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MASTER'S DISSERTATION

The impact of oil prices changes on the economic performance of Kazakhstan

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Abstract

A major property of both economic and financial time series data has been their highly skewed nature throughout various stages of the economic cycle. Oil price fluctuations are considered to be one of the key macroeconomic parameters that are used to predict the behavior of various phases of economic development. Currently, oil prices are extremely volatile, which leads to significant changes in the macroeconomic indicators of both oil-importing and oil-exporting countries, which subsequently determines the further vector of development of such countries. For this reason, this research paper examines the impact of oil price spikes on the economic condition of the Kazakhstan Republic.

In accordance with the existing models which describes an economic relationships, the main focus of this paper lies within eight macroeconomic indicators: real GDP, government expenditures, net export, investments , inflation rate , interest rate, unemployment rate and money supply. To examine the influence of oil price shocks on these variables, a vector autoregression model, with data from year 2000 to 2021 was used. The empirical results of the analysis demonstrate the significant positive correlation between oil prices, real GDP, government expenditures, net export, money aggregates M2 and some negative influence with unemployment rate. Variance decomposition function results of VAR model displays that change in oil prices explain the positive behavior of the indicators, especially real GDP. Finally, impulse response function results, numerically and graphically proves the positive impact of price shocks to economy of Kazakhstan, showing that in a short and medium term, an increase in oil prices leads to increase in GDP.

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I. Introduction

A. Overall oil market overview

In the modern society, energy production and processing are a fundamental factor in the development of industry and the economy as a whole. Thus, one of the most important strategic commodities is oil, which derivatives, passing through all sectors of the industry, are a vital irreplaceable element of our lives. Nevertheless, due to the emergence of new types of renewable energy, social perceptions of oil are contradictory. Some groups of people perceive oil as a critical issue for sustainable economic development and the environment. For instance, Heidarian and Green (1989), using the case of Algeria, revealed that a majority of economic sectors of the country are highly dependent on oil revenues, as well as the rapid expansion of the oil field has caused a substantial deceleration in the growth of other spheres. This goes in tandem with the "Dutch Disease" problem, due to which the economies of the oil-exporting countries, because of their high dependence on oil production, are extremely vulnerable to changes in oil prices (Charfeddine and Barkat, 2020). In confirmation of their finding it is possible to bring examples of the majority of various different countries such as Russia, Uzbekistan, Canada and others which have invested the most part of the received profit from oil in the same sphere. The only exceptions are the examples of Dubai and Norway, which, instead of investing in the oil industry, developed other economically important sectors. On top of that, Mariano and Rovere (2017) in their work outlined the negative effects of oil extraction and refining on the environment, such as pollution of the oceans, the release of solids into the atmosphere, and the subsequent intensification of the greenhouse effect, leading to global warming. All of these combined, besides the negative social effect, contributes to the enormous economic costs. In contrast to this, another people believe that oil production has a positive effect on the micro and macroeconomic development of the country. Lim and Sek (2017) using panel data for various countries, observed that, depending on the fluctuations in oil prices, both oil-exporting and oil-importing countries are economically growing by improving their macroeconomic performance.

In reality, regardless of all these disputes, and more importantly, despite the trendy hype around renewable and clean energy, I think that oil is strategically essential and one of the principal energy resources, products of which are used in numerous fields of the world economy. According to the Energy Information Administration (2021), the worldwide production of different types of energy in 2018 was 600.020 quad Btu, where oil represents 193.336 quad Btu, which is 32.2% of all energy produced. Meanwhile, global energy consumption in 2018 was 599.459 quad Btu, of which oil worked out 198.317 quad Btu.

Based on the statistics above, it is obvious that oil remains by far the most produced and the most used energy in the world. This in turn indicates the strong economic impact of oil production on the economies of various countries, one of the main problems of which is the volatility of oil prices. Historically, oil prices play a major role for either oil-importing and oil-exporting countries. Therefore, in the realities of a market economy, oil price shocks have a significant impact on the economic development of many countries. The correlation between crude oil price fluctuations and economic performance has become the subject of interest of many scholars worldwide. One of the first researchers who took an interest in the relationship between changes in oil prices and economic performance was Hamilton (1983), who, using the example of the United States, observed that an increase in oil prices has a positive effect on the economic growth of the country. Gonzalez and Sherzod (2009) compared such an economic giant in oil production and consumption as the United States to a country with low oil production and imports, namely Sweden, and found no correlation between growth in real GDP and changes in the price of oil in Sweden. Moreover, they discovered a positive trend between the increase in oil prices and U.S. economic expansion, concluding that the economies of oil-dependent countries are very sensitive to changes in oil prices(Gonzalez and Sherzod, 2009).

B. Reason for undertaking research (Aim, Research Questions)

As noted above, the strong volatility in the price of oil affects different economic factors in different ways. Hence the relevance of the problem in finding one or another effect of oil price shocks on the country's economy. In order to describe this problem I have chosen Kazakhstan as an example

Today Kazakhstan Republic is one of the leading exporters of the oil. The development of the oil sector in Kazakhstan began back in 1993, which to this day is still profitable and plays a crucial role in the economy of Kazakhstan. According to Deloitte CIS Research Centre (2019), the oil and gas sector accounted for 7.372 billion tenge in GDP in 2018. Also, oil production is in the top three export categories category of the country and accounts for 70% of all exports (Deloitte CIS Research Centre, 2019). Moreover according to Petrick, Raitzer and Burkitbayeva (2018) the portion of oil-and-gas exports rose from 8% to 63% during 1994–2018 and the percent of oil-and-gas profit to total government revenue increased from 17% in 1999 to 54% in 2014. However, apart from all these advantages in the form of increased GDP and economic growth, there is one big drawback, namely, a huge dependence of oil production on its price, changes in which have a very strong impact on the final profit. Therefore, based on the above facts, the main purpose of this research work is to study the impact of oil price fluctuations on the economy of Kazakhstan, namely the impact on such macroeconomic indicators as real GDP, inflation, foreign exchange rate, money supply, net exports, government spending and international investment.

In order to achieve the core purpose of this research paper, the following key questions must be answered:

1. Is there a correlation between oil prices and economic performance in Kazakhstan?
2. If there is a correlation, is it positive or negative?
3. What is the real effect of falling or rising oil prices on the above economic indicators?

II. Literature Review

A. Oil prices distribution channels for development of the country economy

Looking at the oil market, as well as previous research papers, it is obvious that oil prices have a very strong influence on various economic indicators as well as for oil prices distribution channels. Charfeddine and Barkat (2020) in their work identified 4 main channels of oil price transmission and how they affect the economic activity of countries.

The first channel is related to the fiscal policies of oil-exporting countries. Thus, changes in oil prices greatly affect the net balance of the country's budget, which then determines the amount of government spending, which is part of the economic equation (Y = C+I+G+NX) for calculating the level of GDP (Charfeddine and Barkat, 2020). Calculating the effect of higher oil prices on the country's trade budget using Iran as an example, Emami and Adibpour (2012) concluded that high oil prices have a positive effect on the country's final fiscal balance, allowing government spending to increase, which stimulates the economy to rise. In addition to this by constructing and analyzing a fiscal policy equation that relates government expenditures not only to oil price fluctuations, but also to oil price fickleness and skewed oil price movements, El Anshasy and Bradley (2012) found out a strong positive correlation between increases in oil prices and government spending in the long run, resulting in increases in GDP. In the short term, however, the correlation is no longer as strong and government spending is growing less than in proportion to oil revenues (El Anshasy and Bradley, 2012).

On the contrary, a decline in oil prices negatively affects the trade balance of oil-exporting countries, causing budget cuts, resulting in reduced government spending (Charfeddine and Barkat, 2020). This in turn triggers a series of events such as an increase in interest rates, a decrease in investment, an increase in imports, which together cause economic instability and a decline in GDP. Anshasy (2008) noted that a sharp drop in oil prices has very negative consequences for the fiscal policy of the state, which entails a decrease in government spending and GDP.

The second channel is the exchange rate markets, which relates to the depreciation of national currencies after oil prices rise (Charfeddine and Barkat, 2020). As noted earlier, an increase in oil prices has a positive impact on the budget of oil-exporting countries. Moreover, the inflow of foreign capital in the form of multinational currency leads to an appreciation of the national currency, which in turn increases the purchasing power of the population and reduces the price of imported foreign goods. By making an analysis of the effect of oil prices on the exchange rate of Kazakhstan and Azerbaijan Dikkaya (2017) came to the conclusion that an increase in oil prices has a positive effect on the level of real interest rates, resulting in lower inflation and appreciation of the national currency. In comparison to this, Yildirim and Arifli (2021) found out that negative oil prices shocks entails a decrease in the real effective exchange rate, which in turn causes devaluation of the national currency, increased inflation and may cause a potential currency crisis.

The third is “Dutch disease” channel (Charfeddine and Barkat, 2020). According to this “Dutch disease” theory the increase in oil prices increase the revenues of oil-exporting countries, but also forces these countries to concentrate more and more on the oil market alone. This leads to an increase in the percentage ratio of oil sales to GDP, which in turn causes a strong dependence of the overall level of the economy on oil sales and also leads to increased sensitivity to changes in oil prices. (Ali and Wyzan, 2005). In general, this “Dutch disease” effect, together with the increase in oil prices, negatively affects the state and development of the economy.

The fourth channel is the resource dependence channel, which relates to the fact that resource-dependent countries tend to have poorer economic indicators than non-resource economies. (Charfeddine and Barkat, 2020). This is primarily due to the fact that in the long term, energy prices are very volatile and depend on the overall level of the global economy (Frankel cited in Charfeddine and Barkat, 2020). Secondly, this volatility in oil prices entails unstable productivity of the economy, which negatively affects external investments in the country of oil exporters, increasing their riskiness. Last but not least, dependence on the oil market in the country prevents not only the development of other sectors but also completely destroys the development of some industries (Frankel cited in Charfeddine and Barkat, 2020).

