DIGITALES ARCHIV

ZBW – Leibniz-Informationszentrum Wirtschaft
ZBW – Leibniz Information Centre for Economics

Mukhamediyev, Bulat; Spankulova, Lazat

Article

The impact of innovation, knowledge spillovers and oil prices on economic growth of the regions of Kazakhstan

Provided in Cooperation with:
International Journal of Energy Economics and Policy (IJEEP)

Reference: Mukhamediyev, Bulat/Spankulova, Lazat (2020). The impact of innovation, knowledge spillovers and oil prices on economic growth of the regions of Kazakhstan. In: International Journal of Energy Economics and Policy 10 (4), S. 78 - 84.
https://www.econjournals.com/index.php/ijeep/article/download/9034/5105.
doi:10.32479/ijeep.9034.

This Version is available at:
http://hdl.handle.net/11159/8395

Kontakt/Contact
ZBW – Leibniz-Informationszentrum Wirtschaft/Leibniz Information Centre for Economics
Düsternbrooker Weg 120
24105 Kiel (Germany)
E-Mail: *rights[at]zbw.eu*
https://www.zbw.eu/econis-archiv/

Standard-Nutzungsbedingungen:
Dieses Dokument darf zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden. Sie dürfen dieses Dokument nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, aufführen, vertreiben oder anderweitig nutzen. Sofern für das Dokument eine Open-Content-Lizenz verwendet wurde, so gelten abweichend von diesen Nutzungsbedingungen die in der Lizenz gewährten Nutzungsrechte.

https://zbw.eu/econis-archiv/termsofuse

Terms of use:
This document may be saved and copied for your personal and scholarly purposes. You are not to copy it for public or commercial purposes, to exhibit the document in public, to perform, distribute or otherwise use the document in public. If the document is made available under a Creative Commons Licence you may exercise further usage rights as specified in the licence.

ZBW Leibniz-Informationszentrum Wirtschaft
Leibniz Information Centre for Economics

Mitglied der Leibniz-Gemeinschaft

International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2020, 10(4), 78-84.

The Impact of Innovation, Knowledge Spillovers and Oil Prices on Economic Growth of the Regions of Kazakhstan

Bulat Mukhamediyev[1]*, Lazat Spankulova[2]

[1]Department of Economics, Al-Farabi Kazakh National University, Almaty, Kazakhstan, [2]Narxoz University, Almaty Technological University, Almaty, Kazakhstan. *Email: bmukhamediyev@gmail.com

Received: 27 November 2019 **Accepted:** 29 March 2020 **DOI:** https://doi.org/10.32479/ijeep.9034

ABSTRACT

The study of impact of innovation and diffusion of knowledge for economic growth of European regions and other developed countries is increasingly attracting attention of scientists. Along with this, there are many studies for impact of world economic growth of oil prices. At the same time, there is an insufficient attention to joint assessment and comparative analysis of effectiveness of these internal and external growth factors. Moreover, this important issue has been studying a little in relation to countries with economies in transition. This paper is devoted to the study of the impact of innovation and the knowledge spillover in combination with an assessment of the impact of fluctuations in the world oil price on economic growth of regions of Kazakhstan. Catching-up development models are constructed according to annual data from 2005 to 2016 for 16 regions of Kazakhstan. Calculations based on the panel data with fixed effects have confirmed that costs of technological innovations, their spillovers between regions, healthcare costs, as well as the growth rate of the world oil price positively influenced for economic growth in regions. Moreover, socio-economic conditions reinforced their positive impact on growth. It has been established that changes in the world oil price and costs of technological innovations and their spillovers between regions are effects at the same order, whereas impact of health care costs and socio-economic conditions on regional growth is noticeably weaker. The results of the study confirm that for innovation activity is essential for the economic growth of the oil exporting country as well.

Keywords: Oil Prices, R&D, Innovations, Knowledge Spillovers, Regional Growth, Kazakhstan

JEL Classifications: C33, O11, O32, O40

1. INTRODUCTION

The study of the impact of innovation on the economic growth of European regions and other developed countries has become one of the most important areas in modern economic literature. Availability of knowledge creates opportunities for their dissemination and repeated use at no additional cost. The diffusion of knowledge brings benefits for low-productivity regions, if they can significantly accelerate growth by borrowing innovation from more successful neighbors. Meanwhile, this important issue has been studying a little in relation to countries with economies in transition.

