesser amount of US dollars per barrel of oil. Hence, maintaining a stable exchange rate in oil exporting countries is crucial for macroeconomic stability and the stock exchange. In particular, in oil exporting countries, a depreciation in the exchange rate reduces gains, impacting negatively on stock exchanges. In this situation, keeping a stable exchange rate is desirable for a stable stock exchange. In other words, the oil price should be at a level conducive to gaining enough revenue to reduce depreciations in exchange rates.

The price elasticity of oil demand is relatively inelastic, according to Tovar-García and Carrasco (2019). Oil, which is a crucial component in production, can cause macroeconomic problems in importing countries when its price rises. However, at the same time, this can mean that the oil exporting countries are going to enjoy more prosperous economic conditions and more stability in their macroeconomic factors, such as in their trade balance and exchange rate. Nevertheless, this situation can become reversed when the oil price decreases in oil exporting countries, as they earn a lesser amount of foreign currency per barrel of oil. This can cause depreciation in their exchange rates and create macroeconomic imbalances, such as a surging trade deficit, because demand for imported agricultural or industrial products cannot be covered by oil revenue. For instance, Tovar-García and Carrasco (2019) states that the main export product of Russia is oil, while the country imports foodstuffs, chemicals and heavy engineering equipment. The share of high-tech export compared with that of oil export has remained low.

In light of the discussion above, it is assumed that the oil price can create asymmetric effects on stock exchanges in oil producing economies. First, the oil price impacts positively on stock exchanges because the country receives more revenue. This means a favorable effect on stock exchanges. Second, in the oil exporting economies, a falling oil price negatively affects growth performance and reduces gains in stock markets. In other words, in the case of a declining oil price, there will be a negative signal on the stock exchanges. Hence, stock exchange indexes decrease. Moreover, a rising oil price sends a positive signal to stock exchanges. In this case, it is expected that stock exchange indexes will increase. Thus, a rising oil price impacts positively on stock exchanges in the Caspian Basin countries. The more these countries gain from oil-related products, the more the countries enjoy economic growth, stable macroeconomic factors and rising stock exchange indexes. These countries are heavily dependent on the export of oil. Thus, the economy is vulnerable to oil price shocks. This vulnerability creates asymmetric effects. Oil price shocks can have positive or negative effects on stock exchanges because of high dependency on oil. Hence, it is assumed that the negative impact of oil price shocks on stock exchanges can be significant.

3.2 Data collection

The data for this analysis was collected between March 2005 and June 2018. For data collection, various sources were used. As these countries followed closed economic policies and their information was usually not available in international organizations' databases, it was challenging to collect the data. The data was drawn from stock exchange indexes, CPI, IPI, nominal exchange rates, and oil price records. For this data, the most up-to-date information was included in the analysis. For instance, for the stock exchange index, daily data at closing time was collected. Then, daily data was converted into monthly data for the analysis, alongside other variables in the SVAR model.

One of the most challenging issues was to collect stock exchange indexes from the three countries. The indexes were the Tehran Stock Exchange Index (TEPIX) for Iran, the Kazakhstan Stock Exchange (KASE) index for Kazakhstan and the Moscow Interbank Currency Exchange Index (MICEX) for Russia. TEPIX and MICEX were derived from the historical prices of Business Insider (Markets Insider, Indices sections). The database of Business Insider enables the derivation of daily historical data from the indexes. The KASE index was derived from the homepage of the KASE index on the Kazakhstan Stock Exchange's website. The problems encountered in these databases were that while these indexes were available on a daily basis, every country has different national holidays and closing times. This caused a problem, as the number of observations did not match in each country. Therefore, in order to standardize the analysis, daily data was converted for each country into monthly data. For this task, Iran's stock exchange information was considered the starting point of the series because it begins in March 2005. Hence, the data of every country starts from March 2005 in the analysis.

The Brent crude oil price (Europe) is in US dollars per barrel; the most important variable for the analysis, it was derived from FRED, the Federal Reserve Bank of St. Louis. Monthly data was chosen for the analysis. When estimating the impacts of oil shocks on stock exchanges, the Brent crude oil price was taken into account, because the Caspian Basin countries mostly export oil-related products to European or neighboring countries. Also, the relationship between the Brent crude oil price and other oil prices are correlated with each other. Hence, it is not expected that using different internationally accepted oil price data would change the results in the analysis.