Overall, it is clearly seen that all these studies observed some correlation between oil prices and certain macroeconomic indicators. However, they do not discuss the dependence of oil prices and the overall supply and demand of the oil in the market and how this affects the economic development of countries.

B. Correlation between oil prices and the level of oil supply and demand and its effect on economic development

Today, oil and its derivatives are one of the earth's most consumed energy resources. Moreover, historically, not all countries have oil reserves, so the world economy has a concept of oil exporting and importing countries with their own level of supply and demand. In fact, the level of supply and demand for oil depends on various indicators, but this does not negate the fact that oil supply and demand shocks greatly affect the level of oil prices and its end products. For instance, Difiglio (2014) described the significant effects of non-elastic supply and demand changes on oil prices. He concluded that because of the low-price elasticity, a significant increase in supply or decrease in demand requires a very large shift in the level of oil prices. It follows that a small disruption in the supply of oil can lead to a spike in oil prices. In addition, due to high revenue elasticity of oil demand, rapidly growing global economic growth increases the demand for oil, which in turn increases the price. Further Difiglio (2014) notes that oil prices are also regulated by OECD countries, as they account for more than two-thirds of the world's oil reserves. He argues that these countries regulate most of the oil supply, which in turn leads to oil price uncertainty. Another study conducted by Cashin *et al.* (2014) also shows that changes in supply and demand influence the economic growth of oil-exporting and oil-importing countries. By analyzing a VAR model calculated for 38 different oil exporting and importing countries for the period from 1979-2013, which takes into account the impact of the price elasticity of oil supply and demand on oil prices, Cashin *et al.* (2014) conclude that oil importers usually experience a long-term decline in their economic performance in response to supply-induced oil price spikes, whereas oil exporters show stable economic growth.

In addition to the above, looking at the oil price market from 2008 to 2016, Kim (2018) concluded that the sharp fall in oil prices in 2007-2008, mainly related to the global financial crisis, which in turn led to a complete recession of the world economy, especially affecting oil producing and selling countries. Moreover, Kim (2018) noted that the fall in oil prices in 2014-2016 was associated with the shale revolution in USA, however he did not deny the fact of the impact of reduced demand and increased supply from the OPEC countries on these price changes. Compared to the Kim findings, Prest (2018) disputes that the U.S. oil revolution has played a major role in the drop in crude oil prices. On the contrary, he argues that the decreasing oil demand played a greater role in lowering oil prices in 2014, leading to simultaneous declines in key economic indicators such as commodity prices, Treasury bond yields, and the U.S. dollar exchange rate.

C. The impact of oil prices on the economic performance of different countries

Observing the oil market, it is clear that changes in oil prices have different effects on different economies. In this connection, to make an accurate assessment of the effect of oil prices on the economy of Kazakhstan, we should consider the effect of changes in oil prices on economic indicators of other countries.

One of the first to try to assess the impact of changing oil prices on the country's economic performance was Hamilton. Analyzing the U.S. market and economy after World War II, Hamilton (1983) concluded that the U.S. recessions from 1942 to 1978 was not due to higher oil prices. On the contrary, he found a positive correlation between U.S. economic growth and oil prices.

Another researchers from Europe by analyzing the oil market in several European countries, found that in the short term, the dynamics of rising oil prices affects the increased inflation, while in the long-term increase in oil prices contribute to economic growth (Cuñado and Pérez de Gracia, 2003).

Choi *et al.* (2018) In their work, looking at the statistics of 72 countries concluded that higher oil prices lead to an increase in inflation.

Yildirim and Arifli (2021) phaving analyzed the economy of Azerbaijan concluded that a strong dependence on oil negatively affects the growth of the economy because it is very sensitive to changes in oil prices. Moreover, they found that in 2016-2019, due to the drop-in oil prices, Afghanistan's economy sagged, causing a crisis in the country.

By analyzing the major players in both oil-exporting and oil-importing countries, Taghizadeh-Hesary *et al.*(2019) clearly identified a positive correlation between higher oil prices and GDP growth for oil-exporting countries and an inverse negative correlation for oil-importing countries. Moreover, using the example of Russia, Iran and Dubai, they noted that the higher the percentage of oil supply, the higher the growth of GDP and the increase in oil prices.

D. Summary

Overall all these studies examine the clear correlation between oil prices fluctuations and economic performance of different countries. From the first part it is clearly seen how decrease or increase in crude oil prices can affect to some major economic figures such as: Real GDP, Exchange rate, Government expenditures and Net Export, which together determine the overall level of economic development of a country. Second part of Literature review summarize how changes in oil supply and demand affect to oil prices changes and on the economy of the country in general. The third but not the least part of the work, determines the significance of changes in oil prices on the economic evolution of different oil-exporting and oil-importing countries. All these aspects must be summarized all together in order to properly assess the economic activity of Kazakhstan and show the real effect of changes in oil prices on the development of the economy of Kazakhstan.

III. Methodology

A. Model

Today, vector autoregressive (VAR) models of the global oil sector become the standard instrument for interpreting the effect of the crude oil price fluctuations on the macroeconomy of different countries. Many researchers use this model to describe any economic relationships. The popularity of the model arises from its simple usage, as well as the ability to determine the interrelationships between different shocks in a country's economy using the variance decomposition function and receive an economic justification of the results. Thus, most of the above-mentioned works in the literature review also use different variations of the vector model to describe the impact of oil prices changes on the economy.

In this paper, in order to properly assess the effect of changes in oil prices on economic performance and to find out the correlation between macroeconomic variables and crude oil prices, the VAR model is used, which explained as follows:

$$Yt = \beta 1Yt-1 + \beta 2Xt-1 + \cdots + \beta nXt-p + \varepsilon t,$$

Where:

Yt: is the vector function of endogenous variable for country;

$Xt-p$: is the vector of exogenous variables in period $t-1$;

β: is the coefficients of exogenous variables**;**

εt: is the error term of vector function with normal distribution.

Furthermore, in order to properly construct the model and receive the appropriate economic evidence, it is essential to verify the collected data against the necessary assumptions of the VAR model. the gathered data for stationarity, elimination of autocorrelation, elimination of heteroscedasticity, and test for normality of residuals.

The first stage of data evaluation, is to examine all data for economic growth or decline to some degree, as well as to plot the correlation matrix to inspect the relationships among the variables. The second step of the analysis, is to find the optimal number of lags that fit best to construct a vector model. To find the best number of lags, the results of Akaike Information Criteria test is used. The next step is to check the data for stationarity, elimination of autocorrelation, elimination of heteroscedasticity, and test for normality of residuals. The following tests are used to conduct this verification: Augmented Dickey-Fuller unit root test is conducted for testing stationarity of the data; The Breusch-Godfrey test is used to test for autocorrelation; White test is conducted to test for heteroscedasticity; The Granger causality test is used to investigate whether lagged values of one variable can predict another variable. The last but not the least step is to construct impulse response function and variance decomposition to determine the effect of oil price shocks to macroeconomic indicators. To analyze and build the vector autoregression model The EViews12 software package was used.

B. Data

For empirical analysis and assessment of the impact of oil price variability on the economy of Kazakhstan, yearly dataset from 2000 to 2021 is used, because there are no monthly or quarterly statistics for some macroeconomic indicators.

Since the main objective of this research is to find the effect of oil price shocks on economic growth in Kazakhstan, the following macroeconomic indicators were used:

BRENT_OIL: The annual percentage growth rate in the price of Brent crude oil, estimated on the basis of the average annual prices of Brent crude oil. Retrieved: US Energy Information Administration.

GDP: The annual percentage growth rate of the real GDP of the Kazakhstan, estimated on the basis of annual statistics of nominal GDP by production method in current prices and local currency, considering the GDP deflator.

Retrieved: «Taldau» information-analytical system Bureau of National Statistics of the Agency for Strategic of the Republic of Kazakhstan.

I: The annual foreign direct investment expressed as a percentage of GDP.

Retrieved: National Bank of the Kazakhstan Republic.

U: The annual percentage unemployment growth rate. calculated on the basis of the ratio of the number of unemployed people to the total population.

Retrieved: «Taldau» information-analytical system Bureau of National Statistics of the Agency for Strategic of the Republic of Kazakhstan.

G_EXP: The annual percentage growth rate of the public expenditures, calculated on the basis of the annual budget expenditures of the Republic of Kazakhstan local currency.

Retrieved: «Taldau» information-analytical system Bureau of National Statistics of the Agency for Strategic of the Republic of Kazakhstan.

NX: The annual percentage growth rate of the net export of goods and services, calculated on the basis of the difference in the balance of payments between export and import in local currency.

Retrieved: «Taldau» information-analytical system Bureau of National Statistics of the Agency for Strategic of the Republic of Kazakhstan.

M2: The annual percentage growth rate of the money supply, calculated on the basis of the annual money supply indicator, which includes cash, 1-year deposits and convertible money in the national currency.

Retrieved: National Bank of the Kazakhstan Republic.

INFL_CHANGE: The annual percentage growth rate of inflation calculated on the basis of the annual inflation rate and yearly CPI.

Retrieved: National Bank of the Kazakhstan Republic.

R_CHANGE: The annual percentage growth rate of base rate calculated on the basis of the annual base rate at which National Bank of the Kazakhstan Republic lends money to second tire banks and investors.

Retrieved: National Bank of the Kazakhstan Republic.

IV. Empirical Results

To accomplish the objectives of this dissertation, it is essential to build a VAR framework, which states that variables must satisfy several requirements. Collected data must be stationary, and meet terms of normality, omission of heteroscedasticity and autocorrelation. As well ass VAR must be built by using optimal level of lag length.