The absorption capacity of a region to new knowledge directly depends on the quality of its human capital. The financing of science affects for the developing of human capital, higher education and health. In addition, the socio-economic conditions of the region, in particular, employment in R&D, industry and agriculture, the share of the population with higher education, the unemployment rate, as well as their spillovers between regions, can affect the susceptibility to innovations.

Among the external factors of economic growth, the most important is the world oil price, both for the oil exporting country and for the country that imports oil. Moreover, changes in oil prices and economic growth can be either unidirectional or bidirectional, which depends on the state of the country's economy. Moreover, the impact of the global oil price on economic growth may vary not only among oil producing countries, but also across regions of the country.

This Journal is licensed under a Creative Commons Attribution 4.0 International License

Kazakhstan is a country with a relatively large territory and uneven developed regions. The country has a high level of human capital. Along with the manifestation of the general laws of the transition period, in the fact that Kazakhstan has moved to the group of "catching up" countries, forced to be guided by strategies specific to developing countries. The new economy requires, accordingly, new forms of state science and technology policy. The main problem of Kazakhstan is to develop a strategy for transforming the country from an exporter of oil and other raw materials into a country with a technologically advanced economy. All this forces the country, relying on raw materials income, to seek development priorities, including by creating and borrowing new technologies.

The remainder of the paper is organized as follows: Section 2 provides an overview of relevant literature; section 3 describes data used and econometric model; section 4 presents empirical results and their discussion; section 5 presents the conclusion of the study.

2. LITERATURE REVIEW

2.1. Innovation and Knowledge Spillover

For the 1st time, the idea of spatial diffusion of innovations and knowledge spillovers was put forward by Griliches (1957), studying the process of distribution of hybrid wheat seeds in the USA. Hagerstrand (1967) indicated that innovations in space propagate according to the law of diffusion of innovations, and the speed and directions of diffusion of innovations depend on the distance from the center of origin of innovation, as well as on the innovative potential of the region. This has also been confirmed in studies by Acs and Varga (2002), Marrocu et al. (2013). The theory was further developed in articles by Romer (1990), Grossman and Helpman (1994) on innovation and knowledge transfer. The studies show that the dissemination of knowledge has a significant impact on economic growth. Moreno et al. (2005) studied the spatial effects of innovation in Europe. Varga et al. (2005) performed similar studies for the United States.

Audretsch and Feldman (1996) note that knowledge is able to transcend administrative boundaries and stimulate technological change both in the region itself and in neighboring territories. It is assumed that regions located close to other regions with high R&D and technological innovation costs will grow faster than regions near which there are no regions that are R&D intensive (Meissner, 2012). The ability to absorb knowledge from exchange participants decreases inversely with the distance between them. Moreover, the effectiveness of knowledge spillovers depends on the absorption capacity of the regions. Most often in the economic literature, as indicators of innovation, internal costs for R&D, costs of technological innovations and their spillovers are considered.

2.2. Education and Health

Since the beginning of the 2000s, the level of human capital has been regarded as another significant factor in economic growth (Ó hUallacháin and Leslie, 2007; Marrocu et al., 2013; Charlot et al., 2015; Baburin and Zemtsov, 2016). Then, the spillovers of knowledge began to be included in the set of growth factors, taking into account the distance matrix. For example, Charlot et al. (2015) introduce the regional production function of knowledge as a function of R&D expenditures as a percentage of the region's GRP, the stock of human capital calculated as a percentage of the population with higher education in the region, and variables reflecting their spillovers.

Education is often one of the main factors in the formation of human capital. An article by Ramesh and Jani (2009) examines educational factors that have helped to strengthen and expand the quality of affordable human capital in the case of Malaysia. An analysis of cause and effect relationships carried out by Andrade et al. (2018) showed mixed results regarding education and health spending within and between groups of OECD countries. Nevertheless, for a group of high-income OECD countries, the results of their research unequivocally confirm the use of social policy variables as the means of stimulating economic growth.

An empirical analysis by Beraldo et al. (2009) for 19 OECD countries confirms that spending on health and education has a positive effect on growth. Moreover, the estimated impact is stronger for health than for education. Zhou and Luo (2018) conclude that contributions to higher education are an important source and driving force for technological innovation, and technological innovation will contribute to further economic growth. However, this effect is delayed and immediate benefits should not be expected.

