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Mukhamediyev, Bulat; Temerbulatova, Zhansaya

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The Impact of Oil Prices on the Global Competitiveness of National Economies

Bulat Mukhamediyev*, Zhansaya Temerbulatova

Department of Economics, Al-Farabi Kazakh National University, Almaty, Kazakhstan. *Email: bmukhamediyev@gmail.com

ABSTRACT

The influence of various factors on the competitiveness of national economies is investigated in many articles, however, there is little research on the impact of resource prices on it. This article aims to examine the effect of crude oil prices on the global competitiveness of both producing countries and countries consuming oil. Based on annual data from 60 countries for 2006-2017, a regression analysis of panel data with fixed effects shows that exceeding the annual growth rate of oil prices over gross domestic product growth rates reduces the growth rate of the global competitiveness index (*GCI*), and it is twice strong for oil exporting countries than for countries non-oil exporters. And the growth of average labor productivity, total factor productivity, the share of employed in the total population, High-technology exports, and the Gross capital formation raises the country's *GCI*. Due to the rise in world oil prices, exporting countries are moving downward in the global competitiveness ranking more than non-oil exporters.

Keywords: Oil Price, Global Competitiveness Index, Panel Data
JEL Classifications: C33, C55, F6, O47

1. INTRODUCTION

In the context of globalization, for each country integrated into the world community, the problem of increasing the competitiveness of the national economy is paramount. This is due to several reasons. First, the absence of foreign economic barriers makes the world market into a single field of competition, and only those countries that are able to compete take their place in it. Secondly, every year more and more countries enter into global competition, and to retain their positions along with developed countries that emphasize high-technology production, countries need to ensure high productivity of production factors, efficient use of resources, improve asset profitability, and consistently high gross margin, thereby constantly increasing the level of competitiveness of the economy as a whole.

Factors affecting the competitiveness of a country can be classified based on the approaches of the World Economic Forum and the Institute for Management Development. The Global Competitiveness

Index (*GCI*) of the World Economic Forum is calculated on the basis of 98 factors, 30% of which are calculated on the basis of statistical data, and the rest according to estimates of enterprise managers and officials. Of these 98 indicators, 12 categories of competitiveness are derived (Institutions, Infrastructure, Macroeconomic environment, Healthcare and Primary Education, Higher Education and Food Services, Financial Market Development, Technological readiness, Market size, Business sophistication, Innovation), which describe in detail the competitiveness of countries of the world (World Economic Forum, 2018).

The World Competitiveness Rating by the Institute for Management Development is compiled based on an analysis of 340 criteria based on four indicators of key aspects of a country's economic life: state of the economy, government efficiency, business environment, infrastructure condition. The study covers 63 countries. Two thirds of the criteria are calculated on the basis of statistical data and one third based on expert estimates. Each indicator has equal weight. The calculation uses data from

international organizations, including the United Nations, the Organization for Economic Cooperation and Development, the World Trade Organization, the World Bank, the International Monetary Fund and other institutions, as well as 57 partner institutions around the world (IMD, 2018).

Also, the competitiveness of the economy is estimated according to Porter's (1993) international competitiveness theory. According to this theory, the criterion for the economy to enter the world market is the state of the macroeconomic environment in the country, the determinants of which are like sides of the "diamond." One side of the diamond is factor conditions, including natural, labor, technological and investment resources, as well as infrastructure. The second side of the diamond is the demand conditions in the country for products and services of the industry, the third is the presence of related and supporting industries, which are competitive in the international market, and finally, the fourth side of the diamond is the company's strategy, its structure and the nature of competition in the domestic market.

Natural resources are one of the most important factors in the development of a country's economy, which largely determine its place in the world economy. In many countries of the world, the export of natural resources significantly exceeds the export of other types of goods. According to the theory of comparative advantage of Riccardo, the country should produce those goods, the costs for which are the lowest. However, large reserves of natural resources are not a guarantee of a country's welfare. There is the concept of a "resource curse," due to the fact that some countries with significant reserves of natural resources are less economically developed than countries with few or no resources at all. This is proved by the experience of a number of developed countries (Japan, Italy, Great Britain, Switzerland, Germany), the lack of significant natural resources is not an insurmountable obstacle to their economic development and the achievement of a high level of international competitiveness.