A. Sample analysis

By constructing the VAR model, oil price growth rate and some of the most relevant macroeconomic factors in a country, like Real GDP growth rate, Unemployment rate, Direct foreign investment rate, Government expenditure growth rate, Net Export growth rate, Money supply growth rate, Inflation growth rate, Base rate growth rate and Exchange rate were used. The values of these indicators can be viewed in Appendix 1. Furthermore, in order to provide more in-depth analytical insights, values of annual Real GDP, government expenditures, net exports, money supply, inflation rate, unemployment rate, refinancing rate and oil price have been added and can be seen in Appendix 2.

The analysis of the narrative dynamics of each variable represented in Table 1 and provides insight into the macroeconomic performance of the Kazakhstan Republic.

According to Table 1 and Figures 1 and 2 it is clearly seen that that Kazakhstan's Real GDP is increasing year by year, with mean GDP growth of 18,52%. The lowest GDP growth was recorded at 3.1 percent in 2016, while the highest growth was 33.31 percent in 2001. The inflation and refinancing rates behaved in a similar manner. Based on Figure.1 and Figure.2 it can be seen that there have been average fluctuations, but in general both indicators have decreased since 2000, amounting to 6.37% and 9.31% respectively. The average growth of inflation rate totaled 1.98%, whereas mean increase for base rate was 0,056%. In addition, with the increase in real GDP, there is a sharp increase in government spending, net export and the money supply in the country. The mean growth for these indicators amounted 19.22%, 32,27% and 29,49% respectively. The direct investment amounted 7.2% of the national GDP yearly. Table.1 and Figure.2 shows that the unemployment rate has declined annually from 11.5% to 4.9% since 2000. The average decrease rate accounted for 4.1%. Looking at oil prices, there was a dramatic rise in prices during the economic boom in oil demand from 2000 to 2007. In addition, there was negative dynamics during the recession of demand and the world economy as a whole in the period from 2007 to 2010 and 2014 to 2016.

Table 1. Statistics of variables

	BRENT_OIL	GDP	R_CHANGE	INFL_CHAN	G_EXP	NX	M2	I
Mean	0.082960	0.185283	0.005653	0.019857	0.192281	0.327598	0.294934	0.072318
Median	0.067862	0.179244	0.008000	0.000000	0.152634	0.266761	0.235731	0.068526
Maximum	0.688751	0.333177	0.588235	0.794430	0.848359	1.774990	0.973256	0.130129
Minimum	-0.471355	0.030559	-0.301587	-0.494939	-0.216919	-0.700612	-0.082257	0.000465
Std. Dev.	0.288118	0.088325	0.235412	0.323680	0.210423	0.611177	0.262445	0.040311
Skewness	-0.055499	0.076801	0.689760	0.542753	1.155027	0.857262	1.210961	0.091780
Kurtosis	2.525559	2.054391	2.958895	2.806712	5.856666	3.690054	3.923259	1.743494
Jarque-Bera	0.217631	0.841289	1.746035	1.114378	12.37215	3.131122	6.158268	1.478127
Probability	0.896896	0.656624	0.417689	0.572817	0.002058	0.208971	0.045999	0.477561
Sum	1.825115	4.076222	0.124370	0.436865	4.230177	7.207151	6.488543	1.591005
Sum Sq. Dev.	1.743254	0.163829	1.163796	2.200146	0.929836	7.844286	1.446423	0.034124
Observations	22	22	22	22	22	22	22	22

	U
Mean	-0.041027
Median	-0.036376
Maximum	0.020833
Minimum	-0.121212
Std. Dev.	0.040785
Skewness	-0.365753
Kurtosis	2.150959
Jarque-Bera	1.151307
Probability	0.562337
Sum	-0.902592
Sum Sq. Dev.	0.034932
Observations	22

Figure 1. Dynamics of macroeconomic variables

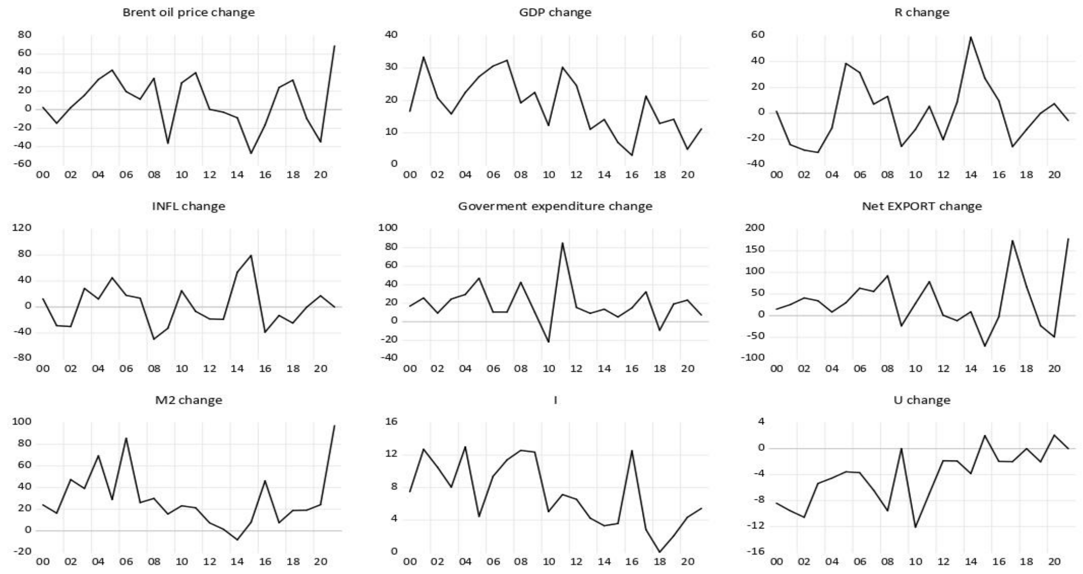


Figure 2. Dynamics of additional macroeconomic variables

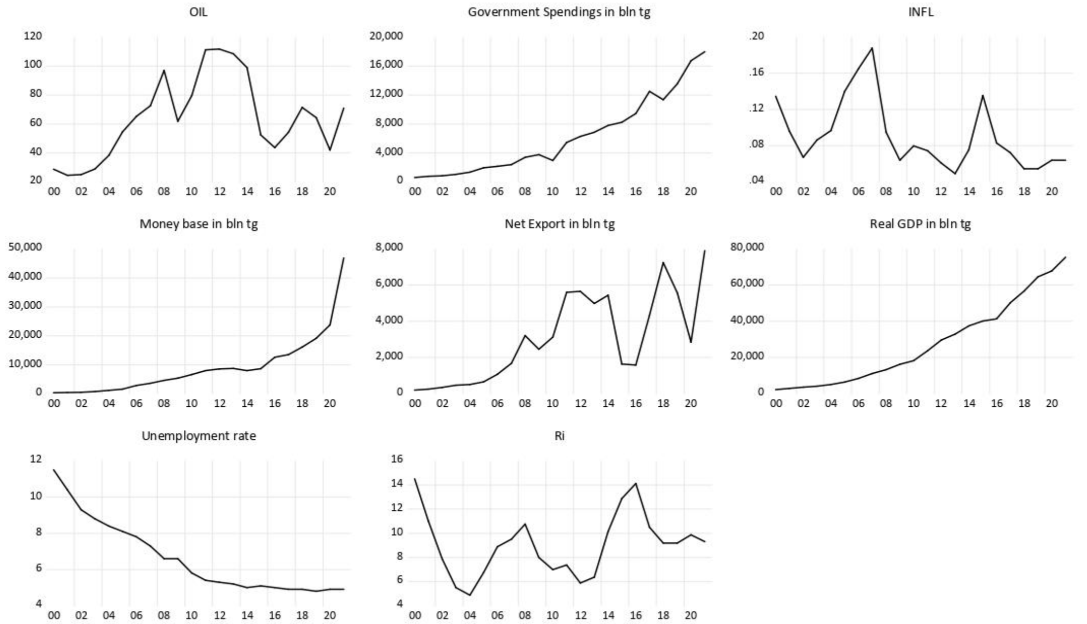


Table 2 provides information on the correlation coefficients between all variables for Kazakhstan. The table above shows that the growth rate of oil prices is positively correlated with annual GDP growth, government spending growth, net exports growth, and money supply growth. The correlation coefficients for these indicators were 0.29, 0.23, 0.79 and 0.5, respectively. The coefficients obtained indicate an intermediate level of relationship between the variables. On the other hand, based on this table, we can see that changes in oil prices are negatively correlated with base rate growth, inflation rate growth, foreign direct investment rate and unemployment growth rate.

Table 2. Correlation

	BRENT	GDP	R_CH	INFL_	G_EXP	NX	M2	I	U	EXCH
BRENT	1.0000	0.2917	-0.0524	-0.1011	0.2356	0.7944	0.5010	-0.0624	-0.3055	-0.0422
GDP	0.2917	1.0000	-0.1131	-0.1336	0.4249	0.2975	0.0727	0.4070	-0.4316	-0.6168
R_CHA	-0.0524	-0.1131	1.0000	0.5444	0.1280	-0.2000	-0.0753	-0.2299	0.1833	-0.0667
INFL_C	-0.1011	-0.1336	0.5444	1.0000	-0.0958	-0.2897	-0.0664	-0.4126	0.1884	-0.0789
G_EXP	0.2356	0.4249	0.1280	-0.0958	1.0000	0.1958	-0.0365	0.1887	-0.1106	-0.1779
NX	0.7944	0.2975	-0.2000	-0.2897	0.1958	1.0000	0.3970	-0.0217	-0.2079	0.1430
M2	0.5010	0.0727	-0.0753	-0.0664	-0.0365	0.3970	1.0000	0.3663	-0.0403	0.1352
I	-0.0624	0.4070	-0.2299	-0.4126	0.1887	-0.0217	0.3663	1.0000	-0.4390	-0.4876
U	-0.3055	-0.4316	0.1833	0.1884	-0.1106	-0.2079	-0.0403	-0.4390	1.0000	0.6088
EXCHGR	-0.0422	-0.6168	-0.0667	-0.0789	-0.1779	0.1430	0.1352	-0.4876	0.6088	1.0000

By performing a basic analysis of the indicators, it can be concluded that there are some differences in macroeconomic variables behavior in Kazakhstan. Nevertheless, general tendencies such as the growth or decline of the indices over time and the correlation with oil prices can be observed.