2.3. Oil Prices and Economic Growth

Undoubtedly, the world price of oil affects the economic growth of countries. However, not everything is clear here. Mohaddes and Pesaran (2017) note that the fall in oil prices since the financial crisis of 2008 has cast doubt on the generally accepted belief that lower oil prices are good for the US and the global economy. However, they show that this relationship was unstable when viewed over a long period, and that the effect of the fall in oil prices on real production then was positive.

Apergis et al. (2015) investigated the dynamic relationship between oil prices and US growth based on panel data. They indicate that long-term coefficients turn out to be statistically significant in all empirical models, while positive oil prices decrease output and negative oil prices increase output. At the same time, they found evidence of a unidirectional causal relationship from both positive and from negative oil prices to production based on annual data.

Li (2013) conducted a study on the relationship between crude oil prices and the US economy and came to the following conclusion. Oil prices have a significant negative impact on the US economy in terms of expansion, while relations between them are positive when the US economy is undergoing recessionary regimes.

A study by Jayaraman and Choong (2009) for some small Pacific Island countries shows that oil prices, gross domestic product and international reserves are co-integrated. Moreover, in both the long and short term, one-way relationship is observed.

Naser (2014) argues that the level of world crude oil prices (WTI) play a crucial role in determining economic growth in Russia, China, South Korea, and India. His results show that there is a one-way causal relationship between real GDP and oil consumption in China and South Korea; while in India there is a two-way relationship between oil consumption and real GDP growth. Alkhateeb and Sultan (2019) show that the price of oil in India adversely affects the country's economic growth. Similarly, the results of a study by Akhmad et al. (2019) indicate that rising oil prices have a negative effect on Indonesia's economy.

According to Ozekicioglu (2010), changes in crude oil prices give different results, respectively, in countries that export, transport and import. For countries that export and import gasoline, rising and falling gas prices can have both positive and negative consequences. On the base of the analysis of the time series for 1980-2006 for the EU and Turkey, the author concludes that the increase in crude oil prices is not the reason for the increase in GDP and CPI.

For Russia, Bass (2019) examined the relationship between institutional quality, as measured by the corruption perception index, world oil prices and Russian GDP. From the results of the study, it follows that oil prices, the quality of institutions and economic growth in Russia are linked with each other in the long run. The results of the Granger causality test show unidirectional causality from oil prices and institutional quality to economic growth.

3. DATA AND METHODOLOGY

3.1. Data

The study is based on annual data from 2005 to 2016 for all 14 regions and two major cities of Kazakhstan. Data for these two cities (Astana, the current capital, and Almaty, the former capital) were excluded from data for the respective regions. For calculations, we used the real price of Brent Crude oil from the World Development indicators of World Bank database, and data on the bulk regional product (GRP), and R&D, technological innovations, education, healthcare costs, fixed capital investment in constant prices in 2010, as well as data on social economic conditions in the regions of the country from the website of Statistics committee of the Ministry of National Economy of the Republic of Kazakhstan[1].

3.2. Methodology

The model proposed in this study corresponds to traditional catch-up growth models, for example, the model in the Fagerberg (1988) study. Currently, the Jaffe (1986) approach to modeling the return of knowledge spillovers to regional growth is widely used. Therefore, along with various factors of economic growth, we included in the model spillovers of costs for R&D, technological innovations, education, as well as spillovers of socio-economic conditions between regions. In addition, the model investigates the joint influence of factors of innovative development of regions, diffusion of knowledge and the world oil price. The basic model with panel data is described by an equation of the following form:

1 Ministry of National Economy of the Republic of Kazakhstan. Statistics committee. www.stat.gov.kz

$$growth_{it}=\alpha+\beta_1\, ln(y_{it-1})+\beta_2\, R\&D+\beta_3\, Spill\_R\&D_{it}+\beta_4\, Inno_{it}+\beta_5\, Spill\_Inno_{it}+\beta_6\, HEDU_{it}+\beta_7\, Spill\_HEDU_{it}+\beta_8\, Health_{it}+\beta_9\, SocFilter_{it}+\beta_{10}\, ExtSocFilter_{it}+\beta_{11}\, rPoil_t+u_i+\varepsilon_{it} \quad (1)$$