CPI was derived from the International Monetary Fund (IMF). The name of the database is the Consumer Price, Producer Price, and Labor from International Financial Statistics (IFS) database. CPI was derived from the database, which is indexed as 2010=100. This database provides monthly information about CPI. IPI, which was indexed as 2010=100, could be derived directly from the IFS database as well. Collecting IPI was challenging for the analysis because the IMF only has information on monthly IPI for Kazakhstan and Russia. The desired information for Iran could not be collected from the IFS database. Therefore, an alternative method was used to obtain data on the IPI of Iran. Iran's national calendar system and national database have limited relevant data, which made the collecting process difficult. The

Statistical Center of Iran, which collects data on gross domestic product (GDP), has detailed information about industrial production from 1370 to 1396 (Jalali Calendar), which in the Gregorian calendar is 1991 to 2018. The data is called ‘quarterly national accounts’ (base year=1376 in the Jalali Calendar). From the national accounts database, industrial production was derived from the GDP section and value added by national economic activities at constant prices (1376=100). The year 1376 is the year 1997 in the Gregorian calendar. In the Jalali Calendar, the New Year starts in March of the Gregorian calendar. Therefore, the data for March, which was the last data of the first quarter in the national accounts of Iran, was added to the month of June in the Gregorian calendar in the time-series for standardizing the analysis between Iran, Kazakhstan and Russia. As a last step in data collecting, a 1976=100 index of IPI in Iran was transformed into a 2010=100 index. Finally, the IPI data of Iran, provided on a quarterly basis, was linear-interpolated to derive monthly data in order to implement the SVAR model.

Exchange rates were derived from the central bank of each country. The exchange rates are nominal and based on the US dollar. Iran’s exchange rate was derived from the Central Bank of the Islamic Republic of Iran, from the Foreign Exchange Rates section of the Statistics database. Kazakhstan’s exchange rates were derived from the National Bank of Kazakhstan Official Internet Resource. The data was collected from Daily Official Foreign Exchange Rates in the Statistics database. Russia’s exchange rates were collected from the Central Bank of Russia. The data was derived from the Foreign Currency Market, Dynamics of the Official Exchange Rates section. Exchange rates were daily rates for all the countries. For the analysis, the daily exchange rates were converted into monthly exchange rates. Finally, all variables were made ready for the implementation of the SVAR model. Collected data is in logarithmic form and is described in tables and figures as follows:

se: stock exchange index
cpi: consumer price index (2010=100)
ipi: industrial production index (2010=100)
exr: nominal exchange rates (per US dollar)
oil: Brent crude oil price (US dollars)
nos: negative oil price shock
pos: positive oil price shock

4. Empirical analysis

4.1 Unit root test results

To estimate whether a series has a unit root, the Phillips-Perron unit root test, which has been used extensively in econometric analysis, was implemented to determine the integrated order of variables. The equation included only the intercept term. The results of the test are given in Table 1.

Table 1. Phillips-Perron unit root test results

Variable	Level		First Difference	
	Test statistic	p-value	Test statistic	p-value
oil	−2.2018	0.2066	−8.5635	0.0000
Iran				
se	0.1452	0.9681	−7.0579	0.0000
ipi	−2.1315	0.2327	−15.2642	0.0000
cpi	−0.4802	0.8906	−8.0621	0.0000
exr	0.1029	0.9650	−11.8316	0.0000
Kazakhstan				
se	−3.3669	0.0137	−	−
ipi	−1.9770	0.2968	−13.4955	0.0000
cpi	−0.8829	0.7915	−5.6119	0.0000
exr	0.1926	0.9714	−7.5644	0.0000
Russia				
se	−2.9794	0.0391	−	−
ipi	−1.1671	0.6878	−5.4025	0.0000
cpi	−1.6386	0.4605	−6.0035	0.0000
exr	−0.4765	0.8913	−6.8936	0.0000

As seen in the table, the results of the unit root test imply that the all series are stationary in the first difference at a 5% level of significance, except the stock exchanges in Kazakhstan and Russia. The stock exchange series in Kazakhstan and Russia are stationary at a 5% level of significance. Thereby, the short-run analysis is conducted by using the SVAR model in the stationary form.

4.2 The scaled model for asymmetric specification of oil price

There are three main non-linear transformations for oil prices. These are Mork (1989), Lee (1995) and Hamilton (1996). Mork only focuses on the rate of change in the oil price and Hamilton neglects the impact of declining oil prices (Köse and Baimaganbetov, 2015). Both positive and negative oil price shocks can play a role in stock exchanges. Hence, we used the scaled model for asymmetric specification of the oil price, as proposed by Lee et al. (1995). Lee et al. (1995) define asymmetric effects of oil price shocks as those included in a VAR system that reflects both the unanticipated component of oil price movement and the time-varying conditional variance of oil price changes. Lee et al. (1995) used a generalized autoregressive conditional heteroscedasticity (GARCH) model to normalize unexpected movements in oil prices.