B. Stationarity

As mentioned previously, in order to build a proper VAR model, it is necessary for all variables to meet several assumptions. One of the first required presumptions for any time-series dataset is the stationarity of variables. Stationarity implies that the statistical characteristics of the time series process remain unchanged over time. Which means that the mean, variance and covariance of the data are constant over time. Therefore, to perform a further analysis, we first examine the stationarity of our data using Augmented Dickey-Fuller unit root test.

In statistics, the Augmented Dickey-Fuller Test is a unit root test in a time series sample, which looks as follows:

$$Yt = c + \beta t + \alpha Y\text{-}1 + \varphi 1Yt\text{-}1 + \varphi 2Yt\text{-}2 + \cdots + \varphi nYt\text{-}p + \varepsilon t,$$

Where: Yt: value of time series in time t;

αY-: coefficient of the first lag;

Y(t-1): lag of time series data;

φ1Yt-1: the first difference in time series data;

φ2Yt-1: the second difference in time series data.

Based on the formula above the ADF test makes the null hypothesis that the coefficient of the first lag alpha = 1, indicating that the data are non-stationary. In order to obtain stationary data, it is necessary to reject the null hypothesis based on the results of the ADF test with different level of differences.

Table 3. ADF results

UNIT ROOT TEST RESULTS TABLE (ADF)
Null Hypothesis: the variable has a unit root

	At Level	BRENT_OIL	GDP	R_CHANGE	INFL_CHA	G_EXP	NX	M2	I	U
With Constant	t-Statistic	-3.7357	-2.8181	-4.2832	-3.8183	-5.3353	-5.0001	-2.7667	-2.9138	-2.9843
	Prob.	***0.0112*** **	***0.0727*** *	***0.0042*** ***	***0.0094*** ***	***0.0004*** ***	***0.0008*** ***	***0.0801*** *	***0.0606*** *	***0.0528*** *
With Constant & Trend	t-Statistic	-3.5983	-4.5337	-3.9416	-3.7207	-5.8944	-4.7882	-1.1056	-4.6058	-5.1373
	Prob.	***0.0545*** *	***0.0088*** ***	***0.0319*** **	***0.0434*** **	***0.0006*** ***	***0.0056*** ***	***0.9025*** n0	***0.0076*** ***	***0.0026*** ***
Without Constant & Trend	t-Statistic	-3.5060	-1.1590	-3.4482	-3.9121	-0.8903	-2.9809	-0.1903	-1.3359	-2.1180
	Prob.	***0.0013*** ***	***0.2165*** n0	***0.0016*** ***	***0.0005*** ***	***0.3175*** n0	***0.0049*** ***	***0.6051*** n0	***0.1625*** n0	***0.0360*** **
	At First Difference	d(BRENT_OIL)	d(GDP)	d(R_CHA	d(INFL_C	d(G_EXP)	d(NX)	d(M2)	d(I)	d(U)
With Constant	t-Statistic	-4.9628	-7.1409	-4.4258	-4.1213	-7.7586	-4.8236	-7.0400	-6.5841	-6.0590
	Prob.	***0.0009*** ***	***0.0000*** ***	***0.0027*** ***	***0.0058*** ***	***0.0000*** ***	***0.0014*** ***	***0.0000*** ***	***0.0000*** ***	***0.0001*** ***
With Constant & Trend	t-Statistic	-4.6867	-6.8561	-4.3145	-3.9523	-7.5214	-4.6005	-6.9411	-4.0707	-5.8976
	Prob.	***0.0074*** ***	***0.0001*** ***	***0.0143*** **	***0.0313*** **	***0.0000*** ***	***0.0095*** ***	***0.0001*** ***	***0.0266*** **	***0.0007*** ***
Without Constant & Trend	t-Statistic	-5.1183	-7.2112	-4.5425	-4.2710	-7.9973	-5.0013	-7.1478	-6.7169	-5.7085
	Prob.	***0.0000*** ***	***0.0000*** ***	***0.0001*** ***	***0.0002*** ***	***0.0000*** ***	***0.0000*** ***	***0.0000*** ***	***0.0000*** ***	***0.0000*** ***

Notes:
a: (*)Significant at the 10%; (**)Significant at the 5%; (***) Significant at the 1% and (no) Not Significant
b: Lag Length based on SIC
c: Probability based on MacKinnon (1996) one-sided p-values.

Table 3 illustrates the results of the ADF test performed for all variables simultaneously at the initial level and at the first difference, considering the trends and the constant. From table 3 it is clear that some indices, namely BRENT_OIL, R_CHANGE, INFL_CHANGE, G_EXP and NX were stationary at the initial phase with a p-value below 0.05 and with a level of significance of at least 5%. But despite this, there were also indicators with a p-value greater than 0.05 and with a significance level of less than 10%, indicating that the data are not stationary.

In order to avoid this problem, as well as to achieve the stationarity of the data, the values of the first difference were used. Based on the ADF results for the values of the first difference, all variables are stationary, allowing the use this data to construct a var model.

C. Lag length

In order to select the best VAR model, it is necessary to identify the optimal number of lags. Because the selection of the optimal number of lags is essential for the evaluation of the VAR model, the following criteria will be used: LR statistic (LR); finite prediction error (FPE); Akaike information criterion (AIC); Schwartz information criterion information criterion (SC); Hannan-Quinn information criterion (HQ). Applying the lag length analysis, all these tests demonstrate the most appropriate number of lags for the model.

To obtain an optimal number of lags, the results of the Akaike information criterion test were used. From the Table 4, according to the AIC results, it is clear that the optimal number of lags for presented VAR model is lag 1.

Table 4. ADF results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	69.14307	NA	1.44e-14	-6.330849	-5.883484	-6.255137
1	221.5235	144.3604*	2.26e-17*	-13.84458*	-9.370923	-13.08746
2	5576.349	0.000000	NA	-568.9841	-560.4842	-567.5456

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

D. Normality test

We have already determined that 1 differences data are completely stationary. However, in order to build the VAR model, we must also check that these data correspond to a normal distribution by performing some tests of normality. In order to confirm whether our data meet the criteria of normality, the analysis of the histograms was carried out, as well as the Jarque Bera test.

From Figure 4 it is obvious that most of the coefficients correspond to a normal distribution, determined by the mean and standard deviation of the given data. However, the values of DR_change, DINFL_CHANGE and DGDP deviate slightly from the normal distribution.

Moreover, in order to more accurately verify compliance with the normality assumption of time-series data, the Jarque Bera test was also performed. In Table 5, the Jarque-Bera test indexes and its p-value are presented. Based on the results obtained, we can see that at the 1% significance level the p-values of each variable are greater than the p=0.05 value, allowing us not to reject the null hypothesis of distribution normality. In other words, based on the test performed, our data is fully consistent with the assumption of normality.

Table 5. Jarque Bera Test

	DBRENT_OIL	DR_CHANGE	DINFL_CHA	DG_EXP	DNX	DM2	DI	DU	DGDP
Jarque-Bera	1.578564	0.796161	2.291470	8.600999	3.314945	0.238409	0.510358	1.931541	1.232077
Probability	0.454171	0.671608	0.317990	0.013562	0.190620	0.887626	0.774778	0.380690	0.540080

E. Autocorrelation test

Other significant assumption that we have to test, that our time series data is free from autocorrelation. For checking the assumption of absence of autocorrelation in time series dataset Breusch-Godfrey test was used. In this method the residuals produced by the model considered in the analysis are taken and a t-stats are obtained on their basis using the optimal lag. The null hypothesis is the absence of serial correlation in the time series data, whereas the alternative hypothesis confirms serial correlation in a series of data.

Table 6 presents the autocorrelation test results. By constructing a var model with the number of lags equal to 1, the data were analyzed for the absence of autocorrelation. Based on the results of the test, it is clear that our number p is much greater than the value of 0.05 and in this regard, we do not remove the null hypothesis. In turn, this tells us that there is no autocorrelation in our data series, allowing us to use it for further analysis.