There are a lot of research that determines the influence of such factors as natural resources, innovations, macroeconomic indicators, growth rates, interest rate on the competitiveness of the economy. At the same time, there are many studies proving the effects of oil prices on gross domestic product (*GDP*), economic growth, inflation, the exchange rate, and poverty. And the purpose of this article is to directly assess the impact of world oil prices on competitiveness.

This paper is organized according to the structure, as follows. Section 1 is the introduction that includes the importance of competitiveness in the era of globalization, approaches to assessing competitiveness and factors affecting on competitiveness. Part 2 is the literature review on previous studies. Part 3 is the data and methodology that explains the data analysis. Part 4 is the results and discussion, and finally part 5 is the conclusion.

2. LITERATURE REVIEW

The competitiveness of the economy is the object of large-scale scientific economic research. Determining the degree of influence of various factors on the competitiveness of the economy as a whole is the goal of many studies.

Fagerberg (1996) determined the degree of influence of 5 factors (direct investment in research, indirect investment in research, average wages, investment in physical capital and the volume of demand in the domestic market) on competitiveness. As a result of a study of 22 industries in 10 countries, it was found that the size of the domestic market and the level of wages do not effect on competitiveness. The degree of influence of the other factors have different values depending on the size of the country. At the same time, the competitiveness of the industries of large countries depends mainly on research within the country, and small ones - on innovations obtained from abroad. However, investment in research has proven to be more efficient than investment in physical capital, regardless of the size of the country.

National competitiveness is determined on the basis of studying the competitive advantages and weaknesses of a particular country. Among their indicators, the most commonly used in international practice are the following: *GDP*, the share of final consumption expenditure in *GDP* and gross savings in final consumption, the ratio of the export-import balance to the total foreign trade turnover of the country, the ratio of average price indices for goods and services exported and imported by a country, a country's *GDP* structure, especially the share created by the processing industries (Golovachev, 2010).

Carayannis and Grigoroudis (2014) identified innovation and productivity as key drivers for competitiveness. Since there is no generally accepted method for determining and measuring the above concepts, they propose to assess the degree of interdependence of these factors using a regression model based on data from 25 indicators for 19 countries for the period 1998-2008. The most important results include a series of contour maps and gap analysis diagrams that illustrate the evolution of the overall innovation, productivity, and competitiveness indices and compare the performance of the examined countries.

As a result of many studies, it has been determined that the innovative activity of the economy increases its competitiveness. For this reason, the key factors for increasing the innovation activity of the economy can also be considered as factors for increasing the country's competitiveness. Sadykhanova and Zhuparova (2013) considered the effectiveness of human capital as a source of increasing the innovation activity of the national economy. The role of human capital is determined by the fact that it has a significant impact on the development of innovative system, determines the pace of its development and the effectiveness of economic growth. Sagiyeva and Zhuparova (2013) defined the knowledge economy as a key engine for the development of innovation activity of the economy and consider the institutional support system for innovation activity based on a combination of government regulation and self-regulation mechanisms.

Despite the fairly large number of works on both the competitiveness of national economies in general and the development of countries

with a predominant commodity sector, in particular, questions concerning the mechanism of the impact of the commodity sector (including the oil sector) on the competitiveness of the national economy are relatively poorly developed.

Mottaeva and Ćetković (2018) considered the country's resource potential as an objective basis for the formation of competitiveness. The authors explored the role of the sustainable development of the fuel power complex in formation of the competitiveness of the economy and argue that the lack of real competition creates the full range of socio-economic problems.

Porter (2005) determined the total factor productivity as the only criterion of competitiveness and acceleration of economic development at the national level.

Flachenecker (2018) assessed the causal effect of factor productivity on six macroeconomic indicators using panel data from 28 EU member states from 2000 to 2014, and found that increasing factor productivity had improved macroeconomic competitiveness in the EU.

After a sharp drop in world oil prices, scientists from around the world began to investigate the impact of shocks on the economy, inflation, fiscal balances, etc. Since, these shocks are usually considered as the main factor affecting the macroeconomic situation in the country, especially in oil-exporting countries.