The *i* is the region index; *t* is the time period; dependent variable $growth_{it}$ is the growth rate of gross regional product per capita, %; $ln(y_{it-1})$ is the natural logarithm of GRP per capita with a lag of 1 year. The lag for this variable allows us to test the convergence hypothesis, according to which lagging regions are growing at a faster pace; $R\&D_{it}$ is R&D costs as a percentage of the region's GRP; $Spill\_R\&D_{it}$ is spillover of costs for R&D to region *i* from other regions; $Inno_{it}$ is costs of technological innovations as a percentage of the region's GRP; $Spill\_Inno_{it}$ is spillover of costs for technological innovations into region *i* from other regions; $SocFilter_{it}$ is index of socio-economic conditions in this region; $ExtSocFilter_{it}$ is the influence of socio-economic conditions of all other regions on this region or the "spillover of socio-economic conditions;" $HEDU_{it}$ is the cost of education as a percentage of the region's GRP; $Spill\_HEDU_{it}$ is the spillover of education costs to region *i* from other regions; $Health_{it}$ it is health care costs as a percentage of the region's GRP; $FixInv_{it}$ is the share of fixed capital investment as a percentage of the region's GRP; $rPoil_t$ is rate of change in the real oil price; u_i is the individual effect of region *i*; ε_{it} it is the random error of the model.

First, we note that in the econometric model (1) of economic growth in the regions, along with the costs of R&D and technological innovations, the costs of education and healthcare, the socio-economic conditions, as well as the growth rate of the world oil price have taken into account.

Secondly, the social filter and its spillovers between regions are included in the list of independent variables. The social filter is a composite index, which characterizes the integral level of development of human capital and the demographic structure of the region. Rodgriguez-Pose (1999) first pointed out the importance of the social filter in evaluating innovation in the region. The author claims that territories with a large share of youth, a highly educated population, and more employment in high-tech industries have a higher innovative potential. Innovations in such regions contribute to a larger increase in GRP compared to other regions. Crescenzi et al. (2007), Rodríguez-Pose and Crescenzi (2008) confirmed the positive effect of the social filter by calculations on regression models linking the growth rate of GRP per capita and the innovative activity of the regions.

Following Rodgriguez-Pose and Villareal (2015), we calculated the social filter for the regions of Kazakhstan using the principal component method based on a factor analysis of the following indicators: the percentage of people employed in R&D of the total number of employees; the percentage of employees in industry of the total number of employees; the percentage of people employed in agriculture in the region of the total number of employees; the percentage of the population under the age of 28 years of the total number of employees; the unemployment rate in the region; the percentage of the population with higher education from the adult population of the region. As a result, two variants of the social filter were selected: the first with the inclusion in the analysis the share of workers in industry of the total number of employees and the second, in which the set of analyzed indicators included the share of people employed in agriculture of the total number of employees in the region.

Schurmann and Talaat (2000) proposed evaluating knowledge spillovers based on an accessibility index. The accessibility index formula for region *i* is as follows:

$$I_i = \sum_j g_j f_{ij} \quad (2)$$

Where g_j is activity function, f_{ij} is impedance function. In case of spillover of costs for technological innovations $Spill\_Inno_{it}$, the function g_j represents the costs of technological innovations as a percentage of the regional GRP, and the impedance function is calculated by the formula

$$f_{ij} = \frac{1/d_{ij}}{\sum_k 1/d_{ik}}, \quad (3)$$

Where d_{ij} is the distance between the two regions *i* and *j*. Rodríguez-Pose and Crescenzi (2008) along with knowledge spillovers were the first to consider the influence of socio-economic conditions on the region's economic growth and their impact on other regions. The R&D cost spillover $Spill\_R\&D_{it}$, the technological innovations cost spillover $Spill\_Inno_{it}$, the socio-economic conditions spillover $ExtSocFilter_{it}$, and the spillover of education cost $Spill\_HEDU_{it}$ between regions were calculated according to formulas (2) and (3) with the choice as an activity function g_j variables $R\&D_{jt}$, $Inno_{jt}$, $SocFilter_{jt}$, and $HEDU_{jt}$, respectively. The study verifies the following two hypotheses.

H_1: The costs of R&D, technological innovation, education and healthcare, as well as socio-economic conditions, investments in fixed capital, and the dynamics of the world oil price have a significant and positive impact on the growth of the region.

H_2: Spillovers of R&D costs, technological innovations, education, as well as spillovers of socio-economic conditions have a significant and positive impact on the region's economic growth.