Figure 3. Histograms of the differenced data

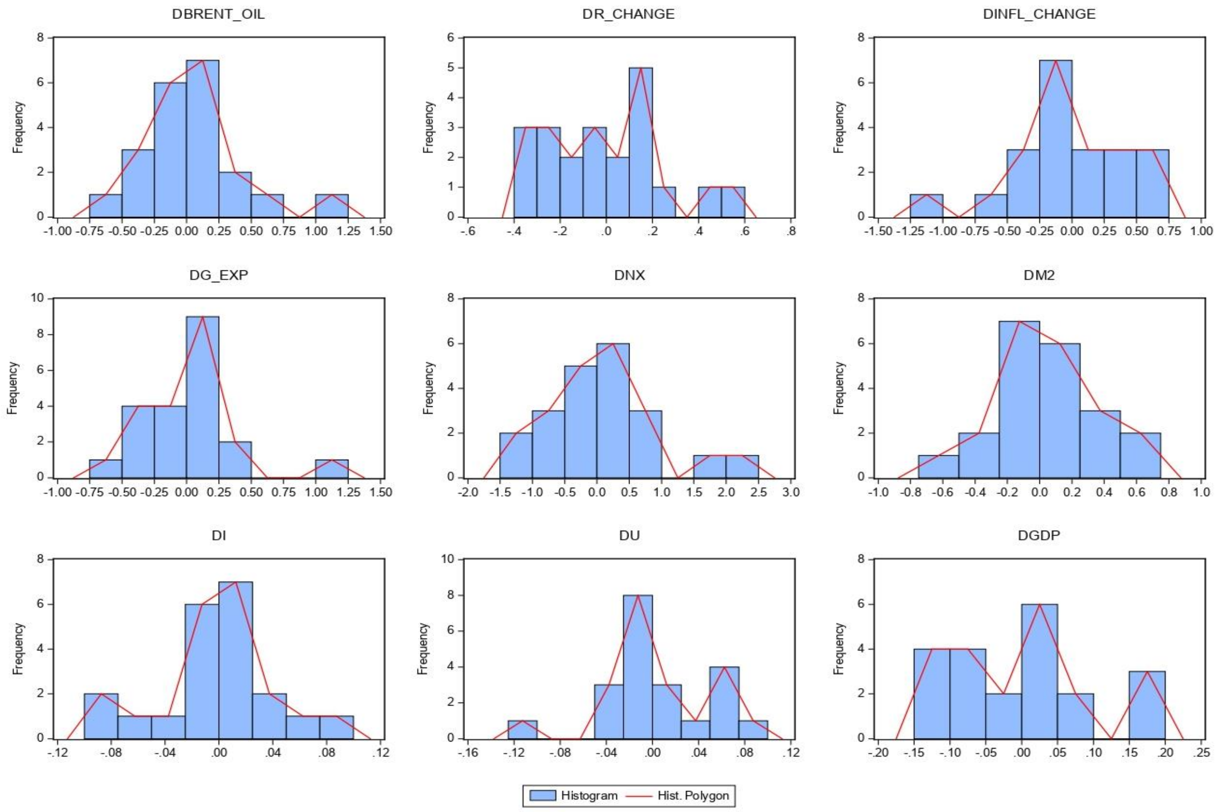


Table 6. Breusch – Godfrey test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.512890	Prob. F(1,11)	0.4888
Obs*R-squared	0.935534	Prob. Chi-Square(1)	0.3334

F. Heteroscedasticity test

VAR-model evaluation involves examination of heteroscedasticity in data set. For this purpose, we use Heteroskedasticity Test: Breusch-Pagan-Godfrey, which is required in order to pass to hypothesis testing or prediction. In this test, the null hypothesis implies the absence of heteroscedasticity in the data, and the alternative hypothesis assumes the presence of heteroscedasticity in the outcomes.

Table 7 shows the results of the test, based on which it can be seen that the p value is 0.49, which is many times greater than the p value equal 0.05. This test result confirms the null hypothesis of the absence of homoscedasticity in the model.

Table 7. Heteroskedasticity Test: Breusch-Pagan-Godfrey

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.819911	Prob. F(8,13)	0.5992
Obs*R-squared	7.377789	Prob. Chi-Square(8)	0.4965
Scaled explained SS	1.263321	Prob. Chi-Square(8)	0.9960

G. Granger Causality Test

Granger causality test is a process for verifying the cause-effect connection between time-series data. The concept of this test is how changes in one variable over time help to explain shifts in another variable. The null hypothesis of Granger Causality Test states that dependent variable cannot be explained by temporal changes in other values of times series data. The alternative hypothesis, on the contrary, suggests that one variable can describe some modifications in another variable

Table 8. Granger causality test

Dependent variable: DBRENT_OIL

Excluded	Chi-sq	df	Prob.
DGDP	0.743560	1	0.3885
DR_CHANGE	2.155446	1	0.1421
DINFL_CHANGE	2.718986	1	0.0992
DG_EXP	0.430567	1	0.5117
DNX	0.592032	1	0.4416
DM2	0.247584	1	0.6188
DI	2.386425	1	0.1224
DU	1.008780	1	0.3152
All	7.218217	8	0.5133

Dependent variable: DGDP

Excluded	Chi-sq	df	Prob.
DBRENT_OIL	3.260781	1	0.0710
DR_CHANGE	0.440749	1	0.5068
DINFL_CHANGE	0.116284	1	0.7331
DG_EXP	0.043267	1	0.8352
DNX	0.020825	1	0.8853
DM2	0.949110	1	0.3299
DI	0.429964	1	0.5120
DU	0.337853	1	0.5611
All	15.01563	8	0.0588

Dependent variable: DR_CHANGE

Excluded	Chi-sq	df	Prob.
DBRENT_OIL	2.119576	1	0.1454
DGDP	0.705758	1	0.4009
DINFL_CHANGE	0.152583	1	0.6961
DG_EXP	1.407395	1	0.2355
DNX	1.967271	1	0.1607
DM2	0.400401	1	0.5269
DI	0.006324	1	0.9366
DU	0.294813	1	0.5872
All	7.066790	8	0.5294

Dependent variable: DINFL_CHANGE

Excluded	Chi-sq	df	Prob.
DBRENT_OIL	0.099271	1	0.7527
DGDP	0.027880	1	0.8674
DR_CHANGE	1.965604	1	0.1609
DG_EXP	0.430623	1	0.5117
DNX	0.022723	1	0.8802
DM2	0.155322	1	0.6935
DI	0.162544	1	0.6868
DU	0.051394	1	0.8207
All	2.876693	8	0.9419

Dependent variable: DG_EXP

Excluded	Chi-sq	df	Prob.
DBRENT_OIL	19.10166	1	0.0000
DGDP	0.357588	1	0.5498
DR_CHANGE	8.060322	1	0.0045
DINFL_CHANGE	16.07794	1	0.0001
DNX	16.16447	1	0.0001
DM2	0.096972	1	0.7555
DI	6.261573	1	0.0123
DU	18.02873	1	0.0000
All	101.9585	8	0.0000

Dependent variable: DNX

Excluded	Chi-sq	df	Prob.
DBRENT_OIL	0.000771	1	0.9778
DGDP	1.101319	1	0.2940
DR_CHANGE	0.037344	1	0.8468
DINFL_CHANGE	0.391400	1	0.5316
DG_EXP	0.201053	1	0.6539
DM2	0.214962	1	0.6429
DI	1.591769	1	0.2071
DU	0.080945	1	0.7760
All	3.468664	8	0.9016

Dependent variable: DM2

Excluded	Chi-sq	df	Prob.
DBRENT_OIL	0.083870	1	0.7721
DGDP	0.895135	1	0.3441
DR_CHANGE	0.033861	1	0.8540
DINFL_CHANGE	1.297011	1	0.2548
DG_EXP	0.547882	1	0.4592
DNX	0.012522	1	0.9109
DI	3.04E-05	1	0.9956
DU	0.233734	1	0.6288
All	4.845837	8	0.7739

Dependent variable: DI

Excluded	Chi-sq	df	Prob.
DBRENT_OIL	0.544598	1	0.4605
DGDP	0.919295	1	0.3377
DR_CHANGE	0.081312	1	0.7755
DINFL_CHANGE	1.029391	1	0.3103
DG_EXP	1.532594	1	0.2157
DNX	0.017211	1	0.8956
DM2	0.150687	1	0.6979
DU	0.318630	1	0.5724
All	4.861980	8	0.7722

Dependent variable: DU

Excluded	Chi-sq	df	Prob.
DBRENT_OIL	0.019599	1	0.8887
DGDP	0.467969	1	0.4939
DR_CHANGE	0.285695	1	0.5930
DINFL_CHANGE	0.005582	1	0.9404
DG_EXP	2.747264	1	0.0974
DNX	0.076774	1	0.7817
DM2	0.426166	1	0.5139
DI	0.153319	1	0.6954
All	8.625149	8	0.3749

H. VAR model

Once we were satisfied that all our inputs were fully consistent with the assumptions of the VAR model, a model itself was built using the first-difference data. The outputs of this model are can be seen in Appendix 3.

Nevertheless, the coefficients of the VAR model themselves do not explain the relationships between the variables. That is why the analysis of this VAR model was performed on the basis of impulse response function and variance decomposition function.

I. Variance decomposition function

It is very important to conduct variance decomposition of the VAR results, due to the fact that this analytical tool allows to find out to what degree a change in one variable promotes a change in another variable. This analysis also gives insight about the relative significance of every random disturbance in the effect on the variables in the VAR framework. The main benefit of this method for economical interpretation of the findings is that these contributions can be compared to each other.

All outputs of variance decomposition analysis presented in Appendix 3. Examining the first difference data, it can be stated that changes in oil prices during the time have a different effect on the macroeconomic indicators of Kazakhstan.

According to the variance decomposition results for GDP in a short-term period, which lasts 2-3 years, it is clearly seen that BRENT OIL price explain 60.28% and 56.37% of the GDP. This outcome means that changes in the price of oil impact to the changes in GDP. Moreover, it can be concluded that there is some correlation between these variables and that if oil prices increase, GDP will increase. Nevertheless, in the long run period, the impact of oil price changes slightly decreases.

Considering the results for NX in the short-term period, it is obvious that BRENT OIL price explains more that 80% of the net export in Kazakhstan. In comparison, the relationship between the variables is slightly decrease in the long run, but still remains strong. All this in turn, as in the case of GDP, indicates a strong interrelation of these variables, and shows that the amount of Kazakhstan's net exports depends on fluctuations in oil prices.

Regarding the results of variance decomposition of G EXP and M2, it can be concluded that in the short run, oil price changes justify more than 20% of the changes in both variables. For the long run period, this figure ranges from 25-33%.

The same general picture is observed among the indicators of the real interest rate, inflation and direct foreign investments. In the short term, changes in oil prices do not greatly explain changes in these indexes. However, with the lapse of time there is an increase of influence of changes in oil prices on changes in these parameters.

The results for U, both in the short and long run stay constant. Oil price changes explains 40-50% of the changes in the unemployment rate.

J. Impulse Response Function

The next step in the analysis of the obtained VAR model is to construct an impulse response function, which represents the reaction of the data series in response to some external shocks. A shock is defined as a momentary change in external variables that is equal to one standard deviation of their variances over the observable period.

Figure 5 shows the impulse response results for Kazakhstan economic indicators to oil price shocks. Starting from the DGDP, it is clearly seen that standard deviation shock on the Brent oil price, has a positive effect to GDP in first 3 periods. Then from period 3 to period 5 it is observable that shoks on the oil price, has some negative effect. From period 3 to period 8 again we see a positive effect.