Table 2. AR(1)-ARCH(1) model results

Mean Equation				
Variable	**Coefficient**	**Std. Error**	**z-Statistic**	**p-value**
Constant	0.0079	0.0066	1.1865	0.2354
Δoil_{t-1}	0.2059	0.0960	2.1433	0.0321
Variance Equation				
Constant	0.0033	0.0007	4.9807	0.0000
e_{t-1}^2	0.5691	0.1834	3.1028	0.0019
Lag	Q-Statistic	p-value	ARCH-LM	p-value
1	1.9099	0.1670	0.6901	0.4061
2	2.6124	0.2710	4.1295	0.1268
3	2.7606	0.4300	4.0488	0.2562
4	2.9270	0.5700	4.1635	0.3843
5	4.2234	0.5180	4.6176	0.4643
6	7.6235	0.2670	5.8545	0.4397

The scaled model builds on the asymmetric model, while also employing a transformation of the oil price that standardizes the estimated residuals of the AR model by its time-varying (conditional) variability. The mean model for the logarithmic first difference of the oil price is determined as a first order autoregressive model AR(1) by examining the correlogram. The parameters of the AR(1) model are estimated by using the ordinary least square method. The ARCH effects for lags from 1 to 6 are tested via the ARCH- LM test, and the null hypotheses of the absence of ARCH effects are rejected at a 1% significance level. These results show that the residuals of the AR(1) model have an ARCH effect. The variance equation is determined as an ARCH(1) model by using the Akaike information criteria. Thus the AR(1)-ARCH(1) model is specified as below:

$$\Delta oil_t = \alpha_0 + \alpha_1 \Delta oil_{t-1} + e_t$$
$$e_t |\, I_{t-1} \sim N(0, h_t)$$
$$h_t = \beta_0 + \beta_1 e_{t-1}^2$$

The estimates of the coefficients of mean and variance equations are given in Table 2. The estimated coefficients of variance equation are positive. Therefore, the restrictions on parameters are satisfied. For the specification of the model, the presence of both autocorrelation and the ARCH effect of residuals are tested using Ljung-Box Q statistics and an ARCH-LM test for lags from 1 to 6, respectively. Their p-values are given in Table 2. The null hypothesis that "the autocorrelation is not present in k-lags" is not rejected at a 5% level of significance for all lags. Similarly, the null hypothesis that "the ARCH effect is not present in k-lags" is not rejected at a 5% level of significance for all lags. Therefore, the AR(1)-ARCH(1) model residuals do not have any autocorrelations or ARCH effects.

The asymmetric shocks of the oil price proposed by Lee et al. (1995) is specified as follows:

$$pos_t = max\left(0, \hat{e}_t/\sqrt{h_t}\right)$$
$$nos_t = min\left(0, \hat{e}_t/\sqrt{h_t}\right)$$

where *pos* and *nos* stand for scaled positive and scaled negative oil price shocks, respectively.

4.3 SVAR model

SVAR model equation is

$$\boldsymbol{A}\left(\mathbf{I}_{\boldsymbol{k}} - \boldsymbol{A}_{\mathbf{1}}\boldsymbol{L} - \boldsymbol{A}_{\mathbf{2}}\boldsymbol{L}^{\mathbf{2}} - \ldots\ldots\ldots\ \boldsymbol{A}_{\boldsymbol{p}}\boldsymbol{L}^{\boldsymbol{p}}\right)\boldsymbol{y}_{\boldsymbol{t}} = \boldsymbol{A}\boldsymbol{e}_{\boldsymbol{t}} = \boldsymbol{B}\boldsymbol{\varepsilon}_{\boldsymbol{t}}$$

where

L: Lag operator,

e_t: Error terms of Standard VAR Model,

ε_t: Error terms of Structural VAR Model,

K: Number of variable in the model,

A and B: Restriction matrices.

Shocks to other variables do not affect oil price shocks. In addition, there are no contemporaneous relationships between positive and negative oil price shocks. In that sense, oil prices shocks are exogenous. While exchange rate shocks contemporaneously affect stock exchanges, industrial production and inflation, they are not in turn affected by their shocks. Since the exchange rate is a price for imported intermediate goods, it causes cost inflation. Thus, exchange rates can cause rising costs in industrial production, which also directly affect inflation. The exchange rate plays an important role in the trade balance. If countries cannot create enough exports, they can be faced with a rising trade deficit. Thus, industrial production is sensitive to exchange rates and their cost effect. Furthermore, industrial production shocks contemporaneously affect stock exchanges and inflation, but their shocks do not in turn affect industrial production. In other words, falling industrial production results in inflation. As costs increase in an economy through declining performance in industrial production, this slows growth and stimulates inflation. In addition, falling industrial growth negatively affects shares on the stock exchange. Finally, inflation shocks affect stock exchanges, but are not themselves influenced by the stock exchanges. For instance, rising inflation is a signal to industries that macroeconomic stability is under threat so this impacts on shares on the stock exchange. Under these restrictions, a structural VAR model with A and B matrices can be specified, as below:

$$\begin{bmatrix} a_{11} & 0 & 0 & 0 & 0 & 0 \\ 0 & a_{22} & 0 & 0 & 0 & 0 \\ 0 & 0 & a_{33} & 0 & 0 & 0 \\ 0 & 0 & 0 & a_{44} & 0 & 0 \\ 0 & 0 & 0 & 0 & a_{55} & 0 \\ 0 & 0 & 0 & 0 & 0 & a_{66} \end{bmatrix} \begin{bmatrix} e_t^{se} \\ e_t^{cpi} \\ e_t^{ip} \\ e_t^{exr} \\ e_t^{pos} \\ e_t^{nos} \end{bmatrix} = \begin{bmatrix} 1 & b_{12} & b_{13} & b_{14} & b_{15} & b_{16} \\ 0 & 1 & b_{23} & b_{24} & b_{25} & b_{26} \\ 0 & 0 & 1 & b_{34} & b_{35} & b_{36} \\ 0 & 0 & 0 & 1 & b_{45} & b_{46} \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} u_t^{se} \\ u_t^{cpi} \\ u_t^{ip} \\ u_t^{exr} \\ u_t^{pos} \\ u_t^{nos} \end{bmatrix}$$

4.4 Variance decomposition

Considering these assumptions, the results of forecast variance decomposition for stock exchanges for the three countries were examined in tables. Table 3 shows the results of variance decomposition for the stock exchange in Iran. It shows the proportion of change in the stock exchange due to shocks in the oil price and other variables. According to the table, the stock exchange was largely impacted in the first month – approximately 1.5, 1.7 and 9% – by the exchange rate, a positive oil shock and a negative oil shock, respectively. The proportion of the positive oil shock remained limited to around 1.7%. The negative oil shock showed the strongest impact on the stock exchange. Over the months, the impact of inflation rose from 0.1 to 6.8%. It became a second variable that showed a strong effect on the stock exchange. The impact of negative oil shocks on the stock exchange increased to 12.8%, whereas that of positive oil shocks remained at around 1.9%. As a result, the proportion of negative oil shocks in Iran created the largest impact on the stock exchange. This means that negative oil shocks play a serious role in the Iranian stock exchange.

Table 3. Results of variance decomposition for the stock exchange in Iran

Period	*se*	*cpi*	*ipi*	*exr*	*pos*	*nos*
1	87.15	0.16	0.45	1.53	1.75	8.97
2	81.63	2.43	0.42	1.26	1.96	12.30
3	79.03	4.59	0.41	1.18	1.94	12.84
4	77.79	5.82	0.41	1.15	1.93	12.90
5	77.22	6.41	0.41	1.14	1.93	12.89
6	76.98	6.67	0.40	1.14	1.93	12.88
7	76.88	6.78	0.40	1.14	1.93	12.87
8	76.84	6.83	0.40	1.14	1.93	12.87
9	76.82	6.85	0.40	1.14	1.93	12.86
10	76.81	6.86	0.40	1.14	1.93	12.86
11	76.81	6.86	0.40	1.14	1.93	12.86
12	76.81	6.86	0.40	1.14	1.93	12.86

Note: *Lag length of VAR is estimated as 2 both Kazakhstan and Russia, it is estimated as 1 for Iran using the Akaike information criteria, while maximum lag length is 12.*

Table 4 indicates the results of forecast variance decomposition for the stock exchange in Kazakhstan. According to the table, inflation, positive oil shocks and negative oil shocks made approximately 1.3, 4.1 and 8.9% contributions to the stock exchange, respectively. The strongest impact was created by negative oil shocks. Over the months, whereas the impact of positive oil shocks on the stock exchange significantly decreased, that of negative oil shocks increased. The proportion of positive oil shocks decreased from 4.1 to 0.7% in the country, meaning that over the months, positive oil shocks lost their significance as an explanation for stock market fluctuations. However, the impact of negative oil shocks increased to 24%, thus exerting an increasing influence on the stock exchange in the long-run. It constituted the strongest factor impacting on the stock exchange, whereas the proportion of other variables decreased as explanatory variables.

Table 4. Results of variance decomposition for the stock exchange in Kazakhstan

Period	*se*	*cpi*	*ipi*	*exr*	*pos*	*nos*
1	85.02	1.37	0.29	0.25	4.11	8.96
2	84.94	1.27	0.20	0.11	2.53	10.95
3	81.31	1.25	0.86	0.17	1.98	14.44
4	78.01	1.26	1.33	0.41	1.55	17.44
5	75.64	1.27	1.63	0.70	1.27	19.49
6	73.92	1.26	1.85	0.96	1.08	20.93
7	72.68	1.25	1.99	1.18	0.95	21.95
8	71.77	1.23	2.09	1.35	0.87	22.69
9	71.11	1.22	2.16	1.47	0.81	23.23
10	70.63	1.21	2.21	1.56	0.77	23.63
11	70.27	1.20	2.24	1.62	0.74	23.92
12	70.02	1.19	2.26	1.67	0.72	24.14

Note: *see Table 3.*

Table 5 shows the results of forecast variance decomposition for the stock exchange in Russia. As seen in the table, for the 12 month forecast, the most important explanatory variable for the stock exchange was negative oil shocks, in general. It is seen that the positive oil shocks accounted for approximately 10.6% on the Russian stock exchange for the first month. The proportion of negative oil shocks was 11.8%.