Akhmad et al. (2019) using quarterly data of time series for the period 1980-2017 built a vector autoregression (VAR) model to study the effect of fuel oil prices on economic growth, inflation and poverty in Indonesia. The results of the study showed that the increase in the price of fuel oil had a negative impact on the economy of Indonesia. A similar study was conducted by Ibrahim et al. (2019) using the example of Oman and determined the Granger causality between oil prices and *GDP* growth, capital accumulation and inflation.

Hajiyev and Rustamov (2019) constructed cointegrated vector autoregressive model for Azerbaijan to study the reaction of inflation to oil price shocks. The model showed that high import inflation had arisen as a result of the fall in the world oil price, due to decreasing in the value of the internal exchange rate and increasing in the value of imports.

Based on data on crude oil prices and economic growth for 1987-2016, Saidi et al. (2019), applying the autoregression model with distributed lags, determined that crude oil prices affect economic growth only in the short term.

Kurihara (2015) examined the relationship between oil prices, exchange rates and economic growth in developing and developed countries. A VAR test was conducted using quarterly data for the years 1990-2015. The test results showed that the increase in oil prices had a positive effect on the economic growth of developed countries. In addition, he found that an increase in the exchange rate also had affected economic growth.

3. DATA AND METHODOLOGY

3.1. Data
This study uses annual data from 2006 to 2017 for 60 countries that occupy the first 60 positions in the global competitiveness ranking for 2018. For all these countries, we used data on the *GCI* from the World Economic Forum (2018). The data on real *GDP*, employment, capital stock, real price of Brent oil, High-technology exports (% of manufactured exports), Gross Capital Formation are obtained from the World Development indicators of World Bank (2019).

3.2. Methodology
For this data structure, the most appropriate research tool is the panel data model. Panel data combines both spatial type data and time series for each object. The use of panel data makes it possible to control the individual heterogeneity of economic objects, whereas this is not available when using time series models or spatial type models. Moreover, ignoring it leads to the risk of getting biased results. It is possible to analyze the individual differences between them, in particular, to take into account the effect of unobservable factors. The list of properties of panel data models is given in the book Baltagi (2013).

Based on the research goal, the logarithm of the *GCI* is selected as the dependent variable. The panel data model is specified as follows:

$$
\ln\left(GCI_{it}\right) = \beta_1 \ln\left(\frac{rGDP_{it}}{L_{it}}\right) + \beta_2 \ln(A_{it}) +
$$
$$
\beta_3 \ln\left(\frac{L_{it}}{POP_{it}}\right) + \beta_4 \ln\left(\frac{rPOIL_t}{rGDP_{it}}\right) \cdot OIL\,exp_{it} +
$$
$$
\beta_5 \ln\left(\frac{rPOIL_t}{rGDP_{it}}\right) \cdot (1 - OIL\,exp_{it}) +
$$
$$
\beta_6 HTexport_{it} + \beta_7 \ln\left(GCF_{it}\right) + \alpha_i + \varepsilon_{it}
$$

(1)

Where:
$rGDP_{it}$ – GDP at constant prices of 2010 (US $);
L_{it} – The number of people employed in the country's economy (people);
A_{it} – Total factor productivity;
POP_{it} – Population of the country (people);
$rPOP_t$ – Crude oil, Brent, annual prices, real 2010 US dollars ($/bbl);
$OIL\,exp_{it}$ – Dummy variable, equal to 1 if the country is an exporter of oil, and equal to 0 otherwise;
$HT\,export_{it}$ - High-technology exports (% of manufactured exports);
GCF_{it} - Gross capital formation (% of *GDP*);
$\beta_1, \beta_2, \ldots, \beta_7$ are coefficients, α_i denotes unobservable individual-specific effect, and ε_{it} is remainder disturbance, i=1, 2,…, 60 index t takes values from 2006 to 2017.

The total factor productivity A_{it} for each country is estimated from real gross domestic product $rGDP_{it}$, capital stock and employment

using the production function in the form of the Cobb-Douglas function.