For the DE_EXP indicator, oil price shocks had both positive and negative effects. As can be seen from the graph, during the whole period there were noticeable fluctuations in the index.

Considering the DNX indicator, we can see that in the first 3 periods oil shocks have a negative impact on net exports and lead to its reduction. In the next 4 years there is a positive relationship, with a gradual increase in the indicator to 0 %.

Regarding the DINFL, in the first 3 years the impact of oil price shocks on inflation is very small, although after the 4th period there is a positive dynamic between the variables, which gradually reduces to 0% by the end of the period.

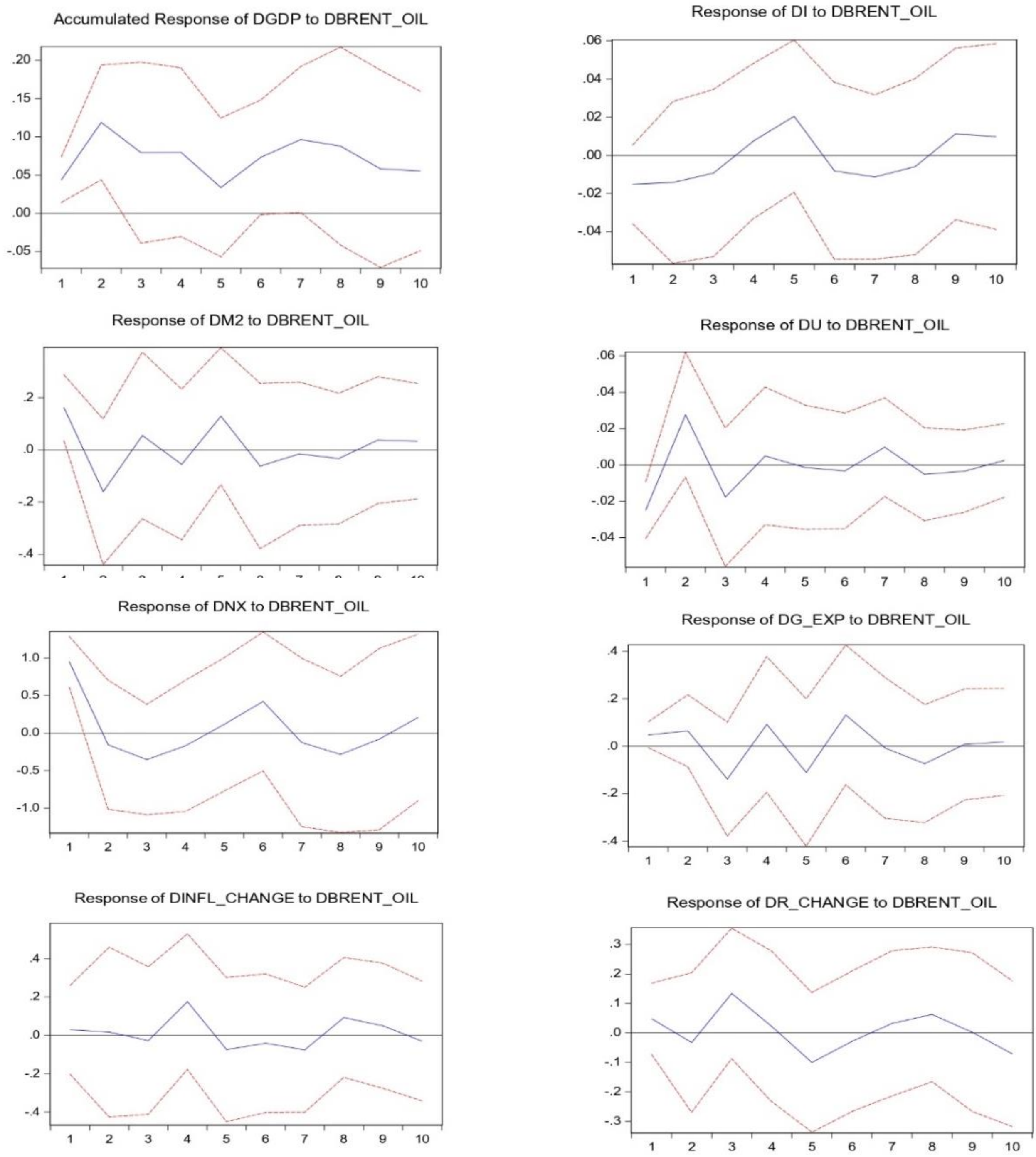
For the DI indicator, there is a positive trend for 5 years when there is a shock to oil prices. After that a negative correlation is observed until the end of the period.

For the indicator DR there is a positive and negative dependence, which changes each following period, tending to 0% at the end of the period.

Looking at the DU indicator it is noticeable that in the first two years there is a positive trend with oil price shocks. However, after this period there is a negative relationship between the variables.

Generally, it is clear from the impulse response function analysis that the increase in the standard deviation shock on the Brent oil price differently affect to the give variables in VAR model. However, the general trends of increase or decrease in variables can be observed.

Figure 4. Impulse Response Function



V. Conclusion and Limitations.

In today's market economy, almost all economic indicators are interrelated and together show one or another trend in the country's development. Given the rapid economic growth of Kazakhstan in the early 2000s, as well as the huge amount of oil produced and its quantity in the export structure of the country, the main objective of this dissertation was finding the impact of changes in oil prices on the economic development of Kazakhstan. From a review of the various literature, it was clear that oil price shocks have different effects on the economic performance of oil-exporting and oil-importing countries. Since Kazakhstan is a country that exports a huge amount of oil, macroeconomic indicators increase with an increase in the price of oil.

By conducting an economic analysis and constructing a vector model of the dependence of such variables as oil prices, net exports, real GDP, inflation and unemployment, a positive relationship of the variables was found. Thus, using variance decompsoition fucntion a positive relationship was found between changes in the price of oil and one of the most important indicators of any economy – GDP. In addition, there is a positive trend between oil price shocks, net exports and government spending.

In the context of my findings, and based on recent oil market events and world economy changes, I consider that this question requires further study. For a more detailed and precise examination of this problem, I suggest to introduce other Macroeconomic drivers into the model. Another more important suggestion to get a deeper picture would be to offer a comparative analysis of Kazakhstan as an oil exporting country with an oil importing country.

VI. Appendix

Appendix 1. Values of indicators

	BRENT_OIL	GDP	R_CHANGE	INFL_CHANGE	G_EXP	NX	M2	I	U
2000	2.40%	16.60%	1.60%	12.60%	17.00%	15.00%	24.00	7.49%	-8.40%
2001	-14.65%	33.32%	-24.14%	-28.77%	25.73%	25.58%	16.29	12.72%	-9.57%
2002	2.17%	20.78%	-28.41%	-30.17%	9.49%	41.22%	47.37	10.51%	-10.58%
2003	15.45%	15.79%	-30.16%	28.55%	24.58%	34.39%	39.21	8.05%	-5.38%
2004	32.62%	22.46%	-11.36%	12.21%	29.56%	8.45%	69.53	13.01%	-4.55%
2005	42.63%	27.34%	38.46%	45.08%	47.01%	29.84%	28.96	4.46%	-3.57%
2006	19.41%	30.57%	31.48%	17.86%	10.50%	63.73%	85.66	9.40%	-3.70%
2007	11.17%	32.35%	7.04%	13.76%	10.59%	55.77%	26.26	11.42%	-6.41%
2008	33.82%	19.25%	13.16%	-49.49%	42.72%	92.23%	30.02	12.60%	-9.59%
2009	-36.31%	22.44%	-25.58%	-32.70%	10.39%	-23.68%	15.47	12.38%	0.00%
2010	28.94%	12.29%	-12.50%	24.92%	-21.69%	27.78%	23.15	5.04%	-12.12%
2011	39.76%	30.23%	5.36%	-6.78%	84.84%	78.74%	21.27	7.14%	-6.90%
2012	0.33%	24.59%	-20.34%	-18.44%	15.59%	0.99%	7.27	6.56%	-1.85%
2013	-2.75%	11.09%	8.51%	-19.14%	9.31%	-11.73%	1.53	4.23%	-1.89%
2014	-8.83%	14.07%	58.82%	53.88%	13.70%	9.07%	-8.23	3.30%	-3.85%
2015	-47.14%	6.99%	27.16%	79.44%	5.34%	-70.06%	7.96	3.57%	2.00%
2016	-16.59%	3.06%	9.71%	-38.73%	14.93%	-2.63%	46.16	12.54%	-1.96%
2017	24.04%	21.32%	-25.66%	-12.91%	32.35%	173.31%	7.54	2.83%	-2.00%
2018	31.79%	12.85%	-12.50%	-24.79%	-9.13%	67.20%	18.80	0.05%	0.00%
2019	-9.87%	14.15%	0.00%	0.00%	19.30%	-23.05%	19.19	2.05%	-2.04%
2020	-34.74%	4.92%	7.48%	17.31%	23.56%	-48.92%	24.12	4.33%	2.08%
2021	68.88%	11.19%	-5.70%	0.00%	7.34%	177.50%	97.33	5.43%	0.00%