Table 5. Results of variance decomposition for stock exchange in Russia

Period	*se*	*cpi*	*ipi*	*exr*	*pos*	*nos*
1	76.41	0.03	1.11	0.00	10.61	11.84
2	78.12	0.24	1.66	0.09	9.17	10.73
3	76.72	0.40	1.72	0.68	6.26	14.20
4	75.44	0.53	1.71	1.24	4.78	16.30
5	74.44	0.52	1.56	1.57	3.87	18.04
6	73.70	0.46	1.39	1.72	3.37	19.36
7	73.05	0.42	1.27	1.75	3.08	20.44
8	72.53	0.41	1.19	1.73	2.89	21.26
9	72.12	0.43	1.14	1.70	2.76	21.86
10	71.83	0.44	1.11	1.67	2.67	22.29
11	71.63	0.45	1.09	1.65	2.59	22.59
12	71.49	0.45	1.07	1.63	2.54	22.81

Note: *see Table 3.*

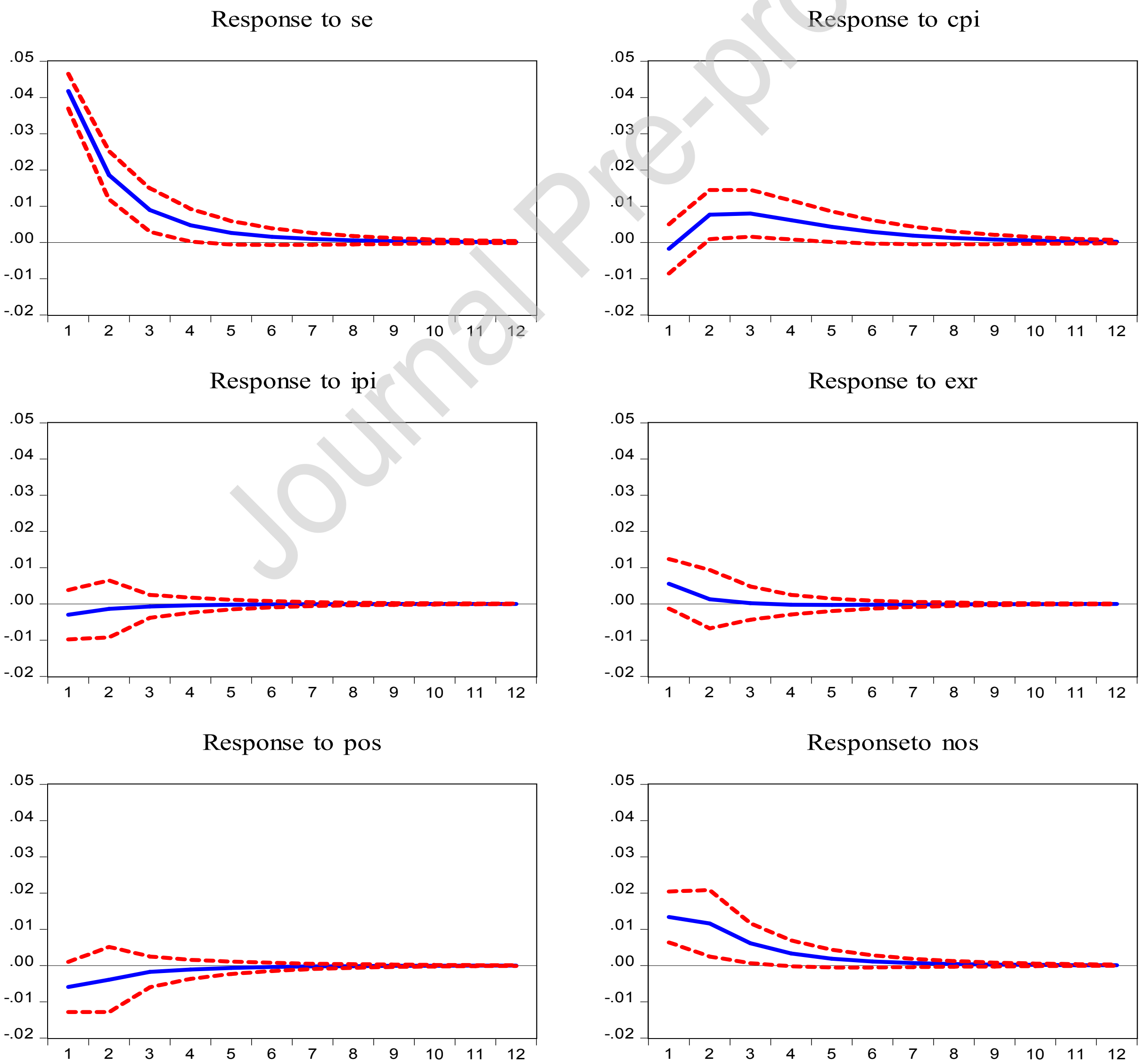
In Table 5, the strongest impact on the stock exchange was caused by negative oil shocks. The proportions of other variables were too low to warrant consideration in the first month. For the twelfth month, the impact of positive oil shocks decreased significantly from 10.6 to 2.5%. However, the impact of negative oil shocks on the stock exchange increased dramatically to 22.8%. Other variables showed little change, and need not be taken into account as significant impacts.