In order to separately identify the effect of changes in oil prices on growth in the regions where oil is extracted or refined, and in other regions, instead of $rPoil_t$, two variables $rPoil_t*Oil_i$ and $rPoil_t*(1–Oil_i)$ were included in the model. Here Oil_i is a dummy variable equal to 1 for the regions of Atyrau, West Kazakhstan, Mangistau, South Kazakhstan, and Pavlodar related to oil production or refining, and equal to 0 for other regions.

4. RESULTS AND DISCUSSION

4.1. Research Results

Table 1 contains the results of evaluating panel regression with fixed effects according to the catch-up growth model (1) for 16 regions of Kazakhstan by annual data for the period from 2005 to 2016. The dependent variable is the growth rate of gross regional

Table 1: Panel regression with fixed-effects, dependent variable is logarithm of the GRP per capita growth rate

Independent variables	Equations			
	I	II	III	IV
Logarithm of GRP per capita with a lag of 2 years	–2.36 (9.63)	–8.55 (12.3)	–5.67 (10.36)	–10.74 (11.87)
R&D costs as a percentage of GRP with a lag of 1 year	–8.31 (17.0)	–7.89 (13.8)	–8.20 (16.2)	–7.29 (13.3)
The spillover of R&D costs between regions with a lag of 1 year	–33.8 (32.1)	–35.4 (32.3)	–37.9 (32.7)	–39.3 (34.9)
The technological innovation costs as a percentage of GRP with a lag of 1 year	2.15*** (0.60)	2.19*** (0.65)	2.14*** (0.59)	2.20*** (0.65)
The spillover of technological innovation costs between regions with a lag of 1 year	11.8*** (1.9)	11.0*** (2.0)	11.6*** (1.9)	10.9*** (2.0)
Education costs as a percentage of GRP with a lag of 1 year	1.27 (2.27)	2.13 (2.35)	1.36 (2.36)	2.33 (2.42)
The spillover of educational costs between regions with a lag of 1 year	–5.19 (4.03)	–5.30 (4.11)	–4.43 (3.85)	–4.35 (4.02)
Health expenditures as a percentage of GRP with a lag of 1 year	5.66** (2.57)	5.66** (2.45)	5.51** (2.61)	5.37** (2.53)
Social filter based on employment in industry with a lag of 1 year	0.93** (0.32)		0.83** (0.34)	
Social filter based on employment in agriculture with a lag of 1 year		12.23 (10.63)		12.75 (10.7)
The spillover of socio-economic conditions, taking into account employment in industry with a lag of 1 year	–1.37 (1.12)		–1.51 (1.09)	
The spillover of socio-economic conditions, taking into account employment in agriculture with a lag of 1 year		–16.43 (13.58)		–17.9 (13.4)
Fixed capital investment with 1 year lag	0.20* (0.11)	0.14 (0.11)	0.19* (0.11)	0.12 (0.10)
The effect of oil price growth on regional growth	0.48*** (0.04)	0.47*** (0.04)		
The effect of oil price growth on growth in oil producing regions			0.53*** (0.09)	0.54*** (0.08)
The effect of oil price growth on growth in regions non-producers of oil			0.45*** (0.04)	0.43*** (0.04)
Constant	24.1 (79.4)	68.8 (94.4)	51.0 (86.0)	83.4 (91.0)
Fixed effects	Yes	Yes	Yes	Yes
Number of observations	175	175	175	175
R-squared	0.66	0.65	0.66	0.65
Fisher test for the significance of the coefficients	F(12, 15)=26.83 (0.0000)	F(12,15)=50.61 (0.0000)	F(13,15)=44.65 (0.0000)	F(13,15)=105.7 (0.0000)

In parentheses there are robust standard regression coefficient errors (option vce [robust]); *, **, ***significance of coefficients at 10%, 5%, and 1% levels, respectively product per capita. The first column of Table 1 contains the names of the independent variables. The second through fifth columns show the estimated coefficients of the four model specifications (equations I-IV). To eliminate the problem of simultaneity, the variable "logarithm of GRP per capita" was included in all specifications with a lag of 2 years, and the rest of the variables, except for the variables of the oil price growth rate, were used with a lag of 1 year. In equations I and III, a social filter is included in a set of independent variables, as well as an spillover of socio-economic conditions, calculated taking into account employment in industry. Whereas, in equations II and IV, the social filter and the spillover of socio-economic conditions, calculated taking into account employment in agriculture, are used.