Appendix 2. Values of additional indicators

	OIL	GOVERNME	INFL	MONEY_BA	NET_EXPORT	REAL_GDP	UNEMPLOUM
2000	28.66	595.792	13.4500%	290.643	195.10	2214.566	11.500%
2001	24.46	749.092	9.5800%	337.980	245.00	2952.407	10.400%
2002	24.99	820.162	6.6900%	498.071	346.00	3565.911	9.300%
2003	28.85	1021.769	8.6000%	693.381	465.00	4128.917	8.800%
2004	38.26	1323.821	9.6500%	1175.491	504.30	5056.072	8.400%
2005	54.57	1946.128	14.0000%	1515.970	654.80	6438.168	8.100%
2006	65.16	2150.560	16.5000%	2814.551	1072.10	8406.337	7.800%
2007	72.44	2378.200	18.7700%	3553.643	1670.00	11125.37	7.300%
2008	96.94	3394.100	9.4800%	4620.329	3210.30	13266.86	6.600%
2009	61.74	3746.840	6.3800%	5335.204	2450.00	16244.13	6.600%
2010	79.61	2934.081	7.9700%	6570.099	3130.50	18240.38	5.800%
2011	111.26	5423.235	7.4300%	7967.502	5595.40	23753.66	5.400%
2012	111.63	6268.972	6.0600%	8546.937	5650.53	29594.66	5.300%
2013	108.56	6852.711	4.9000%	8677.614	4987.54	32875.80	5.200%
2014	98.97	7791.867	7.5400%	7963.822	5440.10	37500.76	5.000%
2015	52.32	8208.097	13.5300%	8597.832	1628.70	40121.79	5.100%
2016	43.64	9433.745	8.2900%	12566.465	1585.80	41347.89	5.000%
2017	54.13	12485.378	7.2200%	13513.732	4334.10	50165.04	4.900%
2018	71.34	11346.054	5.4300%	16054.341	7246.80	56611.26	4.900%
2019	64.30	13535.581	5.4300%	19134.928	5576.10	64621.38	4.800%
2020	41.96	16725.097	6.3700%	23750.269	2848.10	67801.34	4.900%
2021	70.86	17951.888	6.3700%	46865.360	7903.45	75388.87	4.900%

	RI
2000	14.50%
2001	11.00%
2002	7.88%
2003	5.50%
2004	4.88%
2005	6.75%
2006	8.88%
2007	9.50%
2008	10.75%
2009	8.00%
2010	7.00%
2011	7.38%
2012	5.88%
2013	6.38%
2014	10.13%
2015	12.88%
2016	14.13%
2017	10.50%
2018	9.19%
2019	9.19%
2020	9.88%
2021	9.31%

Appendix 3. Variance decomposition

Period	S.E.	DBRENT_O	DGDP	DR_CHAN	DINFL_CH	DG_EXP	DNX	DM2	DI	DU
1	0.398977	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.448812	79.02881	2.084162	12.13436	0.272849	0.099804	0.016604	2.143997	3.366581	0.852835
3	0.474888	72.35812	2.453766	11.20485	5.033950	0.734504	1.751648	2.426513	3.167667	0.868977
4	0.579813	65.45512	2.229112	14.99738	4.175156	2.322925	4.048740	2.943100	2.368025	1.460437
5	0.596709	62.29759	3.092820	14.50063	4.340926	4.625127	3.935659	3.206827	2.487738	1.512687
6	0.647968	65.80305	2.673011	13.07912	4.130600	4.081990	3.660060	2.854060	2.217620	1.500488
7	0.658576	63.74806	3.373795	13.46430	4.070303	4.222947	3.589818	3.472672	2.604970	1.453139
8	0.676337	65.04090	3.251981	12.98247	3.930908	4.123203	3.444619	3.293768	2.506244	1.425900
9	0.696284	63.43247	3.528580	14.20094	3.709903	3.968428	3.426386	3.637581	2.619893	1.475822
10	0.703282	63.09279	3.672135	14.00292	3.874625	4.270985	3.370348	3.660638	2.575699	1.479858

Variance Decomposition of DGDP:

Period	S.E.	DBRENT_O	DGDP	DR_CHAN	DINFL_CH	DG_EXP	DNX	DM2	DI	DU
1	0.073358	35.57020	64.42980	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.111862	60.28853	32.12017	0.054877	1.425126	1.927909	0.022436	3.643274	0.362233	0.155439
3	0.127116	56.37216	28.45577	0.730146	7.932200	1.939307	0.048029	2.845500	1.215593	0.461296
4	0.134171	50.60167	26.17432	1.239084	14.51253	1.783452	0.279606	2.947358	1.611827	0.850147
5	0.149406	50.32172	21.14365	4.204930	14.72383	1.868583	1.490856	4.176693	1.326637	0.743096
6	0.158019	51.19862	19.41468	5.228501	13.34493	3.349174	1.678461	3.783427	1.244146	0.758066
7	0.160628	51.66088	19.26451	5.216944	12.91923	3.292539	1.657425	3.731086	1.436443	0.820935
8	0.161549	51.35793	19.18119	5.335303	12.77482	3.372923	1.651308	4.016422	1.476280	0.833824
9	0.165093	52.43886	18.36940	5.779599	12.23424	3.294395	1.581228	3.974488	1.494164	0.833633
10	0.166044	51.86815	18.51662	6.074901	12.09660	3.263541	1.636038	4.124414	1.573510	0.846229

Variance Decomposition of DR_CHANGE:

Period	S.E.	DBRENT_O	DGDP	DR_CHAN	DINFL_CH	DG_EXP	DNX	DM2	DI	DU
1	0.272240	3.136207	3.071601	93.79219	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.309781	3.525638	3.738662	74.59945	14.54180	1.373128	0.882662	1.051200	0.043875	0.243581
3	0.355941	16.83908	2.844194	59.55395	12.14190	3.170812	3.460606	1.063889	0.041620	0.883945
4	0.362599	16.58608	3.408712	57.45182	11.90840	4.445315	3.515015	1.403307	0.394514	0.886839
5	0.377461	22.31236	3.188951	53.02005	11.47018	4.156684	3.318753	1.297477	0.364804	0.870731
6	0.383604	22.16055	3.459067	52.42224	11.42509	4.041685	3.271828	1.638313	0.716190	0.865040
7	0.386378	22.54567	3.581811	51.69436	11.46100	3.998912	3.442983	1.716542	0.705942	0.852782
8	0.396833	23.88823	3.505711	50.60295	10.87268	4.111385	3.455525	1.838144	0.765758	0.959616
9	0.398640	23.67697	3.713476	50.14891	11.01145	4.261343	3.459198	1.975774	0.800887	0.951992
10	0.406794	25.76182	3.568543	48.57762	10.62038	4.291177	3.470675	1.923683	0.782657	1.003440

Variance Decomposition of DINFL_CHANGE:

Period	S.E.	DBRENT_O	DGDP	DR_CHAN	DINFL_CH	DG_EXP	DNX	DM2	DI	DU
1	0.516798	0.323083	10.41706	15.93652	73.32334	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.558539	0.370667	9.040176	16.65191	70.89201	2.246387	0.608950	0.000849	0.141976	0.047071
3	0.572350	0.577640	8.720972	16.67139	69.58784	2.210045	0.587882	1.306207	0.144998	0.193032
4	0.610830	8.819523	7.718077	16.60938	61.57051	2.210392	0.518780	2.217356	0.166506	0.169479
5	0.619967	9.978709	8.397653	16.12702	60.01077	2.264587	0.558677	2.152500	0.291658	0.218424
6	0.625315	10.23189	8.394484	16.14345	59.47663	2.326477	0.560546	2.128042	0.374629	0.363843
7	0.634475	11.33143	8.207097	16.12994	58.20903	2.260457	0.668939	2.442467	0.393694	0.356943
8	0.643974	13.09860	8.051492	15.93181	56.55207	2.500932	0.723592	2.376387	0.386695	0.378418
9	0.647488	13.55617	8.115464	15.90215	55.94021	2.484683	0.719123	2.414155	0.472771	0.395276
10	0.648853	13.71070	8.136551	15.85693	55.71119	2.513160	0.716325	2.476094	0.480102	0.398952

Variance Decomposition of DG_EXP:

Period	S.E.	DBRENT_O	DGDP	DR_CHAN	DINFL_CH	DG_EXP	DNX	DM2	DI	DU
1	0.126050	14.50120	3.714695	4.671841	19.74384	57.36843	0.000000	0.000000	0.000000	0.000000
2	0.279619	8.307208	1.671475	3.449425	38.40223	13.07451	23.21385	7.329464	0.632449	3.919390
3	0.351212	20.85392	2.540772	4.813845	24.64317	13.11260	23.44041	5.287151	0.404579	4.903550
4	0.411651	20.15424	3.318626	9.872119	28.94387	11.49273	17.11615	3.849179	0.833768	4.419313
5	0.457973	22.12247	2.713476	8.019843	33.52904	9.293004	16.41647	3.423989	0.911126	3.570586
6	0.502732	25.20888	2.260877	8.903091	29.96881	9.718383	16.69626	3.121750	0.829561	3.292379
7	0.512558	24.27759	2.349002	9.673774	28.84512	11.05470	16.61425	3.003227	0.918074	3.264253
8	0.520382	25.55479	2.279827	9.666021	28.55172	10.80175	16.15410	2.930726	0.890703	3.170357
9	0.523881	25.23185	2.293833	9.827567	28.63692	10.68428	16.19476	3.000551	0.999393	3.130840
10	0.525702	25.16947	2.316320	9.799698	28.54440	10.66177	16.39447	2.987566	1.002297	3.124010

Variance Decomposition of DNX:

Period	S.E.	DBRENT_O	DGDP	DR_CHAN	DINFL_CH	DG_EXP	DNX	DM2	DI	DU
1	1.010734	88.57631	3.143398	0.670192	4.847523	0.265136	2.497445	0.000000	0.000000	0.000000
2	1.078093	79.93696	3.533625	1.649436	8.176560	0.528586	2.411772	1.598038	2.088907	0.076113
3	1.147178	80.06870	3.436024	2.143989	7.361977	0.838770	2.426839	1.475214	2.105674	0.142817
4	1.208424	74.13732	4.598516	5.564680	6.679513	0.961622	3.167235	1.954549	2.329534	0.607031
5	1.235129	71.87520	4.525339	5.825261	7.454565	2.087917	3.045655	2.135889	2.230615	0.819558
6	1.331292	71.96747	4.015921	6.548830	7.149148	1.943353	3.088628	2.396050	2.042108	0.848492
7	1.349823	70.87035	4.541226	6.378842	7.002892	2.520460	3.091719	2.551266	2.202274	0.840972
8	1.384094	71.60647	4.345898	6.454675	6.673326	2.432487	2.940526	2.459345	2.209413	0.877857
9	1.400644	70.24756	4.630134	7.231736	6.518362	2.376483	2.924879	2.861407	2.328499	0.880944
10	1.421835	70.32881	4.540406	7.357509	6.412661	2.571475	2.838482	2.777076	2.267051	0.906526