As a consequence, in the Caspian Basin countries, the most important factor for stock exchanges is negative oil shocks. Negative oil shocks are the most significant variable behind changes in stock exchanges in the long-term. Other variables show limited influences or no significant impact on stock exchanges. The negative oil shock is the most descriptive variable that must be considered in these economies.

4.5 Impulse response functions

The figures show the response of the stock exchanges to a number of variables. The impulses are *cpi, ipi*, *exr*, *pos* and *nos* and the response is *se*. The response of the stock exchange to structural one standard deviation positive innovations was estimated. In other words, it is estimated whether the response of stock exchanges is statistically significant against negative and positive oil shocks.

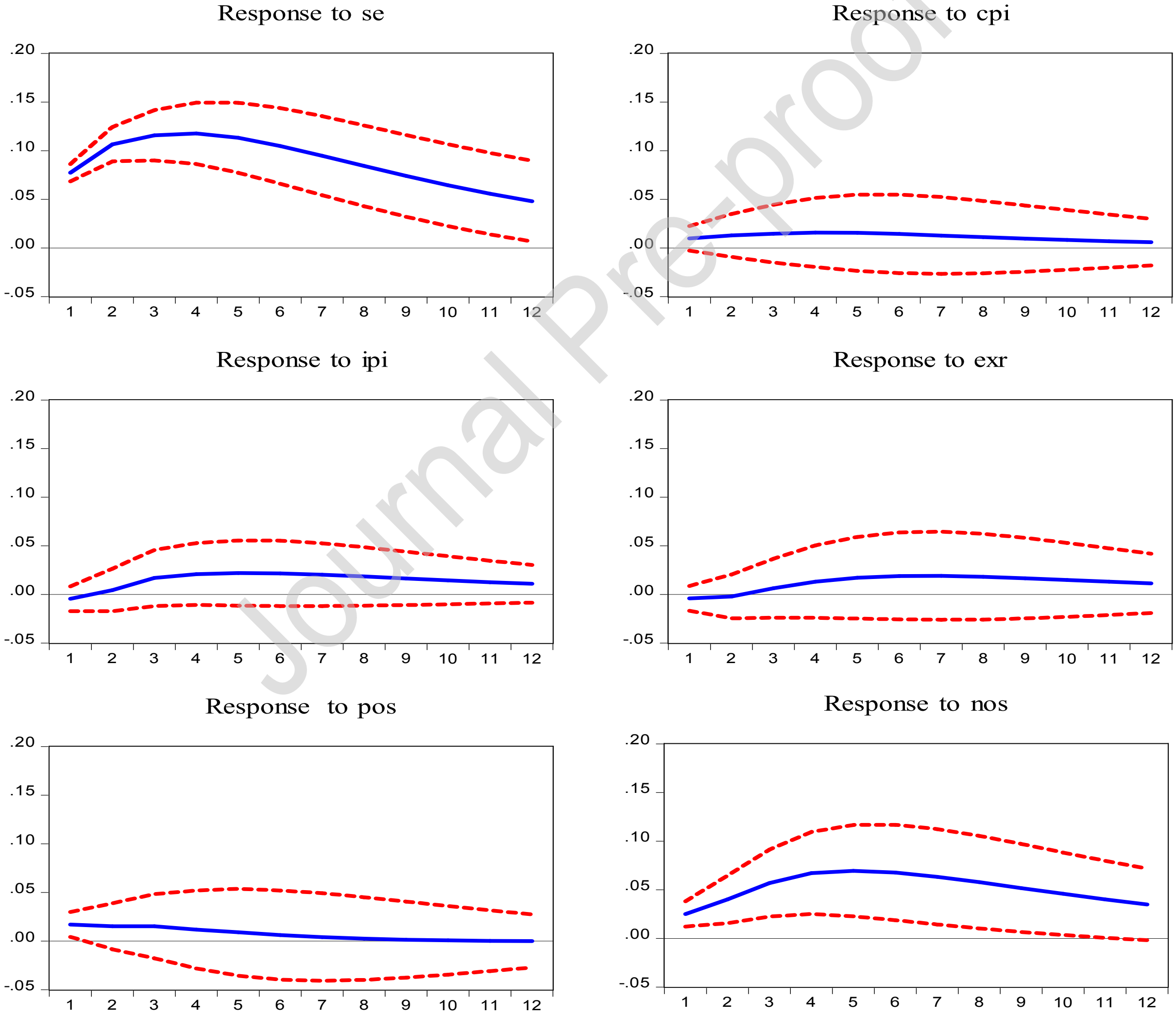
Figure 1. Response of the stock exchange to structural one standard deviation positive innovations for Iran