In the right-hand side of equation (1), in the first term, the ratio $\frac{rGDP_{it}}{L_{it}}$ shows the average labor productivity in constant prices. In the third term, the ratio $\frac{L_{it}}{POP_{it}}$ represents the proportion of the number of employed people in the total population of the country. The fourth and fifth terms include the ratio $\frac{rPOIL_t}{rGDP_{it}}$, which shows the real price of oil in relation to the $rGDP_{it}$ of the country. At the same time, in order to divide the impact of oil prices on the GCI of oil-exporting countries and other countries, the fourth member is actually included only in the equations for oil-exporting countries, and the fifth member is included only in the equations for other countries, which is provided by multipliers $OIL\ exp_{it}$ and $(1-OIL\ exp_{it})$, respectively.

4. RESULTS AND DISCUSSION

4.1. Research Results
In the process of evaluating the model (1), two specifications are selected. One of them among the independent variables contains the logarithm of average labor productivity, and the other one instead contains the logarithm of the total productivity of factors. Both specifications are given in Table 1 (equations I and II). For each of them, the Wald test confirms the presence of individual effects. Since the set of countries included in the study is chosen for unchanged years, it is usually advisable to use a fixed-effect panel model. In addition, a Hausman test was performed to compare a fixed-effect model with a model with random effects. To eliminate the effects of possible heteroscedasticity, Table 1 presents robust estimates of the significance of the coefficients. Statistical analysis was performed with the STATA statistic software package.

In the first equation, the coefficients at a variable of average productivity of factors and a variable of share of employed people in the total population of the country are positive and significant at the 1% level. The coefficients at variable of ratio of real oil prices to $rGDP_{it}$ for oil exporting countries, High-technology exports, as well as constant are statistically significant at the 5% level. However, coefficient at variable of ratio of real oil prices to $rGDP_{it}$ for non-exporters of oil is statistically insignificant, even at 10% level.

In the second equation, instead of the variable of average labor productivity, the variable of the total factor productivity $ln\ (A_{it})$ is introduced, and the variable of Gross capital formation is also added. All coefficients in this equation are statistically significant at least at the 5% level. In particular, at the 5% level, the most interesting for us coefficients at variable of ratios of the real price of oil to $rGDP_{it}$ for both countries-exporters of oil and countries-non-exporters of oil are significant.

Note, the values of the coefficients of determination in both equations are not high. However, the purpose of the study is not to identify all the factors of global competitiveness, but only to assess the impact of the price of oil on it.

Table 1: Panel regression with fixed-effect, dependent variable is logarithm of the global competitiveness index $ln\ (GCI_{it})$

Independent variables	Equations	
	I	II
$n\left(\frac{rGDP_{it}}{L_{it}}\right)$	0.085*** (0.029)	-
$ln\ (A_{it})$	-	0.110** (0.048)
$ln\left(\frac{L_{it}}{POP_{it}}\right)$	0.2703*** (0.049)	0.2514*** (0.060)
$ln\left(\frac{rPOIL_t}{rGDP_{it}}\right)OIL\ exp_{it}$	−0.0200** (0.0082)	−0.0203** (0.0086)
$ln\left(\frac{rPOIL_t}{rGDP_{it}}\right)(1-OIL\ exp_{it})$	−0.0061 (0.0042)	−0.0096** (0.0043)
$HT\ export_{it}$	0.00072** (0.0003)	0.00073** (0.0003)
$ln\ (GCF_{it})$	-	0.039* (0.022)
Constant	−0.676** (0.283)	−0.732** (0.361)
Number of observations	720	719
Number of groups	60	60
R²	0.299	0.285
Fisher test for significance coefficients	F(5,59)=21.92 [0.0000]	F (6,59)=19.58 [0.0000]

In parentheses there are robust standard regression coefficient errors (option vce [robust]); *, **, *** - significance of coefficients at 10%, 5%, and 1% levels, respectively

5. DISCUSSION

All independent variables except for the variable of High-technology exports are presented in a logarithmic form. Therefore, the estimated coefficients for them show the percentage change in the dependent variable of the GCI in response to a one percent increase in the corresponding variable. And the coefficient at variable of High-technology exports shows the relative change in the variable of GCI in response to the absolute change in the variable of $HT\ export_{it}$.

As expected, the increase in average labor productivity, total factor productivity, the share of the number of employed people in the total population of the country, High-technology exports, and the Gross capital formation supports an increase in the countries' GCI_{it}.