Equations I and II study the influence of the world oil price growth rate on regional growth, and equations III and IV study its effect on growth separately in the oil producing regions and in other regions. Since the set of regions is constant over the years, it is usually advisable to use the panel data approach with fixed effects in the calculations in such a situation. However, to confirm this choice, the Hausman test was performed comparing a model with fixed effects with a model with random effects. In order to eliminate the consequences of possible heteroskedasticity, Table 1 presents robust estimates of the significance of the coefficients. For econometric analysis, we used STATA statistic software package.

According to the data in Table 1, hypothesis H_1 is confirmed at a 1% significance level for the variables "The technological innovation costs" and "The effect of oil price growth on regional growth." Moreover, it is also confirmed at a 5% significance level for the variables "Health expenditures" in all four equations and "Social filter based on employment in industry" in the first and third equations. We note that the coefficients for these variables are positive. Although the coefficients for the variable "Education costs" are also positive, the H_1 hypothesis is not confirmed for it in all four equations, although it is poorly confirmed at a 10% significance level for the variable "Fixed capital investment" only in equations I and III.

Hypothesis H_2 is confirmed at a 1% significance level for the variable "The spillover of technological innovation costs" in all four equations. However, it is not confirmed for the spillover of costs for R&D, education, as well as for the spillover of socio-economic conditions between regions.

The coefficient for the variable "The effect of oil price growth on regional growth" is positive and significant at a 1% level in the first and second equations. The coefficients for the variables "The effect of oil price growth on growth in oil producing regions" and "The effect of oil price growth on growth in regions non-producers of oil" are also positive and significant at the 1% level in the third and fourth equations.

According to Harris (2011), the negative signs of the coefficients of the variable "Logarithm of GRP per capita" in Table 1 are consistent with the neoclassical growth theory of the catch-up development of lagging regions. This conclusion was made for the regions of Russia in the study of Kaneva and Untura (2017). However, the coefficients for this variable in Table 1 are not statistically significant, and the hypothesis of convergence of its regions is not confirmed for Kazakhstan.

4.2. Discussion

This study shows the influence of innovative and other factors in combination with the dynamics of the world oil price on the economic development of the regions of Kazakhstan. It has been revealed that the economic growth of the regions of Kazakhstan is significantly affected by the costs of technological innovations and their spillovers between the regions.

At the same time, the costs of R&D, as well as their spillovers between the regions, did not provide significant support to the economic growth of the regions. This means that the ongoing development activities in the regions of the country do not give proper returns and ineffective. Similarly, there is no positive significant effect on the rate of regional growth of education costs and their spillovers between regions. This can be explained by the fact that the return on investment in education is very late, and their consequences are not detected with a lag of 1 year. The same is true for investments in fixed capital.

However, health care costs contribute to regional economic growth. Indeed, unlike education costs, health care costs can give a quick return by preserving the working capacity of the population of the region, for example, due to vaccination against influenza and the use of more effective treatment methods.

Socio-economic conditions, assessed taking into account employment in industry, significantly contributed to the increase in the rate of economic growth of the region, while those assessed taking into account employment in agriculture did not significantly affect them. In addition, no influence of spillover of socio-economic conditions between the regions was revealed, both taking into account employment in industry and taking into account employment in agriculture.

As expected, there is a direct relationship between changes in the world oil price and the economic growth rates in the regions. This is illustrated in Figure 1, where *rPoil* is the global oil price growth rate, and *growth avr* is the average GRP growth rate in all regions of Kazakhstan.

The correlation coefficient between these variables equals 0.87. It is unlikely that one can expect the emergence of an endogenous problem here, and assume that the GRP of the regions of Kazakhstan can affect the world price of oil. According to the data in Table 1, an increase in the world oil price by 1% increases the GRP growth rate on average by approximately 0.48%. Moreover, the increase in the GRP growth rate in the regions producing or refining oil is approximately 0.54%, while in other regions it is on average 0.44%.

It is of interest to compare the effect of changes in the world oil price and factors of innovative development on the GRP growth rates. Table 2 shows the estimates of the effect on the

Figure 1: The growth rate of world oil prices and the average growth rate of GRP in the regions of Kazakhstan in 2006-2016

Table 2: Comparison of the influence of various factors on the growth of GRP

Independent variables	Coefficients	The average standard deviations	Assessing the effect of a variable on GRP growth
The oil price growth, %	0.48	22.7	10.90
The technological innovation costs as a percentage of GRP with a lag of 1 year	2.15	11.43	3.07
The spillover of technological innovation costs between regions with a lag of 1 year	11.8	0.83	9.80
Health expenditures as a percentage of GRP with a lag of 1 year	5.66	0.30	1.70
Social filter based on employment in industry with a lag of 1 year	0.93	2.26	2.10

GRP growth rate of those variables in Table 1, the coefficients at which are significant at least at the 5% level. The second column contains these coefficients. The third column shows the average standard deviations of the variables. The fourth column contains the products of the corresponding quantities from the second and third columns.