Note: *Y-axis shows responses and X-axis shows monthly periods.*

Figure 1 shows the response of the stock exchange in Iran. The figure shows that the response of the stock exchange to inflation is positive but not statistically significant until second month. Then, the response becomes significant until the fifth month. Although the rest of months show a positive effect, the response is not statistically significant. The most important thing in the figure is to see the impact of negative oil shocks on the stock exchange. The response of the stock exchange starts as a positive and significant effect, and runs for approximately 3.5 months, then loses its significance. The response of stock exchange to stock exchange starts out being positive and statistically significant, but its significance gradually falls until the fourth month. Responses to industrial production, the exchange rate and positive oil shock are positive but not sufficiently statistically significant to be taken into account for this research.

Figure 2. Response of the stock exchange to structural one standard deviation positive innovations for Kazakhstan

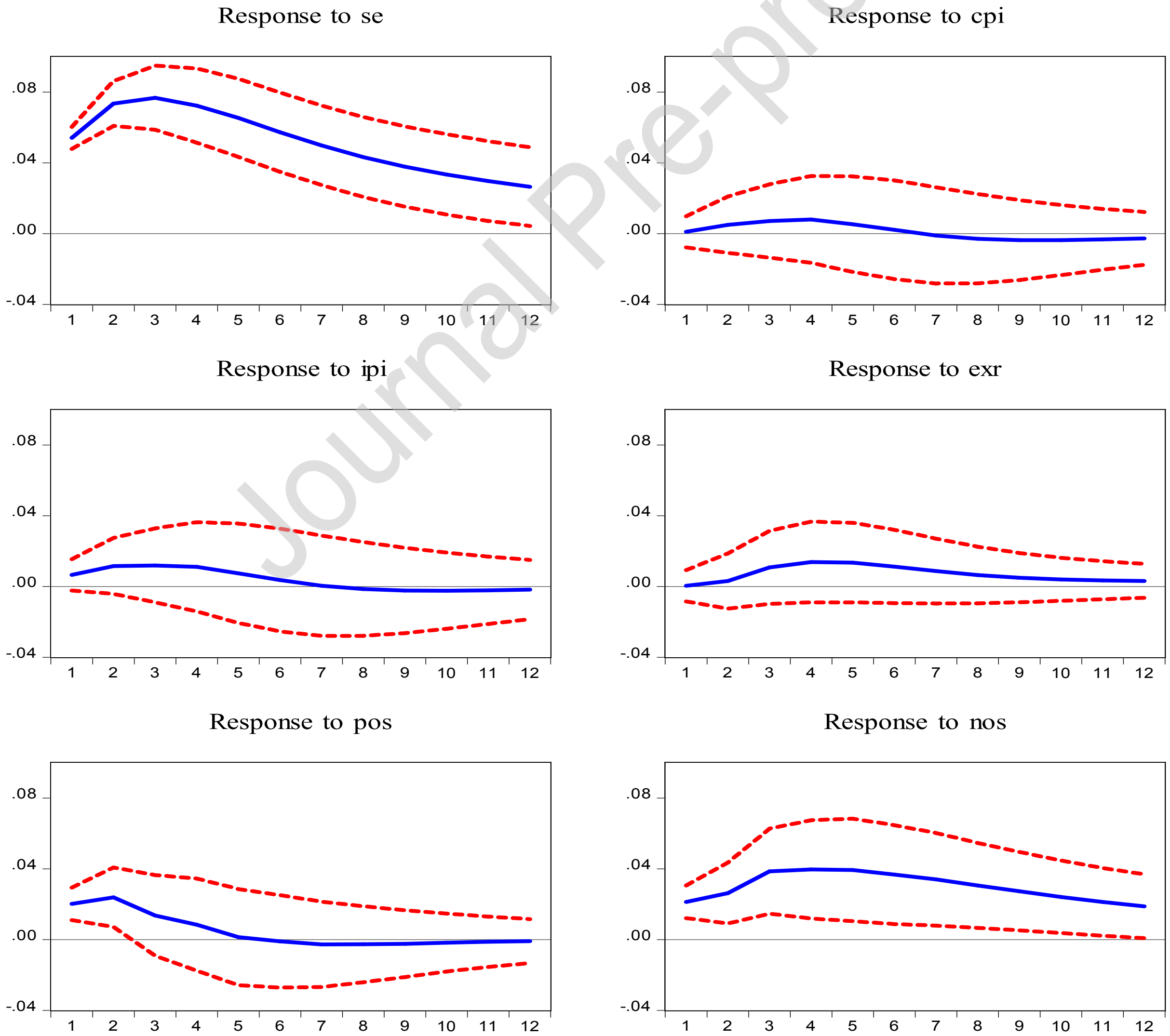


Note: Y-*axis shows responses and X-axis shows monthly periods.*

Figure 2 shows the response of the stock exchange in Kazakhstan. In the figure, the response of stock exchange to stock exchange starts rising until the fourth month, but then falls gradually over subsequent months. The responses of the stock exchange to inflation, industrial production and the exchange rate are positive but do not show any significance. The response of the stock exchange to positive oil shock indicates a positive significance for only 1.5 months. The strongest impact on the stock exchange is created by negative oil shock. The response of the stock exchange to negative oil shock remains positive and increases dramatically until midway through the fifth month. Then, its effect declines over subsequent months.