Variance Decomposition of DM2:

Period	S.E.	DBRENT_O	DGDP	DR_CHAN	DINFL_CH	DG_EXP	DNX	DM2	DI	DU
1	0.304440	28.48352	0.013481	22.61837	4.972573	16.66197	0.211980	27.03811	0.000000	0.000000
2	0.414945	30.31678	6.532828	19.21958	14.69558	10.99232	0.193315	17.90678	0.008223	0.134600
3	0.437611	28.87333	9.175468	17.29633	16.64821	9.989852	0.529252	16.60802	0.235847	0.643691
4	0.450693	28.74434	9.062934	16.37525	17.98346	9.513266	0.554173	16.58937	0.241822	0.935388
5	0.476122	33.14274	8.269310	15.28947	17.62506	8.590949	0.579690	15.44396	0.216842	0.841988
6	0.484169	33.68145	8.505833	14.79425	17.72833	8.531493	0.647058	14.93797	0.354907	0.818703
7	0.485802	33.54964	8.518043	14.69561	17.92695	8.487865	0.706685	14.85701	0.424235	0.833969
8	0.489487	33.51142	8.415325	15.04117	17.71967	8.414251	0.786619	14.84658	0.433035	0.831937
9	0.492047	33.75688	8.369831	15.09895	17.54892	8.485274	0.780448	14.69631	0.428555	0.834839
10	0.494007	33.95056	8.376403	15.08334	17.42866	8.420142	0.826302	14.61135	0.450985	0.852264

Variance Decomposition of DI:

Period	S.E.	DBRENT_O	DGDP	DR_CHAN	DINFL_CH	DG_EXP	DNX	DM2	DI	DU
1	0.047376	10.27571	6.684012	9.756493	48.82322	0.701376	4.194260	13.86530	5.699629	0.000000
2	0.059017	12.42270	10.82651	8.588623	50.70581	1.094019	2.711808	9.093156	4.337696	0.219667
3	0.061709	13.61608	12.60079	9.386687	46.67427	1.004905	3.244011	8.710831	4.243104	0.519319
4	0.063043	14.51546	12.10797	9.168414	44.85905	2.111087	3.510077	8.747882	4.079207	0.900849
5	0.067074	22.16679	10.76236	9.132624	39.97873	1.865033	3.120365	8.371792	3.783778	0.818521
6	0.068160	22.90431	11.16004	9.024179	38.91570	2.009338	3.027294	8.301996	3.864016	0.793124
7	0.069587	24.63711	10.75930	9.337034	37.62106	2.005493	2.915685	7.997390	3.869875	0.857051
8	0.070639	24.60282	10.78048	9.993039	36.64367	1.951801	3.063542	8.233804	3.860969	0.869879
9	0.071987	26.13425	10.42530	10.19543	35.32009	2.362395	2.989864	7.928931	3.719561	0.924179
10	0.073124	27.14508	10.33284	10.35965	34.30876	2.289593	2.995274	7.901288	3.722265	0.945248

Variance Decomposition of DU:

Period	S.E.	DBRENT_O	DGDP	DR_CHAN	DINFL_CH	DG_EXP	DNX	DM2	DI	DU

1	0.039075	40.57644	15.41380	0.695559	0.017062	20.00072	10.48268	0.468495	0.781525	11.56371
2	0.049760	55.95039	9.508242	2.519838	0.055401	15.53305	6.620293	0.681161	0.881493	8.250135
3	0.055592	54.97250	7.854349	2.596585	5.867581	12.44555	7.639718	0.554514	1.459200	6.610004
4	0.058625	50.14310	7.066128	2.575125	8.268306	12.39561	11.17331	0.499007	1.707098	6.172318
5	0.060943	46.44897	6.622584	5.377549	7.651310	13.44957	12.19070	0.574468	1.584830	6.100023
6	0.062344	44.65847	6.328918	6.770013	8.868503	13.71164	11.65261	0.553474	1.528170	5.928200
7	0.063898	44.85044	6.032154	6.444775	10.08941	13.07292	11.81302	0.551056	1.472290	5.673938
8	0.064719	44.36130	5.898279	6.460363	10.13941	13.27536	12.21821	0.537724	1.498602	5.610747
9	0.065003	44.24790	5.848815	6.567414	10.06933	13.40782	12.24140	0.533070	1.507154	5.577097
10	0.065250	44.05762	5.829980	6.801729	10.20845	13.33695	12.15071	0.561518	1.513930	5.539110

Cholesky Ordering: DBRENT_OIL DGDP DR_CHANGE DINFL_CHANGE DG_EXP DNX DM2 DI DU

References

Anshasy, A. A. El (2008) *OIL PRICES AND ECONOMIC GROWTH IN OIL-EXPORTING COUNTRIES*. UAE.

El Anshasy, A. A. and Bradley, M. D. (2012) ‘Oil prices and the fiscal policy response in oil-exporting countries’, *Journal of Policy Modeling*, 34(5), pp. 605–620. doi: https://doi.org/10.1016/j.jpolmod.2011.08.021.

Cashin, P. *et al.* (2014) ‘The differential effects of oil demand and supply shocks on the global economy’, *Energy Economics*, 44, pp. 113–134. doi: https://doi.org/10.1016/j.eneco.2014.03.014.

Charfeddine, L. and Barkat, K. (2020) ‘Short- and long-run asymmetric effect of oil prices and oil and gas revenues on the real GDP and economic diversification in oil-dependent economy’, *Energy Economics*, 86, p. 104680. doi: 10.1016/j.eneco.2020.104680.

Choi, S. *et al.* (2018) ‘Oil prices and inflation dynamics: Evidence from advanced and developing economies’, *Journal of International Money and Finance*, 82, pp. 71–96. doi: https://doi.org/10.1016/j.jimonfin.2017.12.004.

Cuñado, J. and Pérez de Gracia, F. (2003) ‘Do oil price shocks matter? Evidence for some European countries’, *Energy Economics*, 25(2), pp. 137–154. doi: https://doi.org/10.1016/S0140-9883(02)00099-3.

Deloitte CIS Research Centre (2019) *Business Outlook in Kazakhstan*. Available at: https://www2.deloitte.com/content/dam/Deloitte/ru/Documents/research-center/Business_Outlook_Kazakhstan_2019_en.pdf.

Difiglio, C. (2014) ‘Oil, economic growth and strategic petroleum stocks’, *Energy Strategy Reviews*, 5, pp. 48–58. doi: https://doi.org/10.1016/j.esr.2014.10.004.

Dikkaya, M. (2017) ‘Causality Among Oil Prices , GDP and Exchange Rate : Evidence from Azerbaijan and Kazakhstan’, (83), pp. 79–98.

Emami, K. and Adibpour, M. (2012) ‘Oil income shocks and economic growth in Iran’, *Economic Modelling*, 29(5), pp. 1774–1779. doi: https://doi.org/10.1016/j.econmod.2012.05.035.

Energy Information Administration (2021). Available at: https://www.eia.gov/international/data/world/total-energy/total-energy-production.

Gonzalez, A. and Sherzod, N. (2009) *Oil price fluctuations and its effect on GDP growth*. Available at: http://www.diva-portal.org/smash/get/diva2:202051/FULLTEXT01.pdf.

Hamilton, J. D. (1983) ‘Oil and the Macroeconomy since World War II’, *Journal of Political Economy*, 91(2), pp. 228–248. doi: 10.1086/261140.

Heidarian, J. and Green, R. D. (1989) ‘The impact of oil-export dependency on a developing country: The case of Algeria’, *Energy Economics*, 11(4), pp. 247–261. doi: https://doi.org/10.1016/0140-9883(89)90041-8.

Kim, M. S. (2018) ‘Impacts of supply and demand factors on declining oil prices’, *Energy*, 155, pp. 1059–1065. doi: https://doi.org/10.1016/j.energy.2018.05.061.

Lim, K. B. and Sek, S. K. (2017) ‘Examining the impacts of oil price changes on economic indicators: A panel approach’, *AIP Conference Proceedings*, 1830(1), p. 80016. doi: 10.1063/1.4981000.

Mariano, J. B. and Rovere, E. R. La (2017) ‘Environmental impacts of the oil industry’, *Encyclopedia of Life Support Systems (EOLSS)*. Available at: https://www.eolss.net/Eolss-SampleAllChapter.aspx.

Petrick, M., Raitzer, D. and Burkitbayeva, S. (2018) *Kazakhstan: Accelerating Economic Diversification*, *Policies to Unlock Kazakhstan’s Agricultural Potential*.

Prest, B. C. (2018) ‘Explanations for the 2014 oil price decline: Supply or demand?’, *Energy Economics*, 74, pp. 63–75. doi: https://doi.org/10.1016/j.eneco.2018.05.029.

Taghizadeh-Hesary, F. *et al.* (2019) ‘Trade linkages and transmission of oil price fluctuations’, *Energy Policy*, 133, p. 110872. doi: https://doi.org/10.1016/j.enpol.2019.07.008.

Yildirim, Z. and Arifli, A. (2021) ‘Oil price shocks, exchange rate and macroeconomic fluctuations in a small oil-exporting economy’, *Energy*, 219, p. 119527. doi: https://doi.org/10.1016/j.energy.2020.119527

Kutan Ali M. and Michael L. Wyzan (2005). “Explaining the real exchange rate in Kazakhstan, 1996–2003: Is Kazakhstan vulnerable to the Dutch disease?”. Economic Systems 29: 242–255.