As can be seen in the last column of Table 2, the effect on the growth of GRP of technological changes and their spillovers between regions is quite comparable with the effect of changes in oil prices. While, impact of health care costs and socio-economic conditions of region is several times weaker than the impact of changes in oil prices.

5. CONCLUSION

Fluctuations in the price of oil definitely affect the economy of Kazakhstan, which exports it to world markets. In addition, R&D, technological innovation, socio-economic conditions and other factors can influence economic growth. Investments in creation of new knowledge, as well as their spillovers from neighboring regions, taking into account their geographical remoteness, enhance regional productivity. This study aimed to assess their impact on growth in regions of the country in which oil is produced, as well as in those in which there is no oil production.

Estimated models of catch-up development according to annual data from 2005 to 2016 for 16 regions of Kazakhstan contain variables of world oil prices, R&D costs, technological innovations, their spillovers between regions and other factors contributing to innovative development of country's regions. Calculations based on panel data with fixed effects confirmed that costs of technological innovations, their spillovers between regions, health care costs, as well as the growth rate of the world oil price, had a significant positive effect on economic growth in regions. Moreover, socio-economic conditions, taking into account employment in industry, reinforced their positive impact on growth.

Whereas the socio-economic conditions that take into account employment in the agricultural sector do not possess this property. In addition, no statistically significant effect on growth of R&D costs, education, their spillovers between regions, investments in fixed capital was revealed.

The increase in the world oil price significantly increased the economic growth rate of the regions of Kazakhstan, and this influence was stronger for the regions producing oil than for other regions. In particular, this is one of the explanations that convergence of the regions of Kazakhstan is not confirmed. The positive impact of oil prices on the growth of non-oil producing regions is understandable both by the production interconnections of the regions in the country, and by changes in demand for their products from regions producing oil.

Thus, the study reveals the internal and external factors of regional growth in Kazakhstan. It has been established that for the growth of GRP, changes in the world oil price and costs of technological innovations and their spillovers between regions are effects of the same order, whereas the impact on the growth of GRP of health care costs and the socio-economic conditions of region is noticeably weaker. Similar results may occur for other oil producing countries. They can be taken into account when forming development policy of country's regions.

REFERENCES

Acs, Z., Varga, A. (2002), Geography, endogenous growth, and innovation. International Regional Science Review, 25(1), 132-148.

Akhmad, R.B., Karim, K., Tajibu, M.J., Syukur, M. (2019), The impact of fuel oil price fluctuations on Indonesia's macro economic condition. International Journal of Energy Economics and Policy, 9(2), 277-282.

Alkhateeb, T.T.Y., Sultan, Z.A. (2019), Oil price and economic growth: The case of Indian economy. International Journal of Energy Economics and Policy, 9(3), 274-279.

Andrade, J.A.S., Duarte, A.P.S., Simões, M.C.N. (2018), Education and health: Welfare state composition and growth across country groups. Eastern Journal of European Studies, 9(2), 111-144.

Apergis, N., Aslan, A., Aye, G.C., Gupta, R. (2015), The asymmetric effect of oil price on growth across US States. Energy Exploration and Exploitation, 33(4), 575-590.

Audretsch, D.B., Feldman M.P. (1996), R&D spillovers and the geography of innovation and production. The American Economic Review, 86(3), 630-640.

Baburin, V.L., Zemtsov, S.P. (2016), Factors of patent activity in the regions of Russia. World of Economics and Management, Vestnik NSU. Series: Social and Economics Sciences, 16(1), 86-100.

Bass, A. (2019), Do Institutional Quality and Oil Prices Matter for Economic Growth in Russia: An Empirical Study. International Journal of Energy Economics and Policy, 9(1), 76-83. Beraldo, S., Montolio, D., Turati, G. (2009), Healthy, educated and wealthy: A primer on the impact of public and private welfare expenditures on economic growth. Journal of Socio-Economics, 38(6), 946-956.