Figure 3 indicates the response of the stock exchange in Russia. The stock exchange in Russia is significantly impacted by negative oil shock. Although positive oil shock shows a positive impact, it remains limited compared with that of negative oil shock. The response of the stock exchange to the positive oil shock is positive and statistically significant for approximately 2.5 months. Then, it loses its effect on stock exchange. The response of the stock exchange to negative oil shock shows significance in every month. Nevertheless, the response of the stock exchange to inflation and industrial production is insignificant.

Figure 3. Response of stock exchange to structural one standard deviation positive innovations for Russia



Note: *Y-axis shows responses and X-axis shows monthly periods.*

In consequence, for the Caspian Basin countries, the most important component of the stock exchange is negative oil shock. Negative oil shock is the most explanatory variable in analyzing the stock exchanges. The impacts of other variables are insignificant or remain limited.

5. Political implications

The research shows that the stock exchange is mostly influenced by oil price shocks in the Caspian Basin countries. However, the exchange rate, industrial production and inflation do not display any significant impacts on the stock exchanges, in contrast to the case of oil price shocks. There are several reasons for this. These countries have a natural abundance in oil. The price elasticity of oil demand is relatively inelastic in economies, which makes it a profitable resource for producer countries. Exporting oil-related products creates foreign currency revenue, but this production method does not allow manufacturing industries to develop and gain power in international trade. Countries usually want to use that which is abundant in their economies. Governments incline towards their most competitive industries in international trade. Rising revenue has an appreciation effect on the exchange rate in these countries. Hence, it weakens manufacturing industries which could focus on exports.

Intensified production of oil-related products causes a dramatic dependency on the oil price. Therefore, oil price shocks impact on stock exchanges in producer countries. However, stock exchanges are much more dramatically impacted by negative oil shocks than positive ones. It shows that a negative oil price shock can influence the stock exchanges of these countries. This is mostly because the oil price is what these countries depend on. Increasing oil prices and revenue produces a favorable condition in the economy. Nevertheless, high dependency on oil-related products stimulates negative impacts more than positive ones, because these countries do not have any substitute production to keep their exports stable. A falling oil price decreases revenue by impacting negatively on their stock exchanges. Therefore, the Caspian Basin countries should create industrial base production and invest more in manufacturing industries that focus on export rather than in oil-related industries. In this way, these countries can create a substitution effect against negative oil price shocks.

6. Conclusion

In this work, for the first time, three Caspian Basin countries – Iran, Kazakhstan and Russia – were compared with each other in terms of oil price shocks to their stock exchanges. These countries are oil-production oriented and their economic performance is strongly dependent on oil-related products. The countries were examined through the impacts of inflation, industrial production, the exchange rate and oil price shocks on their stock exchanges. Data was collected on a monthly basis between March 2005 and June 2018. The oil price shocks were categorized as positive and negative shocks. For this analysis, the SVAR model was used to derive the results of forecast variance decomposition and impulse response functions for the stock exchanges.

The order of variables was designed in terms of assumed effects on the stock exchanges. It is assumed that the most important variable that affects the exchange rate, industrial production, inflation and the stock exchanges is oil price shocks. According to the results of forecast variance decomposition and impulse response functions, the stock exchanges of the Caspian Basin countries are significantly impacted by negative oil price shocks. The impact of other variables on the stock exchanges remained limited or insignificant. The general reason behind this result is that the countries are mostly run by oil price performance. Thus, it shows a significant impact on the stock exchanges. The most important conclusion in this research is that negative oil price shocks have the strongest impact on the stock exchanges; more so than positive oil price shocks. This is because the countries have an abundance of oil resources, and industrial production has not been developed sufficiently for export. In other words, positive oil price shocks are much more ordinary phenomena, in contrast to negative shocks. Therefore, it is a must for these countries to avoid macroeconomic imbalances and falls in their stock exchanges by exporting oil. Hence, as a political implication, these countries should focus on industrial production that contributes to export. In this way, the countries can avoid the negative impact of oil price shocks on stock exchanges.

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Highlights

- The stock exchange is influenced by oil price shocks in the Caspian Basin countries
- Stock exchanges are much more impacted by negative oil shocks than positive ones
- The oil price creates asymmetric effects on stock exchanges
- Caspian Basin countries should focus on industrial production contributes to export