Let's separately consider the influence of the ratio of the real price of oil to $rGDP_{it}$ on the GCI_{it}. This independent variable for both the oil exporting country and the non-oil exporting country is of the form $ln\left(\frac{rPOIL_t}{rGDP_{it}}\right)$, since in both cases the multiplier $OILexp_i$ or $(1-OILexp_{it})$ is equal to 1. Assuming that the remaining independent variables are unchanged, the relative change in the dependent variable over the year is

$$\frac{\Delta GCI_{it}}{GCI_{it-1}} = \beta \frac{\Delta\left(\frac{rPOIL_t}{rGDP_{it}}\right)}{\left(\frac{rPOIL_{t-1}}{rGDP_{it-1}}\right)} \cong -\beta\left(\frac{\Delta rGDP_{it}}{rGDP_{it-1}} - \frac{\Delta rPOIL_t}{rPOIL_{t-1}}\right) \qquad (2)$$

Where the β coefficient is β_4 in the case of the oil exporting country or β_5 in the case of the non-oil exporting country. In other words, according to (2), the increase in the annual growth rate of the GCI_{it} is equal to excess of the annual growth rate of the real gross domestic product $rGDP_{it}$ of the country over the annual growth rate of real world oil prices $rPOIL_t$ multiplied by minus β.

According to the calculations in Table 1, in both equations for the oil exporting country, the estimate of the coefficient β_4 is approximately -0.02. This means that the 1% excess of annual growth rate of the real GDP $rGDP_{it}$ of the oil exporting country over the annual growth rate of the real world oil price $rPOIL_t$ will lead to an increase in the GCI_{it} by 0.02%. For the non-oil exporting country, the estimate of the coefficient β_5 in equation I is statistically insignificant, and in equation II it is significant at the 5% level and is equal to approximately -0.01. Consequently, a 1% excess of the annual growth rate of real GDP $rGDP_{it}$ f the non-oil exporting country over the annual growth rate of the real world oil price $rPIL_t$ will lead it to increase the GCI_{it} by 0.01%, It is twice weak than for the oil exporting country's.

To illustrate, consider the specific cases. Note that among all the considered indicators, the most volatile value is the price of oil. In 2015, it fell by 41.1% in real terms compared with 2014. For Kazakhstan, the $rGDP_{it}$ growth rate was 1.1%, i.e. the excess of the GDP growth rate over the growth rate of the real oil price is estimated at 42.2%. Multiplying this excess by 0.02, according to equality (2), we obtain an increase in the GCI growth rate of 0.84% due to the change in the oil price and $rGDP_{it}$ in 2015. This is comparable to the growth of Kazakhstan's GCI due to the influence of all factors in 2015 by 1.6%. Similarly, we can find that the growth of the GCI by 1.6% for Russia and 1.26% for the USA was provided by 0.89% and 0.88%, respectively, due to changes in the real oil price and $rGDP_{it}$.

6. CONCLUSION

The purpose of this article is to assess the impact of changes in world oil prices on the GCI. The data for the study are annual data for 60 countries for 2006-2017. The dependent variable is the logarithm of the GCI, and the independent variables are logarithms of average labor productivity, total factor productivity, the share of the number of employed people in the total population of the country, the ratio of real world oil prices to $rGDP_{it}$ of the country, and Gross capital formation, as well as High-technology exports.

Regression analysis of panel data with fixed effects shows that exceeding the growth rate of oil prices over GDP growth by 1% reduces the average growth rate of the GCI of the oil exporting country by 0.02% and the non-oil exporting country – by 0.01%. Since the price of oil is a rather changeable variable, specific examples show that the annual changes in the GCI caused by its fluctuations are quite comparable with its actual changes. An increase in the remaining independent variables mentioned above has a positive effect on a country's GCI.

Thus, the rise in the price of oil contributes to a decrease in the GCI of countries. In particular, this is confirmed by the fact that the correlation coefficient between the real price of oil and the average GCI for all 60 countries is equal to minus 0.44. Moreover, a greater reduction in the GCI exists for oil exporting countries than for non-oil exporters. And this means that due to rising of oil prices, oil exporting countries lose more in this index. They move to lower positions in the global competitiveness ranking. Since most countries, with the exception of large oil producers, cannot influence its price, in order to achieve higher positions in this ranking they must increase the total factor productivity, diversify the economy, develop high-tech production, and create competitive advantages in different sectors of the economy.

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