Charlot, S., Crescenzi, R., Musolesi, A. (2015), Econometric modelling of the regional knowledge production function in Europe. Journal of Economic Geography, 15(6), 1227-1259.

Crescenzi R., Rodriguez-Pose A., Stoper M. (2007), The territorial dynamics of innovation: A Europe-United States comparative analysis. Journal of Economic Geography, 7(5), 673-709.

Fagerberg, J. (1988), Why growth rates differ. In: Dosi, G., Freeman, C., Nelson, R., Silverberg, G., Soete, L., editors. Technical Change and Economic Theory. London: Pinter. p432-457.

Griliches Z. (1957), Hybrid corn: An exploration in the economics of technological change. Econometrica, 25(4), 501-522.

Grossman, G.M., Helpman, E. (1994), Endogenous innovation in the theory of growth. The Journal of Economic Perspective, 8(1), 23-44.

Hagerstrand, R.P. (1967), Innovation Diffusion as a Spatial Process. Chicago: University of Chicago Press. Available from: https://www.cabdirect.org/cabdirect/abstract/19691800901.

Harris R. (2011), Models of regional growth: Past, present and future. Journal of Economic Surveys, 25(5), 913-951.

Jaffe, A.B. (1986), Technological opportunity and spillovers of R&D: Evidence from firms patents, profit and market share. American Economic Review, 76, 984-1001.

Jayaraman, T.K., Choong, C.K. (2009), Growth and oil price: A study of causal relationships in small Pacific Island countries. Energy Policy, 37(6), 2182-2189.

Kaneva, M., Untura, G. (2017), Innovation indicators and regional growth in Russia. Economic Change and Restructuring, 50(2), 133-159.

Li, M.Y.L. (2013), Reexamining the relationship between oil prices and the US economy using a quantile regression approach. Energy Sources, Part B: Economics, Planning, and Policy, 8(3), 304-311.

Marrocu, E., Paci, R., Usai, S. (2013), Proximity, networking and knowledge production in Europe: What lessons for innovation policy? Technological Forecasting and Social Change, 80, 1484-1498.

Meissner, D. (2012), The economic impact of spillovers from R&D and innovation. Foresight-Russia, 6(4), 20-31.

Mohaddes, K., Pesaran, M.H. (2017), Oil prices and the global economy: Is it different this time around? Energy Economics, 65, 315-325.

Moreno, R., Paci, R., Usai, S. (2005), Spatial spillovers and innovation activity in European regions. Environment and Planning, 37, 1793-1812.

Naser, H. (2014), Oil market, nuclear energy consumption and economic growth: Evidence from emerging economies. International Journal of Energy Economics and Policy, 4(2), 288-296.

Ó hUallacháin, B., Leslie, T. (2007), Rethinking the regional knowledge production function. Journal of Economic Geography, 7, 737-752.

Ozekicioglu, H. (2010), The macroeconomic effects of changes in petrol prices: The case of EU and Turkey. International Journal of Interdisciplinary Social Sciences, 5(2), 245-253.

Ramesh R., Jani, R. (2009), Spurring economic growth through education: The Malaysian approach. Educational Research and Reviews, 4(4), 135-140.

Rodgriguez-Pose, A. (1999), Innovation prone and innovation averse societies. Economic performance in Europe. Growth and Change, 30, 75-105.

Rodgriguez-Pose, A., Villareal Peralta, E.M. (2015), Innovation and regional growth in Mexico: 2000-2010. Growth and Change, 46(2), 172-195.

Rodríguez-Pose, A., Crescenzi, R. (2008), Research and development, spillovers, innovation systems, and the genesis of regional growth in Europe. Regional Studies, 42(1), 51-67.

Romer, D. (1990), Endogenous technological change. Journal of Political Economy, 98(5), 71-102.

Schurmann, C., Talaat, A. (2000), Towards a European Peripherally Index: Report for General Directorate 16th Regional Policy of the European Commission. Dortmund: IRPUD. Available from: https://www.econstor.eu/bitstream/10419/115681/1/ERSA2002_224.pdf.

Varga, A., Anselin, L., Acs, Z.J. (2005), Regional innovation in the US over space and time. In: Maier, G., Sedlacek, S., editors. Spillovers and Innovations. Interdisciplinary Studies in Economics and Management. Ch. 4. Berlin: Springer. p93-104.

Zhou, G., Luo, S. (2018), Higher education input, technological innovation, and economic growth in China. Sustainability, 10(8), 2615.